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# Occupational Therapy for Children and Youth Using Sensory Integration Theory and Methods in School-Based Practice

The American Occupational Therapy Association (AOTA) recognizes that occupational therapists and occupational therapy assistants<sup>1</sup> working within public school settings may provide intervention to students in general and special education programs. When the processing and integrating of sensory information interferes with a child's performance in school activities, occupational therapy practitioners<sup>2</sup> may use sensory-based interventions or a sensory integration (SI) approach (Ayres, 1972a) to support the child's ability to participate in his or her educational program. Evidence to support SI and sensory processing interventions can be found in Watling, Koenig, Davies, and Schaaf (2011) and also in Dunn (2014). Occupational therapy practitioners working in schools use evidence-based sensory-based interventions or a SI approach when sensory-related issues are identified and affect a child's ability to benefit from his or her education.

Studies have identified atypical sensory reactivity within the general population of between 5% and 16.5% (Ahn, Miller, Milberger, & McIntosh, 2004; Ben-Sasson, Carter, & Briggs-Gowan, 2009). The incidence of sensory modulation disorders increases to 35% in a Head Start sample, with 45% of those children showing extreme differences in underresponsive or seeking behaviors (Reynolds, Shepherd, & Lane, 2008). In a study of children with autism spectrum disorder, approximately 95% of the sample demonstrated some degree of sensory processing dysfunction (Tomchek & Dunn, 2007). Given that sensory reactivity is only one of the several patterns of sensory integrative deficits (Parham & Mailloux, 2010), estimates of school-age children with all types of sensory difficulties who require occupational therapy may be even higher. The research suggests that sensory-based interventions may be necessary for these students to participate in school.

## Federal and State Mandates for Occupational Therapy Practitioners Working in Public Education

Occupational therapy practitioners working in schools, including preschools, are required to follow federal and state education laws and regulations as well as professional licensure regulations and guidelines. In addition, occupational therapy practitioners are guided by the *Occupational Therapy Practice Framework: Domain and Process* (3rd ed.; AOTA, 2014b), the *Occupational Therapy Code of Ethics* (2015) (AOTA, 2015), and *Standards of Practice for Occupational Therapy* (AOTA, 2010). The *Framework* promotes occupation-based, client-centered, contextual, and evidence-based services. The scope of occupational therapy evaluation and intervention in the school setting includes areas that affect the child's "learning and participation in the context of educational activities, routines, and environments" (AOTA, 2011, p. S49).

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<sup>1</sup>Occupational therapists are responsible for all aspects of occupational therapy service delivery and are accountable for the safety and effectiveness of the occupational therapy service delivery process. Occupational therapy assistants deliver safe and effective occupational therapy services under the supervision of and in partnership with an occupational therapist (AOTA, 2014a).

<sup>2</sup>When the term *occupational therapy practitioner* is used in this document, it refers to both occupational therapists and occupational therapy assistants (AOTA, 2006).

Specific to public schools are parameters established by federal laws, including the No Child Left Behind Act of 2001 (NCLB; Pub. L. 107–110); the Individuals With Disabilities Education Improvement Act of 2004 (IDEA 2004; Pub. L. 108–446); and Section 504 of the Rehabilitation Act of 1973, as amended (Pub. L. 93–112, Pub. L. 99–506), mandating a child’s right to a free, appropriate public education (FAPE) that includes occupational therapy as a related service. NCLB focuses on improving education for all children, requiring schools to use “effective methods and instructional strategies that are based on scientifically based research” (§ 1114(b)(1)(B)(ii)) and to demonstrate “adequate yearly progress” as measured by annual statewide assessment of student learning.

IDEA establishes the rights of children with disabilities to receive a FAPE in the least restrictive environment (LRE) and reinforces the need for effective instructional practices within special education. A child meeting the eligibility criteria for one of the disability categories identified in IDEA 2004, and also demonstrating a need for specialized instruction, is entitled to special education and related services. The individualized education program (IEP) must contain a statement of special education and related services and supplementary aids and services, based on peer-reviewed research to the extent practical, to be provided to the child, or on behalf of the child, and a statement of the program modifications or supports for school personnel that will be provided to enable the child to attain the annual goals, to be involved in and make progress in the general education curriculum, and to be educated and participate with other children (§300.320(a)(4)).

The LRE mandate within IDEA requires that children with disabilities be educated within the general education environment unless “the nature or severity of the disability is such that education in regular classes with the use of supplementary aids and services cannot be achieved satisfactorily” (§300.114(a)(2)). The IEP must identify the extent to which the child will not participate with other children in the regular classroom and other activities within the educational environment (§300.114(a)(5)), and state departments of education must report to the Office of Special Education Programs the amount of time the child is removed from the classroom (IDEA 2004).

Under IDEA, each state must establish rules and regulations for determining eligibility for special education on the basis of the federal code. Local education agencies (LEAs) have some discretion regarding the provision of services so long as they meet the minimum requirements mandated by the federal and state education agencies. Many state and LEAs provide early intervening services (EIS) under IDEA 2004, which authorizes multitiered systems of support (e.g., Response to Intervention, positive behavior interventions and supports; §1413(f)).

Under EIS, occupational therapy practitioners working in public schools may provide professional development to educators to support the delivery of scientifically based instruction or interventions and, if state professional regulations allow, evaluations, services, and supports to general education children to increase their performance in general education. This encourages occupational therapy practitioners to provide systems (i.e., schoolwide) and team approaches as well as, possibly, individual services to enhance general education performance. For example, an occupational therapist may provide professional development based on SI theory and methods to general education teachers regarding ways to modify or adapt the environment and context to support participation and engagement in the classroom or on the playground.

Under Section 504 of the Rehabilitation Act of 1973, children who are not eligible for specially designed instruction under IDEA but who need supports and accommodations for equal access may be determined by the school district to be eligible for a 504 plan, which identifies the accommodations, modifications, and services needed. Occupational therapy practitioners may be participants in the development and implementation of the 504 plan.

