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AUTHOR(S)

T Brown, I Morrison, Karen Stagnitti

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The convergent validity of two sensory processing scales used with school-age children: Comparing the Sensory Profile and the Sensory Processing Measure

Ted Brown, Ilona C. Morrison, and Karen Stagnitti

Abstract

Aim: To investigate the convergent validity between the Sensory Profile, the Sensory Profile School Companion, and the Home and Main Classroom Forms of the Sensory Processing Measure.

Method: Thirty mothers completed the Sensory Profile and the Sensory Processing Measure – Home Form on one child each. Nineteen teachers of the same children completed the Sensory Profile School Companion and the Sensory Processing Measure – Main Classroom Form.

Results: The Sensory Profile and the Sensory Processing Measure – Home Form were significantly correlated ($\rho=0.86$, $p<.01$). The Sensory Profile School Companion and Sensory Processing Measure – Main Classroom Form were also significantly correlated ($\rho=.74$, $p<.01$).

Conclusion: The two sets of sensory processing scales had moderate levels of convergent validity.

Key words

Child, occupational therapy, validity, Sensory Profile, Sensory Processing Measure

Reference

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Sensory processing problems can often negatively impact on a child's occupational performance. For example, the limited range of foods a child will eat, sensitivity to certain types of clothing textures, low tolerance for noisy environments, and aversion to being hugged. Occupational therapists have a key role in assessing the sensory needs of children. Sensory processing scales used with school-age children include the Sensory Profile (Dunn, 1999), the Sensory Profile School Companion (SPSC) (Dunn, 2006), and the Sensory Processing Measure (SPM) (Miller-Kuhausen, Henry, Glennon, & Mu, 2007; Parham, Ecker, Miller-Kuhausen, Henry, & Glennon, 2007). These scales are all standardized parent-report, teacher-report, judgment-based questionnaires that require the respondent to complete a rating scale based on how frequently certain behaviours occur. For any standardized test, it is important that a body of psychometric evidence is established, particularly studies completed by independent investigators, in addition to the studies completed by the original test authors (Anastasi & Urbina, 1997; Downing, 2003; Streiner & Norman, 1995). Since the scales under investigation are all relatively new, additional empirical studies documenting their reliability and validity are needed (Baranek, 2002; Goodwin, 2002; Kielhofner, 2006).

The purpose of this study is to examine the convergent validity of the Sensory Profile, the SPSC, and the Home and Main Classroom Forms of the SPM. The specific research questions are: i) what is the convergent validity of the SPM – Home Form

Dr Ted Brown, PhD

Department of Occupational Therapy
School of Primary Health Care
Faculty of Medicine, Nursing and Health Sciences
Monash University
PO Box 527
Frankston, Victoria, 3199, Australia
Phone: +613 9904 4462
Email: ted.brown@med.monash.edu.au

Ilona C. Morrison

Deakin University, Waterfront Campus
Geelong, VIC

Dr Karen Stagnitti, PhD

Deakin University, Waterfront Campus
Geelong, VIC

and the Sensory Profile?; ii) what is the convergent validity of the SPM – Main Classroom Form and the SPSC?; and iii) what is the association between the ratings of mothers of children who complete the Sensory Profile and the SPM – Home Form and the ratings of teachers of the same children who complete the SPSC and the SPM – Main Classroom Form?

The Sensory Profile, the SPSC, and the SPM were all developed in the United States, but are used by therapists in New Zealand and Australia as well as other Western countries (Rodger, Brown, & Brown, 2006; Rodger, Brown, Brown, & Roevers, 2006). Completing studies in a cross cultural context provides valuable data about the relevance, usability, and applicability of the scales (Brown, Leo, & Austin, 2008; Streiner & Norman, 1995). Information regarding convergent validity is currently lacking with the Sensory Profile, SPSC, and the SPM (Fairbank, 2005; Miller-Kuhaneck et al., 2007).

Literature review

Sensory processing is a neurological process that occurs in all of us. Sensory input from the environment and from the body itself provides information to the brain (Dunn, 2007). The brain organizes, integrates, synthesizes, and uses this information to understand experiences and organize appropriate responses. The processing of information allows individuals to respond automatically, efficiently, and comfortably in response to the specific sensory inputs received (Dunn, 2007; Yack, Aquilla, & Sutton, 2002). Sensory processing skills influence a child's ability to perform everyday tasks and activities (occupations), and therefore they are used by occupational therapists for specific assessment, intervention, monitoring, and follow-up evaluation (Case-Smith, Richardson, & Schultz-Krohn, 2005; Yack et al., 2002).

