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NORMATIVE FACTOR STRUCTURE OF THE AAMR ADAPTIVE BEHAVIOR SCALE-SCHOOL, SECOND EDITION

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The Adaptive Behavior Scale-School, Second Edition (ABS-S:2; Lambert, Nihira, & Leland, 1993) is one of the most popular tests of adaptive behavior. Critical methodological flaws in the confirmatory factor analysis reported in the test manual and the results of independent exploratory factor analyses leave the structural validity of the ABS-S:2 underdefined. The present study conducted exploratory factor analysis of the combined ABS-S:2 normative sample of 3,328 students (2,074 with mental retardation and 1,254 without mental retardation). Following principal axis factor extraction and oblique rotation, a two-factor solution was deemed the best dimensional model. These results suggest that interpretation of the ABS-S:2 should focus on its two major conceptual components (personal independence and social behavior) rather than the five factors and 16 domains endorsed by its authors.

Psychological constructs such as intelligence, self-esteem, and anxiety are an "attribute of people, assumed to be reflected in test performance" (Cronbach & Meehl, 1955, p. 283). Because these unobservable constructs are abstracted from observed test performance, evidence must be educed to verify that test scores accurately reflect the intended constructs. This process is called construct validation (Benson, 1998) and is integral to competent psychological assessment (American Educational Research Association, American Psychological Association, National Council on Measurement in Education, 1999).

Valid measurement of the construct of adaptive behavior is especially important because it is central to the definition of mental retardation (APA, 1994). Adaptive behavior is a term that refers to a person's effectiveness in coping with daily environmental demands and must accompany subaverage general intellectual functioning to constitute mental retardation (Nihira, 1999). Unfortunately, there is little consensus regarding the dimensional structure of adaptive behavior (Thompson, McGrew, & Bruininks, 1999). For example, the

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American Association on Mental Retardation (1992) published guidelines that delineate ten areas of adaptive behavior, but other experts have suggested that it is composed of one (Bruininks, McGrew, & Maruyama, 1988), five (Kamphaus, 1987), and seven (Meyers, Nihira, & Zetlin, 1979) dimensions. McGrew and Bruininks (1989) reviewed the literature on the dimensionality of adaptive behavior and concluded that disparate results were related to the adaptive behavior test being analyzed and the type of analytic method used.

Given these confounds, it is important to scrutinize each test of adaptive behavior. Of the 200 published instruments designed to measure adaptive behavior (Spreat, 1999), the Adaptive Behavior Scale-School, Second Edition (ABS-S:2; Lambert, Nihira, & Leland, 1993) is one of the most popular (Stinnett, Havey, & Oehler-Stinnett, 1994). Its dimensional structure was analyzed by confirmatory factor analysis (CFA) of 28 components extracted from the ABS-S:2 among the combined normative sample of 3,328 students. Some components consisted of single items, whereas others contained two, three, or more items. A five-factor model, corresponding to an a priori hypothesized structure, was selected by Lambert et al. (1993) based upon high component-factor loadings. Unfortunately, no alternative models were tested, loadings of components onto nonhypothesized factors were not reported, and model fit statistics were not provided. These are critical methodological flaws (Kline, 1998; Thompson, 2000) that leave the structural validity of the ABS-S:2 underdefined.

Stinnett, Fuqua, and Coombs (1999) recognized this situation and applied exploratory factor analysis (EFA) to the ABS-S:2 normative sample. However, correlation matrices were presented separately in the ABS-S:2 manual (Lambert et al., 1993, p. 51) for the sample of students with mental retardation and the sample of students without mental retardation. Consequently, Stinnett et al. (1999) had to analyze and report factor analytic results separately for students with and without mental retardation rather than for the combined sample analyzed by Lambert et al. (1993). Results from both samples suggested a similar two-factor structure, and the authors concluded that there was no empirical support for the five-factor model advocated by Lambert et al.

Such inconsistent construct validity results led Stinnett et al. (1999) to recommend continuing study of the dimensional structure of the ABS-S:2, especially among a general population comprised of students with and without mental retardation. A combined sample was deemed desirable for two reasons. First, psychologists typically use the ABS-S:2 with referral samples that contain students with and without mental retardation. Thus, the combined sample consists "of people similar to those with whom the scale will be ultimately used" (Gorsuch, 1997, p. 541). Second, sampling participants from the extremes of expected factors often produces clearer factors than would otherwise result (Gorsuch, 1988). Therefore, the present study conducted EFA analyses of the combined ABS-S:2 normative sample.

