THE EFFECTS OF SENSORY STORIES ON BEHAVIORS IN CHILDREN WITH AUTISM

A Thesis

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By

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ABSTRACT

The purpose of this study was designed to compare stereotypic behaviors in children with autism before, during, and after the use of Sensory Stories. Sensory Stories were developed to help a child learn sensory strategies to help them confront sensory components of typical activities. A convenience sample of five children with documented autism spectrum disorder participated in this study. The children were between the ages of 5 and 10 years old. The Sensory Profile determined if a child displayed sensory processing difficulties and qualified to participate in the study. Spontaneous vocalizations, repetitive movements and non-purposeful behaviors were tallied on a data chart during baseline, intervention and follow-up periods. Binomial distribution was used to determine if behaviors during intervention were different significantly than behaviors in the initial baseline phase. After the initial binomial test of significance was completed, a combined test of significance was completed. This combined the data for all the subjects to determine if the results were significant when put together. When comparing baseline to intervention phase, there was a significant decrease in spontaneous vocalizations (p=.041). There was not a significant decrease in spontaneous vocalizations when the follow up period was compared to the first baseline phase (p=.897). When combining all subjects, non-purposeful behaviors were no
different in the baseline and intervention phases (p=.677) nor in follow up (p=.444).

There was a significant decrease in repetitive movements from baseline to intervention (p=<.001). However, this effect was not maintained in follow up (p=.223). The results of this study indicate that Sensory Stories may help in decreasing behaviors in children with autism.
Dedicated to my parents who have instilled in me the love of special children and who have enabled me to walk down the path I have taken.
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CHAPTER 1

BACKGROUND OF THE PROBLEM

Sensory integration is a theoretical approach often used by occupational therapists in their work with children in school systems. A sensory integration approach is defined as therapist designed activities to help children organize and process sensory information from different sensory channels in order to make an adaptive response for a specific purpose. The particular purposes can include helping children perceive their body or world, to enhance the learning process, or to relate input from one sensory system to another (Ayres, 1987).

Sensory processing difficulties is an irregularity or disorder in brain function that makes it difficult to process and use sensory information for functional purposes (Ayres, 1987). It is reported that 42-88% of children with autism exhibit unusual sensory responses, for example, hypo- and hyper- responses, preoccupations with sensory features of objects, and perceptual distortions (Kientz & Dunn, 1997). A child with these difficulties often cannot cope with the sensory aspects of certain daily activities. Due to a child's unique way of processing sensory information, a task that would be enjoyable for one child could be unpleasant and unnerving for a child with sensory processing difficulties. Children with autism often avoid or resist an activity rather than
participate in it. The way that the child processes sensory information can thus preclude the child from participation in typical day to day activities.

Sensory processing transcends all aspects of a child’s life. Results of sensory processing difficulties can be uncomfortable sensations that affect the child’s performance at home, at school, and even in the community. The noises, smells, touch experiences, and the movements all have a cumulative effect on the child as each subsequent situation conveys a new level of discomfort. As the child’s day progresses, the child’s coping mechanisms are stretched to the limit.

Adults mistakenly interpret the stereotypic behaviors associated with stress filled activities as poor behavior on the part of the child. The adult sees the behavior as noncompliant or controlling. For example, a child might avoid or resist an activity by producing spontaneous vocalizations, repetitive movements or nonpurposeful behavior. A child may exhibit these same repetitive movements because he or she craves additional stimulation and needs excessive sensory stimulation to maintain arousal. Another example may occur during circle time, when a child cannot cope with the sensory stimuli occurring in the environment. A child might talk out of turn or yell, trying to tune out or compensate for being unable to handle that stressor. A child might also sing louder or make other noises as he is seeking additional sensory input to achieve that “just right” state of arousal.

Behavioral responses in children with autism can be a result of difficulty in modulating sensory input. Some of this behavior could be hyperresponsivity, which is a disorder of sensory modulation in which the child registers sensations too intensely. Overaroused by sensation, he may react as if typical sensory input is irritating, annoying,
or even threatening. If a child is hyposensitive, sensations are registered less intensely than others are. The child thus needs excessive, intense stimulation to achieve ordinary arousal or alertness (Baranek, Foster, & Berkson, 1997a; Kranowitz, 1998).

Sensory Stories use the format of Social Stories to address the individual sensory processing needs of children (Deborah Marr, personal communication, September 18, 2002). Interventions are needed to consider the individualized sensory processing needs of children demonstrating modulation issues (Baranek, 2002). Sensory Stories were developed to equip the child with strategies to tolerate the sensory aspects of typical activities that the child perceives to be uncomfortable or to help the child inhibit inappropriate behaviors used to obtain intense sensory input. These sensory strategies are based on sensory integration theory and sensory integration treatment principles. In order to address the modulation difficulties, calming sensory input is encouraged to counteract stimuli that the child finds aversive. Deep touch pressure, slow movement activities, and heavy work activities that provide active resistance to movement tend to have a calming effect on the child. Through the use of these calming sensory experiences, the child can better cope with the unpleasant sensory aspects of daily activities and can inhibit inappropriate sensory seeking behaviors (Deborah Marr, personal communication, September 18, 2002).

It is well documented that children with autism process visual information better than auditory information (Quill, 1995). Temple Grandin, an animal scientist who has autism, describes how she thinks in pictures and how words are like a second language for her (Grandin, 1995). Visual prompts provide a structured teaching environment, make expectations more clear, and lessen the need for continuous verbal prompting (Shapler,
Mesibov & Hearsey, 1995). Sensory Stories use pictures of the behavioral strategies to reinforce the child’s learning.

Many children with autism have a particular learning style in which they rely heavily on information that is predictable. Therefore, children with autism may comprehend repeated information more successfully than novel. Research by Boucher and Lewis (1989) suggests that presenting a picture of a situation to a child who has autism can aid in his or her memory of the purpose of the situation and how to appropriately react in that situation. Sensory Stories use pictures paired with written words to convey meaning about routine situations to which the child must respond.

PURPOSE OF THE STUDY

The purpose of this study was to examine the effects of Sensory Stories on frequency of stereotypic behaviors with children with autism. These include behaviors to inhibit excessive sensory input and behaviors to gain additional sensory input. The behaviors measured in this study were spontaneous vocalizations, aggression, non-purposeful behavior and repetitive movements.
OBJECTIVE

Using a sample of children ages 5-10 years old with documented autism spectrum disorder the research objective was to:

1. Compare the frequency of stereotypic behaviors in children with autism before, during and after Sensory Story intervention. Targeted behaviors were defined for each child. The behaviors observed included spontaneous vocalizations, repetitive movements and non-purposeful behavior. Measurements were taken during baseline, Sensory Story intervention, and follow up periods.

RESEARCH APPROACH

An ABA, single subject experimental design was replicated across five subjects. During the baseline period, the children received their regular therapy services. During the intervention period, the children continued to receive their regular therapy services and in addition were read a Sensory Story before circle time. The Sensory Story described appropriate behaviors during circle time. Spontaneous vocalizations, non-purposeful behavior and repetitive movements were measured every day during baseline, intervention and follow up periods.
CHAPTER 2

LITERATURE REVIEW

This chapter provides an overview of the literature related to social cognition and sensory modulation in autism. Intervention using stories is addressed by describing theories and principles of Social Stories followed by describing Sensory Stories.

AUTISM

The prevalence of autism is in the range of 2-20 cases per 10,000 individuals (American Psychiatric Association, 2000). Autism is a developmental disorder characterized by impairments in socialization, communication, cognitive functioning, sensory stimulation and behavior (American Psychiatric Association, 2000). More specifically, children with autism are dependent on adults for staying on task, completing activities, and transitioning between activities (Bryan & Gast, 2000). Children with autism often demonstrate deficits in cognitive impairments and adaptive functioning. Adaptive functioning refers to the skills that are involved in coping with the demands of the everyday environment. Research has consistently demonstrated that children with autism have deficits in adaptive functioning that extend beyond their cognitive deficits (Liss et al., 2001). Even though sensory disorders are not yet part of the
diagnostic criteria for autism, descriptions of the way in which sensory processing issues prevail in autism are common in the literature. The literature suggests that although sensory processing abnormalities are not universal or specific to autism, the prevalence of such abnormalities in autism is relatively high. It is estimated that between 30% and 100% of children with autism spectrum disorders have sensory-perceptual abnormalities of some kind (Dawson & Watling, 2000). This deficit in sensory processing is manifested in a variety of atypical behaviors (Ayres & Tickle, 1980). Because of the heterogeneity and severity of deficits in the population of children with autism, a wide variety of symptoms have been noted, including repetitive and self-stimulating behaviors (e.g., repetitive hand movements, body rocking, unusual object manipulation, focused interests) (Baranek, Foster, & Berkson, 1997b).

Behavioral observations of children with autism demonstrate that the overwhelming majority of these children display atypical sensorimotor behaviors at some point, including reports of both hypo- and hyper-response to sensory input, raising the possibility that two groups of sensory responders may exist in children with autism. Sensory processing abnormalities also have been found to be correlated with higher levels of stereotypic, rigid, and repetitive behaviors (Baranek, Foster, & Berkson, 1997a). Unusual sensory and motor behaviors that have been documented and observed are failing to respond to sounds (81%), heightened sensitivity to loud noises (53%), watching hands or fingers (62%), and arm flapping (52%) (Volkmar & Cohen, 1989). A pattern of atypical sensory modulation and motor behaviors, including rubbing surfaces, finger licking, body rocking, and absence of responses to stimuli was present in almost 60% of children in one study (in 15% to a severe degree) (Rapin, 1996).
Some of the unusual sensory processing and motor patterns seen in autism have been thought to result from problems in arousal modulation or habituation that result in withdrawal, rejection, or lack of response to sensory stimuli (National Research Council, 2001). Some studies suggest that children may be more sensitive to the environment and may use behavioral strategies such as avoiding environmental change and social interaction, as methods of reducing further disorganizing experiences.

The social domain, a skill area that influences a child’s ability to successfully function in almost every daily situation, is another of the many areas typically affected by autism. One model that is used in conceptualizing the particular social deficit evidenced by children with autism is theory of mind (Baron-Cohen, Leslie, & Frith, 1985). Theory of mind is the ability to assign beliefs and thoughts to others, to understand that others have perspectives which are unique and different from one’s own (Leslie, 1987). Many children with autism have difficulty understanding other people’s beliefs, attitudes and emotions (Frith, 1991).

One of the key components in the understanding of relationships is what children understand about themselves and other people, an understanding of “other minds” (Dunn, 1993). Theory of mind has also been referred to as the “capacity to mind read” (Happe & Frith, 1995), which provides children with basic information about what the people around them know and feel. It is the understanding of people and social situations, which makes it possible to learn and apply social skills independently.

Typically developing children acquire this type of understanding by approximately age 4. In a study of children with Asperger’s Disorder, which is part of the autism spectrum of disorders, the children did not develop any basic understanding of another
person’s ability to have his or her own perspective until between ages 9 and 14 (Happe & Frith, 1995). The children with Asperger’s Disorder also seemed to lack the ability to use this information in more sophisticated ways, namely, that not only did other people have their own thoughts but also that they were unable to compare, analyze, and reflect on their own and other people’s ideas and emotions.

Some evidence suggests children with autism can be aware that a socially significant event has occurred, but not know how to respond to it (Loveland & Tunali, 1991). Children with autism may detect relevant social information and make social judgements, but they do not always know the functional significance of what they observe. Failure to know the functional significance of other people’s social behavior could lead to inappropriate actions if children with autism cannot accurately regulate their own behavior in response to changing conditions in the social environment (Loveland, Pearson, Tunali-Kotoski, Ortegon, Gibbs, 2001). Thus, the ability not only to understand other’s internal states in relation to social context but also to regulate one’s own social behavior in response to what is understood may be impaired (Loveland et al., 2001).

