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Psychometric Properties

This chapter reviews reliability and validity evidence from the SPM-2 standardization and clinical validity studies. Validation of a scale is an ongoing process, and it is hoped that the research presented here will provide a foundation for further psychometric evaluations of the SPM-2.

Reliability

Reliability refers to the consistency, stability, and predictability of test scores. The major purpose of any behavior rating scale is to facilitate clinical inferences in support of diagnostic and treatment decisions. If these inferences are to be valid, they must be based on reliable scores. This section describes seven approaches that were used to estimate the reliability of the SPM-2: internal consistency, test–retest reliability, standard error of measurement, interrater reliability, alternate-forms reliability, cross-rater concordance, and an online and paper forms equivalence study.

Internal Consistency

Internal consistency represents the degree to which all items on a rating scale consistently measure the same dimension or trait. In statistical terms, internal

consistency is a measure of the average intercorrelations among the items that compose a scale. For the SPM-2, Cronbach's coefficient alpha (1988) was used to estimate internal consistency. Alpha takes the form of a correlation coefficient with a range of 0 to 1 and represents the lower bound of a scale's reliability. Tables 5.1 through 5.5 present alphas for each of the main SPM-2 forms in the standardization sample, subdivided by age. Table 5.6 presents alphas for the School Environment and Driving Environment Forms. Table 5.7 presents alphas for all forms in the overall clinical sample except the Infant/Toddler age level. Because the clinical sample size was low for the Infant Form ($n = 11$), those cases were analyzed with the Toddler Form ($n = 43$) by summing the item scores from the 46 items shared by both forms, thus creating a provisional "total" score, which showed an alpha of .90.

In general, for behavior rating scales, alphas above .80 are considered ideal, and above .70 are acceptable. Across the entire standardization sample, all of the Sensory Total (ST) scores were above .90. The individual sensory scales showed a broader range of coefficients: most were above .80, some were in the .70s, and a few, mainly in the Infant/Toddler age level forms, were in the high .60s.

These results were expected for two main reasons. First, aside from the ST, which is a 60-item scale, the SPM-2 scales are quite brief at 10 items each. This brevity allows the SPM-2 to measure its main constructs efficiently, but with somewhat lower internal consistency than a longer scale. Second, with respect to the Infant/Toddler scales, relatively lower coefficients are consistent with other measures of sensory processing in infants and toddlers, such as the Sensory Profile. This could be due to lesser stability in sensory responding among infants and toddlers, or to the difficulty raters may have in correctly interpreting their sensory processing.

Overall, these data suggest that the SPM-2 scales show levels of internal consistency that support the use of these scores in clinical applications. Further, the SPM-2 scales retain this level of internal consistency in groups of individuals with different clinical diagnoses.

Test–Retest Reliability

Test–retest reliability, also known as *temporal stability*, refers to the stability of test scores over time. Test–retest reliability is estimated by having a single respondent rate a person using the same form on two separate occasions and correlating the resulting scores.

The SPM-2 test–retest studies included participants from the standardization sample who were assessed twice with the same form: an initial assessment and a second assessment approximately two weeks later. Overall, the demographic characteristics of the retest sample participants drawn from the standardization sample were similarly representative of the U.S. Census. Tables 5.1 through 5.5 present the test–retest correlations for each of the main forms across the two-week retest interval. Most correlations were above .80, with a small number of correlations in the .70s, mostly at the Infant/Toddler age level. These

results are consistent with other behavior rating scales of this kind and support a level of test–retest reliability that is appropriate for clinical use of the SPM-2.

Standard Error of Measurement and Confidence Intervals

The *standard error of measurement (SEM)* statistic translates a reliability estimate into more practical terms by providing an index of how close an individual's observed score is to their "true" score (i.e., what the score would be if there were no measurement error). The *SEM* is inversely related to the reliability of the scale. Therefore, greater reliability means a smaller *SEM*, which increases the amount of confidence the clinician can have in the precision of an observed test score. The *SEM* is calculated using the formula $SEM = SD \sqrt{1-r}$, where *SD* is the standard deviation of the scale, and *r* is the reliability coefficient of the scale. Tables 5.1 through 5.5 present *SEM* values and 95% confidence intervals for the SPM-2 scales in *T*-score units, calculated separately for the test–retest and internal consistency reliability methods.

SEM values can be converted into confidence intervals (CI) that give a range of possible values for the true score. For example, the 95% confidence interval represents the range of scores that has a 95% probability of containing the true score. To obtain a specific confidence interval for any observed SPM-2 score, add and subtract the tabled CI value from the observed *T*-score to create a score range. For instance, if a child's observed *T*-score on the ST scale of the Preschool Home Form (Table 5.2) is 55, you would add and subtract 3.40, the test–retest reliability CI value to get the confidence interval range. In this example, there is a 95% probability that the true *T*-score lies in the range of 51.6 to 58.4. The test–retest method is generally more relevant to practical use of the SPM-2 because it represents variability of observed test scores over time. The alpha method, on the other hand, represents the more abstract issue of the extent to which a scale measures a nonheterogeneous construct. As noted previously, alpha provides a lower bound on a scale's reliability and thus is a more conservative estimate, resulting in a wider, less precise, confidence interval.

Table 5.1. SPM-2 Internal Consistency, Test–Retest Reliability, and Confidence Interval Estimates in the Standardization Sample: Infant/Toddler Age Level Forms

Scale	No. of items	Internal consistency ^a					Test–retest reliability ^b			
		Age group (months)			SEM ^c	95% CI (±) ^d	<i>r</i>	SEM ^c	95% CI (±) ^d	
		4–6 α	7–9 α	4–9 α						
Infant Form										
Vision (VIS)	10	.68	.77	.73	4.98	9.8	.72	3.65	7.15	
Hearing (HEA)	10	.74	.71	.73	4.91	9.6	.74	3.63	7.11	
Touch (TOU)	10	.68	.66	.67	5.47	10.7	.82	3.67	7.20	
Taste and Smell (T&S)	10	.80	.76	.78	3.94	7.7	.71	4.38	8.58	
Body Awareness (BOD)	10	.81	.72	.76	4.67	9.2	.77	4.02	7.88	
Balance and Motion (BAL)	10	.77	.79	.78	4.37	8.6	.88	2.54	4.97	
Sensory Total (ST)	60	.91	.91	.91	2.93	5.8	.91	2.36	4.62	
Planning and Ideas (PLN)	10	.88	.81	.86	3.43	6.7	.77	3.85	7.54	
Social Participation (SOC)	10	.87	.87	.87	3.40	6.7	.78	3.75	7.36	
Scale	No. of items	Age group (months)			SEM ^c	95% CI (±) ^d	<i>r</i>	SEM ^c	95% CI (±) ^d	
		10–20 α	21–30 α	10–30 α						
Toddler Form										
Vision (VIS)	10	.68	.68	.69	5.48	10.7	.78	4.11	8.05	
Hearing (HEA)	10	.74	.73	.73	5.05	9.9	.81	3.98	7.80	
Touch (TOU)	10	.69	.71	.70	5.41	10.6	.79	3.86	7.57	
Taste and Smell (T&S)	10	.79	.65	.75	4.92	9.6	.79	4.01	7.86	
Body Awareness (BOD)	10	.72	.75	.75	4.99	9.8	.85	3.10	6.08	
Balance and Motion (BAL)	10	.75	.69	.75	4.93	9.7	.78	4.42	8.67	
Sensory Total (ST)	60	.92	.91	.92	2.79	5.5	.91	2.50	4.90	
Planning and Ideas (PLN)	10	.88	.70	.87	3.42	6.7	.70	4.94	9.68	
Social Participation (SOC)	10	.81	.81	.81	4.25	8.3	.87	3.19	6.26	
Scale	No. of items	Age group (months)			SEM ^c	95% CI (±) ^d	<i>r</i>	SEM ^c	95% CI (±) ^d	
		4–9 α	10–30 α	4–30 α						
Caregiver Self-Report Form										
Vision (VIS)	10	.82	.77	.80	4.42	8.7	.85	3.52	6.91	
Hearing (HEA)	10	.75	.77	.76	4.94	9.7	.84	3.68	7.21	
Touch (TOU)	10	.72	.72	.72	5.20	10.2	.82	3.97	7.77	
Taste and Smell (T&S)	10	.74	.75	.75	4.92	9.7	.85	3.43	6.73	
Body Awareness (BOD)	10	.82	.81	.81	4.17	8.2	.86	3.24	6.34	
Balance and Motion (BAL)	10	.73	.71	.72	5.24	10.3	.87	3.16	6.20	
Sensory Total (ST)	60	.94	.93	.93	2.57	5.0	.93	2.30	4.50	
Planning and Ideas (PLN)	10	.83	.83	.83	4.06	8.0	.85	3.34	6.55	
Social Participation (SOC)	10	.70	.74	.71	5.37	10.5	.81	3.91	7.67	

Note. CI = confidence interval.

^aCronbach's alpha is given for Infant Form 4- to 6-month-old (*n* = 139) and 7- to 9-month-old (*n* = 127) strata, and 4- to 9-month-old sample (*N* = 266); Toddler Form 10- to 20-month-old (*n* = 253) and 21- to 30-month-old (*n* = 168) strata, and 10- to 30-month-old sample (*N* = 421); and Caregivers of 4- to 9-month-olds (*n* = 363), 10- to 30-month-olds (*n* = 507), and the total sample (*N* = 870).

^bTwo-week test–retest correlation; Infant Form *n* = 40; Toddler Form *n* = 91; Caregiver Self-Report Form *n* = 213.

^cStandard error of measurement in *T*-score units, based on the overall sample for each form.

^d95% confidence interval around the observed *T*-score, based on the overall sample for each form.

Table 5.2. SPM-2 Internal Consistency, Test–Retest Reliability, and Confidence Interval Estimates in the Standardization Sample: Preschool Age Level Forms

Scale	No. of items	Internal consistency ^a					Test–retest reliability ^b			
		Age group (years)			SEM ^c	95% CI (±) ^d	<i>r</i>	SEM ^c	95% CI (±) ^d	
		2–4 α	5 α	2–5 α						
Home Form										
Vision (VIS)	10	.83	.89	.84	4.00	7.9	.84	3.39	6.64	
Hearing (HEA)	10	.86	.91	.87	3.65	7.2	.93	2.40	4.71	
Touch (TOU)	10	.79	.91	.81	4.36	8.6	.83	3.43	6.72	
Taste and Smell (T&S)	10	.82	.88	.83	4.12	8.1	.85	3.40	6.66	
Body Awareness (BOD)	10	.87	.93	.88	3.51	6.9	.91	2.64	5.17	
Balance and Motion (BAL)	10	.80	.90	.83	4.16	8.2	.82	3.80	7.44	
Sensory Total (ST)	60	.95	.98	.96	2.07	4.1	.96	1.73	3.40	
Planning and Ideas (PLN)	10	.87	.90	.88	3.52	6.9	.86	3.09	6.05	
Social Participation (SOC)	10	.89	.92	.90	3.22	6.3	.90	2.83	5.55	
School Form										
Vision (VIS)	10	.87	.82	.87	3.42	6.7	.86	3.77	7.40	
Hearing (HEA)	10	.88	.86	.88	3.21	6.3	.87	3.57	6.99	
Touch (TOU)	10	.84	.79	.84	3.71	7.3	.83	3.89	7.63	
Taste and Smell (T&S)	10	.88	.91	.88	3.13	6.1	.75	4.45	8.72	
Body Awareness (BOD)	10	.90	.90	.90	2.88	5.6	.87	3.07	6.02	
Balance and Motion (BAL)	10	.85	.83	.85	3.57	7.0	.83	3.64	7.13	
Sensory Total (ST)	60	.97	.96	.97	1.73	3.4	.95	2.39	4.69	
Planning and Ideas (PLN)	10	.91	.91	.91	2.83	5.5	.85	3.59	7.04	
Social Participation (SOC)	10	.93	.93	.93	2.61	5.1	.84	4.26	8.35	

Note. CI = confidence interval.

^aCronbach's alpha is given for Home Form 2- to 4-year-old (*n* = 445) and 5-year-old (*n* = 75) strata, and 2- to 5-year-old sample (*N* = 520); School Form 2- to 4-year-old (*n* = 448) and 5-year-old (*n* = 91) strata, and 2- to 5-year-old sample (*N* = 539).

^bTwo-week test–retest correlation; Home Form *n* = 77; School Form *n* = 92.

^cStandard error of measurement in *T*-score units, based on the overall sample for each form.

^d95% confidence interval around the observed *T*-score, based on the overall sample for each form.

Table 5.3. SPM-2 Internal Consistency, Test–Retest Reliability, and Confidence Interval Estimates in the Standardization Sample: Child Age Level Forms

Scale	No. of items	Internal consistency ^a					Test–retest reliability ^b			
		Age group (years)			SEM ^c	95% CI (±) ^d	<i>r</i>	SEM ^c	95% CI (±) ^d	
		5–8 α	9–12 α	5–12 α						
Home Form										
Vision (VIS)	10	.79	.81	.80	4.10	8.0	.85	3.45	6.76	
Hearing (HEA)	10	.86	.87	.86	3.34	6.5	.83	3.61	7.08	
Touch (TOU)	10	.71	.78	.74	4.74	9.3	.80	4.12	8.07	
Taste and Smell (T&S)	10	.80	.81	.81	4.18	8.2	.88	2.75	5.39	
Body Awareness (BOD)	10	.84	.86	.85	3.57	7.0	.80	3.88	7.61	
Balance and Motion (BAL)	10	.75	.83	.79	4.04	7.9	.82	3.51	6.88	
Sensory Total (ST)	60	.94	.95	.95	2.27	4.5	.79	4.22	8.28	
Planning and Ideas (PLN)	10	.84	.90	.87	3.27	6.4	.92	2.64	5.18	
Social Participation (SOC)	10	.91	.90	.91	2.90	5.7	.80	3.89	7.63	
School Form										
Vision (VIS)	10	.83	.87	.85	3.75	7.4	.83	3.93	7.70	
Hearing (HEA)	10	.84	.88	.86	3.57	7.0	.86	3.40	6.67	
Touch (TOU)	10	.75	.87	.83	3.72	7.3	.88	2.97	5.83	
Taste and Smell (T&S)	10	.85	.87	.85	3.32	6.5	.71	4.68	9.17	
Body Awareness (BOD)	10	.90	.90	.90	2.90	5.7	.87	3.53	6.91	
Balance and Motion (BAL)	10	.85	.87	.86	3.44	6.8	.87	3.39	6.64	
Sensory Total (ST)	60	.96	.97	.96	1.73	3.4	.94	2.20	4.31	
Planning and Ideas (PLN)	10	.91	.92	.92	2.82	5.5	.86	3.52	6.91	
Social Participation (SOC)	10	.93	.94	.93	2.54	5.0	.81	3.59	7.05	

Note. CI = confidence interval.