Sensory processing disorder

Sometimes a child's response to the sensory environment can have a negative impact on the successful engagement with and completion of his/her daily life occupations. Sensory processing disorders (SPD) "affects the way the brain interprets the information that comes in and the response that follows, causing emotional, motor, and other reactions that are inappropriate and extreme" (Bowyer & Cahill, 2009, p. 331). Reduced ability to play successfully with other children can be related to poor participation in sensory and motor play, from which cognitive and social skills emerge and develop (Bundy, 2002). The fear, anxiety, or discomfort experienced in everyday situations by children with sensory processing impairments can disrupt daily routines in the home environment (Parham & Mailloux, 2005). Furthermore, school environments may contain social and physical stimuli that cause these children distress (Burleigh, McIntosh, & Thompson, 2002). Challenges stemming from sensory processing disorders sometimes only become apparent once a child enters a day-care or school environment (Burleigh et al.). Sensory processing problems may even persist into adulthood, with related social, behavioural, and emotional difficulties (Kinnealey, Oliver, & Wilbarger, 1995).

Parham and Mailloux (2005) outlined five functional impairments associated with SPD. These include, decreased social participation and occupational engagement; decreased length, frequency, or complexity of adaptive responses (successful response to an environmental challenge); impaired self-confidence and or self-esteem; poor daily life skills and reduced family life; and diminished fine-, gross-, and sensory-motor skill development. SPD can negatively affect development and functional abilities in behavior, emotional, motor, and cognitive domains (Ahn et al., 2004). Children diagnosed with various conditions including Autism Spectrum Disorder, Asperger Syndrome, Attention Deficit Hyperactivity Disorder, Sensory Modulation Disorder, Developmental Coordination Disorder to name a few, are prone to SPD (Ahn et al.; Baranek, 2002; Dunn, 2006; Kern et al., 2007; Reebye & Stalker, 2008; Rogers, Hepburn, & Wehner, 2003). Occupational therapists working with children in these diagnostic groups, aim to promote and optimize their occupational performance and occupational development, therefore they need to assess and understand sensory processing.

Estimated rates of sensory processing disorders for children with developmental disabilities have been derived from reliable and valid survey results and are reported to be as high as 40% to 88% (Tomchek & Dunn, 2007). Among children without disabilities, estimates of the prevalence of sensory processing disorders based on clinical experience have ranged from 5% to 10% (Ahn et al., 2004). However, no prospective published data exists on the rate of sensory processing disorders in a typically developing population. Ahn et al. conducted one such study, to estimate sensory processing disorders in a typically developing population, using a parent-report survey screening instrument. This study found that 5.3% of their sample met criteria for SPD. These figures clearly indicate the importance of having instruments and scales that are valid and reliable when screening and assessing sensory processing issues.

Validity

The validity of a test or scale is gauged by comparing it to tests of the same concept or construct developed through other methods (Streiner & Norman, 1995). The convergent validity of an instrument or scale indicates the degree of consistency between measurements obtained by different approaches measuring the same trait (Anastasi & Urbina, 1997). For instance, to demonstrate the convergent validity of a test of reading skills, two sets of scores from different tests measuring the same reading ability would be compared. High correlations between the test scores would be evidence of a convergent validity between the two instruments. To estimate the degree to which any two scales are related to each other, a correlation coefficient is typically used (Anastasi & Urbina). That is, the patterns of inter correlations among the test scores are reviewed. Correlations between theoretically similar measures should be 'high' while correlations between theoretically dissimilar measures should be 'low' (Streiner & Norman, 1995). Thus, scores from the Sensory Profile, SPSC, and the SPM can be correlated since they claim to measure the same sensory processing constructs.

Method

A prospective quantitative research process was used for this study, since this design enabled the examination of the relationships between variables using numerical presentation of statistical analysis.

Participants

This study involved two groups of participants each recruited via convenience sampling in local school districts. Participants in the first group were mothers of a group of children aged five to ten years. The second group consisted of the classroom teachers of the same group of children. All the participants were city dwellers. The children who were the focus of the report did not have any known or suspected sensory processing problems and were typically developing. Typically developing children were included in the study to compare the sensory process constructs measured by the four scales as reported by mothers and teachers.

A total of 30 mothers took part in the study. The inclusion criteria included:

- having a child between the ages of five and ten years
 - both parents' having input to completing the Sensory Profile and the SPM – Home Form
 - having a working knowledge of written English language.
- Nineteen teachers took part in the study. The inclusion criteria for the teachers included:
- being the main classroom teacher of the child.

