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Construct Validation of the *Supports Intensity Scale – Children* and *Adult* Versions: An Application of a Pseudo Multitrait-Multimethod Approach

Hyojeong Seo, Karrie A. Shogren, Todd D. Little, James R. Thompson, and Michael L. Wehmeyer

Abstract

This study examined the convergent validity of the *Supports Intensity Scale – Adult Version* (SIS-A; Thompson et al., 2015a) and *Supports Intensity Scale – Children's Version* (SIS-C; Thompson et al., 2016a). Data from SISOnline ($n = 129{,}864$) for the SIS-A and from the SIS-C standardization sample ($n = 4{,}015$) were used for analyses. Using a pseudo multitrait-multimethod model, we estimated observed support needs scores as shared trait (support needs concept) and method (type, frequency, and daily support time) variances. Overall, trait variances more strongly influenced support needs scores than method variances, supporting the convergent validity of both versions of SIS. Findings also suggested that each of three methods of measuring support needs uniquely contributed to observed support needs ratings although different patterns existed between the SIS-A and SIS-C.

Key Words: *Supports Intensity Scale – Adult Version; Supports Intensity Scale – Children's Version; multitrait-multimethod model; convergent validity*

Support needs is defined as the "pattern and intensity of supports necessary for a person to participate in activities linked with normative human functioning" whereas supports are defined as "resources and strategies that aim to promote the development, education, interests, and personal well-being of a person and that enhance individual functioning" (Schalock et al., 2010, p. 105). The importance of assessing and planning for support needs using individualized supports has received increased attention in the disability field, particularly as social-ecological models of disability have emerged which define disability by the gap, or mismatch, between personal competencies and environmental demands. This mismatch creates a need for support that must be systematically assessed and planned for to improve quality of life outcomes for people with intellectual disability (ID). Although everyone uses supports, the support needs of people with ID are assumed to be more intense than those needed by most people in terms of frequency, duration, and type. The Supports Intensity Scale (SIS; Thompson et al., 2004a) was developed to provide a standardized measure of the support needs of people with ID and closely related developmental disabilities. The original SIS was published in 2004 and normed for adults, 16 to 64 years of age. The SIS is currently used for multiple purposes by organizations and jurisdictions throughout the United States as well as internationally, including planning for the provision of supports and services, resource allocation and funding analysis, and decision-making related to staffing patterns and professional development (American Association on Intellectual and Developmental Disabilities [AAIDD], 2015; Thompson et al., 2014; van Loon, Claes, Vandevelde, Van Hove, & Schalock, 2010). The original SIS was updated (i.e., the order of some items was changed, the formatting and User's Guide were updated) and renamed the SIS-Adult Version (SIS-A) in 2015, and a standardized version for children with

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intellectual and developmental disabilities, aged 5 to 16 years old, the Supports Intensity Scale – Children's Version (SIS-C), was developed and published in 2016.

The SIS-A (Thompson et al., 2015a) and SIS-C (Thompson et al., 2016a) both include indicators (i.e., items) that assess support needs. The items are grouped into support needs domains, representing normative community activities and environments for the age-range assessed by the scale. The SIS-A includes seven support needs domains: Home Living, Community Living, Lifelong Learning, Employment, Health and Safety, Social, and Protection and Advocacy. The SIS-C also includes seven support needs domains. These domains, however, differ slightly from those on the SIS-A because of the different environmental demands of childhood and adolescence: Home Life, Community and Neighborhood, School Participation, School Learning, Health and Safety, Social, and Advocacy. Sample items on the SIS-A include "Shopping and purchasing goods and services" (Community Living), "Participating in training/educational decisions" (Lifelong Learning), and "Exercising legal/civic responsibilities" (Protection and Advocacy). Sample indicators on the SIS-C include "Following classroom and school rules" (School Participation), "Completing homework assignments" (School Learning), and "Protecting self from exploitation and bullying" (Social).

Studies have evaluated the construct and factorial validity of the SIS-A and SIS-C, with a specific focus on establishing the measurement model (i.e., indicators loading on their respective support needs domains). For example Thompson et al. (2016b) documented measurement invariance across ages using multiple-group confirmatory factor analyses, suggesting that the same indicators and measurement structure can be used across different age groups (Shogren, Seo, Wehmeyer, Thompson, & Little, 2016; Shogren et al., 2015). Other researchers have found that there is comparability in the measurement of parallel domains across on the SIS-A and SIS-C (Seo, Shogren, et al., in press). However, no studies have examined the construct validity of support needs domains after controlling for the three dimensions (type, frequency, and daily support time) on which each SIS indicator is rated.

To examine the influence of these common dimensions from a psychometric perspective, support needs can be understood as a *trait* that conceptually relates to the measures of interests. As depicted in Figure 1, each indicator within support needs domains of the SIS-A and the SIS-C is rated using three different dimensions or *methods* (type [TYPE; the nature of support that is needed], frequency [FREQ; how often support is needed], and daily support time [DST; how much time is needed to provide support]). The same dimensions are used across the SIS-A and SIS-C, but the anchors for the dimensions vary slightly (see Table 1). These three dimensions can be understood as *methods* that can bring biases resulting from "response tendencies that raters apply across measures, similarities in item structure or wording that induce similar responses, the proximity of items in an instrument, and similarities in the medium, timing, or location in which measured are collected" (Edwards, 2008, p. 476). As support needs scores are assessed by different methods, method variances may bias relations among observed SIS scores.