METHOD

Participants

The ABS-S:2 normative sample of 3,328 students (2,074 with mental retardation and 1,254 without mental retardation) served as participants. The separate correlation matrices for the 16 domain scores presented in the ABS-S:2 manual (Lambert et al., 1993, p. 51) for students with and without mental retardation were pooled using the procedure specified by Becker (1996). This involved weighting each correlation coefficient by its degrees of freedom and then combining the weighted correlation matrices into a single matrix by summing the corresponding weighted coefficients and dividing this sum by the sum of the weighting factors. Results are presented in Table 1. Zeros were substituted for unspecified nonsignificant entries in the original correlation matrices. As noted by Stinnett et al. (1999), this "was reasonable because the maximum nonsignificant r was .04 for the MR group and .03 for the Non-MR sample" (p. 35).

Table 1
Combined ABS-S:2 Correlation Matrix for 2,074 Students with Mental Retardation and 1,254 Students without Mental Retardation

	IF	PD	EA	LD	NT	PV	SD	RE	SO	SB	CO	TR	SHB	SAB	SE	DIB
IF	1.0															
PD	.51	1.0														
EA	.74	.38	1.0													
LD	.80	.35	.75	1.0												
NT	.75	.44	.66	.86	1.0											
PV	.55	.39	.36	.50	.47	1.0										
SD	.71	.32	.63	.71	.62	.67	1.0									
RE	.73	.36	.61	.70	.65	.64	.76	1.0								
SO	.69	.44	.50	.68	.59	.61	.76	.74	1.0							
SB	.07	-.02	.09	.09	.07	-.12	.02	-.03	-.07	1.0						
CO	-.10	.00	-.04	-.08	-.06	-.37	-.30	-.30	-.30	.49	1.0					
TR	-.18	.00	-.08	-.13	-.11	-.32	-.26	-.30	-.30	.40	.70	1.0				
SHB	-.24	-.16	-.12	-.21	-.17	-.29	-.32	-.30	-.36	.34	.59	.57	1.0			
SAB	-.17	-.16	-.03	-.18	-.12	-.24	-.24	-.23	-.28	.26	.45	.51	.67	1.0		
SE	-.26	-.21	-.20	-.26	-.19	-.24	-.38	-.29	-.39	.10	.34	.30	.45	.48	1.0	
DIB	-.02	.00	.03	-.23	.05	-.21	-.16	-.10	-.18	.48	.45	.54	.51	.41	.38	1.0

Note.—IF = Independent Functioning; PD = Physical Development; EA = Economic Activity; LD = Language Development; NT = Numbers and Time; PV = Prevocational/Vocational Activity; SD = Self-Direction; RE = Responsibility; SO = Socialization; SB = Social Behavior; CO = Conformity; TR = Trustworthiness; SHB = Stereotyped and Hyperactive Behavior; SAB = Self-Abusive Behavior; SE = Social Engagement; DIB = Disturbing Interpersonal Behavior.

Instrument

The ABS-S:2 is a major revision of the 1975 and 1981 Adaptive Behavior Scales. Items were selected based on reliability and ability to discriminate among adaptive behavior levels (Lambert et al., 1993). The instrument is designed to assist in differential diagnosis of mental retardation, planning of special programs and treatment plans, and identification of relative adaptive

strengths and weaknesses among individuals aged 3 through 21 years. The ABS-S:2 was normed on 2,074 people with mental retardation from 40 states and 1,254 people without mental retardation from 44 states. Additional data regarding the standardization sample and psychometrics of the ABS-S:2 are available in Lambert et al. (1993).

The ABS-S:2 is conceptually separated into two parts. Part I focuses on personal independence and contains 9 separate behavioral domains: Independent Functioning (IF), Physical Development (PD), Economic Activity (EA), Language Development (LD), Numbers and Time (NT), Prevocational/Vocational Activity (PV), Self-Direction (SD), Responsibility (RE), and Socialization (SO). Part II deals with social behavior and is divided into 7 domains: Social Behavior (SB), Conformity (CO), Trustworthiness (TR), Stereotyped and Hyperactive Behavior (SHB), Self-Abusive Behavior (SAB), Social Engagement (SE), and Disturbing Interpersonal Behavior (DIB). The scale yields scores for each of the 16 domains and five factors (personal self-sufficiency, community self-sufficiency, personal-social responsibility, social adjustment, and personal adjustment). Internal consistency reliability coefficients for the domain and factor scores ranged from .82 to .98 (*Mdn* = .905) and from .88 to .98 (*Mdn* = .945), respectively.