^aCronbach's alpha is given for Home Form 5- to 8-year-old ($n = 475$) and 9- to 12-year-old ($n = 400$) strata, and 5- to 12-year-old sample ($N = 875$); School Form 5- to 8-year-old ($n = 331$) and 9- to 12-year-old ($n = 224$) strata, and 5- to 12-year-old sample ($N = 555$).

^bTwo-week test–retest correlation; Home Form $n = 129$; School Form $n = 110$.

^cStandard error of measurement in *T*-score units, based on the overall sample for each form.

^d95% confidence interval around the observed *T*-score, based on the overall sample for each form.

Table 5.4. SPM-2 Internal Consistency, Test–Retest Reliability, and Confidence Interval Estimates in the Standardization Sample: Adolescent Age Level Forms

Scale	No. of items	Internal consistency ^a					SEM ^c	95% CI (±) ^d	Test–retest reliability ^b		
		Age group (years)							r	SEM ^c	95% CI (±) ^d
		12–13 α	14–15 α	16–17 α	18–21 α	12–21 α					
Home Form											
Vision (VIS)	10	.84	.90	.86	.91	.88	3.13	6.1	.85	2.87	5.62
Hearing (HEA)	10	.87	.89	.88	.90	.88	3.22	6.3	.82	3.33	6.53
Touch (TOU)	10	.85	.86	.85	.89	.86	3.44	6.7	.87	3.05	5.98
Taste and Smell (T&S)	10	.87	.88	.86	.88	.87	3.30	6.5	.84	3.63	7.11
Body Awareness (BOD)	10	.89	.89	.86	.92	.89	3.02	5.9	.87	2.69	5.27
Balance and Motion (BAL)	10	.88	.92	.88	.92	.90	2.66	5.2	.75	3.39	6.65
Sensory Total (ST)	60	.96	.97	.97	.98	.97	1.70	3.3	.92	2.22	4.36
Planning and Ideas (PLN)	10	.91	.92	.90	.93	.91	2.76	5.4	.80	3.64	7.13
Social Participation (SOC)	10	.78	.81	.80	.82	.80	4.34	8.5	.89	2.90	5.68
School Form											
Vision (VIS)	10	.90	.93	.90	.95	.92	2.28	4.5	.88	2.43	4.77
Hearing (HEA)	10	.90	.93	.90	.91	.91	2.41	4.7	.88	2.72	5.34
Touch (TOU)	10	.90	.93	.90	.92	.91	2.22	4.4	.82	2.82	5.52
Taste and Smell (T&S)	10	.92	.93	.92	.94	.92	2.20	4.3	.87	2.65	5.19
Body Awareness (BOD)	10	.92	.93	.93	.93	.92	2.06	4.0	.87	2.22	4.35
Balance and Motion (BAL)	10	.90	.93	.94	.93	.93	2.05	4.0	.78	3.12	6.12
Sensory Total (ST)	60	.98	.99	.98	.99	.98	1.18	2.3	.94	2.14	4.19
Planning and Ideas (PLN)	10	.92	.92	.91	.93	.92	2.51	4.9	.85	2.99	5.86
Social Participation (SOC)	10	.89	.88	.88	.90	.88	3.29	6.5	.89	3.24	6.35
Self-Report Form											
Vision (VIS)	10	.83	.86	.83	.84	.84	3.82	7.5	.86	3.21	6.29
Hearing (HEA)	10	.83	.86	.82	.83	.84	3.89	7.6	.87	3.42	6.71
Touch (TOU)	10	.78	.79	.70	.83	.77	4.56	8.9	.87	3.14	6.16
Taste and Smell (T&S)	10	.83	.83	.83	.88	.84	3.86	7.6	.82	4.02	7.88
Body Awareness (BOD)	10	.83	.87	.84	.85	.85	3.69	7.2	.85	3.08	6.04
Balance and Motion (BAL)	10	.82	.87	.83	.87	.84	3.60	7.1	.82	3.24	6.35
Sensory Total (ST)	60	.95	.96	.95	.96	.96	2.03	4.0	.93	2.40	4.71
Planning and Ideas (PLN)	10	.87	.85	.83	.86	.85	3.64	7.1	.88	2.99	5.85
Social Participation (SOC)	10	.67	.75	.68	.74	.71	5.29	10.4	.80	4.21	8.26

Note. CI = confidence interval.

^aCronbach's alpha is given for Home Form 12- to 13-year-old ($n = 288$), 14- to 15-year-old ($n = 319$), 16- to 17-year-old ($n = 327$), and 18- to 21-year-old ($n = 83$) strata, and 12- to 21-year-old sample ($N = 1,021$); School Form 12- to 13-year-old ($n = 202$), 14- to 15-year-old ($n = 190$), 16- to 17-year-old ($n = 199$), and 18- to 21-year-old ($n = 54$) strata, and 12- to 21-year-old sample ($N = 645$); and Self-Report Form 12- to 13-year-old ($n = 258$), 14- to 15-year-old ($n = 256$), 16- to 17-year-old ($n = 314$), and 18- to 21-year-old ($n = 129$) strata, and 12- to 21-year-old sample ($N = 957$).

^bTwo-week test–retest correlation; Home Form $n = 114$; School Form $n = 87$; Self-Report Form $n = 104$.

^cStandard error of measurement in T -score units, based on the overall sample for each form.

^d95% confidence interval around the observed T -score, based on the overall sample for each form.

Table 5.5. SPM-2 Internal Consistency, Test-Retest Reliability, and Confidence Interval Estimates in the Standardization Sample: Adult Age Level Forms

Scale	Internal consistency ^a										Test-retest reliability ^b			
	No. of items	Age group (years)					65-87 α	21-87 α	95% CI (±) ^d	SEM ^c	r	95% CI (±) ^d	SEM ^c	
		21-30 α	31-40 α	41-50 α	51-64 α	65-87 α								
Self-Report Form														
Vision (VIS)	10	.78	.75	.87	.84	.82	.81	4.35	8.5	.86	3.45	6.76		
Hearing (HEA)	10	.82	.84	.85	.87	.86	.84	3.97	7.8	.89	3.18	6.24		
Touch (TOU)	10	.74	.75	.80	.83	.77	.78	4.73	9.3	.80	4.02	7.89		
Taste and Smell (T&S)	10	.78	.71	.80	.80	.79	.78	4.69	9.2	.83	4.14	8.11		
Body Awareness (BOD)	10	.81	.84	.90	.86	.89	.86	3.74	7.3	.83	3.86	7.57		
Balance and Motion (BAL)	10	.82	.75	.85	.86	.84	.82	4.24	8.3	.83	3.42	6.70		
Sensory Total (ST)	60	.94	.93	.96	.95	.95	.95	2.28	4.5	.93	2.38	4.66		
Planning and Ideas (PLN)	10	.86	.84	.86	.85	.87	.86	3.79	7.4	.78	4.12	8.07		
Social Participation (SOC)	10	.75	.73	.73	.76	.82	.75	5.01	9.8	.90	2.38	4.66		
Rater Report Form														
Vision (VIS)	10	.83	.82	.90	.88	.91	.86	3.41	6.7	.79	4.17	8.17		
Hearing (HEA)	10	.84	.83	.86	.88	.88	.85	3.69	7.2	.79	4.08	8.00		
Touch (TOU)	10	.76	.62	.83	.88	.85	.80	4.25	8.3	.76	4.12	8.08		
Taste and Smell (T&S)	10	.86	.84	.89	.87	.89	.87	3.44	6.7	.84	3.58	7.02		
Body Awareness (BOD)	10	.83	.74	.89	.90	.90	.86	3.36	6.6	.84	3.21	6.30		
Balance and Motion (BAL)	10	.78	.66	.89	.90	.89	.86	3.44	6.7	.80	3.41	6.69		
Sensory Total (ST)	60	.94	.92	.97	.98	.97	.96	1.98	3.9	.90	2.80	5.49		
Planning and Ideas (PLN)	10	.86	.84	.86	.90	.90	.87	3.36	6.6	.79	3.75	7.36		
Social Participation (SOC)	10	.82	.80	.81	.84	.89	.82	4.05	7.9	.77	4.77	9.36		

Note. CI = confidence interval.

^aCronbach's alpha is given for Self-Report Form 21- to 30-year-old (n = 184), 31- to 40-year-old (n = 198), 41- to 50-year-old (n = 143), 51- to 64-year-old (n = 111), and 65- to 87-year-old (n = 75) strata, and 21- to 87-year-old sample (N = 711); and Rater Report Form 21- to 30-year-old (n = 185), 31- to 40-year-old (n = 181), 41- to 50-year-old (n = 106), 51- to 64-year-old (n = 81), and 65- to 87-year-old (n = 51) strata, and 21- to 87-year-old sample (N = 604).

^bTwo-week test-retest correlation; Self-Report Form n = 52; Rater Report Form n = 58.

^cStandard error of measurement in T-score units, based on the overall sample for each form.

^d95% confidence interval around the observed T-score, based on the overall sample for each form.

Table 5.6. SPM-2 Internal Consistency Estimates:
Child School Environment and Adolescent and Adult Driving Environment Forms

Scale	No. of items	<i>n</i>	Internal consistency ^a
Child School Environment Forms			
Art (ART)	15	171	.93
School Bus (BUS)	15	170	.91
Cafeteria (CAF)	15	208	.89
Music (MUS)	15	106	.92
Physical Education (PHY)	15	173	.88
Recess/Playground (REC)	15	179	.93
Adolescent and Adult Driving Environment Forms			
Driving Self-Report	18	777	.91
Driving Rater Report	18	292	.89

^aCronbach's alpha.

Table 5.7. SPM-2 Internal Consistency^a Estimates:
Mixed Clinical Sample

Scale	Age level								
	Preschool		Child		Adolescent		Adult		
	Home Form	School Form	Home Form	School Form	Home Form	School Form	Self-Report Form	Self-Report Form	Rater Report Form
Vision (VIS)	.86	.88	.84	.88	.86	.88	.85	.87	.89
Hearing (HEA)	.87	.85	.88	.83	.81	.89	.81	.89	.89
Touch (TOU)	.79	.77	.77	.76	.82	.82	.83	.74	.74
Taste and Smell (T&S)	.85	.84	.82	.85	.86	.80	.89	.77	.88
Body Awareness (BOD)	.91	.94	.85	.89	.89	.82	.92	.88	.89
Balance and Motion (BAL)	.87	.85	.79	.81	.90	.85	.90	.80	.88
Sensory Total (ST)	.95	.96	.95	.95	.96	.96	.96	.95	.96
Planning and Ideas (PLN)	.92	.94	.92	.94	.93	.92	.88	.91	.93
Social Participation (SOC)	.93	.94	.92	.94	.82	.92	.74	.80	.90

Note. Preschool *N* = 107; Child *N* = 218; Adolescent *N* = 105; Adult *N* = 120. All scales are 10 items, except ST (60 items). Infant/Toddler coefficients (*N* = 97) are described in the main text.

^aCronbach's alpha.

Interrater Reliability

Interrater reliability refers to the consistency of scores obtained from different respondents (such as two parents) who rated the same person using the same form. The SPM-2 interrater reliability study consisted of 188 participants (infant through adult) from the standardization sample who were assessed twice with the same form: once by the primary respondent, and once by a second respondent. Specifically, infants and toddlers were assessed by two parents or other caregivers; preschoolers, children, and adolescents were assessed by two parents or other caregivers with the Home Form, or by two teachers or other school staff with the School Form; and adults were assessed by two raters with the Rater Report Form.

In comparison to internal consistency and test–retest reliability, interrater reliability is subject to greater measurement error, due to the two respondents’ differing experiences with the rated individual. Therefore, scores from the two respondents are expected to correlate moderately with each other, and less strongly than internal consistency or test–retest correlation. A clinical corollary of this effect is the importance of obtaining multiple ratings on individuals, to incorporate the unique perspective of each rater in the assessment process.

As expected, the correlations were moderate across all age levels, with a median correlation of .63 for the 10-item scales and .78 for the 60-item Sensory Total. These results are consistent with other behavior rating scales of this kind and support a level of interrater reliability that is appropriate for clinical use of the SPM-2.

Alternate-Forms Reliability

Alternate-forms reliability refers to the consistency of scores obtained from the same respondent rating the same person on two different forms. For the SPM-2, these studies were conducted with individuals whose ages were within the overlapping year between two age levels (such as a 5-year-old who was rated with both the Preschool and Child Home Forms). This study consisted of 54 participants (infant through adult) from the standardization sample who were assessed with each alternate form. Specifically, nine- and ten-month-olds were assessed with both the Infant and Toddler Forms; two-year-olds were

assessed with the Toddler Form and Preschool Home Form; five-year-olds were assessed with the Preschool and Child Home Forms; 12-year-olds were assessed with the Child and Adolescent Home Forms; and 21-year-olds were assessed with the Adolescent and Adult Self-Report Forms. In addition, five-year-olds were assessed with the Preschool and Child School Forms, and 12-year-olds were assessed with the Child and Adolescent School Forms.