SENSORY INTEGRATION THEORY

Sensory integration is a term that is used to describe both the basic and essential neurological function that involves organizing sensory information for use (Ayres, 1979) and a specific theory and intervention approach that emerged from an area within the field of occupational therapy. Sensory integration theory takes into account the individual’s neurobiological ability to process and integrate information and also
considers how that ability either helps or inhibits participation in a wide array of environments. Many researchers, theorists, and clinicians have explored sensory integration since Dr. Ayres' time. Current neurophysiological research provides insight to the sensory integration disorders that are present in many individuals with autism.

Ayres used the term "registration of sensation" (Ayres, 1979) to refer to the way that a child's awareness of sensory stimuli is associated with attaching meaning to situations. Occupational therapists have used the term "poor sensory registration" to mean a failure to notice, record, and respond to relevant information from the environment (Miller & Lane, 2000). Poor registration may account for some of the behaviors observed in individuals with autism. Lack of registration may be the result of having unusually high thresholds for receiving sensory information (Miller, Reisman, McIntosh & Simon, 2001). This lack of registration sometimes causes problems related to attention. A child may pay attention to only part of the visual or auditory field, and events that are significant to others may go unnoticed by a child with autism.

Neurological Threshold Continuum

The entire nervous system operates based on excitation and inhibition (Dunn, 1999). Excitation occurs when the neurons are more likely to respond or are activated. Inhibition occurs when the likelihood of responding is decreased or responses are blocked. It is the balance of these operations that determine when responses are generated. Some refer to this balance of the neurological continuum as modulation. Modulation is the brain's regulation of neural messages by facilitation or inhibition.
responses. When modulation is intact, the nervous system responds to some stimuli while ignoring other stimuli and the child can then generate an appropriate adaptive response to the situation.

Recent research has greatly refined the understanding of sensory modulation in relation to autism (Baranek, 1998; Miller & Glennon, 2001). A critical factor in sensory modulation is the interaction between internal processing and the external environment. More specifically, the interaction between the physiological stability, the perceived challenge imposed by the environment, and environmental supports all affect a person’s ability to tolerate stress and find adaptive coping and interaction strategies (Kraemer, 2001).

Individual behavioral differences vary widely between extreme hyporesponsivity and extreme hyperresponsivity, sensory seeking and sensory avoiding and unusual patterns of sensory play. This conceptual model hypothesizes that there is an interaction between neurological thresholds and behavioral responses (Dunn, 1997). This model presents the neurological thresholds and behavioral responses as a continuum that interacts with each other. The interaction of these two continua provides a method for explaining how children process sensory information. Figure 1.1 demonstrates this idea.
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Figure 2.1: Relationships between behavioral responses and neurological thresholds

Neurological thresholds refer to the amount of stimuli required for a neuron or neuron system to respond. At one end of this continuum, thresholds are very high. This means it would take increased stimuli to meet the threshold and fire the neurons. At the other end of this continuum, thresholds are very low, meaning it would take very little stimuli to meet the threshold and fire the neurons (Dunn, 1999).

Behavioral responses refer to the way people act in consideration of their thresholds. At one end of this continuum, children respond in accordance with their thresholds. This means they would have a tendency to let the nervous system respond (or not respond),
and they would behave consistently with this neural activity. At the other end of the behavioral continuum, children respond to counteract their thresholds. This means they would work against their thresholds as a way to reach homeostasis (Dunn, 1999).

Children with autism who have high neurological thresholds require intense or frequent sensory input to respond. When children have low registration, they do not notice sensory events in daily life that others notice readily. They may not notice when other people come into the room or food or dirt on their face and hands. Adults may have to call the child’s name several times or use additional cues such as touching to get the child’s attention. Children who are sensory seekers enjoy sensory experiences and find ways to enhance and extend sensory events in daily life. They like physical movements such as climbing, twirling, swinging, and bouncing. They search for additional sensory experiences for themselves, such as humming and other mouth noises, touching objects, feeling vibrations, wearing perfume, and smelling flowers (Brown et al., 2001; Dunn, 1997; Dunn & Brown, 1997).

Children with autism who have low neurological thresholds, or are sensory sensitive, notice stimuli and sensory events more frequently in daily life than others do. Movement, sounds, or smells easily distract them while in groups of people. They notice food textures and temperatures more readily than others do. They may be uncomfortable with clothing tags, elastic or certain fabric textures. Their high rate of noticing while continuing to experience all of these is a more passive responding strategy than is seen in sensation avoiders. Sensory avoiders find ways to limit sensory input throughout the day. They stay away from distracting settings. For example, a child might leave the room if others are moving, talking or bumping into them. They create rituals for daily routines,
which may be an active strategy to generate only familiar, predictable sensory patterns for themselves. They also become unhappy when these rituals are disrupted perhaps because of increasing unpredictability (Brown et al., 2001; Dunn, 1997; Dunn & Brown, 1997).

The Alert Program Model

The Alert Program assists students in understanding their bodies and their own state of arousal. The Alert Program consists of teaching tips, discussions, and activities that promote awareness of how children regulate their arousal states while encouraging the use of sensorimotor strategies to manage a child’s level of alertness when it is less than ideal. This awareness and repertoire of strategies enhances the ability to learn, interact with others, and work or play in their environments (Williams & Shellenberger, 1994). Sensory Stories, which are adapted for each individual child, describe situations in which the child learns what to expect in a given situation and then ways to cope with unpredictable sensory stimuli that may be present.

The Alert Program and Sensory Stories draw from some of the same theories. Arousal can be considered a state of the nervous system, describing how alert one feels. To attend, concentrate, and perform tasks in a manner suitable to the situational demands, one’s nervous system must be in an optimal state of arousal for that particular task (Mercer & Snell, 1977). Self-regulation is the ability to attain, maintain, and change arousal appropriately for a task or situation.

Development of self-regulation in the normal nervous system has been separated into three functional levels (Getter, Richter & Frick, 1993). The “second order” self
regulation strategies are developed as infants begin to search visually, monitor, and direct their eyes, to attend selectively, to use adaptive movement and to vocalize in patterns to organize their arousal states appropriately for a situation. As children develop, they become more sophisticated in their ability to choose, use and refine sensorimotor strategies for self-regulation. The “third order” self-regulation strategies require higher level cognitive skills for problem solving, self-monitoring, recognition of need for arousal state change or maintenance, sustained attention, and the formulation, execution, and evaluation of strategies. The Alert Program focuses on third order self-regulation (Williams & Shellenberger, 1996), providing students with information to help them recognize the need for arousal state change or maintenance. Sensory Stories also offer strategies that children can access to change their arousal states.

No empirical studies on the Alert Program were found for children with autism (Baranek, 2002). It may be that this is a recently developed program and has not been subjected to empirical tests.

SOCIAL STORIES

Children with autism who have deficits in sensory processing and communication frequently have behavior difficulties because they don’t understand their world very well and they are not effective in getting their wants and needs met (Parent Information Center, 2002). Children with autism tend to be visual learners living in a very auditory world (The National Autistic Society, 2001). Because children with autism are easily frustrated and often misunderstood, their behavior is frequently not like that of other
students. Sometimes they do not understand how to do what other students do. Sometimes they try to control their world using behaviors and strategies other children don’t usually need to use. Unless the cause of the behavior is addressed in some way, the behavior is likely to keep recurring. By improving communication and teaching the child social strategies he or she can access, behavior often improves (Hodgon, 2000).

Social Stories were developed by Carol Gray in the mid 1990’s. The stories are an instructional technique that teaches social skills through improved social understanding and the extensive use of visual materials. They help parents and professionals understand the perspective of the student while at the same time providing the student with information regarding what is occurring in a given situation and why (Gray & Garand, 1993).

A growing understanding of social cognition in autism and a belief that this understanding should be reflected in how social behavior is taught to students are the foundations behind Social Stories. Children with autism have impairments that impede their ability to “read” and understand social situations and to formulate appropriate responses. Experiences with Social Stories indicate that some students with autism may be more impaired in their access to accurate social information than in their ability to understand and respond appropriately to it (Dawson & Fernald, 1987).

Only one study was found that provides support for the use of Social Stories with children with autism (Swaggert et. al, 1995). Informal case reports and experience with Social Stories suggest they may be effective for individuals from preschool through adult, especially those who are interested in letters or numbers, and/or who are able to comprehend written material.
Traditional teaching involves interaction between teacher and student, creating a social situation whenever instruction occurs. Considering that social interactions are difficult for students with autism, the use of traditional instruction to teach social behavior presents the student with autism with a compounded challenge: understanding the lesson, and accurately interpreting the social cues used in its presentation. Social Stories seek to minimize potentially confusing interactions and to provide students with autism direct access to more socially appropriate behavior. Once the information is presented, new skills are practiced in the targeted situation with needed support (Gray & Garand, 1993).

Authors of Social Stories follow a format involving four basic types of sentences, a rationale defining their relationship and specific guidelines to write and develop each story. The basic Social Story ratio defines the proportion of descriptive, perspective, directive and affirmative sentences in a Social Story. This ratio is maintained regardless of the length of the story, and ensures its descriptive quality. The formula used for most Social Stories is to maintain a proportion of two to five descriptive, perspective and/or affirmative sentences for every directive sentence in a story.

Descriptive sentences are observable statements of fact that identify the most relevant factors in a situation, or the most important aspects of the story topic. They are opinion-free. Descriptive sentences are the only required type of sentence in a Social Story and are the most frequently used. They form the story's "backbone". Descriptive sentences often contain the answer to the important "wh" questions-who, what, where, when and why- that guide the development of a Social Story. The objectivity of these sentences result in a story that is logical and accurate- two qualities that are likely to be reassuring
to those who are frequently overwhelmed or confused by social concepts and situations. For example, the story may say- "My name is ____; Many children like to play on the playground; Sometimes my grandma reads to me."

The second type of sentence used is a perspective sentence. They are statements that refer to, or describe, a person's internal state, their knowledge/thoughts, feelings, beliefs, opinions, motivation, or physical condition/health. They are most frequently used to refer to the internal status of other people. For example- "My sister usually likes to play the piano; Some children work hard so their assignment will be finished before recess; sometimes, people feel sick when they eat too much; some children believe in the Easter bunny."

Directive sentences identify a suggested response or choice of responses to a situation or concept. It is important to consider the possibility of literal interpretation. For example, beginning a directive sentence with "I will" or I can" may mislead a child who may believe the response must be completed exactly as written to be correct. Instead, directive sentences often begin with "I will try to" or I will work on". These sentences may also be stated as a series of response options. These sentences gently direct a student's behavior. For example-"I will try to stay in my chair; I may ask Mom or Dad for a hug; On the playground, I may decide to play on the swings, on the monkey bars, or maybe with something else."

The last type of sentence used in Social Stories is an affirmative sentence. They enhance the meaning of surrounding statements, often expressing a commonly shared value or opinion. The role of an affirmative statement is to stress an important point, refer to a law or rule, or reassure the student. Typically they immediately follow a
descriptive, perspective, or directive sentence. For example- “This is a good idea; This is very important; This is a safe thing to do” (Gray, 1999).