Table 1. Demographic information related to participants

Parent participants (N=30)	N (%)
Gender	
Female (mothers)	30 (100)
Age	
18–25 years	2 (3.3)
26–35 years	7 (25.0)
36–45 years	17 (58.4)
46–55 years	3 (10.0)
56 + years	1 (3.3)
Marital status	
Married	28 (93.4)
De facto / common-law	2 (6.6)
Single	0 (0.0)
Divorced/Separated	0 (0.0)
Time child resides in care	
Full-time	30 (100.0)
Part-time	0 (0.0)
Geographical location of residence	
Inner city	2 (6.6)
Suburban	11 (36.6)
Rural	17 (56.6)

Children (N=30)	N (%)
Gender	
Male	14 (46.7)
Female	16 (53.3)
Age	
5 years	6 (20.0)
6 years	5 (16.6)
7 years	7 (23.3)
8 years	4 (13.3)
9 years	6 (20.0)
10 years	2 (6.6)
Grade level	
Junior Kindergarten	3 (10.0)
Senior Kindergarten	5 (16.7)
1	4 (13.3)
2	8 (26.7)
3	5 (16.7)
4	3 (10.0)
5	2 (6.6)
Type of school attended	
Catholic funded school	7 (23.3)
Private school	2 (6.7)
Publicly funded school	21 (70.0)
Teacher participants (N=19)	N (%)
Gender	
Male	1 (5.3)
Female	18 (94.7)
Age	
18–25 years	4 (21.1)
26–35 years	3 (15.8)
36–45 years	3 (15.8)
46–55 years	3 (15.8)
56+ years	6 (31.6)
Years of teaching experience	
1–5 years	6 (31.6)
6–10 years	3 (15.8)
11 –15 years	2 (10.5)
16–20 years	1 (5.3)
20+ years	7 (36.8)
Type of school where employed	
Catholic education system	5 (26.3)
Private school	1 (5.3)
Publicly funded school	13 (68.4)
School location	
Inner city	1 (5.3)
Suburban	7 (36.8)
Rural	11 (57.9)

Instruments

As mentioned previously, the instruments being tested include the Sensory Profile, the SPSC, the SPM – Home Form, and the SPM – Main Classroom Form. All the scales require the respondent to rate how frequently a behaviour occurs using a Likert-type rating scale (e.g., Never, Occasionally, Frequently, Always).

Sensory Profile

The Sensory Profile (Dunn, 1999) measures a child's sensory processing abilities and provides an overview of their effect on daily functioning. It is designed for children five to ten years of age. The 125 items on the questionnaire are divided into three main sections; Sensory Processing, Modulation and Behavioural and Emotional Responses (each of these sections are further divided for a total of 14 subscales). Sensory Processing is divided into six sections: Auditory, Visual, Vestibular, Touch, Multisensory and Oral. Modulation is composed of five areas: Sensory Processing Related to Endurance/Tone, Modulation Related to Body Position and Movement, Modulation of Movement Affecting Activity Level, Modulation of Sensory Input Affecting Emotional Responses and Modulation of Visual Input Affecting Emotional Responses and Activity Level. Behavioural and Emotional Responses are made up of Emotional/Social Responses, Behavioural Outcomes of Sensory Processing and Items Indicating Thresholds for Response. Scores for each of these scales are calculated.

Normative data was collected on 1,037 children without disabilities (524 girls and 510 boys; gender not reported on 3 year age level) between the ages of three and ten years (Dunn, 1999; Dunn & Westman, 1997). This standardization group was based on a North American population, ethnicity (uneven representation), socioeconomic status, and gender characteristics (Dunn, 1999; Vacca, 2005).

The reliability data reported in the Sensory Profile manual includes that of internal consistency using Cronbach's alpha (Dunn, 1999). The subscale coefficients ranged from 0.47 to 0.90. In regards to validity, the manual provides preliminary evidence of both content and construct validity (Dunn). Content validity was supported by a literature review, expert review and a category analysis. Convergent and discriminant construct validity was demonstrated through comparison of the Sensory Profile and the School Function Assessment; however limitations of this comparison have been reported (Dunn; Fairbank, 2005; Vacca, 2005). Further validity studies have taken place with different diagnostic groups and the Sensory Profile is able to differentiate children diagnosed with Attention Deficit Hyperactivity Disorder, Asperger Syndrome, Pervasive Developmental Disorder, Fragile X Syndrome from children with typical development (Dunn, Myles, & Orr, 2002; Ermer & Dunn, 1998; Fairbank, 2005; Tomchek & Dunn, 2007; Watling et al., 2001). Documented evidence of criterion-related validity, predictive validity, and convergent validity are absent in the Sensory Profile manual and have not been reported in the literature.