Alternate-forms studies emphasize the equivalency of parallel forms intended for different age ranges. As expected, the pairs of parallel forms across all age levels showed a strong median correlation of .69 for the 10-item scales, and .84 for the 60-item Sensory Total. These studies suggest that, in clinical applications, use of either the “younger” or “older” forms with individuals whose ages are within the overlapping ranges of different form levels will produce roughly equivalent results. Therefore, determining which form to use when an examinee’s age falls within the range of two forms is primarily a clinical decision. For more information about selecting the appropriate form, see Chapter 2, “Administration Instructions by Age Level.”

Cross-Rater Concordance

Cross-rater concordance, also known as *cross-form consistency*, refers to the correlation between scores obtained from two respondents rating the same person on two different forms. By convention, these studies are usually reported alongside traditional reliability studies. However, in contrast to interrater and alternate-forms reliability, cross-rater consistency is closer to a metric of validity. This is because it uses both different raters and different forms. In the case of the SPM-2, for example, ratings are given not only by different raters, but by raters who have different role relationships to the person, such as parents and teachers. Parents and teachers observe children in different settings, during different time periods, and with different background knowledge and expectations. In addition, the forms themselves are designed to measure the SPM-2 constructs in different environments, where sensory processing behaviors are likely to vary based on different stimuli and conditions. Therefore, the cross-rater concordance correlations (different raters, different forms) were expected to be lower than both the interrater study (different raters, same form) and the

alternate-forms study (same rater, parallel forms), and also lower than the interscale correlations (same rater, different traits).

This cross-rater concordance study consisted of 2,915 participants (infant through adult) from the standardization sample who were assessed with at least two forms in their age level. The Preschool and Child age levels included Home and School comparisons; the Adolescent age level included Home and School, Home and Self-Report, and School and Self-Report comparisons; and the Adult age level included Self-Report and Rater Report comparisons. Infant/Toddler participants were excluded because only one SPM-2 form is used to assess an infant or toddler.

As expected, the median cross-rater concordance correlations were lower than the interrater (.63 and .78) and alternate-forms (.69 and .84) correlations described earlier in this chapter, as well as the median interscale correlations (.62 and .79) described in the Validity section of this chapter. Across all age levels, the cross-rater concordance form pairs showed a median correlation of .47 for the 10-item scales, and .59 for the 60-item Sensory Total. This suggests that differences between observers or environments affect SPM-2 ratings more strongly than do differences among the sensory systems and the constructs of praxis and social participation.

These findings attest to the utility and clinical value of having separate forms and raters for the home and school environments, as well as for self-report and rater report forms. Thus, in clinical applications, SPM-2 users should strive to obtain multiple ratings on the same individual in order to gain insight into the individual's functioning in different settings, as perceived by different raters.

Online and Paper Forms Equivalence Study

An equivalence study examined the extent to which SPM-2 online and paper administrations, the formats typically used for remote and in-person assessments, show equivalent results. The SPM-2 online and paper forms equivalence study consisted of 173 participants from the standardization sample who completed two research forms in the same testing session: one online form (typically used for remote assessments), and one paper form (typically used for in-person assessments). Across all age levels, median correlations were high: .92 for the Sensory Total (ST), and between .81 and .87 for the other eight scales. These findings suggest that online and print (and, by extension, remote and in-person) administrations can be treated as equivalent methods for administering the SPM-2.

Validity

The concept of test validity has both theoretical and practical dimensions. The theoretical aspects of validity deal with whether a scale measures the constructs that it purports to measure. The practical components of validity refer to what sorts of clinically relevant information can be inferred from test scores. To address these issues, this section presents evidence regarding the content validity, construct validity, and criterion-related validity (i.e., the validity evidence based on clinical groups) of the SPM-2 scales.

Content Validity

Content validity refers to the extent to which a test represents all *facets* of a given construct. The facet structure can be described as a matrix of the content domains and dimensions that define a construct according to theory. For the SPM-2, the sensory domains (e.g., vision) combined with the vulnerability dimensions (e.g., over-reactivity), when represented across all age levels and settings, comprise the facet structure of the SPM-2. Content validity is built into a behavior rating scale by carefully describing the facets to be sampled, writing items that represent those facets, subjecting the items to expert scrutiny, and then analyzing the resulting item pool to ensure that the collection of items retained in the final scales represents the full facet structure of the construct while retaining desirable psychometric characteristics.

Like its predecessors, the SPM-2 is anchored in Ayres Sensory Integration theory. This theory proposes that the integration and processing of sensory inputs is a critical neurobehavioral process that strongly affects development. The theory holds that those with compromised sensory processing may be unable to learn efficiently, regulate their emotions, or function at an expected level in daily activities. Difficulties at the level of sensory integration and processing often contribute to impairment in complex, higher level functions, such as praxis (the ability to plan and organize movement) and social participation. The development procedures described in Chapter 4 generate confidence in the content validity of the SPM-2, ensuring that the items in each form represent sensory integration and processing across relevant content facets.

Construct Validity

Construct validity refers to how well a test performs in measuring a theoretical construct of interest. For the SPM-2, Ayres Sensory Integration theory defines the primary constructs of interest: processing in the visual, auditory, tactile, olfactory/gustatory, proprioceptive, and vestibular systems, along with praxis (motor planning and ideation) and social participation. The SPM-2 is designed to provide access to these theoretical constructs through its *T*-scores. Therefore, the construct validity of the SPM-2 is based on its content validity, already described, as well as its structural validity and nomological validity, both of which are described in the following sections.

Structural Validity

Structural validity refers to the organization of SPM-2 items into scales that purport to measure various aspects of the constructs of sensory integration and processing. Evidence of the structural validity of the SPM-2 is demonstrated through its interscale correlations and its factor structure.

Interscale Correlations

Tables 5.8 through 5.12 show the correlations among the SPM-2 scales in the standardization sample. It is instructive to compare these correlations to the internal consistency (alpha) coefficients in Tables 5.1 through 5.5. Across all SPM-2 forms, the internal consistency reliability coefficients are higher than the interscale correlations. This indicates that each scale's items are more strongly related to each other than they are to other scales, which supports the separate scoring and interpretation of the SPM-2 scales, and by implication supports the structural validity of the instrument. When comparing the alphas to the interscale correlations, however, it is important to exclude any scales that share items, because these common items inflate interscale correlations. For that reason, the Sensory Total (ST) correlations should not be included in this type of comparison.

Table 5.8. SPM-2 Interscale Correlations in the Standardization Sample:
Infant/Toddler Age Level

Scale	Interscale correlations ^a								
	VIS	HEA	TOU	T&S	BOD	BAL	ST	PLN	SOC
Infant Form									
Vision (VIS)	—	—	—	—	—	—	—	—	—
Hearing (HEA)	.34	—	—	—	—	—	—	—	—
Touch (TOU)	.36	.46	—	—	—	—	—	—	—
Taste and Smell (T&S)	.25	.40	.44	—	—	—	—	—	—
Body Awareness (BOD)	.34	.33	.50	.29	—	—	—	—	—
Balance and Motion (BAL)	.22	.53	.57	.31	.39	—	—	—	—
Sensory Total (ST)	.67	.70	.77	.58	.67	.68	—	—	—
Planning and Ideas (PLN)	.09	.41	.26	.20	.24	.39	.35	—	—
Social Participation (SOC)	-.14	.37	.17	.06	-.03	.32	.14	.40	—
Toddler Form									
Vision (VIS)	—	—	—	—	—	—	—	—	—
Hearing (HEA)	.67	—	—	—	—	—	—	—	—
Touch (TOU)	.48	.62	—	—	—	—	—	—	—
Taste and Smell (T&S)	.33	.41	.51	—	—	—	—	—	—
Body Awareness (BOD)	.50	.55	.58	.41	—	—	—	—	—
Balance and Motion (BAL)	.46	.50	.53	.40	.61	—	—	—	—
Sensory Total (ST)	.76	.83	.80	.64	.80	.75	—	—	—
Planning and Ideas (PLN)	.33	.31	.31	.24	.47	.56	.48	—	—
Social Participation (SOC)	.20	.67	.25	.29	.31	.38	.37	.40	—
Caregiver Self-Report Form									
Vision (VIS)	—	—	—	—	—	—	—	—	—
Hearing (HEA)	.67	—	—	—	—	—	—	—	—
Touch (TOU)	.57	.63	—	—	—	—	—	—	—
Taste and Smell (T&S)	.54	.59	.62	—	—	—	—	—	—
Body Awareness (BOD)	.55	.55	.57	.52	—	—	—	—	—
Balance and Motion (BAL)	.58	.57	.58	.58	.62	—	—	—	—
Sensory Total (ST)	.82	.84	.81	.80	.76	.80	—	—	—
Planning and Ideas (PLN)	.53	.56	.54	.50	.58	.59	.67	—	—
Social Participation (SOC)	.39	.39	.37	.30	.36	.28	.43	.40	—

Note. Infant Form $N = 266$; Toddler Form $N = 421$; Caregiver Self-Report Form $N = 870$. Because the Infant/Toddler participants were the primary determinants of the demographic groups, the Caregiver sample was not desampled and thus shows a larger sample size than the Infant/Toddler sample described in Table 4.1.

^aCorrected Pearson correlation coefficients.

Table 5.9. SPM-2 Interscale Correlations in the Standardization Sample:
Preschool Age Level

Scale	Interscale correlations ^a								
	VIS	HEA	TOU	T&S	BOD	BAL	ST	PLN	SOC
Home Form									
Vision (VIS)	—	—	—	—	—	—	—	—	—
Hearing (HEA)	.70	—	—	—	—	—	—	—	—
Touch (TOU)	.64	.68	—	—	—	—	—	—	—
Taste and Smell (T&S)	.56	.56	.63	—	—	—	—	—	—
Body Awareness (BOD)	.60	.61	.69	.56	—	—	—	—	—
Balance and Motion (BAL)	.58	.63	.60	.55	.60	—	—	—	—
Sensory Total (ST)	.85	.86	.85	.76	.83	.76	—	—	—
Planning and Ideas (PLN)	.57	.59	.60	.48	.56	.65	.68	—	—
Social Participation (SOC)	.47	.49	.51	.39	.53	.46	.58	.56	—
School Form									
Vision (VIS)	—	—	—	—	—	—	—	—	—
Hearing (HEA)	.77	—	—	—	—	—	—	—	—
Touch (TOU)	.68	.77	—	—	—	—	—	—	—
Taste and Smell (T&S)	.52	.53	.64	—	—	—	—	—	—
Body Awareness (BOD)	.60	.61	.69	.50	—	—	—	—	—
Balance and Motion (BAL)	.60	.64	.68	.56	.57	—	—	—	—
Sensory Total (ST)	.85	.88	.88	.70	.79	.78	—	—	—
Planning and Ideas (PLN)	.64	.68	.67	.52	.55	.62	.74	—	—
Social Participation (SOC)	.57	.62	.59	.34	.53	.45	.63	.61	—

Note. Home Form *N* = 520; School Form *N* = 539.

^aCorrected Pearson correlation coefficients.

Table 5.10. SPM-2 Interscale Correlations in the Standardization Sample:
Child Age Level

Scale	Interscale correlations ^a								
	VIS	HEA	TOU	T&S	BOD	BAL	ST	PLN	SOC
Home Form									
Vision (VIS)	—	—	—	—	—	—	—	—	—
Hearing (HEA)	.62	—	—	—	—	—	—	—	—
Touch (TOU)	.62	.64	—	—	—	—	—	—	—
Taste and Smell (T&S)	.51	.55	.64	—	—	—	—	—	—
Body Awareness (BOD)	.59	.56	.65	.54	—	—	—	—	—
Balance and Motion (BAL)	.58	.57	.61	.50	.68	—	—	—	—
Sensory Total (ST)	.78	.79	.84	.78	.82	.77	—	—	—
Planning and Ideas (PLN)	.62	.57	.65	.48	.63	.63	.72	—	—
Social Participation (SOC)	.48	.37	.40	.33	.46	.36	.49	.54	—
School Form									
Vision (VIS)	—	—	—	—	—	—	—	—	—
Hearing (HEA)	.73	—	—	—	—	—	—	—	—
Touch (TOU)	.66	.71	—	—	—	—	—	—	—
Taste and Smell (T&S)	.53	.49	.60	—	—	—	—	—	—
Body Awareness (BOD)	.66	.69	.73	.51	—	—	—	—	—
Balance and Motion (BAL)	.65	.66	.67	.55	.72	—	—	—	—
Sensory Total (ST)	.87	.87	.85	.69	.86	.83	—	—	—
Planning and Ideas (PLN)	.71	.73	.65	.46	.69	.61	.78	—	—
Social Participation (SOC)	.55	.59	.49	.34	.49	.37	.58	.60	—

Note. Home Form $N = 875$; School Form $N = 555$.

^aCorrected Pearson correlation coefficients.