## Application of Sensory Integration Theory and Methods in Schools

### *Clinical and Professional Reasoning*

Occupational therapy is provided toward the aim of affording opportunities for full participation in everyday activities and occupations in which individuals choose to engage (Christiansen & Townsend, 2010). The imperative when working in schools is to provide occupational therapy for the purpose of meeting the child's specific needs to support his or her ability to access the curriculum and benefit from his or her education in the LRE. As members of the IEP team, occupational therapists rely on the results of the evaluation to determine the child's needs, to establish goals, and to make recommendations to the IEP team regarding the types and intensity of occupational therapy services the child requires to benefit from the educational program. Through accurate functional baseline data, measurable goals, and data collection to monitor a child's successful participation in the natural environment, occupational therapy practitioners provide accountability for a child's progress in occupational therapy intervention as it relates to education.

Clinical reasoning based on professional training, evidence, and expertise guides the occupational therapist's selection and use of one or more theories on SI (Boyt Schell & Schell, 2008; Burke, 2001; Dunn, 2013; Parham, 1987; Schaaf & Smith Roley, 2006). The child's ability to adapt, organize, and integrate sensory information in school environments and activities is important for performance (Watling et al., 2011).

### *Evaluation*

Occupational therapists evaluate a child's school performance by using "a variety of assessment tools and strategies to gather relevant functional, developmental and academic information including information provided by the parent" (IDEA 2004, § 614(b)(2)(A)). Multiple data sources are used during the evaluation, including review of pertinent medical and educational information; interviews with teachers, parents, and the child; observations in natural settings; and various assessments (Coster & Frolek Clark, 2013).

When referrals or observations suggest sensory, motor, and praxis issues, the occupational therapy evaluation includes assessment of these areas (AOTA, 2014b; Lane, Smith Roley, & Champagne, 2013; Stewart, 2010; Watling et al., 2011). Assessments may include direct observation of the child's performance in a variety of tasks to analyze the demands of the activities (e.g., objects and their properties, space, sequencing, timing), social and physical characteristics of the environments, and effectiveness of the child's performance skills and patterns in those activities and environments. The occupational therapist conducts assessments of sensory and neuromotor functions through observations in various environments and analyzes play performance and functional participation of the child in response to the setting's demands (Blanche, 2002; Blanche, Bodison, Chang, & Reinoso, 2012; Knox, 2008; Lane et al., 2013; Schaaf & Smith Roley, 2006; Skard & Bundy, 2008; Watling et al., 2011; Wilson, Pollock, Kaplan, & Law, 1994). Interventions are then designed on the basis of data analysis, with a focus on assisting the child to benefit from his or her educational program (Schaaf & Blanche, 2012). Several structured screenings and assessments have been developed to assess the child's sensory, motor, and praxis abilities:

- The DeGangi-Berk Test of Sensory Integration (DeGangi & Berk, 1983) is a preschool screening focused on sensory-based postural and motor functions.
- The Sensory Integration and Praxis Tests (SIPT; Ayres, 1989) is a standardized performance measure used to identify sensory integrative dysfunction related to learning and behavior. The SIPT is a series of 17 individual tests that provide information on visual perception; visual-motor and fine motor performance; construction; tactile discrimination; tactile sensitivity; kinesthesia; vestibular functions, including postrotary nystagmus and balance; bilateral motor control; and praxis.
- The Sensory Processing Measure: Home Form (Parham & Ecker, 2007); Sensory Processing Measure: Main Classroom and School Environments Form (Miller-Kuhaneck, Henry, & Glennon, 2007);

Sensory Processing Measure–Preschool: Home Form (Parham & Ecker, 2010); and Sensory Processing Measure–Preschool: Main Classroom and School Environments Form (Miller-Kuhaneck, Henry, & Glennon, 2010) are integrated systems of rating scales that enable assessment on the basis of parent and educational staff report of sensory processing issues, planning and ideas, and social participation in preschool through elementary school-age children.

- The Sensory Profile 2 (Dunn, 2014) includes infant, toddler, child, and school rating forms, and the Adolescent/Adult Sensory Profile (Brown & Dunn, 2002) consists of standardized questionnaires that focus on the student’s sensory processing performance patterns within the natural context.

### **Intervention**

Although the scope of occupational therapy services expands far beyond the use of SI methods, if one or more types of SI and praxis deficits are revealed during the evaluation, the use of SI methods is appropriate (Table 1). Occupational therapy practitioners with this focus may use a continuum of intervention approaches and types to enhance the child’s ability to be educated and participate in daily occupations with other children. Services may be provided individually (e.g., providing one-on-one intervention to remediate vestibular–ocular difficulties affecting visual tracking and handwriting), through consultation and collaboration with groups (e.g., offering staff in-services on sensory regulatory strategies), or through education and training (e.g., establishing an awareness and understanding of sensory needs addressed through occupational therapy; AOTA, 2014b).

