Development of the Sensory Processing Measure–School: Initial Studies of Reliability and Validity

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OBJECTIVE. The history and development of the Sensory Processing Measure–School are detailed, and findings of initial pilot studies are reported.

METHOD. Multiple reviews, focus groups, case studies, and two pilot studies were used to develop the early versions of the tool. Internal consistency and discriminatory ability were examined.

RESULTS. Internal consistency measured with Cronbach’s alphas ranged from .93 to .99 in the first pilot study and .70 to .99 in the second pilot study. Children who were typically developing were correctly classified 92.3% of the time, and children with sensory issues were correctly classified 72% of the time.

CONCLUSION. Initial results suggest that the tool is reliable and valid and discriminates children with and without sensory processing issues. Further research is under way with larger samples.


Over the past 10 years, important changes have occurred in what is considered to be best practice in occupational therapy in the schools (Muhlenhaupt, 2003; Roley, Clark, Bissell, & Brayman, 2003; Swinth & Muhlenhaupt, 2004). Concurrently, occupational therapists are increasingly being asked to evaluate schoolchildren to determine the impact of sensory processing difficulties on the child’s educational performance. In response to this need, the Sensory Processing Measure–School (SPM–School) was created.

Description of the SPM–School

The SPM–School contains items related to sensory processing, praxis, and social participation in seven school environments (classroom, recess, cafeteria, music, art, physical education, and bus), each of which are rated with a Likert scale. Each environment’s rating scale is completed by the appropriate staff member (e.g., classroom teacher, art teacher, lunchroom assistant), who has known the child for at least 1 month. The tool’s purpose is to provide information to the educational team about the sensory facilitators of, and barriers to, successful functional performance in school by comparing and contrasting environments. It is recommended that all environments be completed; however, the tool may be used with the primary classroom teacher alone. The tool’s structure allows comparison within and across environments, between sensory processing categories, praxis items, and social participation. These comparisons facilitate team discussions, which can identify or rule out the sensory basis of social behavior as well as identify specific contextual components facilitating or inhibiting functional performance.
Literature Review: Need for the SPM–School

The decade between 1995 and 2005 has seen two reauthorizations of the law mandating occupational therapy practice in the schools (the Individuals with Disabilities Education Act [IDEA]); the adoption of the Occupational Therapy Practice Framework (American Occupational Therapy Association [AOTA], 2002); a return to our professional roots, with a greater emphasis on occupation throughout our profession (AOTA, 1995; Canadian Association of Occupational Therapists, 1991; Kielhofner, 2004); an increased public awareness of sensory integration and sensory processing disorders; and the resultant changes in practice that all of these other changes prompted. The ability of all children to access a free and public education has been positively affected by occupational therapy services since the passage of the Education for All Handicapped Children Act of 1975 (P.L. 94-142). However, the way that occupational therapists operate within the school environment, and thus the tools that they require to successfully support children, have changed with the revisions of this original legislation. The IDEA of 1990 (P.L. 101-476) emphasized supporting children in the least restrictive environment, accessing general education, and providing an appropriate evaluation. The 1997 reauthorization of IDEA (P.L. 105-117) further illustrated the ideal evaluation process as multidisciplinary, specifically mandating that regular education teachers be involved in the evaluation and planning process. The most recent reauthorization of the IDEA (P.L. 108-446) in 2004, as well as the 2001 No Child Left Behind general education legislation (P.L. 107-110), emphasized that children require support and specifically designed instruction to access and progress in the general education curriculum and that early identification and prevention are key factors to a child’s success. As a result of these legislative changes, a shift away from a primarily diagnostic procedure has occurred in the educational evaluation process. Rather, a process that is considered best practice identifies functional problems, considers how the child manages the general education curriculum, and focuses on the child’s educational needs so the team can support performance within a variety of natural contexts.

Occupational therapists are urged to assess a person’s task performance within appropriate contexts, in collaboration with others, as opposed to measuring isolated skills in a testing situation (Baum & Christiansen, 2004; Dunn, 2000; Law, Baum, & Dunn, 2000; Mancini & Coster, 2004; Orr & Schkade, 1997; Stark & Sanford, 2004). Assessing the environmental aspects of occupational functioning and participation across school settings, and completing these assessments via team collaboration, is now considered best practice (Case-Smith, 1997; Clark & Coster, 1998; Clark & Miller, 1996; Kemmis & Dunn, 1996; Swinth & Muhlenhaupt, 2004). This method benefits not only the student but also the occupational therapist and teachers. Therapists report feeling successful when they are able to reframe a student’s behavior and help the team to greater understanding (Case-Smith, 1997), teachers may perceive greater occupational therapy contribution to student skill development as collaborative practices increase (Barnes & Turner, 2001), and students benefit from the effectiveness of linking occupational therapy evaluation and intervention to the student’s academic goals (Kemmis & Dunn, 1996).