Examining the influence of the three methods (i.e., type, frequency, and daily support time) of rating support needs on observed support needs scores is important for the following reasons. First, the shared ratings across the seven support needs domains on each version of the SIS could obscure relations between support needs by inflating or deflating the correlations (Little, 2013). Thus controlling for the influence of methods on support needs (i.e., separating the variances of three methods from the observed support needs scores) would allow for the examination of measurement error, which leads to a more accurate investigation of the construct validity of the SIS-A and SIS-C. Second, controlling for the methods allows us to explore how ratings of type, frequency, and daily support time function when generating scores for each item on both versions of the SIS. Although, theoretically, a strong case can be made for the importance of type, frequency, and daily support time in defining support needs, empirical work is needed to establish the impact, and therefore need, for the three methods in ratings of support needs. This examination is particularly important as each item score computed from type, frequency, and daily support time is used to generate standardized scores on both versions of the SIS.

Therefore, the purpose of this study was to investigate the relative contributions of trait (i.e., support needs concept) and method (i.e., measurement of TYPE, FREQ, and DST) variances in measuring support needs of people with ID, using a pseudo-multi-trait multi-method approach (described subsequently; Little, 2013).

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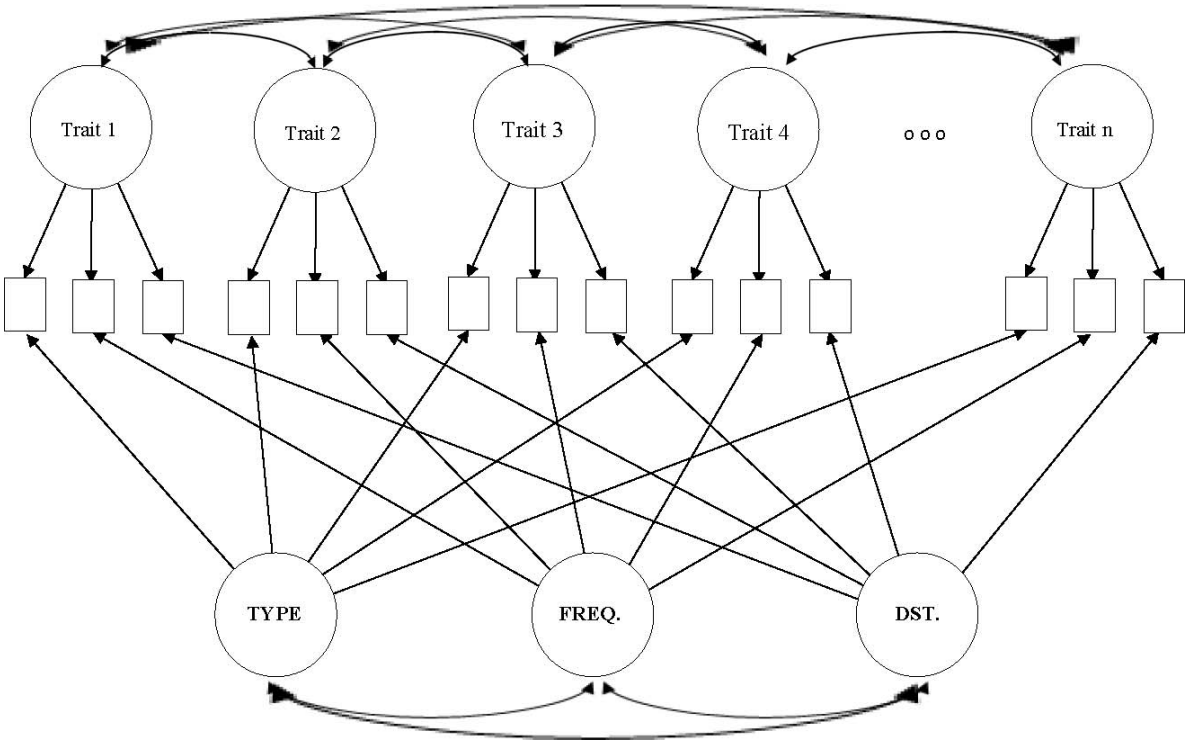

Figure 1. Pseudo Multitrait-multimethod (MTMM) model for each support needs domain model. Type = Type of support; FREQ = Frequency of support; DST = Daily support time.

Specifically, this study sought to address three research questions:

1. Do trait and method variances influence the measurement of support needs (i.e., the observed support needs ratings) on the SIS-A?
2. Do trait and method variances influence the measurement of support needs (i.e., the observed support needs ratings) on the SIS-C?
3. Are there differences in the contribution of trait and method variances in measuring

Table 1
Scoring Keys of Type of Support, Frequency of Support, and Daily Support Time

Scale	Score	Type of Support	Frequency of Support	Daily Support Time
SIS-A	0	None	None or less than monthly	None
	1	Monitoring	At least once a month, but not once a week	Less than 30 minutes
	2	Verbal/gestural prompting	At least once a week, but not once a day	30 minutes to less than 2 hours
	3	Partial physical assistance	At least once a day, but not once an hour	2 hours to less than 4 hours
	4	Full physical assistance	Hourly or more frequently	4 hours or more
SIS-C	0	None	Negligible	None
	1	Monitoring	Infrequently	Less than 30 minutes
	2	Verbal/gestural prompting	Frequently	30 minutes to less than 2 hours
	3	Partial physical assistance	Very Frequently	2 hours to less than 4 hours
	4	Full physical assistance	Always	4 hours or more

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support needs within and across SIS-A and SIS-C?