INTERVENTION USING SENSORY STORIES

Sensory Stories are based on the principles of Social Stories. Sensory Stories do not currently use a certain ratio of sentences. A situation is described and sensory activities are incorporated into the story. An example during circle time would be an explanation of the purpose of circle time. For example-: “Children go to school to learn; When the children are on the floor, the teacher might read, do the calendar or teach something new.” Expectations of a child’s behavior are established. For example-: “The teacher wants children to be quiet and sit still with their legs crossed; The teacher does not want children to touch each other or to move around.” It also validates the feeling a child may have such as “sometimes sitting still and being quiet is hard to do.” Sensory Stories then offer tools which a child can access or an adult can give to a child to better tolerate circle time. For example-: “When the teacher calls the class to sit together on the floor, I get my sock buddy or fanny pack; I give myself three big hugs; Next, I put my hands flat on the floor beside me. I push on my arms and slowly rock back and forth; I take deep breaths to help me listen and learn.”

Sensory Stories (Marr, personal communication, September 18, 2002) use the format of Social Stories to address needed sensory input. The idea of Sensory Stories was
developed by Debbie Marr and Tory Nackley to equip the child with measures to confront sensory components of typical activities. These measures draw from sensory integration theory and the Alert Program principles.

A child who tends to respond aversively to various types of sensory input is thought to have difficulties modulating sensory input. In order to address the modulation difficulties, sensory input is encouraged to counteract the unpleasant sensory stimuli. Deep touch pressure, slow movement activities, and heavy work activities that provide active resistance to movement tend to have a neutralizing effect on the child. Through the use of these calming sensory experiences, the child can better tolerate sensory aspects of daily activities. In some cases, the suggested strategies are designed to dampen the sensory input so the child can tolerate the input without a behavioral outburst. Both types of strategies are consistent with sensory integration treatment principles.

The techniques used in Sensory Stories address the sensory processing problems related to the auditory, vestibular, proprioceptive, tactile and visual systems. Using Sensory Stories requires a basic understanding of sensory system functioning and of which systems are stimulated in specific tasks.

Sensory stories are based on the individual child’s needs, addressing the over- or under-responsiveness to sensory information. By reading the Sensory Stories to the child, he or she can learn strategies to participate in social events and develop a schema of socially acceptable behaviors to use within every day situations.
SUMMARY

Children with autism often show significant delays in the domains of communication, emotion recognition, empathy, and social skills (Happe, 1994; Wing, 1990). These children often fail to process subtle stimuli such as expressed emotions and are overwhelmed by the complexity of social settings. Children with autism often display inappropriate coping strategies such as withdrawal or severe tantrum behavior.

The ability to respond to sensation with appropriate physical and emotional responses depends on effective integration of perceptual and sensory information (Watling, Deitz & White, 2001). Jean Ayres (1972) described the process of sensory integration as the "organization of sensation for use" (p. 1), stating that integration of sensory information was necessary for a child to interact effectively with his or her world. Children with autism who do not acquire developmentally mature perceptual and sensory integrative abilities often display inappropriate emotional and physical responses to environmental stimuli (Williamson & Anzalone, 1997).

Sensory processing is a core feature of our humanity. Understanding the nature of one's sensory processing needs provides background knowledge for constructing daily life routines and contexts that are respectful of the nervous system's needs for balance of excitation and inhibition (Dunn, 2001).

Sensory integration approaches are the most widely researched intervention within pediatric occupational therapy (Miller, 2003). Much of this research indicates that sensory integration approaches are effective in increasing children's motor, sensory
processing and academic skills. Sensory Stories reflect the concepts of a sensory integrative approach while providing visual prompts to make expectations clear and understood by the child.
CHAPTER 3

METHODOLOGY

This chapter describes the methodology employed in this study. The design, procedures, sampling methods, and data analysis are discussed.

RESEARCH DESIGN

An ABA, single subject, experimental research design with a replication across 5 subjects was implemented. During the baseline and follow up periods, the children received their regular therapy services. During the intervention period, the children continued to receive their regular therapy services and in addition were read a Sensory Story before circle time.

Measurements were taken every day during a 5-week summer program. The class was in session 4 days a week. Baseline measurements were taken for 4 days. Intervention was provided the following 8 days. Follow up data were collected for the four remaining days.
RESEARCH OBJECTIVE

Using a sample of children aged 5-10 years old with documented autism spectrum disorder the research objective was to:

1. Compare the effects of Sensory Stories on stereotypic behaviors in children with autism before, during and after Sensory Story intervention. Targeted behaviors were defined for each child. The behaviors observed included spontaneous vocalizations, repetitive movements and non-purposeful behavior. Measurements were taken during baseline, Sensory Story intervention, and follow up periods.

SUBJECT SELECTION

A sample of convenience from one classroom was selected. Five children ranging in age from 5-10 years old with documented autism spectrum disorder were selected.

The participants attended the Franklin County Educational Service Center’s STACK (Structured Teaching for Autistic and Communication Delayed Kids) program. The children were part of an optional summer program that the parents chose for them to attend. Inclusion criteria were that the child had a diagnosis of autism spectrum disorder. Three of the five subjects also displayed significant sensory processing difficulties as evidenced by his or her score on the Sensory Profile. The remaining two children scored a definite difference in up to two out of nine categories on the Sensory Profile, but it was not felt that they had significant sensory processing issues. Children who demonstrated a definite difference in atypical responses in any category of the
Sensory Profile were included. Each child received occupational and speech therapy services. The children were free of visual or hearing impairments, and were able to understand simple stories (i.e., has 2-year-old language comprehension.). Information was obtained from the child's multifactored evaluation (MFE) which is a mandatory part of his or her cumulative school file. The child's comprehension level was determined through assessment by the child's speech language pathologist.

A letter including an explanation of the purposes and procedures of the study, as well as requesting written consent for their child's participation, was sent to parents or guardians of children selected for the study before data collection occurred on that child. Appendix A contains a sample of the parent consent forms sent to parents or guardians.

INSTRUMENTATION

Sensory Profile

The caregiver of each child completed the Sensory Profile (SP). See Appendix B for the Sensory Profile. Each item described the child's response to various sensory experiences. The SP consists of 125 items grouped into three main sections: Sensory Processing, Modulation, and Behavioral and Emotional Responses. The Sensory Processing section indicates the child's responses to basic sensory stimuli. Sensory processing is further broken down into six sensory processing systems: auditory, visual, vestibular, touch, multisensory, and oral sensory processing (Dunn, 1999).

The caregiver reported the frequency with which these behaviors occurred (Always, Frequently, Occasionally, Seldom, and Never). The author then analyzed these scores.
using criteria in the manual. The total score was used to categorize each child as typical performance, probable difference or definite difference. Subscores according to the Sensory Profile factors were recorded.

The research on the Sensory Profile took place from 1993-1999, and included more than 1,200 children with and without disabilities between the ages of 3 and 14 (Dunn 1999). Children with pervasive development disorders were included in the sample. The reliability of the Sensory Profile was estimated by examining the internal consistency of the subscales. Cronbach’s Alpha coefficient ranged from .47 to .91 for the various scale sections (Dunn, 1999).

Behavioral Measures

The method to collect behavioral data was time sampling, which focused on selected aspects of each child’s behavior as it occurred within specified intervals of time. The term sampling conveys the basic idea of interval recording. Behavior is sampled rather than recorded every time it occurs during the observational period. Time sampling implies that brief observations are made at specified times during the day. Such time sampling requires that the target behaviors have a moderate to high frequency of occurrence (Sattler, 2002).

Partial interval time sampling (Sattler, 2002) was used in this study. The observational period was divided into intervals of 10 seconds in length with a 5-second interval after this for recording purposes. Data were collected during the entire circle time routine, however, behaviors for 15 minutes were rated. The presence or absence of the predefined target behavior was recorded at each interval. A behavior was scored only
once if it occurred at some point during the 10-second interval. If a behavior lasted the entire interval it was scored as “1”. If it occurred momentarily or three times in a row it was also only scored as “1”. Each child was scored in all behavior categories during the baseline measurements. The author continued measuring these behaviors during intervention and follow up measurements.

An audiocassette tape provided an auditory cue for every 10-second interval (“observe 1”) and the following 5-second recording interval (“record 1”). The daily recording of behaviors was recorded using the traditional stroke method (vertical line written down). See Appendix C for behavior tally sheet. Behaviors were rated for the initial 15 minutes of circle time after the Sensory Story was read. At the end of the 15-minute observational period, the tally marks were totaled for each child.

The circle time routine was videotaped in an unobtrusive manner from two corners of the room. The two perspectives ensured that the children could be well seen and all behaviors noted. The videotapes were then used to score the children’s behavior and to evaluate inter-rater reliability. A second person other than the investigator completed the videotaping. The videotapes and measurement forms were viewed and scored by the author and one additional occupational therapist. The other occupational therapist scoring the tapes viewed and scored 42% or eight days of videotape. She was given a brief explanation by the researcher regarding scoring. This occupational therapist has more than five years of experience in the school system.

The protocol was piloted on four children to refine the scoring method and evaluate its feasibility in the classroom. The children were videotaped using the established protocols. The four children were scored on all behaviors. The tape was scored by this
investigator and another therapist to evaluate reliability. The behaviors could be scored for each time period. Raters agreed on the presence of a behavior 86.3% of the time.

BEHAVIORAL DEFINITIONS

The following behaviors were measured during the baseline, Sensory Story intervention, and follow up period on each child. 1) Spontaneous vocalizations: When a child is talking or producing vocalizations when it is not their turn, they have not been called on by the teacher, or is not part of the usual circle time routine. 2) Repetitive movements: Stereotypic movements, such as hand clapping, arm flapping or rocking. 3) Nonpurposeful behavior: Perseverative playing with one's own clothing, such as fiddling with shirt collar, threads, zippers, buttons, pockets, pants or socks.

INTERVENTION

One story was introduced in this study. The original authors titled the story “Floor Time” but for the purpose of this study it was changed to “Circle Time” as this specific classroom calls it this. (See Appendix C for Circle Time story). The authors of Sensory Stories encourage adaptation of the stories to best fit the environment and circumstances.

During the intervention phase, the classroom teacher read the same story to the group of children immediately before the daily circle time began. The teacher read to the group and showed them the pictures as she read. Each page had a picture at the top of the page and the words were at the bottom. The original authors used the wording “sit together on
the floor” but this was changed to “sit together in chairs” because the children were required to sit in chairs. Also, each page had pictures of children unfamiliar to the participants in this study. This author retook the pictures of the children used in the study to make it more suitable to this class. A copy of the Sensory Story was also left in the reading area for the children to read. Other Social Stories written for the class were placed here.

The strategies used in the Sensory Stories such as the fanny pack and sock buddy were introduced through demonstration of appropriate use and written rules for their use. Each child needed to demonstrate appropriate use of the items before allowing them to be a choice for circle time.

PROCEDURES

Single subject research studies a single individual or system by taking repeated measurements of one or more dependent variables and systematically applying and sometimes, withdrawing or varying the independent variable (Wolery & Ezell, 1993). These studies almost always involve more than a single person. The name, single subject, originates from the fact that each participant serves as his or her own control. In other words, data are repeatedly collected on each participant and then the trends and variability in data are analyzed for each participant.

The baseline period was a time period where measures of the behavior were taken under natural conditions. The children participated in the circle time routine as part of their usual day. Measurements were taken the first four days of the program. Sensory
Story intervention was implemented for the following eight days and daily measures were recorded. Then the Sensory Stories were withdrawn and ratings were taken for the remaining four days of the summer program.

DATA ANALYSIS

The most common form of analysis of single subject research design is visual inspection of the graphed measurements of the dependent variable (Parsonson & Baer, 1978). The vertical axis displays the value of the dependent variable. The baseline, intervention and follow up time periods are displayed on the horizontal axis. Daily counts of the targeted behaviors are graphed. Total scores representing each child’s behaviors are plotted for each day. These data points are analyzed visually for significant differences within and between phase differences.