**Table 1. Occupational Therapy Approaches in Schools Using SI Theory and Methods**

<b>Occupational Therapy Approach</b>	<b>Examples of Pathways to Outcomes</b>
Create and promote health and participation.	<ul style="list-style-type: none"> <li>• Create a class for parents or educational staff to teach the relationships among sensory processing, learning, and behavior.</li> <li>• Promote increased physical activity for students to improve physical and mental health as well as cognitive and social performance.</li> <li>• Support installation of various equipment available at schools and public playgrounds to promote diversity in sensory play experiences.</li> <li>• Design sensory-enriched classrooms with various seating options as well as opportunities for tactile, movement, and proprioceptive experiences throughout the day.</li> </ul>
Establish or restore performance skills and performance patterns.	<ul style="list-style-type: none"> <li>• Provide controlled sensory input through activities that require increasingly complex adaptive responses to novel activity to support ability to access Common Core curriculum standards and participate in classroom activities.</li> <li>• Design activities rich in tactile, vestibular, and proprioceptive information that increase academic, physical, and social performance skills.</li> <li>• Facilitate development of appropriate SI and motor planning skills needed for organizing materials, completing tasks within an appropriate time frame, and adapting to transitions.</li> <li>• Establish or restore SI and praxis needed for physical, social, and object play.</li> </ul>
Maintain student ability to engage in and cope with school-related activities.	<ul style="list-style-type: none"> <li>• Structure the sensory environment to meet the student’s needs, such as reducing sensory distractions and improving the ergonomic comfort of the chair and desk.</li> <li>• Teach sensory self-regulation strategies for academic achievement, social–emotional well-being, physiological homeostasis, positive behavior, and motor performance in play.</li> <li>• Maintain ability to organize behavior by providing scheduled sensory breaks and sensory accommodations, such as changing the size, maneuverability, comfort, and location of the seat and desk.</li> <li>• Maintain peer relationships by supporting and compensating for motor planning needs in age-appropriate games and sports.</li> <li>• Maintain student productivity by providing compensation techniques for sensory and motor planning deficits using study carrels, visual timers, weighted vests, alternate seating arrangements, modified writing tools, and paper and other assistive technology.</li> </ul>

*(Continued)*

**Table 1. Occupational Therapy Approaches in Schools Using SI Theory and Methods (cont.)**

Occupational Therapy Approach	Examples of Pathways to Outcomes
Modify activity to help student compensate for sensory, motor, and praxis deficits.	<ul style="list-style-type: none"> <li>• Through collaborative consultation with education staff and parents, develop strategies for modifying the sensory, motor, or praxis demands of assignments to increase student productivity.</li> <li>• Support student participation in general curriculum by modifying sensory and motor planning demands of the activity.</li> <li>• Structure or modify the environment to support the student's sensory, motor, motor planning, and self-regulatory capacities and needs.</li> </ul>
Prevent barriers to participation and improve safety.	<ul style="list-style-type: none"> <li>• Prevent inattention, poor posture, and restlessness when sitting for prolonged periods by modifying seating options, allowing sensory breaks, and allowing the student to work in various positions.</li> <li>• Prevent social isolation by providing motor planning and social strategies to participate with peers.</li> <li>• Prevent socially inappropriate behaviors and behavioral distress or disruption by detecting and meeting sensory and self-regulatory needs.</li> <li>• Prevent injury by providing ergonomic seating and safety strategies for students whose nervous systems have reduced registration of sensory information.</li> <li>• Prevent barriers to child participation by increasing the understanding of the school district staff regarding the role that SI and praxis play in influencing learning and behavior.</li> </ul>

Note. SI = sensory integration.

Collaboration with school staff and IEP team members provides opportunities for education and training to increase their understanding of the contribution of SI and praxis to participation at school. Collaboration allows the occupational therapy practitioner to advocate for accommodations and modifications that will assist the child's school performance and to model services that enhance participation in physical and social play. Adaptation of the school environment according to children's sensory, motor, and praxis needs has been consistently recognized in the professional literature as a way to support their successful participation. It may include increasing the number of activity breaks and ensuring that all children have access to recess (Pellegrini, 2005). As teachers, administrators, and paraprofessionals better understand sensory-related behaviors, they can implement suggested evidence-based sensory strategies, embedding them in the classroom routine to improve children's ability to learn (Prizant, Wetherby, Rubin, & Laurent, 2003). Table 2 provides case examples of school-based occupational therapy interventions with a preschool child, an elementary school child, and a middle school child.

**Table 2. Case Examples Using SI Theory in Schools**

The following vignettes are outlined relative to the *Occupational Therapy Practice Framework: Domain and Process* (3rd ed.; AOTA, 2014b) to illustrate occupational therapy using SI theory and methods in schools.

**Case 1. Natasha: Preschool-Age Child**

**Evaluation**

*Referral:* **Natasha** is a **3-year-old child** enrolled in a special education preschool. The IEP team recommended an OT evaluation because Natasha has difficulty with classroom transitions and social interactions.

*Occupational Profile*

Natasha's family and educational team are seeking OT services because of her difficulty with transitioning and coping in the classroom. Natasha is sensitive to noise; she cries and clings to the aide in the classroom. She performs well at skilled tasks. Additional information was gathered from her medical, developmental, educational, and occupational histories. The priorities listed by the teacher and parents include social interactions (i.e., friendships) and performance within the flow of the classroom (i.e., transitioning).

*Analysis of Occupational Performance*

Interview Data	Observation Data	Test Data
<ul style="list-style-type: none"> <li>• <i>Speech-language therapist report:</i> Natasha's receptive language is below</li> </ul>	<ul style="list-style-type: none"> <li>• Natasha prefers to sit alone or next to an adult.</li> </ul>	<ul style="list-style-type: none"> <li>• Evaluation of sensory processing using Infant/Toddler Sensory Profile (Dunn, 2002)</li> </ul>

(Continued)

**Table 2. Case Examples Using SI Theory in Schools** (cont.)

<p>average and decreases when there is noise in the room.</p> <ul style="list-style-type: none"> <li>• <i>Teacher report:</i> Natasha has difficulty adapting to the flow of classroom activities. She needs an exceptional amount of attention from adults to stay calm. She is able to cognitively perform the tasks but is overwhelmed with the noise and movement in the room.</li> <li>• <i>Parent report:</i> The mother is concerned about Natasha's unhappiness at school and inability to play and make friends.</li> </ul>	<ul style="list-style-type: none"> <li>• Natasha needs extra cues to pay attention. Although physically capable, she does not complete a fine motor preschool activity without adult direction.</li> <li>• She does not initiate social interaction with other children and becomes irritable when children come near her.</li> <li>• She cries when entering the lunchroom or when a group of noisy children run past her during recess.</li> <li>• She does not like to go to lunch and refuses to eat anything but chips.</li> </ul>	<ul style="list-style-type: none"> <li>• DeGangi–Berk Test of Sensory Integration (DeGangi &amp; Berk, 1983)</li> <li>• Postrotary Nystagmus Test (Ayres, 1989; Mailloux et al., 2014)</li> <li>• Structured clinical observations (Blanche, 2002)</li> <li>• Evaluation of play skills using Knox Preschool Play Scale (Knox, 2008).</li> </ul>
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**Intervention Examples**