Methods

Participants/Data

SIS-A. SIS-A data were collected through AAIDD's (the publisher of the SIS-A and SIS-C) SISOnline, a web-based portal system that is used by states and large service providers collecting data on the SIS-A. The unique features of the SISOnline are (a) responses are entered electronically and (b) results are immediately accessible in PDF or HTML formats for users. Data from SISOnline are also available for secondary data analysis. The total number of SIS-A protocols in the SISOnline database when the analyses were conducted was 129,864 people with intellectual and developmental disabilities (IDD). Females constituted 41% of the total sample ($n = 53,205$), and males were 59% ($n = 76,635$). Participants ranged in age from 16 to 64 years at the time of SIS-A completion ($M = 38$; $SD = 13.3$). Table 2 provides further demographic information.

SIS-C. SIS-C data came from 4,015 children with ID who participated in SIS-C norming process (Thompson et al., 2014). Males comprised the largest portion of the sample (68%, $n = 2,710$), and females were 30% ($n = 1,202$). The average age at the time of SIS-C completion was 11 years old ($SD = 3.1$; range = 5 to 16). Table 2 provides demographic information based on the age bands used in the standardization process (i.e., stratified in 2-year age bands). More detailed demographic information is provided in the SIS-C User's Manual (Thompson et al., 2016b).

Data collection. For both the SIS-C and SIS-A, support needs ratings were collected via semi-structured interviews. Qualified interviewers who have been trained on administering and scoring the SIS interview included at least two respondents who knew the target person with ID well (e.g., teacher, parent, relative, direct support professional). When a discrepancy between two respondents' perspectives on the support needs rating occurred, the interviewer was trained to probe respondents for clarification and use clinical judgment to arrive at a final rating. For the SIS-C standardization sample, a total of 694 interviewers and 12,050 respondents participated

Table 2
Demographic Information of Participants

	SIS-A ($N = 129,864$)		SIS-C ($N = 4,015$)	
Variable	*n*	%	*n*	%
Age				
5–6 year olds	—	—	513	12.8
7–8 year olds	—	—	562	14.0
9–10 year olds	—	—	762	19.0
11–12 year olds	—	—	804	20.0
13–14 year olds	—	—	818	20.4
15–16 year olds	—	—	487	12.1
16–20 year olds	10,689	8.2	—	—
21–30 year olds	35,883	27.6	—	—
31–40 year olds	27,411	21.1	—	—
41–50 year olds	27,966	21.5	—	—
51–64 year olds	27,915	21.5	—	—
Missing	0	0	69	1.7
Gender				
Female	53,205	41.0	1,202	29.9
Male	76,635	59.0	2,710	67.5
Missing	24	.0	103	2.6

Note. More demographic information on the SIS-C sample is provided in Thompson et al. (2016b).

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across all interviews (Thompson et al., 2016b). Data are not available on the interviewers and respondents on the SIS-A, due to online data only being made available for secondary analysis at the level of scores on the SIS-A protocol. However, because access to the SISOnline is limited to organizations and jurisdictions that have contractual relationships with AAIDD to administer the SIS, it can be assumed that all interviewers who entered data into the system had received training on administering the SIS and followed protocols for including at least two respondents in data collection.

Assessment

SIS-A. The SIS-A was developed to measure the pattern and intensity of supports needs of adults with ID between the ages of 16 and 64 years old. The SIS-A consists of three sections: Exceptional Medical and Behavioral Support Needs, Support Needs Index scale, and Supplemental Protection and Advocacy scale. Section 1, Exceptional Medical and Behavioral Support Needs, provides descriptive information that is not used to generate standard scores. Specifically, these items assess supports needed due to the presence of medical conditions (19 items) and challenging behaviors (13 items) that may influence support needs. Section 2, the Supports Needs scale, is the standardized portion of the scale and is the focus of the present analyses, along with Section 3. Section 2 includes 49 items that are classified into six support needs domains: Home Living, Community Living, Lifelong Learning, Employment, Health and Safety, and Social domains. Information gathered from Section 2 is used to create a Support Needs Profile and standard scores (i.e., Support Needs Index; SNI). Section 3, Supplemental Protection and Advocacy (P&A) scale, has 8 items that were originally included in the standardized portion of the scale, but were removed due to initial concerns with interrater reliability (i.e., intra-class correlation coefficient = .29; Clay-Adkins, 2004). However, subsequent studies have shown the interrater reliability of the P&A scale to be as strong as the six subdomains in Section 2 (Shogren et al., 2014; Thompson, Tassé, & McLaughlin, 2008), and it appears that the initial concerns with the reliability of the P&A scale were the result of a lack of training provided to interviewers in the Clay-Adkins study. Shogren et al. (2014) recommended that subsequent revisions of the SIS-A should move the P&A scale back into the standardized portion of the scale, a recommendation that was seconded when researchers found that the P&A scale has strong factorial and discriminant validity (Shogren et al., 2016). Further, items in Sections 2 and 3 are measured in the same way, using the three methods (i.e., type of support, frequency of support, and daily support time) described previously and in Table 1.

SIS-C. The structure of the SIS-C parallels the SIS-A, except that Section 3 of the SIS-A (P&A scale) was included in the standardized portion of the SIS-C. Thus, the SIS-C includes two sections: (a) Exceptional Medical and Behavioral Support Needs and (b) Support Needs Index scale. As on the SIS-A, Section 1, assesses medical conditions and challenging behaviors that potentially impact the overall support needs using a 3-point scale. Section 2 represents the standardized portion of the scale. Section 2 consists 61 items, organized into seven support needs domains that are relevant to the environmental demands experienced by children with ID (thus, differing slightly from the SIS-A) including: Home Life, Community and Neighborhood, School Participation, School Learning, Health and Safety, Social, and Advocacy. Each item in Section 2 is rated on three dimensions as on the SIS-A: type, frequency, and daily support time (see Table 1 for response anchors).