Binomial distribution was used to determine if behaviors during intervention were significantly different than the initial baseline phase. Similar analyses were conducted to determine if second baseline values were significantly lower than the initial baseline median. Assuming that the null hypothesis is true, there is an equal chance that half the points are above the median for baseline and half the points are below. The first baseline (phase 1) median was recorded. The intervention (phase B) data were recorded as the points above (M+) the median and the points below (M-) the median. P values less than or equal to .05 were considered statistically significant. The same process was completed comparing the second baseline period with the initial baseline phase.
After the initial binomial test of significance was completed, a combined test (Winer, 1971) of significance was completed. This combined data for all the subjects to determine if the results were significant when put together.
CHAPTER 4

RESEARCH RESULTS

This chapter describes the results of the data analysis. Characteristics of the subjects are described. Observations and data analysis for the research objective is presented. Interrater reliability for the data collection instrument is presented.

DESCRIPTION OF THE SAMPLE

A total of 5 subjects participated in this study. The parents of these subjects all voluntarily enrolled them in a 5-week summer program. The gender distribution of the sample was 2 girls, aged 7 and 9 years old, and 3 boys, aged 5, 9 and 10 years old. All the subjects received school-based occupational therapy, speech and language therapy and adapted physical education services during the school year. Figure 4.1 lists their Sensory Profile scores. Following is a synopsis of each of the subjects.

Subject A- This 7-year-old girl is a twin who was adopted from Siberia in 1997. She has mild-moderate autism and also has a cleft palate. Subject A vocalized through noises that were loud enough to be heard but did not involve recognizable words. She attempted to imitate inflections in an adult’s voice. Subject A was easily distractible and played
with her own clothing, such as fiddling with shirt collars, threads, zippers, buttons, pockets, pants or socks. Subject A’s social behavior consisted of repetitive movements such as aimless head spinning, rocking and occasional hand clapping. This child displayed good eye contact with objects she found interesting.

Subject B- This 9-year-old girl is the older of two children in her family. She has a diagnosis of autism. Her speech patterns were both immediate and delayed echolalic in nature. Subject B was easily distracted by her socks and fingers. This child displayed fair eye contact but frequently averted her eye gaze when asked direct questions. Subject B seemed oblivious to environmental stimuli such as someone walking in the door or another child sitting to close to her.

Subject C- This 9-year-old boy is the older of two children in his family. He has a diagnosis of autism. This child could answer familiar questions asked of him. He yelled or repeated “No” when specific routines were interrupted. This child displayed good eye contact with people and objects.

Subject D-This 5-year-old boy is an only child. He has a diagnosis of autism with Asperger’s as a secondary diagnosis. He received intensive Applied Behavior Analysis (ABA) therapy throughout the year. Through his ABA therapy he received one on one instruction daily using the Picture Exchange for Communication System (PECS). Through the PECS system he made choices about what activities he wanted to do or foods he wanted to eat. He communicated primarily thorough unrecognizable babble but
was also echolalic in response to adult prompting. This child had good eye contact.
Subject D displayed some hand clapping, arm flapping and arm clapping, rocking and
spinning. This child would play with his clothing and was easily distracted by irrelevant
stimuli in his environment such as a pencil or something on a table.

Subject E- This 10-year-old boy is an only child. He has a diagnosis of autism. This
subject vocalized through noises that were loud enough to be heard but did not involve
any recognizable words. Poor eye contact was evident. He did not verbally respond or
consistently select a choice given to him. Subject E had a persistent preoccupation with
parts of objects within his reach.

Each parent was given the Sensory Profile to complete. Figure 4.1 shows in which
categories each subject scored a definite difference. A definite difference score is 2
standard deviations below the mean. Scores that fall within this range indicate sensory
processing problems. This range indicates that the child is performing like a child in the
lowest 2% of the research sample.

The questionnaire that each caregiver filled out was organized to provide a way to
consider each child’s pattern of performance (Dunn, 1999). Explicit patterns indicating
high or low thresholds can be evident. Each item in the questionnaire is coded with an H
or an L indicating the thresholds level. An L indicates that the item contributes to low
threshold information (either indicates sensory sensitivity or sensory avoiding patterns of
performance). And H indicates that the item contributes to high threshold information
(either indicates poor registration or sensory seeking patterns of performance). Some
children may have a scattering of scores across items within a section, while other children will have a more distinct pattern in which they have higher scores for one threshold group and lower scores for the other threshold group.

Subject A displayed a scattered pattern along high and low threshold items in the categories of oral sensory sensitivity and inattention/distractibility. This suggests that this subject had poor modulation of sensory input, which may interfere with daily activities. Subject A also displayed high threshold patterns, as she was a sensory seeker seeking out movement activities. She also displayed low threshold patterns, or sensory avoiding patterns, for sensory activities involving tactile items.

Subjects B and C displayed a consistent pattern throughout the Sensory Profile. They each scored in the typical performance range in up to seven out of nine categories on the Sensory Profile. Although each had a diagnosis of autism, neither one displayed a sensory processing difficulty through this assessment. These two subjects were included in the study due to their diagnosis of autism and from observations in the classroom setting.

Subject D did not demonstrate a particular pattern in responses on the Sensory Profile. In each of the categories responses were scattered and inconsistent. He displayed a high threshold pattern, as he sought out movement stimulation. He also displayed a low threshold pattern, or sensory avoiding patterns for sedentary activities and fine motor/perceptual tasks.

Subject E demonstrated the same inconsistent pattern as Subject D. Within each category he had low threshold responses and high threshold responses. The subject displayed a high threshold pattern, or sensory avoiding pattern as was evident from his
poor registration of sensory input. He also displayed a low threshold pattern, or sensory
avoiding patterns for sedentary activities and fine motor/perceptual tasks.

<table>
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<th>Emotionally Reactive</th>
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<th>Oral Sensory Sensitivity</th>
<th>Inattention/ Distractibility</th>
<th>Poor Registration</th>
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</tr>
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</table>

Figure 4.1: Scores of "definite difference" on the Sensory Profile
INTERRATER RELIABILITY

The data collection form consisted of a column for each child in which spontaneous vocalizations, repetitive movements, non-purposeful behavior and the number of prompts given could be tallied. One additional occupational therapist with more than five years of experience in the school system viewed 42%, or eight days of videotape. She then scored the observed behaviors and prompts given to each subject. Reliability was determined on individual behaviors for each day and the total number of prompts given each week. Initial analysis of interrater reliability for the first week scored was 76% agreement for behaviors (38/50) and 77% agreement for prompts given (10/13). The second week scored was 92% reliable for behaviors (196/213) and 84.5% reliable for prompts given (98/116). Discrepancies in scoring were seen in the interpretation of repetitive movements and non-purposeful behaviors.

FINDINGS RELATED TO BEHAVIORAL CHANGES

Stereotypic Behaviors in Children with Autism

To analyze the research objective, to determine the effect of Sensory Stories on stereotypic behaviors in children with autism, behaviors were observed during baseline (phase A), Sensory Story intervention (phase B) and follow up period (phase A). During the intervention phase, Sensory Stories were read prior to the circle time routine. The classroom teacher read the Sensory Story before circle time began. During the follow up
period (phase A) the Sensory Stories were removed. An absence can be seen on the visual data graphs as missing points for those days and no line is connected to that specific day.

The following behaviors were measured during the baseline, Sensory Story intervention, and follow up period on each child. 1) Spontaneous vocalizations: When a child is talking or producing vocalizations when it is not their turn, he or she has not been called on by the teacher, or is not part of the usual circle time routine 2) Repetitive movements: Stereotypic movements, such as hand clapping, arm flapping or rocking. 3) Nonpurposeful behavior: Perseverative playing with ones own clothing, such as fiddling with shirt collar, threads, zippers, buttons, pockets, pants or soaks.

During each of the observation phases, the use of verbal, visual, gestural and physical prompts were used. All of the children required a variety of prompts throughout circle time. Prompts were used to provide the support necessary to increase independence and assist in reducing the number of inappropriate behaviors.

Subject A’s behaviors are shown in Figures 4.2-4.3.
Figure 4.2: Number of spontaneous vocalizations during circle time for subject A

Figure 4.3: Number of non-purposeful behaviors during circle time for subject A
Figure 4.4: Number of repetitive movement behaviors during circle time for subject A

The inappropriate behaviors identified for Subject A were spontaneous vocalizations, non purposeful behavior and repetitive movements. This subject had few identifiable words so vocalizations were her way of showing emotion and communicating. Baseline spontaneous vocalizations were demonstrated through occasional screaming and repetitive use of noises. During the intervention period and final baseline period, Subject A continued to demonstrate spontaneous vocalizations through the use of screaming and repetitive use of noises.

During the initial baseline period, Subject A demonstrated non purposeful behavior by playing with her own clothing, such as fiddling with shirt collars, threads, zippers, buttons, pockets, pants or socks. This behavior continued throughout the remainder of the intervention and final baseline period despite use of a variety of prompts to decrease this behavior. The behavior appears to have decreased somewhat during the intervention and returned when the intervention was removed.
Subject A's repetitive movements consisted of aimless head spinning, rocking and occasional hand clapping. The behavior seems to have decreased during intervention and returned when the intervention was removed.

The results for Subject B are presented in Figures 4.5 and 4.6.

Figure 4.5: Number of non-purposeful behaviors during circle time for subject B
Subject B displayed non-purposeful behavior primarily in the final baseline period when the intervention was taken away. Her nonpurposeful behaviors included fiddling with her socks and picking at her fingers.

Subject B exhibited spontaneous vocalizations through stereotyped and repetitive use of language. Her speech patterns were both immediate and delayed echolalic in nature. These vocalizations decreased during intervention using Sensory Stories and remained below baseline when the intervention was removed.

The results for Subject C are presented in Figures 4.7 and 4.8.
Figure 4.7: Number of spontaneous vocalizations during circle time for subject C

Figure 4.8: Number of repetitive movements during circle time for subject C

Subject C displayed infrequent spontaneous vocalizations and repetitive movements. If other children in the classroom were demonstrating behaviors, if the circle time routine
was interrupted or if this subject did not get a wanted turn at circle time, his behaviors increased.

Spontaneous vocalizations were in the form of yelling or saying “No” over and over. Repetitive movements included rocking and covering his ears and hand flapping. These behaviors appear to decrease during the interventions. Spontaneous vocalizations reappeared when intervention was removed. Repetitive movements remained very low in the follow up phase and were observed only one time in the three follow up measures.

The results for subject D are presented in Figures 4.9-4.11.

Figure 4.9: Number of spontaneous vocalizations during circle time for subject D
Figure 4.10: Number of repetitive movements during circle time for subject D

Figure 4.11: Number of non-purposeful behaviors during circle time for subject D
Subject D behaviors included spontaneous vocalizations, repetitive movements and nonpurposeful behavior. This child had a lack of spoken language and primarily used noises to show emotion and to communicate.

Spontaneous vocalizations were constant for Subject D. He displayed unrecognizable babble but could imitate others’ voice inflections in response to some questions. Spontaneous vocalizations diminished during intervention, but returned to previous levels during the follow up phase.

Repetitive movements were demonstrated as some hand clapping, arm flapping and arm clapping, rocking and spinning. These behaviors were slightly lower during the intervention and follow up periods.

Nonpurposeful behaviors were observed throughout circle time daily for this subject. He would play with his clothing, such as fiddling with shirt collars, threads, zippers, buttons, pockets, pants or socks. He would touch things in his vicinity, such as playing with a pencil or edges of a paper, trailing hands on or along the tabletops or rubbing pant legs. Subject D demonstrated decreased nonpurposeful behaviors during the Sensory Story intervention. These escalated when the intervention was removed.