<i>IEP Goals</i>	<i>OT Intervention Plan and Goals</i>	<i>OT Intervention Process and Strategies</i>
<p><i>Natasha:</i></p> <ul style="list-style-type: none"> <li>• Will transition between classroom activities independently 4 of 5 transitions for 3 days.</li> <li>• Will sustain adult-facilitated interaction with her peers during free play for 5 minutes during a 15-minute observation 4 of 5 free play periods.</li> <li>• Will carry out verbal instructions with visual cues 4 of 5 opportunities with 80% accuracy.</li> </ul>	<p>OT is to be provided within the classroom setting during routine activities. Natasha's response to intervention in relation to learning, behavior, and adjustment to preschool will be monitored closely for progress and signs of a disorder in SI. Changes to service delivery may be recommended to the IEP team as needed.</p> <p><i>OT Goals: Natasha</i></p> <ul style="list-style-type: none"> <li>• Will regulate her responses to environmental stimuli to remain calm during routine class transitions.</li> <li>• Will self-regulate her responses to tactile stimuli to sit next to several peers and focus on the activity during playground and eating activities.</li> <li>• Will motor plan her body movements to engage in preschool play.</li> <li>• Will improve her spatial location of sound relative to the position of her body in the classroom with and without background noise.</li> </ul>	<p>The OT practitioner will facilitate and enhance performance through the following therapeutic activities:</p> <p><i>Client level:</i></p> <ul style="list-style-type: none"> <li>• Increase sensory modulation through the use of heavy work activities.</li> <li>• Improve vestibular spatial body awareness through moving on swings and locating visual and auditory targets.</li> <li>• Improve adaptive responses and motor planning to increase competence when faced with dynamic activities and in her overall repertoire of play skills.</li> </ul> <p><i>Activity level:</i></p> <ul style="list-style-type: none"> <li>• Increase texture and weight of materials used during class activities.</li> <li>• Use visual cues for improved independence during familiar sequences and routines.</li> </ul> <p><i>Environment level:</i></p> <ul style="list-style-type: none"> <li>• Before class, Natasha will arrive early and will enter classroom prior to other children to gradually adjust to the increased noise and pace of the day.</li> <li>• Natasha will receive visual cues and tangible transition prompts, such as a visual schedule, to provide advance notice of classroom activity changes.</li> <li>• Natasha will be provided with a variety of seating options during circle time, such as a bean bag chair, rocking chair, ball chair, or cube seat.</li> <li>• Seating will be arranged near an adult.</li> </ul>

**Outcomes**

Outcomes were reported by members of the IEP team.

*Performance Skills*

- Improvement noted in all skill areas—motor, process, and social skills.

(Continued)

**Table 2. Case Examples Using SI Theory in Schools (cont.)**

<p><i>Performance Patterns</i></p> <ul style="list-style-type: none"> <li>• Easier transitions</li> <li>• Increased attention</li> <li>• New friendships</li> <li>• Sustained participation during classroom activities without withdrawing</li> <li>• Teacher and parent satisfaction that Natasha is able to participate in her preschool program and appears happier at school.</li> </ul>
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<p><i>Participation</i></p> <ul style="list-style-type: none"> <li>• Improved self-regulation and adaptation in the preschool routine.</li> </ul>
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**Case 2. Billy: Elementary School–Age Student**

**Evaluation**

*Referral:* **Billy** is a **7-year-old student** in a general education classroom environment. The IEP team requested an OT evaluation because of Billy's poor handwriting, aggressive behavior, difficulty completing work, and diagnosis of developmental coordination disorder.

*Occupational Profile*

Billy's guardians and educational team requested an OT evaluation because of his difficulty with writing, aggressive behavior, and a medical diagnosis of developmental coordination disorder. Information was obtained from Billy's medical, developmental, educational, and occupational histories. Billy receives speech therapy and specialized academic instruction from a resource specialist. He was referred to OT because of increasing aggressive behavior, difficulty beginning and completing work that was modified for his level of ability, and disorganized handwriting with almost no spacing between words. Billy has difficulty with play and social participation on the playground. He has poorly established habits and routines of organizing his belongings and self-care at school, often appearing disheveled. Parental and IEP team priorities include improving Billy's ability to meet the Common Core Standards (through handwriting and work completion) and ability to play more effectively with his peers.