Data Analysis

Preliminary analysis. Given that different response anchors were used on the SIS-A and SIS-C (see Table 1), there were items on the SIS-A for which limited response options were available for respondents ($n = 22$ for FREQ, $n = 3$ for DST). For example, there is an item in the Lifelong Learning domain that asks about support needs to participate in training/educational decisions. For the FREQ measure, the response range rather than being 0 to 4 (i.e., *none to less than monthly* to *hourly or more frequently*), is restricted to 0 to 3 (i.e., *none to less than monthly* to *at least once a day, but not once an hour*), as it is not logical that people with IDD would need supports hourly or more frequently on this item. Applying the same rationale, the DST response range of the aforementioned item is restricted to 0 to 3 (i.e., *none* to *2 hours to less than 4 hours*) instead of 0 to 4 (i.e., *none* to *4 hours or more*). On the other hand, the SIS-C does not have this issue as the anchors for the FREQ method were slightly modified to

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address this measurement issue that emerged on the SIS-A (See Table 1). To account for the differing range of responses on the SIS-A across items, proportion of maximum scoring (POMS; Little, 2013) was used to place raw scores of the SIS-A on a similar metric. We did not transform raw data from the SIS-C. Transformed item scores for SIS-A and original item scores for SIS-C were used for current data analyses.

Mplus version 7.2 (Muthén & Muthén, 1998-2012) and maximum likelihood estimation were used to evaluate model fit and estimate parameters. The SIS-A did not have any missing data because of the requirements of the online entry system, and the SIS-C had a small amount of missing data on each variable (average: 0.5%, range: 0.1 to 2.0%). Full information maximum likelihood (FIML) estimation was used to address the missing data on the SIS-C.

Pseudo-MTMM analyses. Multitrait-multimethod analyses (MTMM; Campbell & Fiske, 1959) were conducted to examine the degree to which type, frequency, and daily support time uniquely contributed to the measurement of support needs on both SIS-A and SIS-C. Results from classic MTMM models provide empirical evidence for construct validity by informing convergent validity, discriminant validity, and method effects of the scale. Because we had a very large overall model for each SIS scale (seven support needs domains for both the SIS-A and the SIS-C with eight or nine indicators per domain that were estimated by TYPE, FREQ, and DST), we encountered initial difficulties with model convergence and model stability when including all seven domains in one model to examine Research Questions 1 and 2. Because our research interest was to examine the contributions of trait and method variances when measuring support needs of people with ID, we chose to run 14 parallel pseudo-MTMM models for the SIS-A (7 models) and SIS-C (7 models). The pseudo model is "as valid as the core approach or model but contain[s] one or more elements that make it different" (Little, 2013, p. 353). In our case, an element that made the MTMM models different was the model simplicity that included one support needs domain in the model at a time. Otherwise, all analytic components remained the same with the classic MTMM models. Each indicator was loaded on two separate factors that represent trait and method variances (see Figure 1). Correlations among traits and within the methods were freely estimated, whereas correlations across the trait and method were fixed to zero (i.e., the traits and methods are independent of each other; Brown, 2015). Figure 1 depicts the pseudo-MTMM model for each support needs domain.

To assess model fit for each model, we used several goodness of fit statistics within the conventions of structural equation modeling, including the absolute fit index of root mean square error of approximation (RMSEA; $<$. 08 for acceptable fit), comparative fit index (CFI; $>$ .90 for acceptable fit) and Tucker-Lewis index (TLI; $>$ .90 for acceptable fit), and standardized root mean square residual (SRMR; $<$ .08 for acceptable fit; Brown, 2015; Little, 2013). We also evaluated the magnitude and patterns of parameter estimates. The alpha level of .001 was used to evaluate the significance of parameter estimates as sample sizes were large in both cases ($n = 129{,}864$ for the SIS-A, $n = 4{,}015$ for the SIS-C). To address the Research Question 3, we used two approaches to compare the patterns of trait and method variances in the measurement of support needs within and between the SIS-A and the SIS-C: (a) identifying the number of items that had stronger trait factor loadings than method factor loadings (Approach I) and (b) comparing the averaged absolute trait and method factor loadings (Approach II). We used the "Model Constraint" command in Mplus 7.2 to create new parameters quantifying the differences between trait and method factor loadings in both approaches and conducted statistical significance tests. The Mplus syntax for these analyses is provided as online supplementary material at http://www.beachcenter.org/resource_library/supplemental_materials.aspx. These two strategies allowed us to compare the magnitude of trait (i.e., support needs concept) and method (i.e., TYPE, FREQ, and DST) variances within each support needs domain.

Results

Because of the number of models, parameters estimated, and space constraints, it is not possible to present all trait and method factor loadings across the 14 support needs domains ($n = 342$ estimates for SIS-A, $n = 366$ for SIS-C). These results can be found as online supplementary material at http://www.beachcenter.org/resource_library/supplemental_materials.aspx. In the fol-

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lowing sections, we provide a summary of the key findings relevant to our research questions.

Trait and Method Variances of the SIS-A

As shown in Table 3, the pseudo-MTMM model for each SIS-A support needs domain showed acceptable fit to the data with RMSEAs ranging from .04 to .09, CFIs from .94 to .98, TLIs from .91 to .97, and SRMRs from .03 to .05.