Subject E’s results are presented in Figures 4.12-4.14.
Figure 4.12: Number of spontaneous vocalizations during circle time for subject E

Figure 4.13: Number of repetitive movements during circle time for subject E
Figure 4.14: Number of non-purposeful behaviors during circle time for subject E

Subject E demonstrated spontaneous vocalizations, repetitive movements, and nonpurposeful behavior. This subject had no spoken language and communicated through the use of noises only.

This subject’s spontaneous vocalizations also related to his repetitive movements. When his hand clapping increased, so did his spontaneous vocalizations. His repetitive movements were primarily evident with hand clapping right in front of his face or tunneling at his ear.

This subject demonstrated non purposeful behavior such as playing with his own clothing, sucking or chewing on his shirt collar, fanny pack belt or any other item given to him. These non-purposeful behaviors were lowest when the Sensory Story intervention was applied.
DATA ANALYSIS

To determine if individual results were significant, binomial tests were used to see if the values were lower than the median for the initial baseline phase. Binomial tests were used to determine if the children improved during intervention and follow up phases compared to the first baseline phase. Assuming that the null hypothesis is true, there is an equal chance that half the points in the intervention phase are above the median for baseline and half the points are below. The first baseline (phase 1) median is recorded. The intervention (phase B) data are recorded as the points above (M+) the median and the points below (M-) the median. P values less than or equal to .05 are considered statistically significant. The same process was completed comparing the second baseline period with the initial baseline phase.

After the initial binomial test of significance was completed, a combined test (Winer, 1971) of significance was completed. This combined the data for all the subjects to determine if the results were significant when put together. Use of these statistical procedures is illustrated by the data in Figures 4.15-4.17.
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<tr>
<td>E</td>
<td>5</td>
<td>0 7</td>
<td>.008</td>
<td>2 2</td>
<td>.687</td>
</tr>
</tbody>
</table>

Figure 4.15: Data analysis of spontaneous vocalizations

Spontaneous vocalizations were significantly decreased during intervention in Subjects B and E. When the intervention was removed, spontaneous vocalizations did not differ from the baseline phase. When examining the effect of Sensory Stories on spontaneous vocalizations for all the subjects, the value for the initial baseline phase was .041, indicating a significant decrease in spontaneous vocalizations. There was not a significant decrease in spontaneous vocalizations when the follow up period was compared to the first baseline phase ($p = .897$).
<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>PHASE A (1ˢᵗ) MEDIAN</th>
<th>PHASE B M+ M-</th>
<th>P</th>
<th>PHASE A M+ M-</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
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<td>2 3</td>
<td>.500</td>
<td>3 0</td>
<td>1.000</td>
</tr>
<tr>
<td>B</td>
<td>0</td>
<td>2 0</td>
<td>1.000</td>
<td>4 0</td>
<td>1.000</td>
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<tr>
<td>C</td>
<td>NA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>2</td>
<td>2 3</td>
<td>.500</td>
<td>4 0</td>
<td>1.000</td>
</tr>
<tr>
<td>E</td>
<td>3.5</td>
<td>2 5</td>
<td>.227</td>
<td>4 0</td>
<td>1.000</td>
</tr>
</tbody>
</table>

Figure 4.16: Data analysis of non-purposeful behavior

Non purposeful behaviors did not change during the intervention for any of the subjects. When the intervention was removed, non-purposeful behaviors did not differ from the baseline phase. When combining all subjects, non-purposeful behaviors were no different in baseline and intervention phase (p=.677). When the initial baseline phase was compared to the final baseline (p=.444), there was no significant change in non-purposeful behaviors during follow up.
<table>
<thead>
<tr>
<th>SUBJECT</th>
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<th>PHASE B</th>
<th>P</th>
<th>PHASE A (2&lt;sup&gt;nd&lt;/sup&gt;)</th>
<th>P</th>
</tr>
</thead>
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<tr>
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<td></td>
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<td>3</td>
<td>0</td>
<td>6</td>
<td>.016</td>
<td>0</td>
</tr>
<tr>
<td>E</td>
<td>5.5</td>
<td>0</td>
<td>7</td>
<td>.008</td>
<td>1</td>
</tr>
</tbody>
</table>

Figures 4.17: Data analysis of repetitive movements

Repetitive movements were significantly decreased during intervention in all the subjects. When the intervention was removed, repetitive movements did not differ from the baseline phase. In a combined test of significance on all the subjects, p = < .001, indicating a significant decrease in repetitive movements from baseline to intervention. When the follow up period was compared to the baseline phase, p = .223, indicating that the intervention effects did not carry over once Sensory Stories were discontinued.
Prompts Used During Circle Time

Another important observation observed during this study was the number of prompts used to help the children stay on task. The use of prompts was not consistent on a daily basis for any of the subjects. Therefore the data are descriptive in nature.

Visual prompts aided in giving directions through the use of cards with classroom rules on them. Pictures of the expected behavior, along with written word were on the cards. For example, sit down, hands in lap, quiet mouth, feet on floor were illustrated on the cards.

Verbal prompts were sometimes paired with the visual prompts to reinforce expected behavior and for those who did not visually attend to the cards. Gestural prompts included pointing to a chair with the expectation of the child sitting down. These were also paired with either a visual and/or verbal prompt. Physical cues were used if a child needed to be physically guided back to group or away from an undesirable behavior such as touching someone else or hitting a staff member. The following figure shows how many total prompts were provided for each of the measurement phases during the study's phases.
<table>
<thead>
<tr>
<th>Subject</th>
<th>Use of Prompts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(verbal/visual, gestural, physical)</td>
</tr>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>A</td>
<td>22</td>
</tr>
<tr>
<td>B</td>
<td>11</td>
</tr>
<tr>
<td>C</td>
<td>7</td>
</tr>
<tr>
<td>D</td>
<td>15</td>
</tr>
<tr>
<td>E</td>
<td>39</td>
</tr>
</tbody>
</table>

Figure 4.18: Number of prompts provided for each observation phase.

Subject A responded to verbal and visual prompts separately although most directives were visual prompts paired with verbal prompts. If she did not want to follow a prompt given to her she would shake her head, say no and look away from the person or visual prompt given. It appears that the number of prompts given decreased during intervention and increased when the intervention was removed.

Subject B responded to verbal prompts as well as visual prompts when presented individually and together. When participating in an inappropriate behavior, she responded to her name being called and being shown a visual prompt such as hands down or quiet hands. The number of verbal and visual prompts decreased during intervention using Sensory Stories and increased when the intervention was removed.
Subject C responded to visual and verbal prompts. He was able to follow verbal prompts and requests given to him without the directive also being paired with a picture. If he continued a behavior, a verbal prompt was paired with a visual prompt to reinforce appropriate behavior. The number of visual and verbal prompts used seems to have decreased during intervention using Sensory Stories and remained at this level when the intervention was removed.

Subject D needed verbal, visual and gestural prompts throughout the study. He was often out of his seat and in other people’s space, so this at times required the use of multiple prompts. Subject D demonstrated inconsistent results. Visual prompts increased during the intervention using Sensory Stories and increased during the final baseline period. Verbal and visual prompts provided seem to have decreased during the intervention period and significantly increased in the final baseline period. Gestural prompts, although low in the first baseline period and during intervention, increased in the final baseline period.

Subject E required multiple uses of prompts due to his behavior. He would rarely attend to only visual prompts but did respond to simple verbal directives paired with a visual cue. He needed gestural cues such as a finger pointing to a chair to sit down and also needed physical prompts if he would not sit down or was touching something he shouldn’t. Verbal, visual and gestural prompts decreased during intervention and returned when the intervention was removed. Physical prompts for Subject E decreased during intervention and then slightly increased when the intervention was taken away.
CHAPTER 5

DISCUSSION AND CONCLUSION

This chapter presents a discussion of the results found in this research study. Efficacy of sensory integration is discussed. Stereotypic behaviors in children with autism are compared during baseline, Sensory Story intervention and follow up periods. The use of prompts to facilitate task behavior is also discussed. Implications for clinical practice and the limitations of the study are discussed. Recommendations for further research and conclusions are presented.

DISCUSSION OF RESULTS

The objective of this study was to evaluate the effectiveness of Sensory Stories on stereotypic behaviors in children with autism during baseline (one week), Sensory Story intervention (two weeks) and follow up periods (one week). The behaviors observed included spontaneous vocalizations, repetitive movements and non-purposeful behavior. The children's behaviors were observed daily during the circle time routine and recorded. This study did not attempt to eliminate these behaviors, but to see if Sensory Story intervention would decrease the frequency of this behavior.

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The goal of Sensory Stories is to teach a child to learn what to expect in a situation and how to cope with the sensory aspects of the experience with a proactive approach. The child develops a schema of socially acceptable behaviors to use within their environment. Sensory Stories allow the children to select sensory input designed to calm their arousal system. Through the use of proprioceptive input or deep pressure, for example, with the weighted fanny pack or sock buddy, the children may be able to meet their sensory needs and lower their arousal. As a result they may reduce other behaviors, such as repetitive movements or spontaneous vocalizations. Use of deep pressure may provide the needed facilitatory or inhibitory influence on the nervous system that results in a behavioral change.

The findings of this study indicate that Sensory Stories were more effective with certain subjects. Subjects B and C, who were hypo-responsive to most sensory stimuli and did not demonstrate a definite difference in more than 2 out of 9 categories on the Sensory Profile, displayed decreases in behavior in repetitive movements and spontaneous vocalizations during intervention. Subject A, who was hyper-responsive to most sensory stimuli displayed a definite difference in 7 out of 9 categories on the Sensory profile showed a significant decrease in repetitive movement behaviors during the intervention. Subject D, who was hyper-responsive to most sensory stimuli showed a definite difference in 6 out of 9 categories and demonstrated a significant decrease in repetitive movements. Subject E who displayed hyper-and hypo-responsive patterns to sensory stimuli had scored a definite difference 7 out of 9 categories of the Sensory Profile and showed significant decreases in repetitive movements and spontaneous vocalizations during the Sensory Story intervention.
All the subjects showed a significant decrease in individual behaviors of repetitive movements and/or vocalizations. Positive results could be attributed to the length of time the sock buddy or fanny pack was worn. Subject A chose the sock buddy on a daily basis. She did not like the sensation of a fanny pack being secured around her. She could only tolerate the sock buddy for a short duration of time after which she began to inappropriately use it and was taught to put it under her chair. When behaviors seemed to increase an adult would try to facilitate her to again wear the sock buddy, but usually again for only a short period of time. The other subjects consistently chose the fanny pack that could be secured around them and did not need it removed due to inappropriate use.

These results support Jang's (1996) conclusion that the application of sensory integrative based treatment may enhance the behavioral response of children with autism. Two other studies (McClure & Holtz-Yotz, 1990; Ziserman 1991) were found to support this theory. These case reports provide interesting data on using variations of touch pressure garments to diminish self-stimulatory behaviors. Both studies assumed the function of the self-stimulatory behaviors was sensation seeking and/or arousal modulation based. Using pressure gloves and elastic wraps but not pressure vests reduced self-stimulation behaviors (Zisserman, 1991).

Given that autistic symptoms are manifested differently across development and that heterogeneity exists within the autism spectrum, there are several reasons why this intervention may have decreased behaviors for some of the subjects but not for others. It is easier for children with autism to process visual information that does not rapidly change (Quill, 2000). One reason for the general decrease in behaviors could be that
Sensory Stories use visually cued instruction to describe social situations in a way that helps children understand social cues and social information. Sensory Stories help to compensate for a child’s difficulty integrating social and language information by using primarily a repetitive and visual stimulus.