Sensory Profile School Companion

The Sensory Profile School Companion (SPSC) (Dunn, 2006) provides a standardized assessment of a student's sensory processing abilities and provides an indication of their association with the student's functional performance in the classroom and school environments. It is designed for children of 5-10 years of age. The teacher who has routine contact with the student completes the questionnaire. The SPSC consists of 62 items, the items cover five domains: auditory, visual, movement touch, and classroom behaviors. Scale scores for each of these domains are calculated. The standardization sample included 700 children rated by 118 teachers. Sixty-two teachers rated 585 children without disabilities and 61 teachers rated 127 students with disabilities (Dunn, 2006). The reliability data reported in the SPSC manual included internal consistency using Cronbach's alpha which ranged from 0.80 to 0.95, and test-retest coefficients from 0.80 to 0.95 (Dunn, 2006).

In terms of SPSC validity, content validity was established by having teachers rate the items they thought were relevant to school contexts. Construct validity was established through the completion of a principal component analysis of the items. The SPSC has moderate correlations with the Sensory Profile, but varying results were found across items. In relation to discriminant validity, the SPSC was able to differentiate students with Attention Deficit Hyperactivity Disorder, Asperger's Syndrome, and Autism Spectrum Disorder from students without disabilities (Dunn, 2006). The manual also provides evidence of content validity, face validity, discriminant validity, and construct validity (Dunn, 2006). Evidence of criterion-related validity, predictive validity, concurrent validity, and convergent validity are absent in the SPSC manual and are not reported in the literature.

Sensory Processing Measure

The SPM assesses social participation, praxis, and sensory processing issues of children aged between 5-12 years (Parham, et al., 2007). The SPM promotes collaboration between parents and school personnel to identify sensory and environmental issues that may affect a child's performance across home and seven school environments. The SPM consists of three forms; the Home Form made up of 75 items completed by caregiver, the Main Classroom Form with 62 items completed by main classroom teacher, and School Environments Form completed by other school personnel (not used in this study) (Henry, Ecker, Glennon, & Herzberg, 2009). The SPM – Home Form and the SPM – Main Classroom Form were standardized on a sample of 1051 typically developing children aged between 5-12 years. Internal consistency and test-retest reliability data for the Home Form were reported as 0.77 to 0.95 and 0.94 to 0.98 respectively. For the main classroom form internal consistency scores ranged from 0.75 to 0.95 and test-retest estimates ranged from 0.95 to 0.98 (Parham, et al., 2007).

In regards to validity, content validity was established through use of expert review panels and factor analysis was used to provide evidence of SPM scale construct validity (Parham et al., 2007).

The SPM Home Form was found to be significantly correlated with the Sensory Profile, providing evidence of convergent validity (Parham et al., 2007). Discriminant validity was proven as both SPM – Home Form and the SPM – Main Classroom Form were able to differentiate between typical children and those with clinical disorders (Parham et al., 2007). There was no documented evidence of convergent validity.

Procedure

Ethical approval for the study was obtained from the Deakin University Human Research Ethics Committee. Mothers of the children registered their interest in participating after being approached by the researchers. A questionnaire package which included copies of the Sensory Profile and the SPM – Home Form was sent out along with a reply paid envelope. Snowball sampling was also used as a recruitment strategy among suitable parents. Eligible teacher participants were identified through contact details provided by the mothers. The teachers were sent a questionnaire package which included; copies of the SPSC and the SPM – Main Classroom Form, and a reply paid envelope. Of 30 teachers targeted only 19 returned the two completed sensory processing scales.

Data entry, management, and analysis

The data were analyzed using the Statistical Package for Social Sciences program (SPSS) version 15.0. Descriptive statistics were used for all demographic variables such as age, gender and geographical location. A frequency distribution analysis was used to calculate descriptive statistics and Spearman's rho correlation coefficients for the convergent validity between the sensory processing scales. A Spearman's rho correlation, a type of non-parametric statistic was used since the level of data generated by the Sensory Profile, the SPSC, the SPM – Home Form, and the SPM – Main Classroom Form are ordinal. Ordinal level data are measured based on the rank order of concepts / variables / order of importance rather than actual values. The actual distance between values is not known (disagree strongly, disagree, no opinion, agree, agree strongly).