Traits. The standardized trait factor loadings across the seven models were statistically significant at $p < .001$, although there was a range of standardized loadings across models: Home Living: .49–.80, Community Living: .27–.92, Lifelong Learning: .44–.91, Employment: .42–.80, Health and Safety: .40–.91, Social: .59–.90, and Protection and Advocacy: -.09–.84. The only non-significant factor loading was found in the Health and Safety subscale for Frequency for item #3: Obtaining health care services (standardized trait factor loading = –.01), suggesting that the observed score on this item was not well explained by Health and Safety support needs trait after accounting for the FREQ variance. This item, however, had significant trait factor loadings when measured by TYPE and DST indicating that this item functions differently depending on the methods used in its measurement. Additionally, one item in the Protection and Advocacy subscale that was also measured by the FREQ method (#6: Obtaining legal services) had a negative trait factor loading when controlling for the FREQ method, but the magnitude of the loading was very small and thus negligible (standardized factor loading = –.09).

Each of the correlations between traits was also significant at $p < .001$ and ranged from .20 to .83 across the seven support needs domains. This finding suggests that the observed support needs ratings represented the respective underlying support needs traits after controlling for method variances.

Methods. Standardized method (i.e., TYPE, FREQ, and DST) factor loadings on the SIS-A were also significant at $p < .001$ and ranged from –.39 to .84 across seven support needs domains.

Table 3
Fit Indices for Pseudo MTMM Models (SIS-A and SIS-C)

Domain	Chi-square	*p* value	RMSEA (90% confidence interval)	CFI	TLI	SRMR
SIS-A						
HLA	χ^2 (197) = 80567.775	.00	.056 (.056–.056)	.977	.967	.041
CLA	χ^2 (197) = 43907.323	.00	.041 (.041–.042)	.981	.973	.025
LLA	χ^2 (258) = 115769.401	.00	.059 (.058–.059)	.960	.945	.036
EA	χ^2 (197) = 203327.231	.00	.089 (.089–.089)	.938	.913	.042
HSA	χ^2 (197) = 83606.665	.00	.057 (.057–.057)	.964	.950	.052
SA	χ^2 (197) = 58756.990	.00	.048 (.04–.048)	.980	.971	.027
PAA	χ^2 (197) = 89037.053	.00	.059 (.059–.059)	.958	.942	.048
SIS-C						
HFA	χ^2 (258) = 1982.475	.00	.041 (.039–.042)	.983	.977	.030
CNA	χ^2 (197) = 1664.425	.00	.043 (.041–.045)	.983	.976	.027
SPA	χ^2 (258) = 3599.493	.00	.057 (.055–.059)	.966	.954	.034
SLA	χ^2 (258) = 3359.407	.00	.055 (.053–.056)	.972	.962	.094
HSA	χ^2 (197) = 3317.376	.00	.063 (.061–.065)	.965	.951	.062
SA	χ^2 (258) = 1901.334	.00	.040 (.038–.042)	.985	.980	.015
AA	χ^2 (258) = 4389.177	.00	.063 (.062–.065)	.963	.950	.056

Note. MTMM Models = Multitrait-multimethod Models; RMSEA = Root Mean Square Error of Approximation; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; SRMR = Standardized Root Mean-square Residual; HLA = Home Living Activities; CLA = Community Living Activities; LLA = Lifelong Learning Activities; EA = Employment Activities; HSA = Health and Safety Activities; SA = Social Activities; PAA = Protection and Advocacy Activities; HFA = Home Life Activities; CNA = Community and Neighborhood Activities; SPA = School Participation Activities; SLA = School Learning Activities; and AA = Advocacy Activities.

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The significant method factor loadings indicated that each of the three methods uniquely contributed to the measurement of the support needs and method effects did generalize across the items. An interesting pattern was found in the FREQ of the Social domain model on the SIS-A. Although the magnitude of the factor loadings were relatively small (but significant at $p < .001$), three items on the social support needs (#4 Making and keeping friends, #7 Engaging in loving and intimate relationships, and #8 Engaging in volunteer work) had negative FREQ factor loadings (−.06, −.33, and −.39, respectively), indicating that adults with ID who have higher scores on the frequency method tended to have lower observed support needs ratings after accounting for the trait variance. We found that all correlations between methods were significant at $p < .001$ (range: .12–.94).

Trait and Method Variances of the SIS-C

For the SIS-C, the pseudo-MTMM model for each support needs domain demonstrated satisfactory model fit with RMSEAs ranging from .04 to .06, CFIs from .96 to .99, TLIs from .95 to .98, and SRMRs from .02 to .09 (see bottom of Table 3).

Traits. Similar patterns in parameters were found for the SIS-C. All standardized trait factor loadings were statistically significant (Home Life: .49–.99, Community and Neighborhood: .40–.95, School Participation: .46–.94, School Learning: .31–.91, Health and Safety: .27–.94, Social: .52–.93, and Advocacy: .25–.89), indicating that the influences of the trait on the observed support needs ratings were significant after adjusting for the method variances. Likewise, correlations between traits were moderate to strong after correcting for the inflated variances resulted from the shared methods, with correlations ranging from .14 to .90.

Methods. Method factor loadings were also statistically significant at $p < .001$ across support needs domains, with a handful of exceptions. For the FREQ method, three items on the Home Life domain (#7 Keeping track of personal belongings at home, #8 Keeping self-occupied during unstructured time at home, and #9 Operating electronic devices) and two items on the Community and Neighborhood domain (#2 Participating in leisure activities that require physical activity and #3 Participating in leisure activities that do not require physical exertion) showed nonsignificant loadings. After the trait variances were extracted from observed support needs scores, these five items were not strongly associated with the FREQ method but were related to other TYPE and DST methods.