Analysis

Given the lack of agreement concerning the dimensionality of the construct of adaptive behavior, the diverse results found with the ABS-S:2, and the atheoretical foundation of the ABS-S:2, EFA was deemed the most suitable analytic method. As noted by Browne (2001), EFA is probably preferable to CFA under these conditions. That is, lack of both theoretical and empirical congruence recommended an exploratory approach over a confirmatory method (Stinnett et al., 1999).

Domain scores served as dependent variables. Principal axis factor extraction was selected to remove any assumptions about the distribution of the variables (Cudeck, 2000). Initial estimation of communalities was accomplished by placing squared multiple correlations on the diagonal. Because determining the number of factors to retain for rotation is the most critical decision in EFA (Goodwin & Goodwin, 1999), the three most accurate methods identified by Velicer, Eaton, and Fava (2000) were applied: Parallel Analysis (PA; Horn, 1965), Minimum Average Partial Correlation (MAP; Velicer, 1976), and Scree (Cattell, 1966). Following the recommendation of Fabrigar, Wegener, MacCallum, and Strahan (1999), oblique rotation was preferred. To reduce the probability of complex variables and ensure that only important loadings were interpreted (Hair, Anderson, Tatham, & Black, 1995), it was determined a priori that three salient structure coefficients of ≥.40 would be required to form a factor (Ford, MacCallum, & Tait, 1986).

RESULTS

EFA was conducted with SPSS 10 for the Macintosh (SPSS, 2000). The correlation matrix was factorable, as indicated by the KMO measure of sampling adequacy (.65) and Bartlett's Test of Sphericity ($p > .001$). PA, MAP, and Scree procedures all indicated that two factors should be retained. Following Oblimin rotation, both factors were saliently loaded by more than three variables (see Tables 2 and 3) with no complex variables. The factor intercorrelation was -.23. Thus, the two factors were relatively independent (John & Benet-Martinez, 2000). Factor I accounted for 39% and Factor II for 18% of the variance. Analysis of nonredundant residuals found only $6 \geq |.10|$.

Table 2
Structure Coefficients for a Two-Factor Oblique Structure for the Adaptive Behavior Scale-School:2 Normative Sample of 3,328 Students

Domain	Factor I	Factor II	Communality
Independent Functioning	*.90*	-.14	.82
Physical Development	*.49*	-.08	.24
Economic Activity	*.76*	-.02	.60
Language Development	*.89*	-.15	.79
Numbers and Time	*.83*	-.06	.70
Prevoc/Vocational Activity	*.65*	-.38	.47
Self-Direction	*.84*	-.33	.73
Responsibility	*.84*	-.31	.72
Socialization	*.80*	-.37	.68
Social Behavior	.05	*.52*	.30
Conformity	-.19	*.79*	.62
Trustworthiness	-.21	*.78*	.60
Stereotyped/Hyperactive Behavior	-.29	*.78*	.62
Self-Abusive Behavior	-.22	*.67*	.45
Social Engagement	-.33	*.49*	.29
Disturbing Interpersonal Behavior	-.10	*.67*	.46

Note.—Salient structure coefficients (≥ .40) are in italic.

Although the two-factor solution was an adequate explanation of the covariation within the ABS-S:2 correlation matrix, it is better to overextract than to underextract factors (Wood, Tataryn, & Gorsuch, 1996). Further, Table 2 indicates that the communality for two domains (PD and SE) was relatively low. Following the recommendation of Gorsuch (1997), a third factor was extracted and rotated. The resulting three-factor solution was then compared to the original two-factor solution. The third factor accounted for an additional 3.4% of the variance and reduced the nonredundant residuals $\geq |.10|$ to 4. It also resulted in multiple complex variables loading on Factors II and III (see Table 4). Factor I correlated with Factor II at -.05 and with Factor III at -.32. Factor II correlated with Factor III at .48. Communalities of the PD and SE domains remained relatively low. Although the three-factor model explained additional variance, this was purchased with increased complexity. Considering parsimony and interpretability, the two-factor solution was deemed the best dimensional model.