For the convergent validity analysis, the scores of the SPM were reversed (1 was scored as 4, 2 was scored as 3, 3 was scored as 2, and 4 was scored as 1) to ensure scoring consistency with the Sensory Profile and the SPSC, as the scales use opposite rating scales. For instance, a low score on the Sensory Profile indicated sensory processing problems whereby a high score on the SPM indicated sensory processing issues.

Results

Demographic results

The majority of the mothers who took part in the study were in the 36 to 45 year age range (58.4%) and married (93.3%). The number of boys and girls involved in the study were almost equal and most of them attended Grade 2 at a publicly funded primary school. The majority of the

teachers were female (94.7%) and had worked in the education system for more than six years. They were all employed in the publicly funded primary school system (see Table 1). There was a relatively even distribution of teachers across the age categories.

Sensory processing scale scores

Descriptive statistics of the Sensory Profile, the SPSC, and the SPM were calculated and are reported in Tables 2, 3, 4, and 5. It is important to note that the Sensory Profile and the SPSC use alternative rating scales to the SPM. The majority of participants scored highly on the Sensory Profile and the SPSC. The majority of participants scored low on the SPM – Home Form. Low scores were also noted on the SPM – Main Classroom Form.

The majority of participants scored highly on the Sensory Profile, with the lowest total scale score being 425 out of a possible 625. The mean total scale score rated by mothers was 542.83 (SD= 45.39) (see Table 2). The majority of participants scored low on the SPM – Home Form, with the highest total scale score being 116 out of a possible 300, and a mean total scale score of 90.63 (SD= 11.24) for mothers (see Table 3). High scores were also noted on the SPS Companion, with the lowest total scale score

Table 2. Mean scores for the *Sensory Profile* scales completed by mothers (N=30)

Scale	Mothers			Total score possible
	Mean (SD)	Min	Max	
<i>Sensory Profile</i> (complete scale)	542.83 (45.39)	425	619	625
Subscale A: Auditory Processing	33.50 (4.53)	24	39	40
Subscale B: Visual Processing	39.37 (3.83)	30	45	45
Subscale C: Vestibular Processing	50.97 (3.36)	42	55	55
Subscale D: Touch Processing	80.77 (7.93)	57	90	90
Subscale E: Multisensory Processing	31.00 (2.88)	24	35	35
Subscale F: Oral Processing	52.27 (7.65)	32	60	60
Subscale G: Endurance/Tone	42.30 (4.76)	26	45	45
Subscale H: Body Position and Movement	44.80 (3.99)	33	50	50
Subscale I: Affecting Activity Level	24.97 (4.62)	16	34	35
Subscale J: Affecting Emotional Responses	17.60 (1.92)	14	20	20
Subscale K: Visual Input Affecting	16.77 (2.51)	8	19	20
Subscale L: Emotional/Social	70.27 (9.84)	42	85	85
Subscale M: Behavioural Outcome	24.33 (4.11)	15	30	30
Subscale N: Thresholds Response	13.93 (1.36)	10	15	15

Note. SD = standard deviation; Min = minimum; Max = maximum.

being 246 out of a possible 310, and a mean total scale score of 285.47 (SD= 19.29) (see Table 4). Low scores were also noted on the SPM – Main Classroom Form, with the highest total scale score being 87 out of a possible 248, and a mean total scale score of 72.79 (SD= 7.46) (see Table 5).

Convergent validity results

The convergent validity of the Sensory Profile and its fourteen subscales in relation to the SPM – Home Form and its eight subscales is presented in Table 6. This analysis uses the data obtained from the questionnaires completed by the mothers only. The Sensory Profile and the SPM – Home Form were significantly correlated with each other ($\rho=0.86$, $p<.01$). The majority of the Sensory Profile and the SPM – Home Form subscales were significantly correlated with each other. Significant subscale correlations ranged from 0.37 ($p<.05$) to 0.77 ($p<.01$).

Table 7 presents the convergent validity results of the SPSC and its five subscales in relation to the SPM – Main Classroom Form and its eight subscales. The SPSC and SPM – Main Classroom Form were also significantly correlated with each other ($\rho=.74$, $p<.01$). Again, the majority of the SPSC and SPM – Main Classroom Form subscales were also significantly correlated with each other. Significant subscale correlations ranged from 0.36 ($p<.05$) to 0.74 ($p<.01$).