Table 5.11. SPM-2 Interscale Correlations in the Standardization Sample:
Adolescent Age Level

Scale	Interscale correlations ^a								
	VIS	HEA	TOU	T&S	BOD	BAL	ST	PLN	SOC
Home Form									
Vision (VIS)	—	—	—	—	—	—	—	—	—
Hearing (HEA)	.74	—	—	—	—	—	—	—	—
Touch (TOU)	.66	.65	—	—	—	—	—	—	—
Taste and Smell (T&S)	.54	.58	.56	—	—	—	—	—	—
Body Awareness (BOD)	.66	.62	.73	.49	—	—	—	—	—
Balance and Motion (BAL)	.60	.56	.59	.51	.62	—	—	—	—
Sensory Total (ST)	.83	.82	.82	.79	.80	.72	—	—	—
Planning and Ideas (PLN)	.62	.60	.66	.50	.63	.58	.72	—	—
Social Participation (SOC)	.50	.47	.48	.33	.50	.41	.54	.49	—
School Form									
Vision (VIS)	—	—	—	—	—	—	—	—	—
Hearing (HEA)	.72	—	—	—	—	—	—	—	—
Touch (TOU)	.67	.68	—	—	—	—	—	—	—
Taste and Smell (T&S)	.58	.68	.62	—	—	—	—	—	—
Body Awareness (BOD)	.66	.69	.71	.60	—	—	—	—	—
Balance and Motion (BAL)	.65	.71	.69	.64	.71	—	—	—	—
Sensory Total (ST)	.81	.87	.77	.77	.78	.78	—	—	—
Planning and Ideas (PLN)	.61	.61	.58	.54	.59	.56	.69	—	—
Social Participation (SOC)	.40	.38	.37	.28	.37	.33	.45	.53	—
Self-Report Form									
Vision (VIS)	—	—	—	—	—	—	—	—	—
Hearing (HEA)	.77	—	—	—	—	—	—	—	—
Touch (TOU)	.70	.74	—	—	—	—	—	—	—
Taste and Smell (T&S)	.59	.67	.71	—	—	—	—	—	—
Body Awareness (BOD)	.68	.70	.69	.60	—	—	—	—	—
Balance and Motion (BAL)	.69	.71	.69	.61	.73	—	—	—	—
Sensory Total (ST)	.86	.89	.87	.82	.84	.84	—	—	—
Planning and Ideas (PLN)	.71	.71	.69	.60	.71	.75	.80	—	—
Social Participation (SOC)	.52	.49	.47	.39	.49	.47	.55	.49	—

Note. Home Form *N* = 1,014; School Form *N* = 645; Self-Report Form *N* = 957.

^aCorrected Pearson correlation coefficients.

Table 5.12. SPM-2 Interscale Correlations in the Standardization Sample:
Adult Age Level

Scale	Interscale correlations ^a								
	VIS	HEA	TOU	T&S	BOD	BAL	ST	PLN	SOC
Self-Report Form									
Vision (VIS)	—	—	—	—	—	—	—	—	—
Hearing (HEA)	.71	—	—	—	—	—	—	—	—
Touch (TOU)	.62	.61	—	—	—	—	—	—	—
Taste and Smell (T&S)	.50	.49	.63	—	—	—	—	—	—
Body Awareness (BOD)	.59	.48	.54	.51	—	—	—	—	—
Balance and Motion (BAL)	.64	.60	.59	.54	.58	—	—	—	—
Sensory Total (ST)	.84	.82	.83	.76	.74	.82	—	—	—
Planning and Ideas (PLN)	.64	.51	.54	.38	.54	.61	.66	—	—
Social Participation (SOC)	.49	.43	.47	.35	.43	.42	.54	.42	—
Rater Report Form									
Vision (VIS)	—	—	—	—	—	—	—	—	—
Hearing (HEA)	.71	—	—	—	—	—	—	—	—
Touch (TOU)	.70	.72	—	—	—	—	—	—	—
Taste and Smell (T&S)	.61	.63	.65	—	—	—	—	—	—
Body Awareness (BOD)	.57	.54	.61	.46	—	—	—	—	—
Balance and Motion (BAL)	.59	.57	.63	.55	.55	—	—	—	—
Sensory Total (ST)	.84	.86	.87	.81	.72	.76	—	—	—
Planning and Ideas (PLN)	.69	.58	.64	.56	.60	.61	.74	—	—
Social Participation (SOC)	.39	.38	.46	.35	.36	.31	.47	.40	—

Note. Self-Report Form *N* = 711; Rater Report Form *N* = 604.

^aCorrected Pearson correlation coefficients.

Factor Analysis

Factor analysis begins with a correlation matrix encompassing a large set of item responses, and then reduces that multitude of interrelationships to a much smaller set of underlying (or latent) variables. Because these latent variables often represent usable scales, *factorial validity*, or the extent to which the theoretical structure of a scale is recoverable in a set of test scores, is an essential part of establishing a test's structural validity. The factorial validity of the SPM-2 is based in part on prior analyses of the SPM, the SPM-P, and their predecessors.

The theoretical foundations of the SPM-2 assert that its eight domains constitute important aspects of sensory processing, praxis, and social participation. In addition, Ayres (1972, 1979, 2005) postulated a further set of theoretical constructs related to sensory integration vulnerabilities (e.g., under- and over-reactivity to stimuli, sensation-seeking behavior, perception difficulties, etc.). In both the SPM and the SPM-P, as well as their precursors, factor analyses showed a better fit to a sensory systems factor model than a vulnerabilities factor model.

Based on these conceptual and practical considerations, the factor structure of the SPM-2 was examined using an eight-factor theoretical model. Confirmatory factor analysis was applied to evaluate the model, with modification if necessary, and analyzed using Mplus (Version 7) software (Muthén & Muthén, 2012). In the hypothesized model, items were identified as reflecting Vision, Hearing, Touch, Taste and Smell, Body Awareness, Balance and Motion, Planning and Ideas, and Social Participation.

The model fit statistics for an eight-factor model are presented in Table 5.13 for the standardization

samples. A separate chi-square difference test was performed to examine the efficacy of this multifactor model over a general one-factor model. Across all samples, the eight-factor model significantly improves model fit compared to the one-factor model:

- I/T Infant: $\chi^2(28) = 60.42, p < .001$
- I/T Toddler: $\chi^2(28) = 773.47, p < .001$
- I/T Caregiver Self-Report: $\chi^2(28) = 1,711.66, p < .001$
- Preschool Home: $\chi^2(28) = 1,232.48, p < .001$
- Preschool School: $\chi^2(28) = 1,070.60, p < .001$
- Child Home: $\chi^2(28) = 1,846.55, p < .001$
- Child School: $\chi^2(28) = 988.23, p < .001$
- Adolescent Home: $\chi^2(28) = 1,555.59, p < .001$
- Adolescent School: $\chi^2(28) = 1,374.85, p < .001$
- Adolescent Self-Report: $\chi^2(28) = 1,121.36, p < .001$
- Adult Rater Report: $\chi^2(28) = 1,130.22, p < .001$
- Adult Self-Report: $\chi^2(28) = 1,314.77, p < .001$

These findings support a suitable fit of the predicted multifactor model such that the items comprising the SPM-2 meaningfully distinguish distinct aspects of sensory processing.

To summarize, prior evidence from the SPM and the SPM-P, combined with the current examinations of cross-rater concordance, interscale correlations, and confirmatory factor analyses, provides strong and consistent support for separate scoring and interpretation of the Vision, Hearing, Touch, Taste and Smell, Body Awareness, Balance and Motion, Planning and Ideas, and Social Participation scales.

Table 5.13. SPM-2 CFA Fit Statistics for Eight-Factor Model Across Standardization Samples

Standardization sample	<i>n</i>	chi-square	<i>df</i>	<i>p</i>	WRMR	RMSEA	CFI	TLI
Infant/Toddler Forms								
Infant	266	4,355.45	3,052	<.001	1.455	.040	.814	.807
Toddler	421	5,031.87	3,052	<.001	1.526	.039	.825	.819
Caregiver Self-Report	870	7,212.06	3,052	<.001	1.829	.040	.866	.861
Preschool Forms								
Home	520	5,112.48	3,052	<.001	1.432	.036	.926	.923
School	539	5,672.46	3,052	<.001	1.626	.040	.931	.929
Child Forms								
Home	875	5,389.39	3,052	<.001	1.453	.030	.943	.941
School	555	4,414.39	3,052	<.001	1.340	.028	.957	.956
Adolescent Forms								
Home	1,014	7,547.40	3,052	<.001	1.706	.038	.922	.919
School	645	4,495.00	3,052	<.001	1.279	.027	.972	.971
Self-Report	957	6,654.25	3,052	<.001	1.570	.035	.930	.928
Adult Forms								
Self-Report	711	6,310.52	3,052	<.001	1.599	.039	.893	.889
Rater Report	604	4,916.25	3,052	<.001	1.330	.032	.932	.930

Note. The estimator WLSMV was used for analysis, as it is more appropriate for categorical data. In such cases, the chi-square value for categorical data cannot be used for chi-square difference because the chi-square is adjusted to obtain an accurate *p*-value. A separate chi-square difference test was performed for each sample to examine the efficacy of the multifactor model over the single-factor model. These results are reported within the body of the text.

CFA = confirmatory factor analysis; *df* = degrees of freedom; *p* = the probability, testing against the null hypothesis, that the population RMSEA is zero; WRMR (weighted root-mean-square residual) = average correlation residuals; RMSEA (root-mean-square error of approximation) = function of chi-square test of close fit; CFI (Bentler comparative fit index) = measure of proportionate improvement in model fit; TLI (Tucker-Lewis index) = measure of proportionate improvement in model fit.

Nomological Validity

The SPM-2 includes new studies of *nomological validity*, or the degree to which a test conforms to a set of expected relationships with other variables (see Cronbach & Meehl, 1955). The SPM-2 nomological validity studies were based on concurrent administration of the SPM-2 and relevant measures to assess convergent and divergent relationships, or the degree of association between the SPM-2 and measures of similar and dissimilar constructs.

Equivalence With the SPM and SPM-P

A series of analyses examined the level of equivalence between scores from the SPM-2 Child and Preschool age level forms and their predecessors, the analogous forms of the Sensory Processing Measure (SPM) and the Sensory Processing Measure–Preschool (SPM-P). Participants in the standardization and clinical samples rated the same individuals on the SPM-2 and the corresponding SPM/SPM-P

forms in the same testing session. The equivalence study was primarily conducted in the clinical sample, with a smaller sample drawn from the standardization sample mainly for the purpose of comparison. Separate studies were conducted for each of the forms, and the order of administration was counterbalanced across each data collection site.

The results of these studies are presented in Tables 5.14 and 5.15. The correlation coefficients, with a median correlation of .80, show a moderate to strong degree of equivalence between versions. In general, equivalence is affected by several factors. Stronger equivalence is driven by the high degree of similarity in item content between the two versions, and weaker equivalence by revisions to the composition of the scales. In this case, because over 70% of the item content was the same, and many of the changes in the other 30% were edits to existing items rather than new items, these equivalence studies produced the expected results.

Table 5.14. Correlations Between SPM-2 and SPM-P T-Scores:
Preschool Age Level

SPM-P	Standardization sample		Clinical sample	
	<i>n</i>	Corrected <i>r</i>	<i>n</i>	Corrected <i>r</i>
Home Form	25		64	
Vision (VIS)		.69		.80
Hearing (HEA)		.81		.80
Touch (TOU)		.82		.74
Body Awareness (BOD)		.42		.84
Balance and Motion (BAL)		.81		.85
Sensory Total (ST)		.85		.95
Planning and Ideas (PLN) ^a		.80		.86
Social Participation (SOC)		.68		.87
School Form	32		73	
Vision (VIS)		.73		.81
Hearing (HEA)		.79		.79
Touch (TOU)		.43		.50
Body Awareness (BOD)		.71		.74
Balance and Motion (BAL)		.62		.85
Sensory Total (ST)		.89		.91
Planning and Ideas (PLN) ^a		.59		.84
Social Participation (SOC)		.58		.88

Note. Standard scores for the T&S scale were not included in the SPM-P.

^aThe Planning and Ideas (PLN) scale was abbreviated *PLA* in the SPM-P.

Table 5.15. Correlations Between SPM-2 and SPM T-Scores:
Child Age Level

SPM	Standardization sample		Clinical sample	
	<i>n</i>	Corrected <i>r</i>	<i>n</i>	Corrected <i>r</i>
Home Form	13		149	
Vision (VIS)		.86		.76
Hearing (HEA)		.83		.70
Touch (TOU)		.93		.75
Body Awareness (BOD)		.87		.78
Balance and Motion (BAL)		.83		.73
Sensory Total (ST)		.94		.89
Planning and Ideas (PLN) ^a		.83		.80
Social Participation (SOC)		.71		.78
School Form	14		113	
Vision (VIS)		.86		.71
Hearing (HEA)		.76		.74
Touch (TOU)		.93		.70
Body Awareness (BOD)		.90		.76
Balance and Motion (BAL)		.78		.74
Sensory Total (ST)		.96		.90
Planning and Ideas (PLN) ^a		.86		.81
Social Participation (SOC)		.78		.82

Note. Standard scores for the T&S scale were not included in the SPM.

^aThe Planning and Ideas (PLN) scale was abbreviated *PLA* in the SPM.

Convergence With the Sensory Profile

For the SPM-2, the chief convergent measures of interest are the Sensory Profile forms, which included the Sensory Profile 2 (SP-2; Dunn, 2014) and the Adolescent/Adult Sensory Profile (SP; Brown & Dunn, 2002). Accordingly, convergent validity studies were conducted at each age level. In particular, six SPM-2 forms (Infant and Toddler, Preschool Home and School, Child Home and School) were compared to comparable forms of the Sensory Profile 2. Two SPM-2 forms (Adolescent and Adult Self-Reports) were compared to the Adolescent/Adult Sensory Profile because the SP-2 does not include adolescent or adult forms. The remaining SPM-2 forms (Adult Rater Report and I/T Caregiver Self-Report) did not have a comparable Sensory Profile form, and so were not included in these studies. These studies were conducted in the clinical sample, with subsamples showing demographic characteristics similar to those of the clinical sample as a whole (see Table 4.13). Tables 5.16 through 5.18 show the correlation matrices between the SPM-2 and the SP/SP-2 forms. Correlations which were significant at the $p < .01$ level are shown in bold italics. As expected, scales with similar content showed stronger correlations.

