making sense of sensory systems

by Marie Hendrix

Our role as caregivers requires that we continuously assess the needs and performance of children and provide the support necessary for them to achieve their potential. Since children develop along a continuum ranging from typical to atypical, that is a greater challenge for some than for others. High achievers easily perform as expected. Other children, due to genetic factors or trauma, present with significant handicapping conditions that require support from medical and educational specialists to achieve success. Another large group of children falls between these two extremes. They are less successful than the highest performing children and sometimes it is difficult to identify their needs and provide effective instructional strategies. A thorough understanding of child development, including the role and impact of sensory development, is critical for caregivers to properly evaluate and assist these children.

Marie Hendrix is a speech-language pathologist, parent advisor, educational trainer, and life-long student. For more than 30 years, children and their caregivers have been her most inspirational teachers. Although she has pioneered and directed three pediatric rehabilitation facilities, provided preschool and school-age speech therapy services, coached families with differently-abled children, and trained caregivers, her primary role has been learner. She is forever indebted to the ones she has served for helping her fulfill her life's purpose of assisting others in their pursuit of success. She and her husband Kenneth live in Lavonia, Georgia. Please contact her: marie@decodingkids.net.

Life is a sensory experience

Life is a succession of continuous sensory experiences. The ability to learn depends upon the quality of those experiences and a child's capacity to uniquely process sensory information. It is important that caregivers not only provide a variety of sensory experiences, but also understand the role of sensory processing in order to support learning and behavior in young children.

An infant's body has about 100 billion nerve cells — called neurons — at birth. This number does not change throughout life. However, as a child learns and grows, the connections between neurons in the body do change. At birth only about 25 percent of the neurons in the brain connect together. These initial networks control breathing, heartbeat, sucking, and other reflexes necessary for survival. A child's experiences and environment, as well as inherited genetic factors influence the associations made by the remaining majority of neurons (Stephens, 1999). As a child grows and learns, elaborate neural pathways — called sensory systems — develop. There are seven major sensory systems in the human body that provide avenues for the processing of sensory information.

The seven sensory systems

The five sensory systems of sight, sound, smell, taste, and touch are well known. However, two other systems involving body position and movement (proprioceptive system) and gravity, head movement, and balance (vestibular system) are less familiar. Since processing sensory information is the foundation of all learning, all seven sensory systems are important in a child's development.

The Visual System is responsible for sight. By perceiving color, pattern, and light, this system provides visual images to our brains. The ability of the eye muscles to work together and track movement in all directions — vertically, horizontally, and diagonally— is an important component of this system.

Hearing is the result of the Auditory System. This system processes and interprets sound. It determines the direction, loudness, pitch, and duration of sound waves. This system is critical for understanding language and for the development of speech.

The sense of smell is the product of the Olfactory System. Odor influences the flavor and taste of food. Smell also creates memories and associations that influence our choices and preferences. The sense of smell is a major factor in an infant recognizing and bonding with mother.

The Gustatory System is primarily responsible for our sense of taste. The taste buds located on our tongue interpret sweet, sour, bitter, and salty and contribute significantly to our taste preferences and enjoyment of food.

The sense of touch is the result of the Tactile System. Located in our skin, it is the largest sensory system and every surface of our body connects to it. This system interprets many aspects of touch including texture, consistency, pressure, pain, temperature, and vibration.

The Vestibular System regulates our balance and is very sensitive to subtle changes in position or movement. Located in the inner ear, this system is responsible for monitoring and maintaining equilibrium. The vestibular system sends information about the body's movements by interpreting the pull of gravity and change in the direction or speed of movement. An effective vestibular system allows us to walk upright and in a straight line.

The Proprioceptive System is located in the joints, muscles, and tendons. It is the second largest sensory system. This system processes sensory information provided by tiny receptors that monitor the contraction and stretching of muscles and the bending, straightening, pulling, and compression of the joints. Information that it sends to the brain helps maintain normal muscle tone or tension and smooth motor movements. Proprioceptive information is necessary for any part of our body to move successfully.

These systems require appropriate stimulation in order to develop and process sensory information efficiently. Although each of these systems is a pathway for information, they are not separate channels that work independently of one another. Instead, they share the sensations they collect with one another and with our brains for decoding. This collective framework provides the highly organized structure needed to rapidly gather, interpret, communicate, and respond to sensory information.

The development of Sensory Integration (SI)

Sensory integration (SI) is the term for this unconscious process of sharing and organizing our sensations and turning them into perceptions. The degree of SI achieved directly affects how well each child interprets specific sensations. Healthy sensory integrative abilities allow a child to perform and learn by processing the sensations quickly and accurately. SI development influences behavior and thought throughout life and is responsible for a child's reactions and responses to the world.

Sensory integration begins developing before birth. In the womb, a baby's vestibular system senses the movements of mother and feels the vibration of her voice, the swooshing of her blood, and the rhythmic beating of her heart. Caregivers simulate these sounds and movements to comfort young children by rocking, bouncing, and talking to them. Replicating these earliest sensations brings calm to an infant's world. In early childhood, a child increases control and skill in the use of all of the sensory systems. This development provides the opportunity for greater sensory integration so children can better understand themselves, their world, and their relationship with their environment.

Sensory integration develops naturally for most children as they gather, synthesize, and store massive amounts of information from daily experiences. Moving, talking, and playing provide the crucial groundwork necessary to develop a highly integrated sensory system. These experiences allow children to process information about sights, sounds, textures, smells, tastes, and movement in an organized way. As these experiences become meaningful, children develop responses and behavior patterns consistent with what they have learned.