Discussion

Occupational therapists frequently assess the sensory needs of children using the Sensory Profile and the SPM. It is essential that the sensory processing scales used by therapists are valid. The purpose of this study was to investigate the convergent validity between the Sensory Profile, the SPSC, and the Home and Main Classroom Forms of the SPM. Specifically, the association between the ratings of mothers of children who complete the Sensory Profile and the SPM – Home Form and the ratings of teachers of the same children who complete the SPSC and the SPM – Main Classroom Form were investigated.

Convergent validity

The convergent validity of the Sensory Profile and the SPM – Home Form and the SPSC and the SPM – Main Classroom Form were calculated using Spearman's rho correlation statistic. The results of the current study show a relatively high number of significant results, spread across a number of the total scale score and subscale variables of the four instruments. These results suggest a moderate

Table 3. Mean scores for the *Sensory Processing Measure – Home Form* scales completed by mothers (N=30)

Scale	Mothers			Total score possible
	Mean (SD)	Min	Max	
SPM – Home Form (complete scale)	90.63 (11.24)	75	116	300
Subscale A: Social Participation	14.60 (3.77)	10	26	40
Subscale B: Vision	12.40 (1.73)	11	18	44
Subscale C: Hearing	9.20 (1.50)	6	13	32
Subscale D: Touch	13.43 (2.83)	11	21	44
Subscale E: Taste and Smell	5.87 (1.22)	5	10	20
Subscale F: Body Awareness	11.07 (1.68)	10	16	40
Subscale G: Balance and Motion	12.77 (2.54)	11	22	44
Subscale H: Planning and Ideas	11.30 (1.99)	9	16	36

Note. SPM = Sensory Processing Measure; SD = standard deviation; Min = minimum; Max = maximum.

Table 4. Descriptive Statistics for the *Sensory Profile School Companion* (SPSC) scales (N=19)

Scale	Mean (SD)	Minimum	Maximum	Total score possible
SPSC (complete scale)	285.47 (19.29)	246	310	310
Subscale A: Auditory	46.95 (2.82)	40	50	50
Subscale B: Visual	45.90 (6.34)	33	55	55
Subscale C: Movement	66.63 (4.13)	57	70	70
Subscale D: Touch	57.63 (2.89)	50	60	60
Subscale E: Behaviour	68.37 (5.36)	60	75	75

Note. SD = standard deviation; SPSC = *Sensory Profile School Companion*.

Table 5. Descriptive Statistics for the *Sensory Processing Measure – Main Classroom Form* scales (N=19)

Scale	Mean (SD)	Minimum	Maximum	Total score possible
SPM – Main Classroom Form (complete scale)	72.79 (7.46)	63	87	248
Subscale A: Social Participation	14.26 (2.81)	10	19	40
Subscale B: Vision	7.95 (0.78)	7	9	28
Subscale C: Hearing	7.53 (0.84)	7	9	28
Subscale D: Touch	8.95 (1.27)	8	11	32
Subscale E: Taste and Smell	4.63 (0.96)	4	7	16
Subscale F: Body Awareness	7.63 (0.68)	7	9	28
Subscale G: Balance and Motion	9.90 (1.15)	9	13	36
Subscale H: Planning and Ideas	11.95 (2.70)	10	20	40

Note. SPM = *Sensory Processing Measure*; SD = standard deviation

Table 6. Convergent Validity of the *Sensory Profile* with the *Sensory Processing Measure - Home Form* completed by mothers (N=30)

Scale	SPM – Home Form scales				
	Total SPM	Social Participation	Vision	Hearing	Touch
Sensory Profile total (complete scale)	0.863(**)	0.482(**)	0.636(**)	0.563(**)	0.736(**)
Auditory Processing	0.536(**)	0.384(*)	0.571(**)	0.513(**)	0.604(**)
Visual Processing	0.472(**)	0.222	0.505(**)	0.357	0.353
Vestibular Processing	0.625(**)	0.287	0.519(**)	0.320	0.448(*)
Touch Processing	0.669(**)	0.189	0.531(**)	0.452(*)	0.529(**)
Multisensory Processing	0.668(**)	0.349	0.515(**)	0.367(*)	0.515(**)
Oral Processing	0.682(**)	0.328	0.281	0.320	0.410(*)
Endurance/Tone	0.606(**)	0.509(**)	0.437(*)	0.555(**)	0.546(**)
Body Position and Movement	0.563(**)	0.254	0.559(**)	0.329	0.298
Affecting Activity Level	0.537(**)	0.353	0.549(**)	0.446(*)	0.509(**)
Sensory Input Affecting Emotional Responses	0.535(**)	0.456(*)	0.295	0.262	0.417(*)
Visual Input Affecting Emotional Responses and Activity Level	0.631(**)	0.326	0.390(*)	0.221	0.442(*)
Emotional/Social Responses	0.659(**)	0.505(**)	0.454(*)	0.498(**)	0.554(**)
Behavioural Outcomes	0.558(**)	0.480(**)	0.516(**)	0.462(*)	0.517(**)
Thresholds Response	0.558(**)	0.149	0.391(*)	0.230	0.376(*)