Another reason that behaviors may not have decreased, or remained inconsistent could be that each individual child was not assessed as to why he or she was engaged in that pattern of behavior. There are four general schools of thought regarding the origin of stereotypic behavior. The first explanation states that rituals are a means for the child to regulate sensory stimulation (Grandin, 1995; Williams, 1992). The second school of thought presents ritualistic behaviors as a means for the child to create order amid chaos (Muris, 1998). The third theory suggests that ritualized patterns of behavior are the by-product of impaired cognitive function (Ozonoff, 1995; Ozonoff et al., 1991). The last explanation is that the stereotypic behaviors in autism are an expression of poor inhibition and have a neurological basis (Maurer & Damasio, 1982).

This study is consistent with the first explanation and the last explanation in which the rituals are a means for the child to regulate sensory stimulation and is an expression of poor inhibition, which has a neurological basis. This study assumes that if the child receives sensory input as a means to relax or arouse the nervous system, then the child will exhibit more socially acceptable behavior and help the child cope with the situation.

The findings of this study are difficult to interpret because some subjects demonstrated an inconsistent pattern of behavior during the baseline period. A longer baseline period was needed to establish baseline behaviors but was not feasible in the available time frame. Patterns of behavior may or may not have become consistent, but a
longer time period to observe behaviors could have established the typical range of behaviors for each child.

A final reason for inconsistent behaviors could relate to the child’s absences. Subject A was absent 4 days, Subject B and D were absent 3 days, Subject C was absent 2 days and Subject E was absent 1 day.

IMPLICATIONS FOR PRACTICE

This study was designed to examine the effects of Sensory Stories on behaviors in children with autism. The findings indicate that when Sensory Stories are used as part of a child’s educational plan, behaviors decrease. The result of this study has implications for the clinical application of sensory and visually based intervention for children with autism for a number of reasons.

The occupational therapist in the school setting frequently serves as a consultant to the classroom teacher. In the school setting, occupational therapists often work with teachers to develop learning activities and to adapt the classroom environment. Occupational therapists are knowledgeable in recommending sensory-based instructional strategies for children with autism along with others that may benefit from a sensory based approach. These students may demonstrate various sensory, perceptual and/or motor limitations (Baranek et al., 1997b). Although not all children with autism display sensory processing difficulties, this type of difficulty is prevalent in the population and is reported to interfere with performance in many developmental and functional domains
(Baranek, 2002). The Stories were read to the entire group of subjects before circle time, but it is often necessary to individualize instruction based on the needs of the students.

Sensory Stories were effective in decreasing the frequency of socially inappropriate behaviors. The information in the Sensory Stories was presented visually which compensated for the children's difficulty integrating auditory information. It also used the children's strengths in processing visual information. Children with autism are better able to attend to, process, and remember visual material than verbal (Minshew, Goldstein, Muenz, & Payton, 1992). Children with autism can sustain attention to graphic information in the same way as typically developing peers do (Garretson, Fein & Waterhouse, 1990). Sustained attention to concrete visual cues emphasizes relevant social and language information and, thus, can enhance a child’s understanding of social and language messages. Because visual instruction of the Sensory Stories provided the children with a concrete reminder of what to do, it decreased behaviors.

It is important to note that this specific intervention does not claim to be a substitute for another type of curricula. If and when Sensory Stories are utilized, they should be viewed as a supplementary intervention that is integrated at various levels into the individualized program of each child.

**LIMITATIONS OF THE STUDY**

The main purpose of this study was to see if Sensory Stories had any effect on behaviors in children with autism during baseline, Sensory Story intervention and follow periods. The sample of children was very small (n=5). Random sampling was not
possible due to preselecting a classroom and all subjects recruited were included in the study. As a result of using a convenience sample in one self-contained classroom within the Franklin county area, the ability to generalize results is limited. The sample was limited in ethnic and socioeconomic diversity. A replication of this study with more children may produce different results.

Only one other occupational therapist viewed and scored the videotapes. The first week there was 76% reliability for behaviors and 77% reliability for prompts. The second week there was 92% agreement for behaviors and 84.5% agreement for prompts given. The availability of other’s perceptions on behaviors and prompts may have made the results stronger. The tapes were not viewed in random order, therefore the author and other occupational therapist who viewed and watched the tapes had a bias in knowing which phase of the study was being viewed.

RECOMMENDATIONS FOR FUTURE RESEARCH

It would be interesting to replicate this study using Sensory Stories that suggest that children use a variety of sensory modalities such as proprioceptive, vestibular and auditory input. In this study, it appeared that the proprioceptive input did relate to reduction in spontaneous vocalizations and repetitive behaviors. The use of a variety of input, which could be individualized to each child’s preferred sensory preference may also show a similar decline.

Future research endeavors should involve a larger sample with some receiving Sensory Story intervention and some not and allow for a longer treatment period in order
to provide documentation of more functional outcomes of this intervention.

A more individualized approach could be taken to assess why a child is engaged in specific behaviors. Determining the meaning of the behavior would require inquiry into the behavior's antecedent as well as careful observation of other accompanying behaviors and the child's emotional state. Sometimes a child's behavior is in response to other activities going on in the environment. For children who are unable to vocalize their wants and needs, a behavioral response such as increased vocalizations or throwing an object, may be their way of communicating a dislike for something. By analyzing such antecedent behaviors, a more individualized approach to treatment could be used.

CONCLUSION

This study used a single subject design to evaluate the effectiveness of Sensory Stories on stereotypic behaviors in children with autism during baseline, Sensory Story intervention and follow up periods.

Research has shown that there is no conclusive evidence that sensory integrative-based interventions are effective. Results of this study support the idea that sensory integrative input, such as proprioceptive input used in the Sensory Stories, does decrease the amount of stereotypic behaviors in children with autism. Caution must be exercised in interpreting these results due to the small sample size.

Sensory integration as a frame of reference has been useful in assisting occupational therapists, parents, and teachers to understand child behavior in ways that make sense and to intervene (Case-Smith, 1997). Occupational therapists, along with others who work
with children with autism, need a repertoire of strategies to draw upon to meet the individualized needs of the child.

How to support appropriate behavior and reduce socially inappropriate behaviors in children with autism is a highly controversial topic. The behavior-communication-visual strategy of Sensory Stories seems to provide children with a means to develop more appropriate social behaviors.
BIBLIOGRAPHY


Deborah Marr, personal communication, September 18, 2002.


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Protocol Title: Effects of Sensory Stories on Behaviors in Children with Autism Spectrum Disorder

Principal Investigator: Jennifer Sherick

DESCRIPTION OF THE RESEARCH

1. Description of the procedure or treatment. Reason for performing this procedure or treatment.

I agree to volunteer my child as a participant in a research study. I understand the purpose of the research study is to examine the effects of Sensory Stories on the frequency of inappropriate behaviors such as spontaneous vocalizations, aggression, self-injurious behavior, repetitive motor movements, or nonpurposeful behavior that take place during circle time. I understand that the one test (called the Sensory Profile) is a questionnaire that I will fill out to the best of my ability. I understand that during the 5 weeks of the summer program that my child will 1.) Be videotaped by an assistant to the investigator, 2.) A professional will watch my child's performance on the videotape and 3.) A qualified person will tally the number of behaviors observed. I understand that the whole research project will take 5 weeks.

2. Participation in this study is optional and voluntary. Possible appropriate alternative procedures or treatment are:

I can choose not to allow my child to be a subject in this study. If I do choose to allow my child to participate, I know that I can discontinue my child's participation at any time.

3. Discomforts and risks that might reasonably be expected from participation in this study.

There are minimal risks to be expected due to the training and expertise of the staff. My child may be using a weighted fanny pack or a weighted sock buddy as a strategy during the circle time routine. My child will be taught the appropriate ways to use these. My child will be videotaped during a regular circle time. My child will be photographed during a regular circle time routine in order to replace the existing circle time pictures with ones that are familiar to my child.
4. Possible benefits for participants or for society.
As a participant in this study, the treatment of Sensory Stories may be helpful to my child and increase his or her attention to the teacher during circle time. My child’s off task behaviors may decrease with the use of Sensory Stories. Further development of Sensory Stories could provide therapists with a tool to help children cope with sensory stimuli in the school environment.

5. Amount of time it will take (number of sessions; length of each session; period of time):

I understand that my child will be videotaped during circle time through the 5 week program starting June 16, 2003 and ending July 24, 2003. Measurements will be taken 4 days each week. Baseline measurements of circle time behavior will be taken every day until consistency is established. The Sensory Stories will be introduced and data will continue to be taken the same number of days as the baseline period. The remaining days my child’s behaviors will be taken without the use of Sensory Stories.

6. Use of videotapes to collect information for this study.

My child will be videotaped during circle time every day of the 5 week summer program.

7. Access to archival records such as academic records or medical records. List the information that will be obtained from these sources.

My child’s cumulative school records will be accessed to obtain basic diagnostic information and speech and language test scores.

CONSENT:

I consent to my child’s participation in research being conducted by Jane Case-Smith and Jennifer Sherick of The Ohio State University and his/her assistants and associates.

The investigator has explained the purpose of the study, the procedures that will be followed, and the amount of time it will take. I understand the possible benefits, if any, of my participation or my child’s participation.

The investigator has explained the risks, if any, and I understand what they are. No guarantees have been made regarding the effectiveness of this treatment or procedure.

I know that I can, or my child can, choose not to participate without penalty to my child or me. If I give my consent to participate, I can, or my child can withdraw from the study at any time, and there will be no penalty.
I consent to the use of videotapes. I understand how the tapes will be used for this study.

I consent to the use of photographs. I understand how the photographs will be used for this study.

I consent to the use of the following information from my academic or medical records:
Diagnostics, visual impairments, hearing impairments, orthopedic limitations.

I have had a chance to ask questions and to obtain answers to my questions. I can contact the investigator at (614) 445-3760, extension 5149. If I have questions about my rights as a research participant I can call the Office of Research Risks Protection at (614) 688-4792.

I understand in signing this form that, beyond giving consent, I am not waiving any legal rights that I might otherwise have. My signature on this form does not release the investigator, the sponsor, the institution, or its agents from any legal liability for damages that they might otherwise have.

I have read this form or I have had it read to me. I sign it freely and voluntarily. A copy has been given to me.

Name of the participant: ____________________________________________

Date: ____________________________________________________________

Signed ________________________________________________
(Person authorized to consent for participant)

Signed: ________________________________________________________
(Principal investigator)
Dear Caregiver,

Hi, my name is Jennifer Sherick. I am a licensed and registered Occupational Therapist currently working for the Franklin County Educational Service Center. I have been a therapist working with children for 3 years and I have recently been working on my Master's of Science degree at The Ohio State University. In partial fulfillment of this degree I will be conducting a research project at the summer program your child is enrolled in.

My study will focus on evaluating the difficulties your child has with sensory stimuli going on in the environment around him or her. I will evaluate how your child responds behaviorally to the use of Sensory Stories. These stories that are read to your child are designed to help him or her learn strategies to better cope with these incoming stimuli.

If you decide to allow your child to participate, it would mean he/she would be assessed using the Sensory Profile to determine if a sensory need is present. If your child is found to have sensory processing difficulties he/she will be included in the study pending your consent. I will be videotaping the circle time routine daily and taking measurements regarding the amount of verbal, visual, physical and gestural cues needed to attend at circle along with the amount of times your child demonstrates behavior that may need redirection. The whole class will be observed and videotaped in addition to the students that the study will be focusing on.