Because many of the sensory domains of the SP-2 cannot be scored at the youngest ages due to low reliabilities (Dunn, 2014), the most relevant correlations at the Infant/Toddler age level were between the SP-2 general processing score and the SPM-2 scales. These correlations ranged from .44 to .61 across the SPM-2 scales. As expected, the SPM-2 Sensory Total showed the highest correlation (.63).

At the Preschool age level (Table 5.16), both the SPM-2 Home and School Forms showed a pattern of expected correlations with the SP-2 forms. With the exception of Taste and Smell and Vision on the Home Form, the SPM-2 scales all showed significant correlations in the .50s between similar sensory scales. On the School Form, the correlations were

stronger, reaching into the .60s and .70s. The Child age level (Table 5.17) showed a similar pattern of correlations, but generally stronger, with all of the SPM-2 Home and School scales showing correlations in the .50–.70 range with their corresponding SP-2 scales, with the exception of Social Participation on the Home Form (.41).

At the Adult and Adolescent age levels, the results were more variable (Table 5.18). These studies were conducted using the Adolescent/Adult Sensory Profile. For the most part, the SP scales, which are more limited in scope than those of the SP-2 and only include self-report forms, correlated less strongly and consistently with the SPM-2 scales in comparison to the SP-2. In particular, while the overall pattern of significant results was reflective of the shared constructs, most of the SP Adolescent/Adult correlations were nonsignificant with the SPM-2 Adolescent Self-Report Form. The Adult age level was more robust, showing a pattern of correlations similar to the lower age levels, with the main difference being a broader range of significant correlations among similar scales (.32 to .80).

Overall, these results show an expected relationship between scores from two measures of similar constructs. In addition to the expected pattern of correlations among the sensory scales, supplementary analyses revealed a pattern of moderate correlations (.30 to .70) between the Preschool, Child, Adolescent, and Adult age level SPM-2 scales and the SP/SP-2 vulnerability quadrants. These quadrants (seeking, avoiding, sensitivity, and registration) correspond roughly to the main SPM-2 sensory vulnerability dimensions (over-reactivity, under-reactivity, sensory seeking, etc.) underlying the SPM-2 items across all forms. These results, taken together, suggest that the SPM-2 shows a convergent relationship with a criterion measure of both the domain level of sensory systems as well as the dimensional level of sensory vulnerability.

Table 5.16. Correlations Between SPM-2 and SP-2:
SPM-2 Preschool and SP-2 Child Forms

	SP-2 Child Caregiver Form ^a								
	Aud	Vis	Tou	Move	Body	Oral	Cond	Soc/Emo	Attn
SPM-2 Preschool Home Form									
Vision (VIS)	.36	.36	.38	.46	.39	.34	.41	.42	.62
Hearing (HEA)	.58	.07	.32	.35	.30	.34	.41	.43	.45
Touch (TOU)	.44	.16	.54	.58	.21	.56	.59	.43	.47
Taste and Smell (T&S)	.46	.25	.44	.28	.14	.10	.18	.19	.07
Body Awareness (BOD)	.40	.11	.50	.58	.13	.17	.66	.44	.54
Balance and Motion (BAL)	.40	.22	.33	.43	.52	.17	.34	.43	.53
Sensory Total (ST)	.59	.26	.57	.62	.38	.28	.61	.54	.62
Planning and Ideas (PLN)	.40	.09	.41	.46	.38	.38	.52	.45	.68
Social Participation (SOC)	.57	.02	.55	.61	.23	.28	.74	.59	.57
	SP-2 Child Teacher Form ^b								
	Aud	Vis	Tou	Move	Beh	-	-	-	-
SPM-2 Preschool School Form									
Vision (VIS)	.53	.49	.60	.63	.46				
Hearing (HEA)	.72	.55	.68	.68	.65				
Touch (TOU)	.47	.39	.67	.55	.54				
Taste and Smell (T&S)	.48	.22	.33	.22	.42				
Body Awareness (BOD)	.47	.51	.55	.62	.56				
Balance and Motion (BAL)	.51	.54	.51	.61	.50				
Sensory Total (ST)	.68	.59	.71	.72	.67				
Planning and Ideas (PLN)	.62	.58	.45	.56	.48				
Social Participation (SOC)	.60	.50	.48	.62	.73				

Note. Corrected Pearson correlation coefficients, with significance at the $p < .01$ level indicated in bold. **Aud** = Auditory Processing; **Vis** = Visual Processing; **Tou** = Touch Processing; **Move** = Movement Processing; **Body** = Body Position Processing; **Oral** = Oral Sensory Processing; **Cond** = Conduct associated with sensory processing; **Soc/Emo** = Social Emotional responses associated with sensory processing; **Attn** = Attentional responses associated with sensory processing; **Beh** = Behavioral responses associated with sensory processing.

^a $n = 85$, ages 3 to 5 years. ^b $n = 79$, ages 3 to 5 years.

Table 5.17. Correlations Between SPM-2 and SP-2:
SPM-2 Child and SP-2 Child Forms

	SP-2 Child Caregiver Form ^a								
	Aud	Vis	Tou	Move	Body	Oral	Cond	Soc/Emo	Attn
SPM-2 Child Home Form									
Vision (VIS)	.48	.55	.50	.41	.50	.32	.41	.51	.54
Hearing (HEA)	.57	.42	.44	.37	.30	.32	.21	.38	.31
Touch (TOU)	.34	.37	.54	.31	.41	.37	.33	.43	.34
Taste and Smell (T&S)	.30	.28	.46	.40	.39	.75	.30	.37	.26
Body Awareness (BOD)	.34	.32	.62	.67	.45	.37	.61	.29	.52
Balance and Motion (BAL)	.38	.29	.43	.40	.63	.41	.34	.42	.40
Sensory Total (ST)	.52	.48	.65	.55	.57	.54	.47	.52	.51
Planning and Ideas (PLN)	.30	.19	.26	.11	.30	.16	.21	.27	.35
Social Participation (SOC)	.39	.37	.52	.47	.31	.33	.46	.41	.44
	SP-2 Child Teacher Form ^b								
	Aud	Vis	Tou	Move	Beh	-	-	-	-
SPM-2 Child School Form									
Vision (VIS)	.47	.53	.43	.54	.45				
Hearing (HEA)	.55	.44	.55	.45	.48				
Touch (TOU)	.49	.50	.61	.55	.55				
Taste and Smell (T&S)	.27	.31	.39	.32	.39				
Body Awareness (BOD)	.48	.47	.59	.64	.58				
Balance and Motion (BAL)	.39	.39	.50	.54	.47				
Sensory Total (ST)	.56	.56	.64	.64	.61				
Planning and Ideas (PLN)	.55	.59	.49	.54	.59				
Social Participation (SOC)	.59	.53	.57	.54	.73				

Note. Corrected Pearson correlation coefficients, with significance at the $p < .01$ level indicated in bold. **Aud** = Auditory Processing; **Vis** = Visual Processing; **Tou** = Touch Processing; **Move** = Movement Processing; **Body** = Body Position Processing; **Oral** = Oral Sensory Processing; **Cond** = Conduct associated with sensory processing; **Soc/Emo** = Social Emotional responses associated with sensory processing; **Attn** = Attentional responses associated with sensory processing; **Beh** = Behavioral responses associated with sensory processing.

^a $n = 162$, ages 5 to 12 years. ^b $n = 149$, ages 5 to 12 years.

Table 5.18. Correlations Between SPM-2 and SP:
SPM-2 Adolescent, SPM-2 Adult, and SP Adolescent/Adult Self-Report Forms

	SP Adolescent/Adult Self-Report Form					
	Taste/Smell	Move	Vis	Tou	Activity	Aud
SPM-2 Adolescent Self-Report Form^a						
Vision (VIS)	.16	.12	.44	.23	.31	.29
Hearing (HEA)	.26	.13	.19	.33	.33	.39
Touch (TOU)	.25	.00	.09	.28	.27	.25
Taste and Smell (T&S)	.43	.21	.04	.39	.27	.26
Body Awareness (BOD)	.27	.26	-.01	.28	.16	.32
Balance and Motion (BAL)	.33	.22	.20	.24	.19	.30
Sensory Total (ST)	.36	.20	.20	.37	.31	.38
Planning and Ideas (PLN)	.15	-.06	.26	.13	.16	.24
Social Participation (SOC)	.23	.02	.27	.28	.29	.24
SPM-2 Adult Self-Report Form^b						
Vision (VIS)	.23	.56	.63	.30	.21	.50
Hearing (HEA)	.22	.55	.61	.45	.38	.80
Touch (TOU)	.26	.38	.45	.51	.19	.37
Taste and Smell (T&S)	.32	.44	.36	.43	.30	.26
Body Awareness (BOD)	.29	.46	.45	.27	.26	.48
Balance and Motion (BAL)	.37	.67	.59	.51	.26	.52
Sensory Total (ST)	.35	.67	.68	.53	.35	.67
Planning and Ideas (PLN)	.24	.34	.40	.18	.22	.25
Social Participation (SOC)	.24	.41	.55	.32	.36	.43

Note. Corrected Pearson correlation coefficients, with significance at the $p < .01$ level indicated in bold. **Taste/Smell** = Taste/Smell Processing; **Move** = Movement Processing; **Vis** = Visual Processing; **Tou** = Touch Processing; **Activity** = Activity Level; **Aud** = Auditory Processing.

^a $n = 79$, ages 12 to 21 years. ^b $n = 79$, ages 21 to 67 years.

Convergence With the Adaptive Behavior Assessment System, Third Edition (ABAS-3)

Sensory integration and processing is nomologically related to *adaptive behavior*, or the “skills needed to effectively and independently care for one-self, respond to others, and meet environmental demands at home, school, work, and in the community” (Harrison & Oakland, 2015, p. 1). In particular, adaptive behavior is compromised when a disability, such as a sensory processing disorder, negatively impacts the conceptual, social, and practical aspects of daily living. Thus, it was expected that SPM-2 scores would correlate negatively with ABAS-3 scores because greater sensory integration and processing dysfunction should be related to decreased adaptive behavior.

Tables 5.19 through 5.23 show the correlation matrices between the SPM-2 and ABAS-3 forms. As expected, across all age levels, the median Sensory

Total (ST) correlation with the General Adaptive Composite (GAC), the most general metrics on both scales, ranged from $-.43$ to $-.59$, indicating a moderate to strong negative relationship between sensory dysfunction and adaptive behavior. Furthermore, the GAC also showed moderate to strong significant correlations ($-.29$ to $-.67$) with the remaining SPM-2 scales, despite a substantial divergence in item content across scales. Finally, particularly strong median correlations between scales with similar content indicated convergence between similar scales on both measures.

Overall, these results support the construct validity of the SPM-2. The results also support the criterion-related validity of the SPM-2 in terms of its capacity to detect deficits in adaptive functioning in clinical populations affected by sensory processing disorders.

Table 5.19. Correlations Between SPM-2 and ABAS-3: SPM-2 Infant and Toddler Forms and ABAS-3 Parent/Primary Caregiver Form

	ABAS-3 Parent/Primary Caregiver (Ages 0–5) Form							
	Com	HS	LS	SC	SD	Soc	MO	GAC
SPM-2 Infant and Toddler Forms								
Vision (VIS)	-.43	-.33	-.45	-.34	-.33	-.42	-.34	-.43
Hearing (HEA)	-.30	-.25	-.39	-.18	-.28	-.28	-.14	-.28
Touch (TOU)	-.24	-.21	-.22	-.24	-.18	-.20	-.13	-.20
Taste and Smell (T&S)	-.15	.05	-.02	-.14	-.08	-.02	.02	-.02
Body Awareness (BOD)	-.34	-.51	-.38	-.48	-.51	-.49	-.38	-.48
Balance and Motion (BAL)	-.53	-.43	-.41	-.46	-.29	-.45	-.38	-.49
Sensory Total (ST)	-.47	-.37	-.41	-.39	-.35	-.42	-.31	-.43
Planning and Ideas (PLN)	-.58	-.53	-.52	-.66	-.45	-.59	-.60	-.67
Social Participation (SOC)	-.37	-.50	-.52	-.58	-.51	-.58	-.42	-.53

Note. $n = 52$. Participant ages: 4 to 30 months. Corrected Pearson correlation coefficients, with significance at the $p < .01$ level indicated in bold. Com = Communication; HS = Health and Safety; LS = Leisure; SC = Self-Care; SD = Self-Direction; Soc = Social; MO = Motor; GAC = General Adaptive Composite.

Table 5.20. Correlations Between SPM-2 and ABAS-3:
SPM-2 Preschool Home and School Forms
and ABAS-3 Parent/Primary Caregiver and Teacher/Daycare Provider Forms

	ABAS-3 Parent/Primary Caregiver and Teacher/Daycare Provider (Ages 2–5) Forms									
	Com	FA	SL/HL ^a	HS	LS	SC	SD	Soc	MO	GAC
SPM-2 Preschool Home and School Forms										
Vision (VIS)	-.25	-.24	-.28	-.44	-.34	-.24	-.37	-.37	-.34	-.40
Hearing (HEA)	-.31	-.17	-.44	-.46	-.49	-.34	-.52	-.51	-.34	-.48
Touch (TOU)	-.26	-.09	-.29	-.36	-.38	-.34	-.43	-.41	-.21	-.37
Taste and Smell (T&S)	-.11	.00	-.11	-.13	-.19	-.15	-.20	-.14	-.08	-.15
Body Awareness (BOD)	-.23	-.07	-.35	-.46	-.36	-.27	-.51	-.41	-.22	-.39
Balance and Motion (BAL)	-.23	-.17	-.37	-.46	-.39	-.31	-.43	-.41	-.36	-.41
Sensory Total (ST)	-.31	-.17	-.42	-.51	-.48	-.35	-.55	-.49	-.34	-.49
Planning and Ideas (PLN)	-.55	-.42	-.52	-.65	-.63	-.48	-.60	-.63	-.49	-.67
Social Participation (SOC)	-.34	-.19	-.52	-.55	-.60	-.40	-.74	-.60	-.27	-.58

Note. $n = 181$. Participant ages: 2 to 5 years. SPM-2 and ABAS-3 forms were each combined across home and school forms. Corrected Pearson correlation coefficients, with significance at the $p < .01$ level indicated in bold. Com = Communication; FA = Functional Academics; SL/HL = School Living / Home Living; HS = Health and Safety; LS = Leisure; SC = Self-Care; SD = Self-Direction; Soc = Social; MO = Motor; GAC = General Adaptive Composite.