The latent correlations between methods were also significant at $p < .001$ for each support needs model (range: .11–.79), except for the correlations between TYPE and FREQ as well as DST and FREQ in the Home Life and Community and Neighborhood domains, replicating the result that the FREQ method uses a different measurement framework in these two domains of the SIS-C.

Comparisons of Trait and Method Variances Within and Across the SIS-A and SIS-C

Approach I. To compare the influences of traits and methods on observed support needs ratings, we examined the number of items that had stronger factor loadings within each support needs domain. For example, as seen in the highlighted row of SA on the left-side of Table 4, all possible 24 cases in the social activities domain (i.e., 8 items on the Social Activities domain measured by three different methods) had stronger trait loadings than method loadings, which indicates that all items in this domain have higher trait variances than method variances.

When looking across support needs domains of the SIS-A, the overall results from the Approach I suggest that items have stronger trait factor loadings than do method factor loadings (see highlighted rows of Approach I in Table 4). This finding suggests that the observed support needs ratings on the SIS-A are more sensitive to traits than methods as would be expected because the support needs traits, not the method by which the support needs is assessed, are the concepts that the SIS is intended to measure. The Employment and Health and Safety domains were exceptions to this general finding on the SIS-A, as the number of items with higher method factor loadings was greater than the one with higher trait factor loadings. When looking within each support needs model on the SIS-A (see non-highlighted rows in Table 4), both TYPE and FREQ were the methods that strongly influenced support needs ratings in Employment and Health and Safety domains, whereas TYPE influenced on the observed scores of Home Living and Lifelong Learning domains of the SIS-A.

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Table 4
Two Approaches to Compare the Contributions of Traits and Methods in the SIS-A and the SIS-C

		Approach I[a]				Approach II[b]					Approach I[a]				Approach II[b]		
SIS-A	Variable	Trait	Method	=	Strong Factor	Diff.	*p*	Strong Factor	SIS-C	Variable	Trait	Method	=	Strong Factor	Diff.	*p*	Strong Factor
HLA	TYPE	1	7	0	Method	−0.047	.00	Method	HFA	TYPE	9	0	0	Trait	.811	.00	Trait
	FREQ	7	1	0	Trait	.042	.00	Trait		FREQ	9	0	0	Trait	1.108	.00	Trait
	DST	4	4	0	Same	−0.001	.59	Same		DST	6	1	2	Trait	.299	.00	Trait
	Total	**12**	**12**	**0**	**Same**	**−0.002**	**.21**	**Same**		**Total**	**24**	**1**	**2**	**Trait**	**.739**	**.00**	**Trait**
CLA	TYPE	6	1	1	Trait	.077	.00	Trait	CLA	TYPE	8	0	0	Trait	.300	.00	Trait
	FREQ	5	3	0	Trait	.018	.00	Trait		FREQ	8	0	0	Trait	.704	.00	Trait
	DST	5	2	1	Trait	.019	.00	Trait		DST	1	4	3	Method	−0.080	.00	Method
	Total	**16**	**6**	**2**	**Trait**	**.038**	**.00**	**Trait**		**Total**	**17**	**4**	**3**	**Trait**	**.308**	**.00**	**Trait**
LLA	TYPE	3	6	0	Method	−.003	.00	Method	SPA	TYPE	8	0	1	Trait	.243	.00	Trait
	FREQ	7	1	1	Trait	.035	.00	Trait		FREQ	9	0	0	Trait	.701	.00	Trait
	DST	4	4	1	Same	.063	.00	Trait		DST	4	3	2	Trait	.074	.00	Trait
	Total	**14**	**11**	**2**	**Trait**	**.032**	**.00**	**Trait**		**Total**	**21**	**3**	**3**	**Trait**	**.339**	**.00**	**Trait**
EA	TYPE	1	5	2	Method	−.032	.00	Method	SLA	TYPE	4	1	4	Trait	.055	.00	Trait
	FREQ	3	4	1	Method	−.009	.00	Method		FREQ	9	0	0	Trait	.202	.00	Trait
	DST	5	3	0	Trait	.021	.00	Trait		DST	6	3	0	Trait	.234	.00	Trait
	Total	**9**	**12**	**3**	**Method**	**−.007**	**.00**	**Method**		**Total**	**19**	**4**	**4**	**Trait**	**.164**	**.00**	**Trait**
HSA	TYPE	3	5	0	Method	.010	.00	Trait	HSA	TYPE	5	0	3	Trait	.168	.00	Trait
	FREQ	3	4	1	Method	.022	.00	Trait		FREQ	5	0	3	Trait	.223	.00	Trait
	DST	5	3	0	Trait	.044	.00	Trait		DST	4	1	3	Trait	.179	.00	Trait
	Total	**11**	**12**	**1**	**Method**	**.026**	**.00**	**Trait**		**Total**	**14**	**1**	**9**	**Trait**	**.190**	**.00**	**Trait**
SA	TYPE	8	0	0	Trait	.108	.00	Trait	SA	TYPE	9	0	0	Trait	.425	.00	Trait
	FREQ	8	0	0	Trait	.257	.00	Trait		FREQ	9	0	0	Trait	.719	.00	Trait
	DST	8	0	0	Trait	.128	.00	Trait		DST	5	3	1	Trait	.044	.00	Trait
	Total	**24**	**0**	**0**	**Trait**	**.164**	**.00**	**Trait**		**Total**	**23**	**3**	**1**	**Trait**	**.396**	**.00**	**Trait**
PAA	TYPE	8	0	0	Trait	.077	.00	Trait	AA	TYPE	7	0	2	Trait	.186	.00	Trait
	FREQ	4	3	1	Trait	.015	.00	Trait		FREQ	9	0	0	Trait	.353	.00	Trait
	DST	5	3	0	Trait	.023	.00	Trait		DST	3	5	1	Method	−0.082	.00	Method
	Total	**17**	**6**	**1**	**Trait**	**.038**	**.00**	**Trait**		**Total**	**19**	**5**	**3**	**Trait**	**.153**	**.00**	**Trait**