Scale	SPM – Home Form scales			
	Taste & Smell	Body Awareness	Balance & Motion	Planning & Ideas
Sensory Profile total (complete scale)	0.629(**)	0.722(**)	0.527(**)	0.609(**)
Auditory Processing	0.295	0.362(*)	0.182	0.392(*)
Visual Processing	0.159	0.592(**)	0.157	0.391(*)
Vestibular Processing	0.373(*)	0.419(*)	0.429(*)	0.498(**)
Touch Processing	0.736(**)	0.576(**)	0.442(*)	0.442(*)
Multisensory Processing	0.406(*)	0.487(**)	0.510(**)	0.609(**)
Oral Processing	0.318	0.768(**)	0.503(**)	0.460(*)
Endurance/Tone	0.589(**)	0.425(*)	0.263	0.397(*)
Body Position and Movement	0.477(**)	0.413(*)	0.336	0.357
Affecting Activity Level	0.368(*)	0.450(*)	0.360	0.289
Sensory Input Affecting Emotional Responses	0.351	0.459(*)	0.313	0.288
Visual Input Affecting Emotional Responses and Activity Level	0.300	0.447(*)	0.485(**)	0.589(**)
Emotional/Social Responses	0.542(**)	0.458(*)	0.481(**)	0.461(*)
Behavioural Outcomes	0.359	0.333	0.318	0.464(**)
Thresholds Response	0.345	0.432(*)	0.429(*)	0.591(**)

Note. SPM = *Sensory Processing Measure*. *Correlation is significant at the $p < .05$. **Correlation is significant at the $p < .01$.

Table 7. Convergent Validity of the *Sensory Profile School Companion* with the *Sensory Processing Measure - Main Classroom Form* (N=19)

Scale	Sensory Profile School Companion scales					
	Total SPSC	Auditory	Visual	Movement	Touch	Behaviour
SPM - Main Classroom Form total (complete scale)	0.743(**)	0.831(**)	0.666(**)	0.694(**)	0.619(**)	0.627(**)
Social Participation	0.533(*)	0.620(**)	0.379	0.493(*)	0.357	0.649(**)
Vision	0.608(**)	0.627(**)	0.628(**)	0.524(*)	0.589(**)	0.419
Hearing	0.365	0.474(*)	0.381	0.356	0.119	0.286
Touch	0.636(**)	0.647(**)	0.632(**)	0.565(*)	0.598(**)	0.531(*)
Taste and Smell	0.332	0.268	0.365	0.292	0.484(*)	0.288
Body Awareness	0.470(*)	0.711(**)	0.364	0.601(**)	0.336	0.169
Balance and Motion	0.186	0.311	0.250	0.183	0.155	0.004
Planning and Ideas	0.716(**)	0.640(**)	0.666(**)	0.678(**)	0.611(**)	0.706(**)

Note. SPM = *Sensory Processing Measure*; SPSC = *Sensory Profile School Companion*. *

Correlation is significant at the $p < .05$. ** Correlation is significant at the $p < .01$.

level of convergent validity between the Sensory Profile and the SPM - Home Form and between the SPSC and the SPM - Main Classroom Form. This provides occupational therapists with information about the validity of these sensory processing instruments.

The Sensory Profile and the SPM – Home Form were significantly correlated with each other with a coefficient of $\rho=0.86$ ($p<.01$). The majority of the Sensory Profile and the SPM – Home Form subscales were also significantly correlated with each other with coefficients ranging from 0.37 ($p<.05$) to 0.77 ($p<.01$). Similarly, the SPSC and SPM – Main Classroom Form were also significantly correlated with each other with a slightly lower coefficient of $\rho=0.74$ ($p<.01$). Again, the majority of the SPSC and SPM – Main Classroom Form subscales were also significantly correlated with each other with coefficients ranging from 0.36 ($p<.05$) to 0.74 ($p<.01$).