^aOnly ABAS-3 scales present on both forms were included (except School Living and Home Living, which were combined).

Table 5.21. Correlations Between SPM-2 and ABAS-3:
SPM-2 Child Home and School Forms
and ABAS-3 Parent and Teacher Forms

	ABAS-3 Parent and Teacher (Ages 5–21) Forms									
	Com	FA	SL/HL ^a	HS	LS	SC	SD	Soc	MO	GAC
SPM-2 Child Home and School Forms										
Vision (VIS)	-.45	-.42	-.37	-.33	-.39	-.39	-.41	-.42	-.46	-.45
Hearing (HEA)	-.34	-.27	-.28	-.29	-.35	-.36	-.35	-.37	-.37	-.34
Touch (TOU)	-.40	-.31	-.35	-.37	-.42	-.47	-.43	-.42	-.45	-.40
Taste and Smell (T&S)	-.29	-.14	-.20	-.27	-.32	-.37	-.25	-.31	-.30	-.29
Body Awareness (BOD)	-.39	-.31	-.36	-.41	-.43	-.41	-.39	-.44	-.45	-.39
Balance and Motion (BAL)	-.40	-.31	-.33	-.35	-.37	-.47	-.35	-.35	-.43	-.40
Sensory Total (ST)	-.49	-.38	-.40	-.42	-.49	-.51	-.46	-.49	-.52	-.49
Planning and Ideas (PLN)	-.53	-.44	-.45	-.38	-.49	-.49	-.46	-.47	-.53	-.53
Social Participation (SOC)	-.54	-.37	-.48	-.48	-.64	-.49	-.51	-.63	-.58	-.54

Note. $n = 328$. Participant ages: 5 to 21 years. SPM-2 and ABAS-3 forms were each combined across home and school forms. Corrected Pearson correlation coefficients, with significance at the $p < .01$ level indicated in bold. Com = Communication; FA = Functional Academics; SL/HL = School Living / Home Living; HS = Health and Safety; LS = Leisure; SC = Self-Care; SD = Self-Direction; Soc = Social; MO = Motor; GAC = General Adaptive Composite.

^aOnly ABAS-3 scales present on both forms were included (except School Living and Home Living, which were combined).

Table 5.22. Correlations Between SPM-2 and ABAS-3:
SPM-2 Adolescent Home and School Forms
and ABAS-3 Parent and Teacher Forms

	ABAS-3 Parent and Teacher (Ages 5–21) Forms									
	Com	FA	SL/HL ^a	HS	LS	SC	SD	Soc	MO	GAC
SPM-2 Adolescent Home and School Forms										
Vision (VIS)	-.55	-.49	-.44	-.49	-.47	-.40	-.51	-.57	-.57	-.55
Hearing (HEA)	-.46	-.29	-.40	-.42	-.34	-.31	-.46	-.51	-.45	-.46
Touch (TOU)	-.56	-.46	-.52	-.60	-.55	-.50	-.58	-.58	-.62	-.56
Taste and Smell (T&S)	-.31	-.13	-.34	-.29	-.20	-.26	-.31	-.33	-.29	-.31
Body Awareness (BOD)	-.56	-.49	-.54	-.57	-.53	-.46	-.53	-.60	-.61	-.56
Balance and Motion (BAL)	-.42	-.31	-.41	-.44	-.33	-.41	-.36	-.37	-.44	-.42
Sensory Total (ST)	-.57	-.43	-.51	-.54	-.48	-.44	-.55	-.60	-.59	-.57
Planning and Ideas (PLN)	-.58	-.53	-.47	-.50	-.53	-.44	-.53	-.53	-.61	-.58
Social Participation (SOC)	-.57	-.42	-.50	-.50	-.60	-.45	-.55	-.64	-.61	-.57

Note. $n = 189$. Participant ages: 5 to 21 years. SPM-2 and ABAS-3 forms were each combined across home and school forms. Corrected Pearson correlation coefficients, with significance at the $p < .01$ level indicated in bold. Com = Communication; FA = Functional Academics; SL/HL = School Living / Home Living; HS = Health and Safety; LS = Leisure; SC = Self-Care; SD = Self-Direction; Soc = Social; MO = Motor; GAC = General Adaptive Composite.

^aOnly ABAS-3 scales present on both forms were included (except School Living and Home Living, which were combined).

Table 5.23. Correlations Between SPM-2 and ABAS-3:
SPM-2 Adult Self-Report and Rater Report Forms
and ABAS-3 Adult Self-Report and Rated by Others Forms

	ABAS-3 Adult Self-Report and Rated by Others (Ages 16–89) Forms									
	Com	FA	HL	HS	LS	SC	SD	Soc	MO	GAC
SPM-2 Adult Self-Report and Rater Report Forms										
Vision (VIS)	-.46	-.45	-.47	-.42	-.45	-.48	-.46	-.42	-.52	-.46
Hearing (HEA)	-.43	-.26	-.33	-.24	-.33	-.31	-.31	-.28	-.37	-.43
Touch (TOU)	-.37	-.29	-.36	-.25	-.37	-.39	-.36	-.30	-.38	-.37
Taste and Smell (T&S)	-.35	-.27	-.29	-.25	-.32	-.29	-.26	-.30	-.34	-.35
Body Awareness (BOD)	-.53	-.42	-.48	-.46	-.45	-.51	-.48	-.43	-.53	-.53
Balance and Motion (BAL)	-.51	-.48	-.49	-.40	-.45	-.50	-.45	-.35	-.52	-.51
Sensory Total (ST)	-.54	-.45	-.50	-.42	-.49	-.51	-.48	-.44	-.55	-.54
Planning and Ideas (PLN)	-.52	-.57	-.52	-.50	-.52	-.48	-.49	-.48	-.59	-.52
Social Participation (SOC)	-.37	-.35	-.43	-.36	-.36	-.45	-.39	-.50	-.46	-.37

Note. $n = 154$. Participant ages: 21 to 67 years. Corrected Pearson correlation coefficients, with significance at the $p < .01$ level indicated in bold. Com = Communication; FA = Functional Academics; HL = Home Living; HS = Health and Safety; LS = Leisure; SC = Self-Care; SD = Self-Direction; Soc = Social; MO = Motor; GAC = General Adaptive Composite.

Validity Evidence Based on Clinical Groups

Criterion-related validity refers to how well a test predicts an independent outcome, or criterion. For the SPM-2, an important index of criterion validity is the capacity to distinguish between groups of children who are expected to differ in sensory processing function, praxis, and social participation. Unlike the large, demographically representative SPM-2 standardization samples, the clinical groups are smaller, less broadly representative samples collected by clinicians in a variety of settings. The demographic characteristics of these groups are summarized in Table 4.13.

In the sections that follow, SPM-2 score comparisons are presented in tables that display the descriptive statistics for the groups being compared, along with the effect size (Cohen's *d*) of the difference between the mean scores of each group. By convention, effect sizes of $d \geq 0.40$ are deemed to represent clinically significant effects, meaning that the score differences signify behavioral differences that are likely to be observable in individuals, not just in aggregate results from a larger group.

Effect Sizes in the General Clinical Sample

A series of matched-sample studies (total $N = 580$) across all five age levels examined the extent to which typical and clinical group participants showed meaningful differences on SPM-2 variables. Participants from the clinical group were matched to a randomly selected subsample from the standardization sample on the basis of age, gender, education level, and ethnicity. The matched sampling was accomplished by using the propensity score approach (nearest neighbor method), as implemented in the R package "MatchIt" (Ho et al., 2007, 2011).

Tables 5.24 through 5.28 show the means, standard deviations, and effect sizes for the SPM-2 scales in the clinical and matched typical (standardization) samples. On all forms, the scale means are higher (indicating more symptoms) in the clinical sample than in the typical sample. The Sensory Total (ST) scores, for example, show strong effect sizes in the .40 to .50 range for the Infant/Toddler and Preschool age levels, and in the .50 to .80 range for the Child and Adolescent age levels. At the Adult age level, the effect was more modest, in the .20 to .30 range. These clinically meaningful effect sizes demonstrate that the SPM-2 scales can reliably distinguish between typically developing and clinic-referred clients.

Table 5.24. Mean SPM-2 *T*-Scores and Effect Sizes, Mixed Clinical Sample and Matched Control Group: Infant/Toddler Age Level Forms

Scale	Mixed clinical sample		Matched control group		Effect size
	Mean	SD	Mean	SD	
Infant and Toddler Forms					
Vision (VIS)	51.1	11.1	47.5	10.7	0.22
Hearing (HEA)	52.0	10.4	47.6	9.7	0.30
Touch (TOU)	51.7	10.0	48.4	9.4	0.23
Taste and Smell (T&S)	50.8	11.7	48.2	9.4	0.17
Body Awareness (BOD)	53.4	11.2	48.2	9.9	0.34
Balance and Motion (BAL)	59.0	12.4	48.2	10.6	0.64
Sensory Total (ST)	53.7	10.7	47.4	10.3	0.40
Planning and Ideas (PLN)	63.0	13.6	49.3	9.6	0.84
Social Participation (SOC)	56.3	11.8	48.9	9.7	0.48

Note. Combined Infant and Toddler Forms $n = 54$. Caregiver Self-Report Forms were not administered to a clinical sample. Effect size (Cohen's *d*) = the scale mean in the clinical sample minus the scale mean in the control group sample, divided by the pooled standard deviation.

Table 5.25. Mean SPM-2 *T*-Scores and Effect Sizes, Mixed Clinical Sample and Matched Control Group: Preschool Age Level Forms

Scale	Mixed clinical sample		Matched control group		Effect size
	Mean	SD	Mean	SD	
Home Form					
Vision (VIS)	53.9	10.3	49.5	9.0	0.32
Hearing (HEA)	55.8	9.7	49.9	9.2	0.42
Touch (TOU)	55.9	9.8	50.5	9.5	0.38
Taste and Smell (T&S)	52.2	10.5	51.4	9.9	0.05
Body Awareness (BOD)	54.5	11.7	51.5	9.5	0.20
Balance and Motion (BAL)	56.9	11.2	50.1	10.3	0.43
Sensory Total (ST)	56.3	9.7	50.6	9.2	0.40
Planning and Ideas (PLN)	59.0	10.6	49.3	9.5	0.66
Social Participation (SOC)	55.4	11.3	50.6	9.7	0.31
School Form					
Vision (VIS)	56.5	10.7	49.4	10.2	0.46
Hearing (HEA)	57.4	9.7	49.3	9.5	0.56
Touch (TOU)	55.7	9.4	50.6	9.3	0.37
Taste and Smell (T&S)	53.4	10.8	50.3	9.8	0.21
Body Awareness (BOD)	55.8	10.1	51.2	9.1	0.33
Balance and Motion (BAL)	55.9	10.8	50.1	9.9	0.38
Sensory Total (ST)	57.4	9.9	50.0	9.9	0.49
Planning and Ideas (PLN)	58.6	11.0	50.3	9.2	0.56
Social Participation (SOC)	55.6	11.1	49.9	9.7	0.37

Note. Home Form $n = 107$; School Form $n = 99$. Effect size (Cohen's d) = the scale mean in the clinical sample minus the scale mean in the control group sample, divided by the pooled standard deviation.

Table 5.26. Mean SPM-2 *T*-Scores and Effect Sizes, Mixed Clinical Sample and Matched Control Group:
Child Age Level Forms

Scale	Mixed clinical sample		Matched control group		Effect size
	Mean	SD	Mean	SD	
Home Form					
Vision (VIS)	60.0	9.9	50.3	9.1	0.70
Hearing (HEA)	58.9	9.8	50.5	8.9	0.61
Touch (TOU)	59.8	10.1	50.8	9.3	0.62
Taste and Smell (T&S)	55.8	10.6	49.9	9.7	0.39
Body Awareness (BOD)	59.4	9.9	50.6	9.2	0.62
Balance and Motion (BAL)	61.4	9.8	50.7	8.5	0.80
Sensory Total (ST)	61.4	9.5	50.3	9.7	0.77
Planning and Ideas (PLN)	63.0	9.9	49.8	9.3	0.92
Social Participation (SOC)	57.8	10.2	49.6	9.6	0.56
School Form					
Vision (VIS)	62.9	11.2	49.7	9.9	0.86
Hearing (HEA)	65.5	10.2	50.2	9.7	1.03
Touch (TOU)	62.5	11.6	50.0	9.1	0.84
Taste and Smell (T&S)	56.6	11.9	49.9	9.0	0.45
Body Awareness (BOD)	58.2	12.2	50.4	9.3	0.51
Balance and Motion (BAL)	62.2	11.7	50.1	9.4	0.79
Sensory Total (ST)	63.8	10.8	50.1	9.3	0.93
Planning and Ideas (PLN)	65.4	11.1	49.9	9.6	1.02
Social Participation (SOC)	58.4	10.9	49.0	9.4	0.64

Note. Home Form $n = 218$; School Form $n = 194$. Effect size (Cohen's d) = the scale mean in the clinical sample minus the scale mean in the control group sample, divided by the pooled standard deviation.