As children play, they lay the sensory foundation needed for behavior and more complex learning necessary for later academic and social success. Play is a child's work and provides rich opportunities to make sensory integration happen. Frequent and varied play experiences develops sensory integration and leads to better organization and skills. Generalization of these skills into school — and later, work — results in greater success throughout life.

By successfully processing new sensations, children improve their ability to respond appropriately to sensory experiences. As sensory processing skills mature, vital pathways in the nervous system are refined and strengthened, and children get better at problem solving and dealing with life's challenges. For example, an infant may startle and cry when hearing a vacuum. Years later, he might simply cover his ears until the sound stops. As an adult, he may only pause in his conversation until the distraction ceases. This change in behavior indicates the progressive maturing of his sensory integration abilities.

Sensory Integrative Dysfunction or Sensory Processing Disorder

Seeing, smelling, tasting, hearing, feeling, movement, touch, and the pull

of gravity — each of these activities produces sensations that are uniquely processed by each child. For some children, SI does not develop as efficiently as it should. Children with sensory processing disorders do not fully achieve functional and effective integration of information between systems. Through careful observation, caregivers can recognize the symptoms of sensory dysfunction.

- Children with SI Dysfunction are often unable to recognize, interpret, and respond to sensory information demands without great effort. They struggle with simple tasks and have difficulty attending. Many have a diagnosis of Attention Deficit Disorders.
- Problems in learning, development, social interactions, and behavior are common due to the misinterpretation of signals of language and communication. Some children respond by withdrawing, while others tantrum due to their frustration or confusion.
- Underdeveloped SI abilities result in a child having distorted perceptions. Some children have hyposensitive responses and do not detect sensations accurately. Others display hypersensitive reactions and become overly stimulated by everyday sensations. Some children exhibit both hyper- and hyposensitive reactions and they perform inconsistently. Their responses vary from day to day and they exhibit very unpredictable behavior.
- These children sometimes have difficulty with daily activities such as playing, eating, bathing, and dressing due to strong sensory preferences. Children with hyposensitivity may crave the intensity of lemons and pickles, and thrive on rough play. Clothing tags, tooth brushing and even socks and shoes may be overwhelming for ones with hypersensitivity. Some have severely limited diets due to their intolerances.
- Children with SI dysfunction sometimes rely on more developed sensory systems to compensate for less organized ones. For example, some may learn best by touching objects or physically moving themselves around obstacles rather than understanding a verbal explanation or pictured demonstration.

SI Dysfunction is the source of great frustration for children, families, and caregivers. Without training, caregivers often overlook the importance of assessing sensory development and fail to meet the needs of children. However, caregivers can support children by carefully observing behavior and altering the environment and their expectations to meet children's needs. If a child craves strong sensory input, create appropriate opportunities through the day to experience intense flavors, movement, and sensations. For hypersensitive children, low lighting, soft music, and reducing distractions (including television and toys) may improve behavior and concentration. By following a child's lead, caregivers can defuse many of the struggles of children with SI Dysfunction.

The impact of Sensory Integration

In childhood, children explore their environment and adapt to many physical and mental challenges. The successful integration of sensory experiences creates an internal model of who children are physically, where they are in relation to their surroundings, and what is happening in the world around them. Caregivers cannot overemphasize the importance of this process.

- SI, along with innate genetic factors, is responsible for a child's capacity to learn.
- The ability to integrate sensory information is the foundation for all learning and development.
- SI greatly influences the development of motor skills, play, speech, language, and social competence.
- Throughout life, the integration of the sensory systems alerts and directs subconscious and conscious behaviors and thoughts from moment to moment.
- Children with severe sensory processing deficits need professional assessment and treatment by an Occupational Therapist with training in SI. If you have concerns about a child in your care, you should refer the parents to medical or school personnel to pursue these services.

Summary

The most important step in promoting sensory integration in children is to recognize that it exists and that it plays an important role in children's development. Armed with this information and understanding, child care providers can observe and evaluate a child's responses to various sensations and determine their sensory integration skills and needs. By helping children develop sensory processing abilities, caregivers foster success in all developmental areas and support the achievement of every child's potential.

References

Stephens, K. (1999, March/April). Primed for learning: The young child's mind. *Exchange*. Retrieved June 30, 2008, from https://secure.ccie.com/resources/view_article.php?article_id=5012644Child Care Exchange.

Other helpful resources on Sensory Integration Disorders

Organizations

Sensory Processing Disorder Foundation
www.spdfoundation.net

Books

Ayers, A. J. (2005). *Sensory integration and the child: Understanding hidden sensory challenges*. Los Angeles: Western Psychological Services.

Biel, L., & Peske, N. (2005). *Raising a sensory smart child: The definitive handbook for helping your child with sensory integration issues.* New York: Penguin.

Kranowitz, C. S. (2006). *The out-of-sync child: Recognizing & coping with Sensory Processing Disorders*. New York: Perigree Trade.

Kranowitz, C. S. (2006). *The out-of-sync child has fun: Activities for kids with Sensory Integration Disorder.* New York: Perigree Trade.

Williams, M. S., & Shellenberger, S. (1996). *How does your engine run?: The leader's guide to the Alert Program for self regulation.* Albuquerque, NM: TherapyWorks Inc.

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