Miller-Kuhaneck, Henry, and Glennon (2007) reported the results of a concurrent validity study correlating the SPM – Home Form with the Sensory Profile. The sample consisted of 182 children (137 boys, 45 girls) with an age range of 5 to 13 years. It was noted that the Sensory Profile Auditory, Visual, Vestibular, and Touch Processing subscales all significantly correlated with the SPM – Home Form subscales that represented content-similar sensory systems. “In sum, the SPM Home Form scale scores show the expected strong and consistent relationships with the scores of the Sensory Profile, a measure of children’s sensory processing function” (Miller-Kuhaneck, Henry, & Glennon, 2007, p. 71).

Both sets of results showed that the Auditory, Visual, Vestibular, and Touch subscales of the Sensory Profile and the SPSC significantly correlated with the corresponding content-similar subscales on the SPM - Home Form and the SPM - Main Classroom Form. Both also showed that the SPM Planning and Ideas and Social Participation subscales on SPM - Home Form

and SPM - Main Classroom Form were significantly related to the respective Sensory Profile Behavioural Outcomes subscale and the SPSC Behaviour subscale.

The convergent validity of these sensory processing assessments is not reported in the test manuals nor published in the literature therefore direct comparisons to any other published results cannot be made. However, Parham et al. (2007) as noted in the SPM manual did investigate construct validity (using convergent validity). This was done using the SPM – Home Form and the Sensory Profile with a sample of 182 children. Although Parham et al. did not report the data analysis method used, the results presented in the SPM manual are similar to those of the convergent validity shown in the current study. The lack of any investigation into the convergent validity of these assessments makes the results of the current study unique and timely. Parham et al. stated that convergent validity studies employing the SPM – Main Classroom Form and SPSC are an important area for future research, as it will constructively build on the current evidence base about the SPM.

It is important to note that although significant correlations within the convergent validity results may seem weak or moderate, Streiner and Norman (1995) suggested that correlations among measures of the same attribute should fall between 0.4 and 0.8. The majority of significant correlations found in this study were in this range which indicates the scales do exhibit a reasonable degree of convergent validity. Streiner and Norman argued that very high correlations above the stated range are not particularly desirable as this would imply that the tests measure almost exactly the same constructs in which case there is no need for separate tests. Consequently, a correlation below 0.4 indicates the reliability of one of the measures is low, or that they are measuring different phenomena (Streiner & Norman). This is particularly relevant to correlations purporting to measure the

same constructs. However, the small size and the high scoring participants of the sample in this study must be considered influential factors to the results of this study.

Study limitations and suggestions for future research

There were a number of limitations to the study. Of significance was the small number of participants recruited via convenience sampling. It is possible that participants volunteered to take part in this study as they had concerns regarding their child's health and in particular their child's sensory processing, possibly resulting in a sample with a higher percentage of sensory issues than normally reflected in the population. Also, as the sensory processing scales under scrutiny were developed and standardized in the United States of America, there is the possibility of cultural bias in relation to the respondents completing the forms. Conversely, this may be minimal since the Sensory Profile has been used extensively by pediatric occupational therapists in New Zealand and Australia for the past decade.

It is suggested that similar studies could be undertaken with larger, more heterogeneous samples, from larger and more varied geographical areas. Test scores could be analyzed using alternate forms of validity approaches. Studies could involve participants who have some form of impairment. The statistical analysis based on scores achieved by such a sample groups could then be compared to the results of this study. Similar reliability studies could also be completed in other cross-cultural settings.

Conclusion

This study was designed to investigate the convergent validity of the Sensory Profile and the SPM – Home Form and the SPSC and the SPM – Main Classroom Form. The Sensory Profile and the SPM – Home Form as well as the SPSC and the SPM – Main Classroom Form were found to be moderately correlated with each other. This suggests that the scales are measuring comparable sensory processing constructs. The findings from this study contribute to the psychometric body of knowledge related to these four sensory processing scales, as well as providing therapists with a greater understanding of the scales' reliability and validity properties.

Key points

1. The Sensory Profile and Sensory Processing Measure – Home Form have moderate levels of convergent validity.
2. The Sensory Profile School Companion and the Sensory Processing Measure – Main Classroom Form exhibit moderate levels of convergent validity.
3. The findings of this study provide therapists who use these scales with a greater understanding of the scales' validity properties as well as the association between the sensory processing ratings of mothers and classroom teachers of the same child.

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