Children with poor sensory processing and praxis often have difficulties functioning in the classroom environment and can present challenges to educational team members as they attempt to determine the cause of the child’s poor performance. If, as parent report indicates, between 5% and 13% of all children may have sensory processing disorders (Ahn, Miller, Milberger, & McIntosh, 2004), a large number of children attending school may have these difficulties. Although the relationship between poor sensory processing and educational performance has long been hypothesized (Ayres, 1972, 1979) and some supportive evidence exists (Parham, 1998), the sensory integration frame of reference is used in the schools when a student’s sensory concerns contribute to significant, documented, educational difficulties (Roley, Clark, Bissell, & Brayman, 2003). With that said, the sensory integrative frame of reference is frequently used in schools and reportedly is one of the predominantly applied approaches (Storch & Eskow, 1996). School-based occupational therapists report success when they are able to identify an underlying cause for a behavior, often by using the sensory integration frame of reference (Case-Smith, 1997); however, currently no tools are available to guide them in this process.

Many of our current assessments do not readily provide the types of information we need, and the commonly used tools that examine motor skills are not designed to examine educational performance in context. The School Function Assessment (Coster, Deeney, Haltiwanger, & Haley, 1998), which allows comparison of functional abilities across school environments, does not specifically provide information about a child’s sensory processing and its impact on educational performance. The Sensory Integration and Praxis Tests (Ayres, 1989), an excellent diagnostic tool for sensory integrative dysfunction, does not specifically examine educational performance in context, whereas parent or caregiver questionnaires that examine sensory processing have not been designed for school use. Therefore, no published tools are available to assist the school-based practitioner in
specifically examining the impact of sensory processing and praxis difficulties on educational performance across multiple educational environments.

Development and History of the SPM–School

The SPM–School (which was called the School Assessment of Sensory Integration, or SASI, until summer 2005) was initially created in 2000 following procedures set forth in the occupational therapy literature (Benson & Clark, 1982; Bonder, 1989). A table of specifications was developed and various available sensory histories were reviewed to obtain an initial pool of items relevant to sensory integration theory that could be modified for use in the educational environment. This initial version of the test was sent to a panel of experts (n = 10), chosen from the School System and Sensory Integration Special Interest Section committees of AOTA, for their general review of face validity, the need for such a tool, and its practical usefulness. Another expert review was completed using four experts in sensory integration theory and test development, who completed item-by-item analysis of clarity, usefulness, freedom from bias, placement in categories and environments, and potential specificity and sensitivity. A third review was completed by 40 school-based clinicians who each examined a subset of 20 items (out of the tool’s 200+ items) and categorized them by sensory system, type of sensory processing dysfunction, and appropriateness for each educational environment. Revisions occurred after each step based on the feedback provided.

Two focus groups were held during these early phases of development. In one focus group, school-based clinicians and sensory integration experts freely generated observations that they make in the schools that suggest to them that a child may have issues with sensory processing and praxis (i.e., rocking in chair, chewing on shirt). A second focus group, organized for participants who had used the tool, examined its format and provided comments and suggestions on the items, structure, overall content, and ease of use. After the focus groups, the tool was revised again.

Four case studies were completed with the early versions of the tool. The first was with 4 students in an elementary school in the southwestern United States, two students were typically developing, and 2 were suspected to have issues with sensory processing or praxis. Implementing the tool allowed us to gather information about the ease of tool usage and the potential usefulness of the information gathered for an actual educational team. The responses by the occupational therapist and the team were positive; however, this first use did lead to item changes in wording to increase clarity for the educational personnel (Glennon, Henry, & Kuhaneck, 2003). Three additional case studies, all in an elementary school in the southwestern United States, were conducted to examine the SPM–School’s usefulness and outcomes of completion. Interviews with the school personnel involved in these case studies suggested that they found the tool useful, that they thought the SPM–School might be appropriate for pre-referral team use, and that the team valued the collaborative process that occurred with its use (Glennon, Henry, & Kuhaneck, 2005; Glennon, Henry, Kuhaneck, Parham, & Ecker, 2006).

Over a 2-year period, two pilot studies were conducted to examine the reliability and validity of SPM–School. All pilot data were gathered by volunteer occupational therapy coordinators who distributed and gathered forms from appropriate raters in each environment. To complete the forms, the raters reflected on the child’s performance over an entire month. The first pilot study, conducted between the fall of 2003 and spring of 2004 (Glennon, Henry, & Kuhaneck, 2004), completed an initial investigation of reliability. Participants included 23 children who were typically developing, enrolled in kindergarten through sixth grade. Data were analyzed via the SPSS statistical program to examine internal consistency for all items in all environments. Internal consistency was examined via Cronbach’s alpha, which measures how well items correlate with each other and the total score. Cronbach’s alpha scores range from 0 to 1, and scores of .90 or greater are considered to be high (Portney & Watkins, 2000). Cronbach’s alpha scores for the first pilot study ranged from .97 to .99 for each individual sensory processing environment and from .93 to .99 for each environment’s social participation items.