*Analysis of Occupational Performance*

<i>Interview Data</i>	<i>Test Data</i>
<p><i>Teacher report:</i></p> <ul style="list-style-type: none"> <li>• Billy has above-average academic ability but completes fewer than half of his assignments in the proper amount of time.</li> <li>• Billy does not interact with his peers.</li> <li>• Billy has expressed the concern that as the demands of school increase, he is going to fall further and further behind.</li> <li>• Billy has poor use of his hands for tasks, such as opening his lunch containers and managing classroom tools.</li> <li>• Billy's writing is illegible.</li> </ul> <p><i>Parent report:</i></p> <ul style="list-style-type: none"> <li>• Billy has no friends.</li> <li>• Billy has difficulty comprehending simple verbal instructions.</li> <li>• Billy has unusual habits and rituals.</li> <li>• Billy has poorly established patterns of daily activities, such as getting ready to go to bed or mealtimes.</li> </ul>	<ul style="list-style-type: none"> <li>• Sensory Integration and Praxis Tests (Ayres, 1989) and clinical observation results were as follows:               <ul style="list-style-type: none"> <li>○ Visual–perception tests within normal limits</li> <li>○ Visual–motor tests 1–2 standard deviations below the mean</li> <li>○ Visual construction test scores in the high-average range</li> <li>○ Poor bilateral motor control</li> <li>○ Poor oral praxis and postural praxis</li> <li>○ Poor tactile discrimination</li> <li>○ Poor posture and eye control</li> <li>○ Decreased prone extension and supine flexion.</li> </ul> </li> <li>• Sensory Processing Measure–Home Form (Parham &amp; Ecker, 2007) revealed definite differences in social participation, movement, tactile functions, body awareness, and ideas and planning.</li> <li>• Sensory Processing Measure–Main Classroom and Social Environments Form (Miller-Kuhaneck, Henry, &amp; Glennon, 2007) revealed definite differences in response to movement and body awareness; Billy is easily overwhelmed with auditory and visual activity in the environment.</li> <li>• Classroom handwriting portfolio was compared with peers and revealed a discrepancy.</li> </ul>

**Intervention Examples**

<i>IEP Goals</i>	<i>OT Intervention Plan and Goals</i>	<i>OT Intervention Process and Strategies</i>
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**Table 2. Case Examples Using SI Theory in Schools** (cont.)

<p><i>Billy:</i></p> <ul style="list-style-type: none"> <li>• Will be able to write 3 legible sentences in his journal during a 20-minute writing period 4 of 5 opportunities.</li> <li>• Will stay on topic and remain in his seat for the duration of a 15-minute social studies lesson 4 of 5 opportunities.</li> <li>• Will participate appropriately in a structured playground activity with 1 other child without leaving the activity or arguing with the child for 10 minutes during the recess or lunch break 2 of 3 opportunities.</li> </ul> <p>OT is recommended to improve visual–motor control and overall attention.</p> <p>OT is to be provided in a specially equipped environment, and consultation is to be provided to the IEP team members.</p> <p><i>OT Goals: Billy</i></p> <ul style="list-style-type: none"> <li>• Will organize visual–motor information to write legible words.</li> <li>• Will organize somatosensory input from his body to imitate and follow visual directions during structured playground activities.</li> <li>• Will remain comfortably seated and regulate his attention during instruction to remain focused and on task during social studies.</li> <li>• Will confidently access playground equipment and perform in recess and physical education games with peers.</li> </ul>	<p>OT is recommended to improve visual–motor control and overall attention.</p> <p>OT is to be provided in a specially equipped environment, and consultation is to be provided to the IEP team members.</p> <p><i>OT Goals: Billy</i></p> <ul style="list-style-type: none"> <li>• Will organize visual–motor information to write legible words.</li> <li>• Will organize somatosensory input from his body to imitate and follow visual directions during structured playground activities.</li> <li>• Will remain comfortably seated and regulate his attention during instruction to remain focused and on task during social studies.</li> <li>• Will confidently access playground equipment and perform in recess and physical education games with peers.</li> </ul>	<p>The OT practitioner will facilitate adaptive responses through provision of sensory and motor challenges through the following interventions:</p> <p><i>Client level:</i></p> <ul style="list-style-type: none"> <li>• Use weight-bearing and heavy work activities to increase strength of Billy's trunk and upper extremities.</li> <li>• Increase Billy's exploration of multiple textures, sizes, and shapes to improve sensitivity and stereognosis in his hands.</li> </ul> <p><i>Activity level:</i></p> <ul style="list-style-type: none"> <li>• Instruct teacher in kinesthetic and visual support method to reteach fundamentals of handwriting.</li> <li>• Use weighted pencils, pencil grips, and paper with highlighted areas.</li> <li>• Allow Billy to do some of his work while standing, ball-sitting, or lying on his stomach.</li> </ul> <p><i>Environment level:</i></p> <ul style="list-style-type: none"> <li>• Provide written text to copy rather than copying from blackboard.</li> <li>• Provide written instructions and pictures of daily sequences of activities with times and locations.</li> <li>• Allow structured time for movement throughout the day as needed.</li> </ul>
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**Outcomes**

Outcomes were reported by members of the IEP team.

*Occupational Performance*

- Improved writing and language arts skills.
- Increased ADL and functional independence.
- Improved social participation.
- Independent engagement in structured activities.
- Improved participation and organization of behavior in daily routines.

**Case 3. John: Middle School–Age Student**

**Evaluation**

*Referral:* **John is 12 years old** and has just entered middle school. The IEP team requested an OT evaluation because John cannot organize his belongings and schedule or find his way around the middle school campus. He is experiencing high anxiety and refusing to go to school. Although psychoeducational assessments reveal adequate cognitive abilities, the IEP team members report escalating concerns related to John's ability to academically and physically keep up with his peers.