Note. [a]Approach I = Identifying the number of items with stronger factor loadings; [b]Approach II = Comparing the absolute unstandardized trait and method factor loading averages; Diff. = the difference in absolute unstandardized factor loading averages (Trait - Method); Type = Type of support; FREQ = Frequency of support; DST = Daily support time; HLA = Home Living Activities; CLA = Community Living Activities; LLA = Lifelong Learning Activities; EA = Employment Activities; HSA = Health and Safety Activities; SA = Social Activities; PAA = Protection and Advocacy Activities; HFA = Home Life Activities; CNA = Community and Neighborhood Activities; SPA = School Participation Activities; SLA = School Learning Activities; and AA = Advocacy Activities

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In terms of the pattern of findings for the SIS-C, this scale was also more sensitive to traits than methods, but there were differences across the SIS-A and SIS-C. As seen on the highlighted rows in the right-side of Table 4, all domains of the SIS-C were more influenced by traits than methods. When exploring the impact of each method on the observed support needs ratings on the SIS-C, DST primarily influenced scores on the Community Living and Advocacy domains on the SIS-C (see non-highlighted rows in Table 4).

Approach II. To examine the influences of the traits and methods on the SIS-A and the SIS-C, we also compared averages of absolute trait and method factor loadings (unstandardized ones) within and across the SIS-A and the SIS-C. Similar patterns were observed in the SIS-A and the SIS-C. For the SIS-A, as shown in highlighted rows in Table 4, the averaged trait factor loading across all items was weaker than the averaged method factor loading in Employment (difference $= -.007$, $p < .001$); the averaged trait and method factor loadings were the same in Home Living (difference $= -.002$, $p = .21$); and the trait factor loadings were stronger than their respective method factor loadings in the remaining domains (i.e., Community Living, Lifelong Learning, Health and Safety, Social, and Protection and Advocacy). When we focused on the average of each method factor loading of the SIS-A across support needs domains (non-highlighted rows in Table 4), (a) TYPE was higher than its corresponding trait in Home Living and Lifelong Learning; and (b) both TYPE and FREQ were higher than their traits in Employment. For the SIS-C, trait factor loadings were stronger than method factor loadings across all support needs domains. When inspecting the details (non-highlighted rows in Table 4), DST factor loadings in the Community Living and Advocacy domains were stronger than their corresponding trait factor loadings, which is consistent with results from the Approach I for the SIS-C.

Discussion

The purpose of this study was to examine the construct validity of the SIS-A and the SIS-C by partitioning the observed scores into trait (i.e., support needs concept) and method (i.e., type, frequency, and daily support time) variances. This allowed for an examination of the convergent validity of the SIS-A and the SIS-C by exploring the relations among traits, while simultaneously identifying the effects of three methods (i.e., TYPE, FREQ, and DST) on support needs scores, and comparing the relative contributions of traits and methods in observed support needs. Overall we found that all support need domain models demonstrated acceptable fit in MTMM framework. Indicators of each domain tended to be strongly related to their associated traits after controlling for method variances. The finding of significant trait factor loadings as well as the stronger impact of traits than methods in explaining observed SIS scores supports the convergent validity of the scale, suggesting that the items measure the purported support needs construct. Additionally, the three methods (type, intensity, and duration) served unique functions that can be generalized across the domains of the SIS-A and SIS-C. That is, three sources of method variance uniquely contributed to understanding of support needs across the SIS-A and SIS-C, as hypothesized by the theoretical framework that drove the development of the scales.

Limitations

In interpreting the findings of this study, several limitations should be noted. First, data from the SISOnline provides limited demographic data (i.e., only age and gender) because of agreements with SISOnline users, thus, we cannot fully describe the sample or the respondents. Second, we applied a modified version of MTMM analyses (i.e., pseudo-MTMM analyses) by analyzing one support needs domain at a time because there were difficulties with model convergence when all domains ($n = 7$) were simultaneously included in one model. This estimation problem is one of the widely encountered challenges of the complex MTMM analyses (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Although our primary research interest was to examine the relative contribution of trait and method variances in the measurement of support needs, the lack of information on the discriminant validity of the SIS-A and the SIS-C within MTMM framework should be considered as a limitation in this study. In spite of these limitations, however, the results provide important implications for the future use of both scales in assessment contexts or in research settings.

Implications for Future Research and Practice

Overall, in examining the results from Research Questions 1 and 2, the findings provide evidence on

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convergent validity of the SIS-A and the SIS-C. While adjusting for the effects of measurement methods, all trait factor loadings of the SIS-A were statistically significant with one exception on the Health and Safety domain (0.5% of the total cases). This non-significant trait loading was found in the *obtaining health care services* item when measured by frequency, suggesting that the influence of frequency method is greater than the influence of the trait being assessed for this specific item. This contamination may occur because obtaining health services maybe require lower frequencies of support than other items, impacting its measurement. Future studies need to examine the interaction between this item and the frequency method in generating the observed ratings and possibly refine the item description to reflect its underlying trait to the maximum extent possible. The SIS-C, on the other hand, demonstrated stronger convergent validity than the SIS-A, given that all trait factor loadings were significant. These findings are particularly important in construct validation of the SIS-A and the SIS-C, as they suggest that support needs concepts predict item scores after influences of shared methods are eliminated. Having only one measurement approach (i.e., method in our case) in assessing psychological constructs (i.e., support needs in our study) may result in misleading findings in construct validation because it cannot explain how much correlation is due to the effects of a single method versus the true nature of the traits (Brown, 2015). Our study results indicate that support needs measured by the SIS-A and the SIS-C are "true" trait information when three methods are used, which again supports the convergent validity of the SIS-A and the SIS-C.