It is my hope that you will allow your child to participate in this study. Your cooperation will help professionals learn more about how to assist children in coping with unpleasant sensory stimuli in their environment. Your signature on the enclosed permission form will allow your child to participate in this study. Please return the signed permission form by June 9, 2003. Please complete the caregiver questionnaire in the enclosed self-addressed stamped envelope provided. If you have questions regarding this research project, please contact me at (614) 445-3760 ext. 5149.

Jennifer Sherick, OTR/L

Jane Case-Smith, Ed.D., OTR/L

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May 30, 2003
APPENDIX B
Sensory Profile

Winnie Dunn, Ph.D., OTR, FAOTA

Caregiver Questionnaire

Child's Name: ___________________________ Birth Date: ___________________________

Completed by: ___________________________ Relationship to Child: ___________________________

Service Provider's Name: ___________________________ Discipline: ___________________________

INSTRUCTIONS

Please check the box that best describes the frequency with which your child does the following behaviors. Please answer all of the statements. If you are unable to comment because you have not observed the behavior or believe that it does not apply to your child, please draw an X through the number for that item. Write any comments at the end of each section. Please do not write in the Section Raw Score Total row.

Use the following key to mark your responses:

- ALWAYS: When presented with the opportunity, your child always responds in this manner, 100% of the time.
- FREQUENTLY: When presented with the opportunity, your child frequently responds in this manner, about 75% of the time.
- OCCASIONALLY: When presented with the opportunity, your child occasionally responds in this manner, about 50% of the time.
- Seldom: When presented with the opportunity, your child seldom responds in this manner, about 25% of the time.
- NEVER: When presented with the opportunity, your child never responds in this manner, 0% of the time.

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789 10 11 12 A B C D E

0761438059
### Sensory Processing

#### A. Auditory Processing

<table>
<thead>
<tr>
<th>Item</th>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>Responds negatively to unexpected or loud noises (e.g., cries or questions at noise from vacuum cleaner, dog barking, hair dryer)</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Puts hands over ears to protect ears from sound</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Has trouble completing tasks when the radio is on</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Is distracted or has trouble functioning if there is a lot of noise around</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Can't work with background noise (e.g., fan, refrigerator)</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Appears to not hear what you say (e.g., does not &quot;tune in&quot; to what you say, appears to ignore you)</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>Doesn't respond when name is called but you know the child's hearing is OK</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>Enjoys strange noises/noises to make noise for noise's sake</td>
</tr>
</tbody>
</table>

#### B. Visual Processing

<table>
<thead>
<tr>
<th>Item</th>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>Prefers to be in the dark</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Expresses discomfort with or avoids bright lights (e.g., hidden from sunlight through window in car)</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Happy to be in the dark</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Becomes frustrated when trying to find objects in competing backgrounds (e.g., cluttered drawer)</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Has difficulty putting puzzles together (as compared to same age children)</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Is bothered by bright lights after others have adapted to the light</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>Covers eyes or squints to protect eyes from light</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>Looks carefully or intently at objects/people (e.g., stares)</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>Has a hard time finding objects in competing backgrounds (e.g., shoes in a messy room, favorite toy in the &quot;junk drawer&quot;)</td>
</tr>
</tbody>
</table>

Comments

Section Raw Score Total

---

2
<table>
<thead>
<tr>
<th>Item</th>
<th>C. Vestibular Processing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Becomes anxious or distressed when feet leave the ground</td>
</tr>
<tr>
<td></td>
<td>Dislikes activities where head is upside down (e.g., somersaults, roughhousing)</td>
</tr>
<tr>
<td></td>
<td>Avoids playground equipment or moving toys (e.g., swing set, merry-go-round)</td>
</tr>
<tr>
<td></td>
<td>Dislikes riding in a car</td>
</tr>
<tr>
<td></td>
<td>Holds head upright, even when leaning over or leaning (e.g., maintains a rigid posture/position during activity)</td>
</tr>
<tr>
<td></td>
<td>Becomes discontented after bending over sink or table (e.g., falls or gets dizzy)</td>
</tr>
<tr>
<td></td>
<td>Seeks all kinds of movement and fidgets when routines change (e.g., can't sit still, fidgets)</td>
</tr>
<tr>
<td></td>
<td>Seeks out all kinds of movement activities (e.g., being whirled by adult, merry-go-rounds, playground equipment, moving toys)</td>
</tr>
<tr>
<td></td>
<td>Twirls/spins and frequently throughout the day (e.g., feels dizzy, feeling)</td>
</tr>
<tr>
<td></td>
<td>Rocks unconsciously (e.g., while watching TV)</td>
</tr>
<tr>
<td></td>
<td>Rocks in a back/forward motion</td>
</tr>
</tbody>
</table>

Comments
### DL: Touch Processing

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>L 39</td>
<td>Avoids getting &quot;messy&quot; (for example, in paste, sand, finger paint, glue, tape)</td>
</tr>
<tr>
<td>L 30</td>
<td>Expresses distress during grooming (for example, fights or cries during hair cutting, face washing, fingernail cutting)</td>
</tr>
<tr>
<td>L 35</td>
<td>Prefers long-sleeved clothing when it is warm or short sleeves when it is cold</td>
</tr>
<tr>
<td>L 32</td>
<td>Expresses discomfort at dental work or tooth brushing (for example, cries or fights)</td>
</tr>
<tr>
<td>L 33</td>
<td>Is sensitive to certain fabrics (for example, a particular about certain clothes or bedsheets)</td>
</tr>
<tr>
<td>L 34</td>
<td>Becomes irritated by shoes or socks</td>
</tr>
<tr>
<td>L 35</td>
<td>Avoids going barefoot, especially in sand or grass</td>
</tr>
<tr>
<td>L 36</td>
<td>Reacts emotionally or aggressively to touch</td>
</tr>
<tr>
<td>L 37</td>
<td>Withdraws from splashing water</td>
</tr>
<tr>
<td>L 38</td>
<td>Has difficulty standing in line or close to other people</td>
</tr>
<tr>
<td>L 39</td>
<td>Rubs or scratches an item that has been touched</td>
</tr>
<tr>
<td>H 40</td>
<td>Touches people and objects to the point of irritating others</td>
</tr>
<tr>
<td>H 41</td>
<td>Displays unusual need for touching certain toys, surfaces, or textures (for example, constantly touching objects)</td>
</tr>
<tr>
<td>H 42</td>
<td>Decreased awareness of pain and temperature</td>
</tr>
<tr>
<td>H 43</td>
<td>Doesn't seem to notice when someone touches arm or back (for example, unaware)</td>
</tr>
<tr>
<td>H 44</td>
<td>Avoids wearing shoes; loves to be barefoot</td>
</tr>
<tr>
<td>H 45</td>
<td>Touches people and objects</td>
</tr>
<tr>
<td>H 46</td>
<td>Doesn't seem to notice when feet or hands are messy</td>
</tr>
</tbody>
</table>

### EL: Multisensory Processing

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>47</td>
<td>Gets lost easily (even in familiar places)</td>
</tr>
<tr>
<td>48</td>
<td>Has difficulty paying attention</td>
</tr>
<tr>
<td>L 49</td>
<td>Looks away from tasks to notice all shapes in the room</td>
</tr>
<tr>
<td>H 50</td>
<td>Seeks objects within an active environment (for example, unaware of activity)</td>
</tr>
<tr>
<td>H 51</td>
<td>Hangs on people, furniture, or objects even in familiar situations</td>
</tr>
<tr>
<td>H 52</td>
<td>Walks on toes</td>
</tr>
<tr>
<td>H 53</td>
<td>Leaves clothing twisted on body</td>
</tr>
</tbody>
</table>

**Section Raw Score Total**
**E. Oral Sensory Processing**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>L 54</td>
<td>Gags easily with food textures or food stimuli in mouth</td>
</tr>
<tr>
<td>L 55</td>
<td>Averts certain tastes or food smells that are typically part of children's diets</td>
</tr>
<tr>
<td>L 56</td>
<td>Will only eat certain tastes (list: )</td>
</tr>
<tr>
<td>L 57</td>
<td>Limits self to particular food textures/temperatures (list: )</td>
</tr>
<tr>
<td>L 58</td>
<td>Picky eater, especially regarding food textures</td>
</tr>
<tr>
<td>H 59</td>
<td>Recursively smells nonfood objects</td>
</tr>
<tr>
<td>H 60</td>
<td>Shows strong preference for certain smells (list: )</td>
</tr>
<tr>
<td>H 61</td>
<td>Shows strong preference for certain tastes (list: )</td>
</tr>
<tr>
<td>H 62</td>
<td>Craves certain foods/fragrances (list: )</td>
</tr>
<tr>
<td>H 63</td>
<td>Seeks out certain tastes or smells (list: )</td>
</tr>
<tr>
<td>H 64</td>
<td>Chews or licks nonfood objects</td>
</tr>
<tr>
<td>H 65</td>
<td>Mutes objects (for example, pens, hands)</td>
</tr>
</tbody>
</table>

**Modulation**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>L 66</td>
<td>Moves stiffly</td>
</tr>
<tr>
<td>H 67</td>
<td>Tries easily, especially when standing or holding particular body position</td>
</tr>
<tr>
<td>H 68</td>
<td>Looks perfect (for example, shows, knees for stability</td>
</tr>
<tr>
<td>H 69</td>
<td>Seems to have weak muscles</td>
</tr>
<tr>
<td>H 70</td>
<td>Has a weak grasp</td>
</tr>
<tr>
<td>H 71</td>
<td>Can't lift heavy objects (for example, week in comparison to same age children)</td>
</tr>
<tr>
<td>H 72</td>
<td>Prop to support self (even during activity)</td>
</tr>
<tr>
<td>H 73</td>
<td>Poor endurance/easily</td>
</tr>
<tr>
<td>H 74</td>
<td>Appears lethargic (for example, has no energy, is sluggish)</td>
</tr>
</tbody>
</table>

Comments: [ ]
### A. Modulation of Body Position and Movement

<table>
<thead>
<tr>
<th>Item</th>
<th>Score</th>
<th>Description</th>
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<tbody>
<tr>
<td>75</td>
<td>1</td>
<td>Seems accident prone</td>
</tr>
<tr>
<td>76</td>
<td>2</td>
<td>Has a habit of swallowing or chewing objects internally</td>
</tr>
<tr>
<td>77</td>
<td>1</td>
<td>Has a habit of hitting or rubbing</td>
</tr>
<tr>
<td>78</td>
<td>2</td>
<td>Avoids climbing or jumping or avoids bumpy/uneven ground</td>
</tr>
<tr>
<td>79</td>
<td>1</td>
<td>Has a habit of walking or running (for example, runs on their toes)</td>
</tr>
<tr>
<td>80</td>
<td>2</td>
<td>Takes excessive risks during play (for example, climbs high into a tree, jumps off tall furniture)</td>
</tr>
<tr>
<td>81</td>
<td>2</td>
<td>Has a habit of climbing or jumping or avoids bumpy/uneven ground</td>
</tr>
<tr>
<td>82</td>
<td>1</td>
<td>Turns whole body to look at you</td>
</tr>
<tr>
<td>83</td>
<td>3</td>
<td>Seeks opportunities to fall without regard to personal safety</td>
</tr>
<tr>
<td>84</td>
<td>4</td>
<td>Appears to enjoy falling</td>
</tr>
</tbody>
</table>