(Continued)

**Table 2. Case Examples Using SI Theory in Schools** (cont.)

<i>Occupational Profile</i>		
<p>John's family and the educational team requested an OT evaluation because of his difficulty finding his way around his school and resulting anxiety and depression. Additional information from John's medical, developmental, educational, and occupational histories was reviewed. Team priorities include increasing John's confidence and independence in performing school curriculum activities and ability to navigate around school without getting lost.</p>		
<i>Analysis of Occupational Performance</i>		
<i>Interview Data</i>	<i>Data From Record Review</i>	<i>Test Data</i>
<p><i>Parent report:</i></p> <ul style="list-style-type: none"> <li>• John gets lost easily.</li> <li>• John works best in a self-contained classroom with group transitions; however, the middle school is not structured this way.</li> <li>• John demonstrates poor spatial abilities, such as when he needs to align numbers in math.</li> <li>• John talks his way out of anything he finds difficult.</li> </ul> <p><i>John's self-report:</i></p> <ul style="list-style-type: none"> <li>• He has anxiety attacks.</li> <li>• He feels sick during rides in the car to school.</li> <li>• He feels stupid.</li> <li>• He wants to be home schooled.</li> <li>• He spends most of his day in sedentary activities.</li> <li>• He cannot tolerate backward movement of his head.</li> <li>• He cannot play desired team sports at the skill level of his peers and as a result feels rejected and humiliated by other children.</li> </ul>	<p>The elementary school file indicates that John performed well in academics but rarely finished written work on time in a legible or organized manner. He was well behaved and liked by peers.</p> <ul style="list-style-type: none"> <li>• John's teacher notes that John does not volunteer for classroom errands on the school grounds unless he could go with a peer.</li> <li>• John often lost his completed assignments in the classroom, later to be found in his messy desk or in unlikely places in the classroom.</li> </ul>	<ul style="list-style-type: none"> <li>• Below age level on VMI visual-motor integration and visual perception (Beery, Buktenica, &amp; Beery, 2010).</li> <li>• Within normal limits on VMI fine motor coordination in tracing precision (Beery et al., 2010).</li> <li>• Poor 2- and 3-dimensional construction ability.</li> <li>• Poor balance with eyes closed.</li> <li>• Self-reports of dizziness on playground swings.</li> <li>• Poor disassociation of his head, neck, and body.</li> <li>• Excessive talking to avoid performing during the evaluation observation.</li> <li>• Inability to locate familiar landmarks (e.g., office).</li> </ul>
<b>Intervention Examples</b>		
<i>IEP Goals</i>	<i>OT Intervention Plan and Goals.</i>	<i>OT Intervention Process and Strategies</i>
<p><i>John:</i></p> <ul style="list-style-type: none"> <li>• Will arrive at all of his classes independently and on time for 2 weeks.</li> <li>• Will attend school 8 of 10 days with low levels of anxiety, as noted by self-report.</li> <li>• Will show increased tolerance for bus rides as reported by John, parent, and bus driver 4 of 5 days.</li> <li>• Will identify age-appropriate leisure time options that are within his ability and interest level, such as individually oriented community sports and lessons (e.g., karate, yoga, swimming, chess, arts and crafts).</li> <li>• Will explore junior high extracurricular activities and clubs.</li> </ul>	<p>OT is recommended in the school setting.</p> <p><i>OT Goals:</i> John</p> <ul style="list-style-type: none"> <li>• Will identify 1 strategy of 3 options (i.e., map, written sequence, self-instruction) that works best for him to get to familiar places.</li> <li>• Will identify, select, and participate in leisure and extracurricular physical activities.</li> <li>• Will learn to identify antecedents to periods of increased anxiety and use relaxation techniques to remain calm when transitioning from home to school and between classes.</li> </ul>	<p>The OT practitioner will facilitate and enhance performance through the following interventions:</p> <p><i>Client level:</i></p> <ul style="list-style-type: none"> <li>• Develop various strategies for John to practice to improve his awareness of the geography of the campus.</li> <li>• Provide strategies to help John become aware of and identify his own sensory strengths, sensitivities, and preferences.</li> <li>• Increase proprioceptive heavy work activities to improve John's sense of his body in space.</li> <li>• Educate John to avoid intense vestibular activities.</li> </ul>

(Continued)

**Table 2. Case Examples Using SI Theory in Schools** (cont.)

		<p><i>Activity level:</i></p> <ul style="list-style-type: none"> <li>• Provide cues, landmarks, and signs that John can record as he walks to class.</li> <li>• Enroll John in extracurricular activities such as karate, yoga, swimming, or rock climbing.</li> </ul> <p><i>Environment level:</i></p> <ul style="list-style-type: none"> <li>• Pair John initially with a peer to walk to class.</li> <li>• Make a list of visual details as landmarks, take pictures, or put room numbers on an index card, color-coded for each of John's classes, to enable him to get to different classes.</li> </ul>
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**Outcomes**

Outcomes were reported by members of the IEP team.

*Participation*

- Improved confidence in his own ability to adapt to and meet the everyday spatial demands of school activities, greatly reducing stress at school.
- Increased self-awareness and self-determination in seeking advice to devise strategies to compensate in situations that are uncomfortable or intimidating.
- Improved ability to arrive at class on time.
- Independence in finishing and finding 75% of his assignments.
- Decreased resistance to going to school.
- Increased initiation of participation in leisure activities with peers, such as school clubs.

*Client Satisfaction*

- Confidence in traveling between classes without assistance.
- Increased parent-reported happiness at home and at school.
- Cessation of reports of depression or anxiety.

*Note.* ADL = activity of daily living; AOTA = American Occupational Therapy Association; IEP = individualized education program; OT = occupational therapy; SI = sensory integration; VMI = Beery–Buktenica Developmental Test of Visual–Motor Integration.

Occupational therapy services provided to support a child with sensory processing differences may be delivered within multiple contexts that include the variety of educational environments and routines. Two types of commonly applied occupational therapy interventions for children with sensory processing and SI challenges in school-based practice include (1) occupational therapy using sensory-based interventions and (2) occupational therapy using an SI approach.

## Occupational Therapy Using Sensory-Based Interventions

Sensory-based interventions focus on how sensory input within the school environment affects student participation (Foster & Cox, 2013). Occupational therapy practitioners use sensory-based interventions to address specific sensory needs related to sensory modulation or sensory discrimination (Watling et al., 2011). Sensory-based interventions used in school settings commonly involve the application of Dunn's (2013) model that organizes sensory processing into four basic patterns of behavioral responses ("seekers," "avoiders," "bystanders," and "sensors"), which depend on individuals' thresholds for sensory input and whether they use active or passive strategies to support self-regulation. Using this strengths-based model,

the occupational therapy practitioner designs interventions that consider the sensory needs of the students and teachers within the context (i.e., authentic activity settings and routines). Interventions may include helping school personnel consider sensory processing patterns or factors when addressing student concerns, implementing daily routines that incorporate sensory-based activities, and modifying the environment to match students' sensory needs and support participation. Self-regulation strategies may be taught using the Alert Program (Williams & Shellenberger, 1994) and Zones of Regulation (Kuypers, 2011).