When specifically examining the impact of the methods (type, frequency, and duration) in the measurement of support needs, the SIS-A indicators had significant factor loadings for the three methods across the support needs domains and the majority of items on the SIS-C had significant factor loadings with the exception of five non-significant Frequency factor loadings (three items on Home Life and two items on Community and Neighborhood domains). A possible interpretation on the findings of the SIS-C relates to the particularly large trait factor loadings of non-significant method items. The standardized trait loadings for these items ranged from .94 to .99 (average = .95), indicating that these items were very strongly influenced by their associated support needs trait. It is also possible that children with IDD have different frequency patterns for non-significant items versus other significant items on a given support needs domain. For example, on the Home Life domain, frequencies for three non-significant items (i.e., keeping track of personal belongs at home, keeping self-occupied during unstructured time at home, or operating electronic devices) may differ in the frequency of support needed in these items when compared to other significant items (e.g., eating, dressing, using the toilet; the activities needed by children more), particularly in their measurement. Likewise, on the Community and Neighborhood domain, the SIS-C may demonstrate different measurement properties for the two non-significant items (i.e., participating in leisure activities that do and do not require physical exertion) when compared to the significant items (e.g., moving around the neighborhood and community, using public services, shopping). The item *participating in recreation activities* on the SIS-A that is comparable to the item of *participating in leisure activities* on the SIS-C (Seo, Shogren, et al., in press), however, did share the frequency method variance with other items on the Community Living domain of the SIS-A. This result supports that there are slightly different method functions between the SIS-A and the SIS-C depending on age. More research is needed exploring these findings in a larger sample, and considering issues related to measurement of specific items.

When looking at the methods, overall, the findings empirically supported that the type, frequency, and daily support time methods contributed a unique portion of variance to ratings of supports needed by people with ID across the lifespan. That is, all of the methods influenced support needs, supporting the importance of including all three methods when rating support needs. This supports the theoretical model (Thompson et al., 2009) and the rationale that grounded the development and norming process of the SIS-A and SIS-C. Scores from three methods are summed up for the SIS-A (Thompson et al., 2004b) or averaged for the SIS-C (Seo, Little, Shogren, & Lang, 2016; Thompson et al., 2016b) so as to generate standard scores that reflect the function of the three methods in defining and measuring support needs of people with IDD.

The previous research findings were also replicated when testing statistical differences between trait and method factor loadings within each support needs domain (Research Question

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3). Traits contributed more to the observed support needs ratings than methods did, which supports that the items measure support needs constructs that both versions of the SIS are intended to evaluate. It should be also acknowledged that, as previously addressed, all three methods contributed important and unique information and all three appear to be critical to the specified models although there were different patterns of findings for the SIS-A and the SIS-C. Further work is needed to examine why type and frequency contributed more variance on the SIS-A and daily support time on the SIS-C. One possible reason relates to the contextual differences across children and adults in obtaining necessary supports to function successfully in typical life activities. Perhaps the time factor to provide supports (i.e., daily support time; how much the *cumulative time* during the 24-hour cycle would be needed to provide supports?) is more relevant for children as they have more people in their environment to provide support. Whereas, for adults, the nature of extraordinary support (i.e., type; what type of supports would be needed to enable an individual with ID to be successful?) and/or frequency of supports (i.e., frequency; how often would support be provided?) may exert a stronger influence on certain support needs domains. Another reason perhaps relates to differential developmental trajectories that children and adults with ID have. Scoring items on both SIS-A and SIS-C is based on the comparison of the person being assessed to typically functioning peers of the same age (Thompson et al., 2015b; Thompson et al., 2016b). Thus the gap between what support people with ID need may widen with age (Shogren et al., 2015), and it is assumed that three methods (FREQ, TYPE, and DST) may function differently in conceptualizing certain support needs as people with intellectual and developmental disabilities age. Future research should explore the need for different response anchors for frequency and daily support time for the SIS-A (see Table 1), and consideration should be given to the prospect of aligning the anchors in future revisions of the SIS-A to the SIS-C.

Taken together, the findings from this study extend the SIS literature by establishing convergent validity within the pseudo MTMM framework and by empirically supporting the hypothesis that type, frequency, and daily support time all uniquely contribute to understanding and measuring support needs of people with IDD. This study provides evidence for convergent validity of the SIS-A and the SIS-C and suggests the importance, when engaging in supports planning, of considering the type, frequency, and daily support time needed across each support needs domain, and across the lifespan.

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Authors:
Hyojeong Seo, Kongju National University, Department of Special Education; **Karrie A. Shogren,** University of Kansas, Beach Center on Disability; **Todd D. Little,** Texas Tech University, Department of Educational Psychology and Leadership; **James R. Thompson** and **Michael**

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L. Wehmeyer, University of Kansas, Beach Center on Disability.

Correspondence concerning this article should be addressed to Hyojeong Seo, Department of Special Education, Kongju National University, Kongju University Road 56, Kongju, ChungNam, 32588, South Korea (e-mail: hyojeongseo@kongju.ac.kr).