Data for the second pilot study were collected between the late spring of 2004 through December 2004 (Glennon et al., 2005) and included 26 children who were typically developing and 25 children who were receiving occupational therapy in their schools. The latter students were identified by their occupational therapist as having sensory processing difficulties via the Sensory Integration and Praxis Tests (Ayres, 1989), the Sensory Profile (Dunn, 1999), or observations of behaviors that clinicians associate with sensory processing deficits. The statistical procedures used in the first pilot study also were used for the second pilot study, with the addition of discriminant analysis to examine the validity of the instrument. Cronbach’s alpha for sensory processing items for children with sensory issues in the second pilot study ranged from .87 to .99, whereas the range was .70 to .99 for the children who were typically developing. Cronbach’s alpha for social participation ranged from .91 to .97 for children with sensory issues and from .98 to .99 for children who were typically developing. Discriminant anal-
ysis also was conducted to examine the SPM–School’s ability to accurately discriminate children with sensory issues from those without. The SPM–School accurately discriminated 82.4% of the cases, both children who were typically developing and children who had sensory issues. The SPM–School correctly classified children who were typically developing as typical 92.3% of the time and classified children with sensory issues as children having issues 72% of the time.

Discussion
Changes within the occupational therapy profession in general, and within school-based practice in particular, have created a need for assessments that allow occupational therapists to contribute their knowledge of the sensory integrative frame of reference in ways that are useful to an educational team. We believe that the SPM–School will fill that need. The results of the pilot studies suggested that the SPM–School is an internally consistent (Portney & Watkins, 2000) and reliable tool. However, the results also suggested that the groupings of sensory processing items had lower internal consistency than the social participation item groupings. Perhaps sensory processing is a construct that is more difficult to measure consistently than is social participation. This finding is not unexpected, based on sensory integration theory, which hypothesizes that an individual’s sensory processing fluctuates within and across sensory systems and environments. Although temperament literature reports that social behavior may be a stable trait (Lemery, Goldsmith, Linnert, & Mrazek, 1999; Pedlow, Sanson, Prior, & Oberklaid, 1993), it also may be that the sensory processing items were more difficult for the raters to rate consistently. This difficult nature deepens the challenges for researchers and practitioners to accurately assess sensory processing in natural environments to guide occupational therapy services.

The face and content validity suggested by expert reviewers and clinicians was further demonstrated through the tool’s ability to discriminate between children with and without sensory issues. Although this information is preliminary, it suggests that the SPM–School is a valid assessment for examining sensory processing issues in the school environment. As with any instrument development, refinement and improvement is a continuing process. The findings related to the psychometric properties of the early versions of the SPM–School are particularly encouraging.

School-based practitioners have many responsibilities related to the use of sensory integration theory within the educational system. An advantage of the SPM–School will be the ability to compare a student’s performance across and between environments and also to consider the student’s social participation. This comparison will allow the generation of hypotheses regarding the impact of sensory processing and praxis issues on the student’s performance. Occupational therapists report that the ability to determine underlying reasons for a child’s behavior is an important aspect of their successful performance in schools (Case-Smith, 1997). We believe, based on feedback from raters and coordinators and through our case studies, that the use of the SPM–School will assist occupational therapists in determining sensory-based facilitators of and barriers to performance; engender team discussion and collaboration; promote team problem solving; and allow for team intervention planning, which includes developing creative strategies to improve a child’s functional performance.

The SPM’s final version will include two forms, a school form and a home form. The Sensory Processing Measure–Home was formerly the Evaluation of Sensory Processing (Parham & Ecker, 2000). Normative data have been collected for both forms of the Sensory Processing Measure, and further analysis of the tool’s psychometric properties is continuing using Rasch analysis. This project is being coordinated by Western Psychological Services (WPS), the publisher of the Sensory Processing Measure.

Conclusion
Occupational therapy evaluation approaches in schools should promote team problem solving and collaboration and examine performance in natural environments. New assessments are needed to allow occupational therapists to consider the sensory aspects of the environment and the sensory processing abilities of the child that may affect educational performance. Initial results suggest that the SPM–School demonstrates internal consistency and face validity and is able to accurately discriminate between children who are typically developing and children who have issues with sensory processing. Case studies completed with the tool suggested its usefulness in pre-referral planning, team problem solving, education of team personnel, and supporting collaboration. Final research phases with WPS will provide normative data on large samples, for both school and home versions, and we believe that the final tool will promote team collaboration in schools and clinics for a greater understanding of the impact of sensory processing on function.

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References


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