### B. Modulation of Movement Affecting Activity Level

<table>
<thead>
<tr>
<th>Item</th>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>85</td>
<td>3</td>
<td>Speaks most of the day in sedentary play (for example, does quiet things)</td>
</tr>
<tr>
<td>86</td>
<td>2</td>
<td>Prefers quiet, sedentary play (for example, watching TV, books, computers)</td>
</tr>
<tr>
<td>87</td>
<td>1</td>
<td>Seeks sedentary play options</td>
</tr>
<tr>
<td>88</td>
<td>1</td>
<td>Prefers sedentary activities</td>
</tr>
<tr>
<td>89</td>
<td>2</td>
<td>Seeks opportunities to move during movement activity</td>
</tr>
<tr>
<td>90</td>
<td>1</td>
<td>Avoids quiet play activities</td>
</tr>
</tbody>
</table>

### C. Modulation of Sensory Input Affecting Emotional Responses

<table>
<thead>
<tr>
<th>Item</th>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>91</td>
<td>3</td>
<td>Needs more protection than other children (for example, is less sensitive physically or emotionally)</td>
</tr>
<tr>
<td>92</td>
<td>2</td>
<td>Does not perceive body language or facial expressions (for example, unable to interpret)</td>
</tr>
<tr>
<td>93</td>
<td>1</td>
<td>Shows rigidity or lacks in personal hygiene</td>
</tr>
<tr>
<td>94</td>
<td>2</td>
<td>Is overly affectionate with others</td>
</tr>
<tr>
<td>95</td>
<td>1</td>
<td>Doesn't perceive body language or facial expressions (for example, unable to interpret)</td>
</tr>
</tbody>
</table>

Comments:

Section Raw Score Total

---

82
### A. Modulation of Visual Input Affecting Emotional Responses and Activity Level:

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>86</td>
<td>Avoids eye contact</td>
</tr>
<tr>
<td>97</td>
<td>Stares intensively at objects or people</td>
</tr>
<tr>
<td>98</td>
<td>Watches everyone when they move around the room</td>
</tr>
<tr>
<td>99</td>
<td>Doesn’t notice when people enter the room</td>
</tr>
</tbody>
</table>

### Behavior and Emotional Responses:

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>Seems to have difficulty liking self (for example, low self-esteem)</td>
</tr>
<tr>
<td>101</td>
<td>Has trouble “growing up” (for example, reacts immaturity to situations)</td>
</tr>
<tr>
<td>102</td>
<td>Is sensitive to rejection</td>
</tr>
<tr>
<td>103</td>
<td>Has definite tears (for example, tears are predictable)</td>
</tr>
<tr>
<td>104</td>
<td>Seems anxious</td>
</tr>
<tr>
<td>105</td>
<td>Displays excessive emotional outbursts when unsuccessful at a task</td>
</tr>
<tr>
<td>106</td>
<td>Expresses feeling like a failure</td>
</tr>
<tr>
<td>107</td>
<td>Is stubborn or uncooperative</td>
</tr>
<tr>
<td>108</td>
<td>Has temper tantrums</td>
</tr>
<tr>
<td>109</td>
<td>Poor frustration tolerance</td>
</tr>
<tr>
<td>110</td>
<td>Cries easily</td>
</tr>
<tr>
<td>111</td>
<td>Overly serious</td>
</tr>
<tr>
<td>112</td>
<td>Has difficulty making friends (for example, does not interact or participate in group play)</td>
</tr>
<tr>
<td>113</td>
<td>Has nightmares</td>
</tr>
<tr>
<td>114</td>
<td>Has fears that interfere with daily routine</td>
</tr>
<tr>
<td>115</td>
<td>Doesn’t have a sense of humor</td>
</tr>
<tr>
<td>116</td>
<td>Doesn’t express emotions</td>
</tr>
</tbody>
</table>

Comments: [Add comments here]
## Behavior Outcomes of Sensory Processing

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>112</td>
<td>Takes self through tasks</td>
</tr>
<tr>
<td>113</td>
<td>Writing is illegible</td>
</tr>
<tr>
<td>119</td>
<td>Has trouble staying between the lines when coloring or writing</td>
</tr>
<tr>
<td>120</td>
<td>Uses inefficient ways of doing things (for example, wiggles, moves slowly, does things a harder way than is needed)</td>
</tr>
<tr>
<td>L 121</td>
<td>Has difficulty tolerating changes in plans and expectations</td>
</tr>
<tr>
<td>L 122</td>
<td>Has difficulty tolerating changes in routines</td>
</tr>
</tbody>
</table>

## Items Indicating Thresholds for Response

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>123</td>
<td>Jumps from one activity to another so that it interferes with play</td>
</tr>
<tr>
<td>124</td>
<td>Deliberately smudges objects</td>
</tr>
<tr>
<td>125</td>
<td>Does not seem to smell strong odors</td>
</tr>
</tbody>
</table>

---

**Icon Key**
- ![Icon](image)
- ![Icon](image)
- ![Icon](image)
- ![Icon](image)
- ![Icon](image)
- ![Icon](image)
- ![Icon](image)
- ![Icon](image)

**Threshold Key**
- ![Threshold](image)
- ![Threshold](image)

**Score Key**
- 1 | Always |
- 2 | Frequently |
- 3 | Occasionally |
- 4 | Seldom |
- 5 | Never |
Sensory Profile
Winne Dunn, Ph.D., OTR, FAOTA
Summary Score Sheet

Child's Name:__________________________________________ Gender: □ Male □ Female

Questionnaire Completed by: ____________________________ Date Tested: ___________ ___________ ___________

Relationship to Child: ________________________________ Date of Birth: ___________ ___________ ___________

Service Provider's Name: ______________________________ Chronological Age: ___________ ___________ ___________

Discipline: __________________________________________

The child receives the following services:

☐ Early Intervention/Preschool Services
☐ Regular Education
☐ Special Education
☐ Occupational Therapy
☐ Physical Therapy
☐ Speech Therapy
☐ Other (please specify) __________________________________________

Child's condition(s):

☐ Mental Retardation
☐ Specific Learning Disability
☐ Speech or Language Impairment
☐ Autism/Prevase Developmental Disorder (PDD)
☐ Asperger's Syndrome
☐ Emotional/Disturbance or Serious Behavioral Difficulties
☐ Attention Disorder (ADD, ADHD)
☐ Visual Impairment/Blindness
☐ Hearing Impairment/Deafness
☐ Cerebral Palsy
☐ Fragile X
☐ Tourette's
☐ Multiple Disabilities
☐ Traumatic Brain Injury
☐ Other Neurological Disorder
☐ Other Health Conditions (e.g., cardiac disorder, asthma)
☐ Other (please specify) __________________________________________

Other comments: __________________________________________

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### Factor Grid

**Instructions:** Transfer from the Caregiver Questionnaire the item raw score that corresponds with each item listed. Add the Raw Score column to get the Factor Raw Score Total for each factor.

<table>
<thead>
<tr>
<th>FACTOR 1</th>
<th>FACTOR 2</th>
<th>FACTOR 3</th>
<th>FACTOR 4</th>
<th>FACTOR 5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sensory Seeking</strong></td>
<td><strong>Emotionally Reactive</strong></td>
<td><strong>Low Endurance/Tone</strong></td>
<td><strong>Omi Sensory Sensitivity</strong></td>
<td><strong>Inattention/Distractibility</strong></td>
</tr>
<tr>
<td>Item</td>
<td>Raw Score</td>
<td>Item</td>
<td>Raw Score</td>
<td>Item</td>
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<tr>
<td>12</td>
<td>89</td>
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<td>111</td>
<td>Factor Raw Score Total</td>
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<td>15</td>
<td>123</td>
<td>16</td>
<td>114</td>
<td>Factor Raw Score Total</td>
</tr>
</tbody>
</table>

**Factor Raw Score Total**

---

**ICON KEY**
- 🎧 Auditory
- 🎫 Visual
- 🧑‍🎉 Activity Level
- 🎲 Tactile/Touch
- 🦖 Body Position
- 🔴 Movement
- ⬅️ Touch
- 🍀 Emotional/Social
## Factor Summary

**Instructions**: Transfer the child’s score for each factor to the column labeled *Factor Raw Score Total*. Then plot these totals by marking an X in the appropriate classification column (*Typical Performance, Probable Difference, Definite Difference*).

<table>
<thead>
<tr>
<th>Factor</th>
<th>Factor Raw Score Total</th>
<th>Typical Performance</th>
<th>Probable Difference</th>
<th>Definite Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sensory Seeking</td>
<td>/85</td>
<td>/85</td>
<td>/53</td>
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<tr>
<td>2. Emotionally Reactive</td>
<td>/80</td>
<td>80</td>
<td>57</td>
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<tr>
<td>3. Low Endurance/Tone</td>
<td>/45</td>
<td>45</td>
<td>33</td>
<td></td>
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<tr>
<td>4. Oral Sensory Sensitivity</td>
<td>/45</td>
<td>45</td>
<td>33</td>
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<tr>
<td>5. Inattention/Distractibility</td>
<td>/136</td>
<td>136</td>
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<tr>
<td>6. Poor Registration</td>
<td>/140</td>
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<td>7. Sensory Sensitivity</td>
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<td>8. Sedentary</td>
<td>/20</td>
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<td>16</td>
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<tr>
<td>9. Fine Motor/Perceptual</td>
<td>/115</td>
<td>115</td>
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</table>

*Classifications are based on the performance of children without disabilities (n = 1,037).*
### Section Summary

**Instruction:** Transfer the child's score for each section to the Section Raw Score Total column. Then plot these totals by marking an X in the appropriate classification column (Typical Performance, Probable Difference, Definite Difference).

<table>
<thead>
<tr>
<th>Sensory Processing</th>
<th>Section Raw Score Total</th>
<th>Typical Performance</th>
<th>Probable Difference</th>
<th>Definite Difference</th>
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<tr>
<td>A. Auditory Processing</td>
<td>40</td>
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<td>B. Visual Processing</td>
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<td>C. Vestibular Processing</td>
<td>55</td>
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<td>D. Tactile Processing</td>
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<td>E. Multisensory Processing</td>
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<td>F. Oral Sensory Processing</td>
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</table>

**Modulation**

<table>
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<th>Definite Difference</th>
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<td>G. Sensory Processing Related to Endurance/Tone</td>
<td>90</td>
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<td>H. Modulation Related to Body Position and Movement</td>
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<td>I. Modulation of Movement Affecting Activity Level</td>
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<td>J. Modulation of Sensory Input Affecting Emotional Responses</td>
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<td>K. Modulation of Visual Input Affecting Emotional Responses and Activity Level</td>
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**Behavior and Emotional Responses**

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<td>L. Emotional/Social Responses</td>
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<td>M. Behavioral Outcomes of Sensory Processing</td>
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<td>N. Items Indicating Thresholds for Response</td>
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*Classifications are based on the performance of children without disabilities (n = 1,027).*

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*Printed in the United States of America 9 8 7 6 5 4 3 2 1 B C D E*
APPENDIX C
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APPENDIX D
Circle Time Book
Children go to school to learn.

Sometimes in school, the children

Sit together in chairs to listen to the

teacher and learn.
When the children are in chairs, the teacher might read, do the calendar, or teach something new.
The teacher wants the children to be quiet and sit still with their legs crossed. The teacher does not want the children to touch each other or to move around.
Sometimes sitting still and being quiet is hard to do.
There are special things I can do to make it easier to sit and listen. When the teacher calls the class to sit together in the chairs, I get my sock buddy or fanny pack.
I sit on my chair, cross my legs and give myself three big hugs.
Then I do an elbow check to make sure I have enough space.
Next I put my hands flat on the chair beside me. I push on my arms and slowly rock back and forth.
If I have trouble sitting still, I do big body squeezes. Then I take a deep breath to help me listen and learn.
Sitting on chairs with my class is a
great way to learn!