Provision of occupational therapy using sensory-based interventions often involves the use of sensory accommodations or strategies such as the use of mobile-seating options or fidget toys to address single-sensory systems. Some sensory strategies, such as the use of dynamic seating and strategies to increase attention, have shown promising results (Bagatell, Mirigliani, Patterson, Reyes, & Test, 2010; Fertel-Daly, Bedell, & Hinojosa, 2001; Schilling & Schwartz, 2004; Schilling, Washington, Billingsley, & Deitz, 2003). It is important to communicate to the educational team that these strategies must be used within the overall context of an occupational therapy intervention plan. Sensory-based strategies without the oversight of an occupational therapist do not constitute occupational therapy.

## Occupational Therapy Using a Sensory Integrative Approach

Occupational therapy using a sensory integrative approach is grounded in the work of A. Jean Ayres, PhD, OTR, and identified by the trademarked term *Ayres Sensory Integration*<sup>®</sup> (ASI; Fertel-Daly et al., 2001). ASI represents a

- Well-developed theory grounded in basic and applied science (Berthoz, 2002; Berthoz & Petit, 2008; Head, 1920; Sherrington, 1906, 1940; Stein, 2012);
- Model of practice (Ayres, 1972a, 1972b, 1979);
- Set of standardized, structured and unstructured assessments (Ayres, 1989; Blanche, 2002; Davies & Tucker, 2010; Mailloux et al., 2011; Mulligan, 1998; Watling et al., 2011); and
- Replicable intervention, with evidence of its effectiveness (Pfeiffer, Koenig, Kinnealey, Sheppard, & Henderson, 2011; Schaaf et al., 2014; Smith Roley, Mailloux, Miller-Kuhaneck, & Glennon, 2007; Watling et al., 2011).

For school-based practice, difficulties in sensory integration and praxis are predictive of academic achievement in elementary school children (Parham, 1998). A compendium of evidence in SI can be found in Watling and colleagues (2011).

The use of ASI requires additional knowledge and skills, such as administering and interpreting the SIPT (Ayres, 1989). Occupational therapy practitioners gain expertise through workshops, publications, mentoring, pediatric study groups, and postgraduate studies. To ensure implementation of ASI with fidelity, intervention is provided by a skilled occupational therapy practitioner who is guided by the interpretation of a thorough assessment and who provides services within a therapeutically designed setting with appropriate space and equipment. This method relies on interactions between the therapist and child in a sensory-rich environment and uses a collaborative and playful approach, with attention to the child's successful adaptation to a variety of novel challenges, including sensory reactivity, sensory-perceptual and postural skills, and praxis. Collaboration with caregivers is essential, as are the one-to-one interactions with the child (Parham et al., 2011).

Therapy services that support participation in the LRE frequently occur in natural school spaces (e.g., classroom, playground, gym, cafeteria). Provision of SI methods, such as moving through space (e.g., climbing in, over, and under large equipment; swinging on equipment; playing with toys and structures graded for specific needs), may be essential to meet the IEP goals for some children and can be provided on a school campus.

The choice of interventions is guided by the best available research regarding the effectiveness of the intervention related to the identified goals for the child. The efficacy of occupational therapy's use of SI and sensory processing has been investigated by numerous researchers during the past 35 years. The outcome of occupational therapy using SI methods is to improve function in various daily occupations (Ayres, 1979; Bundy, Lane, & Murray, 2002; Dunn, 2001; Parham & Mailloux, 2010; Smith Roley, Blanche, & Schaaf, 2001; Watling et al., 2011). Recent studies adhering to fidelity in ASI intervention have shown promising results (Fazlioğlu & Baran, 2008; Pfeiffer et al., 2011; Smith, Press, Koenig, & Kinnealey, 2005). Research supporting the use of SI methods can be found in *Occupational Therapy Practice Guidelines for Children and Adolescents With Challenges in Sensory Processing and Sensory Integration* (Watling et al., 2011). Selected studies supporting projected educational outcomes, by OT focus area, are provided in Table 3.

**Table 3. Occupational Therapy Service Continuum Focus Areas, Projected Outcomes, and Research Support for School-Based Practice Using SI Theory and Methods**

This table provides samples of studies supporting various SI theory and methods and outcomes in school-based practice. It is not an exhaustive list of the available evidence.