Table 5.27. Mean SPM-2 *T*-Scores and Effect Sizes, Mixed Clinical Sample and Matched Control Group: Adolescent Age Level Forms

Scale	Mixed clinical sample		Matched control group		Effect size
	Mean	SD	Mean	SD	
Home Form					
Vision (VIS)	59.0	8.1	48.3	7.7	0.92
Hearing (HEA)	58.9	8.9	49.1	8.5	0.75
Touch (TOU)	57.8	9.3	49.1	7.9	0.69
Taste and Smell (T&S)	53.9	9.8	49.2	7.9	0.37
Body Awareness (BOD)	57.2	10.4	49.3	8.2	0.59
Balance and Motion (BAL)	55.4	10.0	49.2	7.7	0.49
Sensory Total (ST)	58.9	8.0	48.5	8.7	0.83
Planning and Ideas (PLN)	62.2	8.8	49.3	9.0	0.96
Social Participation (SOC)	56.7	9.7	48.6	10.0	0.54
School Form					
Vision (VIS)	56.4	8.7	50.3	7.8	0.51
Hearing (HEA)	57.9	8.2	49.6	7.6	0.71
Touch (TOU)	57.8	8.8	49.9	7.0	0.69
Taste and Smell (T&S)	57.1	8.5	50.0	7.3	0.61
Body Awareness (BOD)	57.4	8.6	50.2	7.3	0.62
Balance and Motion (BAL)	56.7	8.7	49.7	6.5	0.64
Sensory Total (ST)	58.8	8.0	49.3	8.8	0.74
Planning and Ideas (PLN)	60.1	9.1	50.0	8.8	0.75
Social Participation (SOC)	58.2	11.6	47.4	10.2	0.67
Self-Report Form					
Vision (VIS)	56.8	10.3	47.6	8.5	0.68
Hearing (HEA)	56.6	9.1	46.9	8.3	0.75
Touch (TOU)	55.0	10.3	47.7	7.9	0.56
Taste and Smell (T&S)	53.2	10.7	47.3	9.0	0.41
Body Awareness (BOD)	54.0	11.2	48.5	8.4	0.40
Balance and Motion (BAL)	55.2	10.9	47.0	6.8	0.67
Sensory Total (ST)	56.4	9.9	46.7	8.2	0.73
Planning and Ideas (PLN)	57.7	9.9	48.0	8.5	0.72
Social Participation (SOC)	54.9	10.2	46.9	9.3	0.55

Note. Home Form $n = 105$; School Form $n = 102$; Self-Report Form $n = 105$. Effect size (Cohen's d) = the scale mean in the clinical sample minus the scale mean in the control group sample, divided by the pooled standard deviation.

Table 5.28. Mean SPM-2 *T*-Scores and Effect Sizes, Mixed Clinical Sample and Matched Control Group:
Adult Age Level Forms

Scale	Mixed clinical sample		Matched control group		Effect size
	Mean	SD	Mean	SD	
Self-Report Form					
Vision (VIS)	55.9	11.4	50.5	9.7	0.35
Hearing (HEA)	54.7	11.9	50.1	9.9	0.29
Touch (TOU)	53.6	10.2	49.6	10.8	0.26
Taste and Smell (T&S)	50.1	10.0	50.3	10.3	0.01
Body Awareness (BOD)	52.0	10.7	51.2	9.9	0.05
Balance and Motion (BAL)	53.5	10.5	50.6	10.4	0.19
Sensory Total (ST)	54.2	11.2	50.3	10.4	0.25
Planning and Ideas (PLN)	55.6	11.9	51.3	9.7	0.28
Social Participation (SOC)	52.9	11.0	50.4	9.2	0.17
Rater Report Form					
Vision (VIS)	55.9	10.9	51.5	9.0	0.30
Hearing (HEA)	54.2	10.8	50.8	10.2	0.21
Touch (TOU)	52.0	9.5	51.1	9.5	0.07
Taste and Smell (T&S)	51.5	9.1	51.5	9.7	0.00
Body Awareness (BOD)	53.1	10.3	51.0	8.7	0.16
Balance and Motion (BAL)	53.6	10.8	50.7	9.7	0.19
Sensory Total (ST)	54.3	10.3	51.1	10.2	0.21
Planning and Ideas (PLN)	56.8	11.3	51.2	9.7	0.37
Social Participation (SOC)	55.5	11.6	51.8	9.9	0.23

Note. Self-Report Form $n = 116$; Rater Report Form $n = 120$. Effect size (Cohen's d) = the scale mean in the clinical sample minus the scale mean in the control group sample, divided by the pooled standard deviation.

Effect Sizes by Clinical Disorder

Of greater interest are specific clinical disorders within the general clinic-referred sample. Tables 5.29 to 5.34 show SPM-2 scale descriptive statistics and effect sizes for six diagnostic groups with adequate sample sizes to permit additional analysis: sensory processing disorders (SPD), autism spectrum disorders (ASD), intellectual and developmental disorders (ID/DD), speech–language pathologies (SLP), attention-deficit/hyperactivity disorder (ADHD), and mood and anxiety disorders (MAD). All of these disorders frequently co-occur with various deficits in sensory integration and processing function.

As a whole, the diagnostic groups show clinically meaningful elevations in SPM-2 scale scores when

compared to the typically developing individuals in the SPM-2 standardization sample. The sensory processing and autism groups, in particular, show a pattern of large effects, indicating that the SPM-2 is particularly sensitive to sensory integration and processing dysfunction. The intellectual disability group also shows moderate to large effects, with expected peaks in planning and ideation. The speech pathology group showed small to medium effects, with larger mean score differences in vision and planning and ideation. The mental health disorders groups, composed of participants with ADHD and mood and anxiety disorders, showed clinically meaningful effect sizes across SPM-2 scales in the small to medium range.

Table 5.29. Mean SPM-2 *T*-Scores and Effect Sizes for Sensory Processing Disorders (SPD) and Matched Control Groups

Scale	SPD group		Matched control group		Effect size
	Mean	SD	Mean	SD	
Home Forms					
Vision (VIS)	60.4	9.9	47.9	8.2	0.96
Hearing (HEA)	60.4	10.3	50.1	8.2	0.77
Touch (TOU)	60.9	10.0	48.4	8.5	0.92
Taste and Smell (T&S)	58.3	10.7	50.3	8.7	0.57
Body Awareness (BOD)	61.0	8.1	49.8	7.9	0.94
Balance and Motion (BAL)	63.7	8.7	49.1	7.4	1.25
Sensory Total (ST)	63.1	8.4	49.4	7.2	1.20
Planning and Ideas (PLN)	62.1	10.0	48.3	5.7	1.28
Social Participation (SOC)	57.2	9.2	47.7	9.8	0.66
School Forms					
Vision (VIS)	56.3	10.2	49.2	7.6	0.56
Hearing (HEA)	59.7	10.1	50.4	9.1	0.66
Touch (TOU)	59.5	9.5	50.4	9.7	0.63
Taste and Smell (T&S)	55.2	11.5	49.0	6.2	0.52
Body Awareness (BOD)	58.3	10.0	50.0	8.4	0.62
Balance and Motion (BAL)	58.9	9.8	49.8	8.9	0.66
Sensory Total (ST)	59.8	9.6	49.8	8.6	0.75
Planning and Ideas (PLN)	58.6	9.5	50.9	9.6	0.54
Social Participation (SOC)	58.7	8.3	50.3	10.1	0.59

Note. Home Forms ($n = 39$) include clinical participants from the Infant/Toddler, Preschool, Child, and Adolescent age levels. School Forms ($n = 34$) include clinical participants from the Preschool, Child, and Adolescent age levels. Matched control group participants were randomly drawn from the corresponding standardization samples based on matching demographic variables. Effect size (Cohen's d) = the scale mean in the clinical sample minus the scale mean in the standardization sample, divided by the pooled standard deviation.

Table 5.30. Mean SPM-2 *T*-Scores and Effect Sizes for Autism Spectrum Disorders (ASD) and Matched Control Groups

Scale	ASD group		Matched control group		Effect size
	Mean	SD	Mean	SD	
Home Forms					
Vision (VIS)	62.5	8.4	49.0	9.6	0.97
Hearing (HEA)	63.2	6.5	48.9	9.3	1.14
Touch (TOU)	62.7	7.3	50.4	9.1	0.97
Taste and Smell (T&S)	59.5	8.8	49.4	9.2	0.74
Body Awareness (BOD)	63.4	7.5	49.7	9.0	1.08
Balance and Motion (BAL)	63.2	9.4	48.9	8.6	1.08
Sensory Total (ST)	64.9	6.6	49.1	9.6	1.21
Planning and Ideas (PLN)	66.9	5.8	49.5	10.0	1.35
Social Participation (SOC)	64.6	6.3	50.2	10.5	1.06
School Forms					
Vision (VIS)	64.2	8.3	47.9	8.0	1.35
Hearing (HEA)	65.5	8.5	48.2	7.3	1.50
Touch (TOU)	64.7	9.0	48.8	7.4	1.34
Taste and Smell (T&S)	64.2	9.7	48.7	7.0	1.31
Body Awareness (BOD)	63.6	9.3	49.1	8.1	1.13
Balance and Motion (BAL)	61.6	10.3	49.7	8.4	0.88
Sensory Total (ST)	66.0	7.9	48.3	7.8	1.52
Planning and Ideas (PLN)	66.3	9.4	48.7	8.3	1.35
Social Participation (SOC)	66.0	9.3	47.9	9.3	1.29
Self-Report Forms					
Vision (VIS)	58.3	9.2	50.0	6.5	0.75
Hearing (HEA)	57.9	9.2	49.5	7.9	0.67
Touch (TOU)	57.4	7.5	48.2	7.2	0.84
Taste and Smell (T&S)	52.6	6.9	47.1	7.7	0.49
Body Awareness (BOD)	55.8	9.2	49.3	7.2	0.55
Balance and Motion (BAL)	58.4	9.3	48.2	7.5	0.84
Sensory Total (ST)	58.0	8.1	48.1	7.0	0.90
Planning and Ideas (PLN)	60.1	8.3	49.4	8.5	0.85
Social Participation (SOC)	58.5	8.9	49.9	8.3	0.67

Note. Home Forms ($n = 92$) include clinical participants from the Infant/Toddler, Preschool, Child, and Adolescent age levels. School Forms ($n = 69$) include clinical participants from the Preschool, Child, and Adolescent age levels. Self-Report Forms ($n = 35$) include clinical participants from the Adolescent and Adult age levels. Matched control group participants were randomly drawn from the corresponding standardization samples based on matching demographic variables. Effect size (Cohen's d) = the scale mean in the clinical sample minus the scale mean in the standardization sample, divided by the pooled standard deviation.

Table 5.31. Mean SPM-2 *T*-Scores and Effect Sizes
for Intellectual and Developmental Disabilities (ID/DD) and Matched Control Groups

Scale	ID/DD group		Matched control group		Effect size
	Mean	SD	Mean	SD	
Home Forms					
Vision (VIS)	56.1	9.2	47.6	10.2	0.57
Hearing (HEA)	54.8	9.4	48.0	8.9	0.49
Touch (TOU)	58.5	10.4	47.9	8.8	0.76
Taste and Smell (T&S)	52.4	10.5	48.1	8.0	0.32
Body Awareness (BOD)	55.9	9.2	50.0	10.2	0.40
Balance and Motion (BAL)	60.1	11.5	49.1	9.7	0.71
Sensory Total (ST)	58.1	8.8	48.4	9.3	0.71
Planning and Ideas (PLN)	63.9	9.9	48.9	9.3	1.06
Social Participation (SOC)	55.3	8.7	47.8	8.3	0.59
School Forms					
Vision (VIS)	62.0	10.0	48.7	8.0	1.02
Hearing (HEA)	59.0	9.5	47.7	7.3	0.93
Touch (TOU)	60.7	9.8	49.1	7.0	0.98
Taste and Smell (T&S)	54.0	10.3	50.7	8.7	0.24
Body Awareness (BOD)	59.3	9.5	50.0	7.6	0.75
Balance and Motion (BAL)	57.8	10.5	48.5	7.6	0.72
Sensory Total (ST)	61.1	8.7	48.7	7.0	1.09
Planning and Ideas (PLN)	65.3	10.1	49.4	8.4	1.19
Social Participation (SOC)	59.4	9.9	49.1	8.0	0.79

Note. Home Forms ($n = 51$) include clinical participants from the Infant/Toddler, Preschool, Child, and Adolescent age levels. School Forms ($n = 44$) include clinical participants from the Preschool, Child, and Adolescent age levels. Matched control group participants were randomly drawn from the corresponding standardization samples based on matching demographic variables. Effect size (Cohen's d) = the scale mean in the clinical sample minus the scale mean in the standardization sample, divided by the pooled standard deviation.