Table 3
Pattern Coefficients for a Two-Factor Oblique Structure for the Adaptive Behavior Scale-School:2 Normative Sample of 3,328 Students

Domain	Factor I	Factor II
Independent Functioning	*.92*	.07
Physical Development	*.50*	.03
Economic Activity	*.80*	.16
Language Development	*.90*	.05
Numbers and Time	*.86*	.13
Prevoc/Vocational Activity	*.59*	-.24
Self-Direction	*.81*	-.14
Responsibility	*.81*	-.13
Socialization	*.76*	-.20
Social Behavior	.17	*.56*
Conformity	-.01	*.79*
Trustworthiness	-.04	*.77*
Stereotyped/Hyperactive Behavior	-.12	*.75*
Self-Abusive Behavior	-.07	*.65*
Social Engagement	-.24	*.43*
Disturbing Interpersonal Behavior	.06	*.69*

Note.—Salient pattern coefficients (≥ .40) are in italic.

Table 4
Structure Coefficients for a Three-Factor Oblique Structure for the Adaptive Behavior Scale-School:2 Normative Sample of 3,328 Students

Domain	Factor I	Factor II	Factor III	Communality
Independent Functioning	*.90*	.05	-.28	.82
Physical Development	*.49*	.07	-.21	.26
Economic Activity	*.76*	.12	-.14	.60
Language Development	*.88*	.06	-.30	.80
Numbers and Time	*.82*	.11	-.20	.70
Prevoc/Vocational Activity	*.66*	-.34	-.30	.53
Self-Direction	*.85*	-.20	-.34	.74
Responsibility	*.85*	-.22	-.30	.75
Socialization	*.80*	-.22	*-.41*	.68
Social Behavior	.04	*.56*	.34	.33
Conformity	-.19	*.84*	*.55*	.75
Trustworthiness	-.21	*.74*	*.59*	.63
Stereotyped/Hyperactive Behavior	-.28	*.55*	*.81*	.68
Self-Abusive Behavior	-.21	*.41*	*.79*	.63
Social Engagement	-.33	.25	*.60*	.38
Disturbing Interpersonal Behavior	-.09	*.56*	*.58*	.45

Note.—Salient pattern coefficients (≥ .40) are in italic.

Some authors have suggested that Part I and Part II domains should not be combined for factor analysis (Moss & Hogg, 1990). Following this logic, the ABS-S:2 Part I and Part II domain scores were analyzed separately and resulted in additional factors if PA, MAP, and Scree criteria were ignored. For example, the nine domains of Part I subdivided into three factors with initial eigenvalues of 5.9, .84, and .79. However, PA, MAP, and Scree criteria all suggested that only one factor be retained. Additionally, the factors were highly correlated (.77).

Thus, results from combined and separate analyses were not substantially discrepant when appropriate factor analytic methods were applied (Fabrigar et al., 1999).

DISCUSSION

Two factors parsimoniously explained the covariation within the ABS-S:2 correlation matrix for its combined normative sample of students with and without mental retardation. These results are similar to those reported by Stinnett et al. (1999) for each group separately, but discrepant from the five-factor structure favored by the scale's authors (Lambert et al., 1993). However, the two empirical factors parallel the scale authors' conceptual division of the ABS-S:2 into two parts: Part I focusing on personal independence and Part II dealing with social behavior.

The PD and SE domains were marked by relatively low communalities, however. Specifically, the two common factors accounted for only 24% and 29%, respectively, of the variance of those domains. Stinnett et al. (1999) reported that the PD domain did not load for the sample of students with mental retardation whereas the SE domain failed to fit for the students without mental retardation. Thus, these two domains may function differently across students with and without mental retardation.

These results suggest that interpretation of the ABS-S:2 should focus on its two major conceptual components (personal independence and social behavior) rather than the five factors and 16 domains endorsed by its authors. Correspondingly, comparison of domain scores to identify adaptive strengths and weaknesses should be de-emphasized because variation in these scores is best explained by the two common factors rather than specific adaptive domains.

As with all research, methodological limitations should inform interpretation of these results. Especially pertinent for this study was its level of analysis. Correlations among the 16 domains, or subscales, of the ABS-S:2 were subjected to EFA. Item level data were unavailable (Elizabeth Allen, personal communication, November 28, 2000), so item and item parcel analyses could not be conducted. Thompson et al. (1999) noted that level of analysis (i.e., item, item parcel, subscale) is often responsible for variations in the number of factors identified in factor analytic studies of adaptive behavior. Nevertheless, current results support the conclusion of Stinnett et al. (1999) that clinicians using the ABS-S:2 "should guard against interpretation of domain scores as if they reflect unique and separate adaptive skills" (p. 42).

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