OT Focus Area	Projected Educational Outcomes	Examples of Resources and Evidence
Participation in education Emotional regulation, sensory-perceptual, motor, praxis, and cognitive skills	Students will access general education curriculum and attend to classroom instruction for longer periods of time prior to identification for special education eligibility and formal OT evaluation.	Schilling et al. (2003)
School readiness for education participation Play and leisure Communication and social skills	Students access general education standards and learn adaptive behavior and social skills.	Jarrett & Maxwell (2000) Pellegrini & Smith (1993, 1998)
Self-regulation, including the development of emotional regulation, cognitive, and sensory-perceptual skills	Students build sensory self-awareness and self-regulatory strategies to increase focus of attention and completion of schoolwork.	Wells, Chasnoff, Schmidt, Telford, & Schwartz (2012)
Attention and on-task behavior to improve participation in education	Students increase on-task behavior through classroom modifications, sensory strategies, sensory breaks, and sensory diets integrated into the school routine.	Kinnealey et al. (2012) VandenBerg (2001)
Cognitive, sensory-perceptual, and motor and praxis skills that enhance academic learning	Academic scores are improved through SI methods focusing on eliciting adaptive responses during OT. Gains in language comprehension and on expressive language measures are noted after OT using SI methods.	Ayres (1972a) Ayres & Mailloux (1981)
Sensory functions and sensory-perceptual skills influencing readiness to learn Adaptation	Individuals with hyperresponsiveness such as tactile defensiveness and gravitational insecurity responded better to intervention than those with underresponsiveness or who failed to orient to sensory input.	Ayres & Tickle (1980)
Cognitive, sensory-perceptual, and motor and praxis skills that enhance academic learning and communication and social skills	Following SI intervention, children with decreased cognitive function showed improved spontaneous language, indicating that vestibular activities are effective nonverbal strategies for increasing spontaneous language.	Magrun, Ottenbacher, McCue, & Keefe (1981)
Participation in ADLs and ability to engage in a variety of functional activities	Group who received SI intervention showed reduced self-stimulating behaviors that interfere with participation in functional activities. Study compared an SI approach with tabletop activities in children with pervasive developmental disorder and mental retardation.	Smith, Press, Koenig, & Kinnealey (2005)

(Continued)

**Table 3. Occupational Therapy Service Continuum Focus Areas, Projected Outcomes, and Research Support for School-Based Practice Using SI Theory and Methods (cont.)**

OT Focus Area	Projected Educational Outcomes	Examples of Resources and Evidence
Sensory–perceptual and fine motor skills affecting penmanship and handwriting	Using sensory strategies via classroom consultation and direct intervention related to sensory processing improve visual–motor skills, which support penmanship and writing skills.	Hall & Case-Smith (2007)
Participation in play and leisure, including curiosity and independent learning	SI approaches improve play and interactions with others and with toys and other objects, as well as tolerance for vestibular and proprioceptive sensations, and lead to greater sensory exploration of the environment. Sensory exploration improves as a key feature of independent learning intervention when OT with a SI approach is used to address symptoms related to learning disorders.	Schaaf, Merrill, & Kinsella (1987)
Reading	Smooth eye pursuits, which are important in developing reading skills, improved in this study, which demonstrated a reduction in the number of saccades for the intervention cohort and reduced time necessary to accomplish smooth pursuits.	Horowitz, Oosterveld, & Adrichem (1993)
Academic skills Motor skills	SI intervention methods prove equally as effective as tutoring in improving academic and motor skills, with maintenance of gains in motor skills development. This randomized clinical trial compared OT using SI with tutoring to improve academic and motor skills. Although the SI group did not make greater gains in the initial study, at follow-up 2 years later, only the SI group maintained their gross motor skills.	Wilson, Kaplan, Fellowes, Gruchy, & Faris (1992)
Emotional regulation skills resulting in positive behavior Health and wellness Quality of life	A decrease in disruptive behaviors is noted with improved speech, play, attention, and social dialogue. This single-case study of 2 children demonstrated improvements in social interaction, approach to novel activities, response to affection, and response to movement.	Linderman & Stewart (1999)
Self-advocacy and parent advocacy Quality of life	Parents report increased ability to advocate for their child on the basis of improved understanding of their child’s behavior and validation of their parenting efforts. At the clinic site, waiting room interactions allowed parents time to share experiences and resources with others and expand their understanding of their children.	Cohn (2001) Cohn, Miller, & Tickle-Degnen (2000)
Positive behavior Increased engagement Independent work	SI supports behavior in preschool-aged child, including increased engagement, decreased aggression, less need for intense teacher direction, and decreased mouthing of objects. Using a single-case-study design, researchers found that the child benefited from classic ASI, affecting his preschool performance.	Roberts, King-Thomas, & Boccia (2007)
Participation at school	SI supports occupational performance and behavior in a school-age child, improving participation at school, at home, and in the community. Using a single-case-study design, the researchers found that the child benefited from classic ASI, which affected his occupational performance and behavior.	Schaaf & Nightlinger (2007)

(Continued)

**Table 3. Occupational Therapy Service Continuum Focus Areas, Projected Outcomes, and Research Support for School-Based Practice Using SI Theory and Methods** (cont.)

OT Focus Area	Projected Educational Outcomes	Examples of Resources and Evidence
Play Learning	Research suggests that learning is enhanced by emotion, spontaneity, and play, which are the essential ingredients in a SI approach used within OT. Physiological data show increased cortical blood volume during performance of novel integration activities in a spontaneous, playful manner.	Peyton, Bass, Burke, & Frank (2005)
Occupational performance in educational settings observed via academic achievement	Measures of SI in elementary students are significantly related to school achievement concurrently and predictively over a 4-year period, even when controlling for intelligence. A particularly strong link between praxis and math achievement is evident.	Parham (1998)

*Note.* This table provides examples of studies supporting SI theory, methods, and outcomes in school-based practice. It is not an exhaustive list of the available evidence. ADLs = activities of daily living; ASI = Ayres Sensory Integration®; OT = occupational therapy; SI = sensory integration.

Through accurate functional baseline data, measurable student goals, and data collection to monitor a child's successful participation in the natural environment, occupational therapy practitioners provide accountability for a child's progress in occupational therapy intervention as it relates to education. Goal attainment scaling is a promising method providing practitioners with the possibility of measuring achievement toward customized, participation-based goals (Mailloux et al., 2007).

## Summary

AOTA recognizes SI as one of several theories and methods used by occupational therapists and occupational therapy assistants working with children in public and private schools. Regardless of the theories and methods used, occupational therapy practitioners work within the framework of occupational therapy toward the desired outcome of enhancing a person's ability to participate in life through engagement in everyday activities (AOTA, 2014b). When children demonstrate sensory, motor, or praxis deficits that interfere with their ability to access the general education curriculum, occupational therapy using an SI approach is appropriate.

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