Table 5.32. Mean SPM-2 *T*-Scores and Effect Sizes
for Speech–Language Pathologies (SLP) and Matched Control Groups

Scale	SLP group		Matched control group		Effect size
	Mean	SD	Mean	SD	
Home Forms					
Vision (VIS)	52.5	10.4	48.2	9.4	0.29
Hearing (HEA)	51.0	10.0	48.1	9.6	0.20
Touch (TOU)	52.9	9.0	48.8	8.9	0.31
Taste and Smell (T&S)	49.1	10.4	48.4	9.1	0.05
Body Awareness (BOD)	53.2	11.4	49.7	9.0	0.23
Balance and Motion (BAL)	55.1	10.8	47.5	8.5	0.54
Sensory Total (ST)	53.3	9.8	48.0	9.3	0.38
Planning and Ideas (PLN)	58.4	12.8	48.5	9.1	0.64
Social Participation (SOC)	52.0	12.1	50.5	9.0	0.09
School Forms					
Vision (VIS)	57.9	12.1	49.0	8.8	0.60
Hearing (HEA)	56.1	10.1	49.1	8.0	0.54
Touch (TOU)	56.9	10.7	48.9	8.0	0.60
Taste and Smell (T&S)	52.0	10.0	48.7	7.5	0.26
Body Awareness (BOD)	56.8	11.9	49.0	8.3	0.55
Balance and Motion (BAL)	57.4	11.0	49.9	7.9	0.57
Sensory Total (ST)	57.7	11.7	48.4	8.8	0.63
Planning and Ideas (PLN)	59.4	12.4	49.9	7.8	0.68
Social Participation (SOC)	53.8	12.1	51.1	9.6	0.17
Self-Report Forms					
Vision (VIS)	56.4	10.9	45.3	8.8	0.78
Hearing (HEA)	52.9	9.5	47.7	10.4	0.34
Touch (TOU)	53.0	9.3	49.6	9.2	0.24
Taste and Smell (T&S)	51.1	13.1	47.0	9.7	0.26
Body Awareness (BOD)	51.4	9.6	46.6	9.0	0.35
Balance and Motion (BAL)	55.1	10.1	47.4	8.5	0.57
Sensory Total (ST)	54.4	8.5	46.9	9.2	0.56
Planning and Ideas (PLN)	59.5	10.2	47.6	7.4	0.95
Social Participation (SOC)	54.5	11.5	45.3	9.5	0.60

Note. Home Forms ($n = 80$) include clinical participants from the Infant/Toddler, Preschool, Child, and Adolescent age levels. School Forms ($n = 59$) include clinical participants from the Preschool, Child, and Adolescent age levels. Self-Report Forms ($n = 14$) include clinical participants from the Adolescent and Adult age levels. Matched control group participants were randomly drawn from the corresponding standardization samples based on matching demographic variables. Effect size (Cohen's d) = the scale mean in the clinical sample minus the scale mean in the standardization sample, divided by the pooled standard deviation.

Table 5.33. Mean SPM-2 *T*-Scores and Effect Sizes for Attention-Deficit/Hyperactivity Disorder (ADHD) and Matched Control Groups

Scale	ADHD group		Matched control group		Effect size
	Mean	SD	Mean	SD	
Home Forms					
Vision (VIS)	59.3	7.7	50.2	7.9	0.77
Hearing (HEA)	58.6	8.1	50.8	8.5	0.62
Touch (TOU)	57.8	9.5	50.4	8.4	0.57
Taste and Smell (T&S)	54.2	9.1	50.1	8.6	0.32
Body Awareness (BOD)	58.8	10.6	51.6	9.3	0.49
Balance and Motion (BAL)	58.4	8.2	50.2	8.0	0.68
Sensory Total (ST)	59.9	7.1	50.3	8.7	0.79
Planning and Ideas (PLN)	61.9	8.0	49.6	8.4	0.99
Social Participation (SOC)	59.2	8.1	49.8	8.5	0.75
School Forms					
Vision (VIS)	58.4	9.6	49.2	7.2	0.77
Hearing (HEA)	60.1	9.9	48.6	7.9	0.89
Touch (TOU)	58.6	9.6	48.1	7.8	0.83
Taste and Smell (T&S)	55.5	9.5	49.2	7.4	0.52
Body Awareness (BOD)	59.8	10.5	49.7	8.7	0.72
Balance and Motion (BAL)	57.7	9.6	50.0	8.6	0.58
Sensory Total (ST)	60.2	9.8	49.0	8.9	0.82
Planning and Ideas (PLN)	61.5	9.8	49.7	8.1	0.90
Social Participation (SOC)	58.9	10.2	48.9	10.1	0.66

Note. Home Forms ($n = 57$) include clinical participants from the Preschool, Child, and Adolescent age levels. School Forms ($n = 44$) include clinical participants from the Preschool, Child, and Adolescent age levels. Matched control group participants were randomly drawn from the corresponding standardization samples based on matching demographic variables. Effect size (Cohen's d) = the scale mean in the clinical sample minus the scale mean in the standardization sample, divided by the pooled standard deviation.

Table 5.34. Mean SPM-2 *T*-Scores and Effect Sizes
for Mood and Anxiety Disorders (MAD) and Matched Control Groups

Scale	MAD group		Matched control group		Effect size
	Mean	SD	Mean	SD	
Home Forms					
Vision (VIS)	57.4	8.8	48.3	9.9	0.63
Hearing (HEA)	57.5	8.7	50.1	9.4	0.54
Touch (TOU)	56.1	8.2	48.7	9.9	0.53
Taste and Smell (T&S)	52.9	10.8	48.4	10.3	0.29
Body Awareness (BOD)	55.3	9.1	47.5	8.8	0.58
Balance and Motion (BAL)	54.3	8.5	49.5	10.2	0.33
Sensory Total (ST)	57.4	7.9	47.8	11.2	0.64
Planning and Ideas (PLN)	57.5	8.1	49.7	10.9	0.52
Social Participation (SOC)	57.2	8.4	50.3	9.7	0.50
School Forms					
Vision (VIS)	55.8	10.3	49.2	8.2	0.50
Hearing (HEA)	57.7	9.5	49.4	8.9	0.61
Touch (TOU)	58.2	10.5	48.9	6.2	0.81
Taste and Smell (T&S)	56.7	10.5	49.1	7.5	0.59
Body Awareness (BOD)	56.0	11.0	49.4	7.7	0.50
Balance and Motion (BAL)	54.3	10.3	48.9	7.0	0.45
Sensory Total (ST)	57.9	10.0	49.0	8.1	0.68
Planning and Ideas (PLN)	58.6	10.1	49.9	9.7	0.59
Social Participation (SOC)	58.4	11.4	50.9	10.2	0.47

Note. Home Forms ($n = 42$) include clinical participants from the Preschool, Child, and Adolescent age levels. School Forms ($n = 48$) include clinical participants from the Preschool, Child, and Adolescent age levels. Typical participants were randomly drawn from the corresponding standardization samples based on matching demographic variables. Mood and anxiety disorders were 50% mood disorders and 50% anxiety disorders. Effect size (Cohen's d) = the scale mean in the clinical sample minus the scale mean in the standardization sample, divided by the pooled standard deviation.

Detection of Sensory Processing Disorders

Disorders of sensory integration and processing represent the clinical conditions that are most directly targeted by the SPM-2 sensory systems scales. The SPM-2 clinical sample included a subsample ($n = 39$) of individuals whose primary diagnosis or clinical condition was identified as a disorder of sensory integration or sensory processing. Conditional probability analyses (area under the curve, AUC) were run to determine the ability of the SPM-2 Sensory Total (ST) scale to detect these conditions at various cutoff points. As previously noted, the ST scale is a 60-item composite of all of the SPM-2 sensory systems items. The ST score provided statistically significant improvement over chance in detecting these disorders.

Table 5.35 displays the sensitivity and specificity associated with various values of the ST T -score, for all SPM-2 forms. *Sensitivity* refers to a rating scale's ability to detect true positive cases of the disorder in

question. *Specificity*, on the other hand, refers to a scale's ability to exclude cases that do not have the disorder in question. To illustrate, Table 5.35 shows that at a cutoff score of $T = 60$, the ST scale has sensitivity of .72 and specificity of .83. In practical terms, this means that 72% of the individuals with sensory processing disorders had ST scores of 60 or greater, whereas 83% of the typically developing individuals had scores of 59 or less.

Table 5.35 serves as a reminder that at any level of score elevation, there is a risk of under- or over-identifying cases of sensory processing disorder. In support of the criterion-related validity of the SPM-2 ST scale, it is worth noting that only 2% or less of typically developing individuals had T -scores of 70 or higher on any SPM-2 form (specificity = .98). This finding demonstrates that when an individual's score is in the Severe Difficulties interpretive range ($T \geq 70$), there is a strong probability that the individual has clinically significant problems with sensory processing or integration.

Table 5.35. Conditional Probability Analysis for Detection of Sensory Processing Disorders

Sensory Total (ST) T -score cutoff points	Sensitivity	Specificity
55	.87	.67
60	.72	.83
65	.51	.92
70	.23	.98
75	.03	.99

Note. Sample included 39 individuals with sensory processing/integration disorders and 3,096 typically developing individuals from the standardization sample; analysis included every form.

Detection of Differential Functioning Between Environments and Raters

The Difference (DIF) score was developed to quantify score differences between the same scales (e.g., VIS, HEA, TOU) on different forms. The DIF score is calculated by subtracting the *T*-score of one form from the comparable *T*-score of another, for example, the Child School ST *T*-score from the Child Home ST *T*-score. (See Chapter 2 for a detailed description of scoring procedures.) Because each *T*-score is normalized, the DIF score distribution is also approximately normal. Table 5.36 shows the distributions of the ST scores, in both the standardization and clinical samples, for individuals assessed in the home and school environments (Preschool, Child, Adolescent age levels); for individuals assessed by self-report and rated by others (Adolescent, Adult age levels); and for individuals assessed in conjunction with another individual (Infant/Toddler age level, Caregiver).

In these distributions, the No Difference range (–9 to 9, or within 1 standard deviation) represents differences between the two scores that are within the normal range of variability. The Probable Difference range (–10 to –14 and 10 to 14, or between 1 and 1.5 standard deviations) and the Definite Difference range (≤ -15 and ≥ 15 , or equal to or greater than 1.5 standard deviations) represent two levels of certainty about the difference between the scores.

These interpretive ranges were set to approximate conventional cutoffs for interpreting *T*-scores as typical, mildly atypical, and moderately to extremely atypical. The sign of the DIF score is relevant only for the Probable Difference and Definite Difference ranges, with a positive or negative score indicating more problems reported on one form or the other.

Table 5.36. Frequencies of Sensory Total (ST) Difference (DIF) Scores in the SPM-2 Standardization and Clinical Samples

DIF score interpretive ranges		Standardization sample		Clinical sample	
		<i>n</i>	% of sample	<i>n</i>	% of sample
Infant/Toddler age level					
Infant Form vs. Caregiver Self-Report Form					
≤ -15	Definite Difference	10	3.9	0	0.0
–14 to –10	Probable Difference	21	8.3	2	18.2
–9 to 9	No Difference	182	71.7	6	54.5
10 to 14	Probable Difference	23	9.1	2	18.2
≥ 15	Definite Difference	18	7.1	1	9.1
Toddler Form vs. Caregiver Self-Report Form					
≤ -15	Definite Difference	33	8.2	1	2.3
–14 to –10	Probable Difference	24	6.0	1	2.3
–9 to 9	No Difference	297	73.7	25	58.1
10 to 14	Probable Difference	29	7.2	3	7.0
≥ 15	Definite Difference	20	5.0	13	30.2
Preschool age level					
Home Form vs. School Form					
≤ -15	Definite Difference	30	10.0	11	11.2
–14 to –10	Probable Difference	31	10.3	12	12.2
–9 to 9	No Difference	201	67.0	60	61.2
10 to 14	Probable Difference	9	3.0	8	8.2
≥ 15	Definite Difference	29	9.7	7	7.1

Note. Sample size discrepancies are due to missing data.

Table 5.36. Frequencies of Sensory Total (ST) Difference (DIF) Scores in the SPM-2 Standardization and Clinical Samples (*continued*)

DIF score interpretive ranges		Standardization sample		Clinical sample	
		<i>n</i>	% of sample	<i>n</i>	% of sample
Child age level					
Home Form vs. School Form					
≤ -15	Definite Difference	36	8.7	8	4.4
-14 to -10	Probable Difference	46	11.1	29	15.8
-9 to 9	No Difference	271	65.3	112	61.2
10 to 14	Probable Difference	40	9.6	12	6.6
≥ 15	Definite Difference	22	5.3	22	12.0
Adolescent age level					
Home Form vs. School Form					
≤ -15	Definite Difference	43	7.2	4	4.8
-14 to -10	Probable Difference	58	9.8	6	7.2
-9 to 9	No Difference	398	67.0	62	74.7
10 to 14	Probable Difference	48	8.1	5	6.0
≥ 15	Definite Difference	47	7.9	6	7.2
Home Form vs. Self-Report Form					
≤ -15	Definite Difference	37	5.1	2	2.4
-14 to -10	Probable Difference	55	7.6	3	3.6
-9 to 9	No Difference	538	74.3	59	70.2
10 to 14	Probable Difference	69	9.5	13	15.5
≥ 15	Definite Difference	25	3.5	7	8.3
School Form vs. Self-Report Form					
≤ -15	Definite Difference	50	8.6	7	8.3
-14 to -10	Probable Difference	46	7.9	9	10.7
-9 to 9	No Difference	325	55.7	44	52.4
10 to 14	Probable Difference	102	17.5	18	21.4
≥ 15	Definite Difference	61	10.4	6	7.1
Adult age level					
Self-Report Form vs. Rater Report Form					
≤ -15	Definite Difference	35	7.4	1	0.9
-14 to -10	Probable Difference	54	11.4	9	8.0
-9 to 9	No Difference	314	66.2	88	78.6
10 to 14	Probable Difference	41	8.6	6	5.4
≥ 15	Definite Difference	30	6.3	8	7.1

Note. Sample size discrepancies are due to missing data.

Summary

This chapter has reported on the initial psychometric properties of the SPM-2. The SPM-2 forms perform well on seven key indices of reliability: internal consistency, test–retest reliability, standard error of measurement, interrater reliability, alternate-forms reliability, cross-rater concordance, and online and paper forms equivalence. Analyses of content and structure support the scoring of separate sensory systems, praxis, and social participation scores

across the SPM-2 forms. The SPM-2 forms correlate in expected ways with two measures of sensory integration and processing, the Sensory Profile and the Sensory Profile 2, and a measure of adaptive behavior, the ABAS-3. Finally, the SPM-2 forms distinguish between typically developing and clinic-referred clients, with robust and clinically meaningful effect sizes. The authors of the SPM-2 hope that its publication will stimulate additional research.

SAMPLE