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The construct validity of four dimensions of adaptive and maladaptive behavior was investigated using the multitrait–multimethod matrix procedure of Campbell and Fiske (1959). Measures of four traits—cognitive competence, social competence, social maladaption, and personal maladaption—were obtained on a sample of 157 persons with moderate, severe, or profound mental retardation using each of three methods of measurement—standardized assessment instrument, day shift staff ratings, and evening shift staff ratings. Applying the Campbell and Fiske rules of thumb and recently proposed structural equation modeling techniques to the data demonstrated strong convergent validity, clear discriminant validity, and only moderate levels of method variance in the observed measures. Implications of the results for the assessment of adaptive behavior and its dimensional structure were discussed.

The domain of adaptive behavior has been the focus of considerable research activity over the past 30 years. One major factor motivating this trend was the incorporation of adaptive behavior in the official American Association on Mental Deficiency (now the American Association on Mental Retardation) definition of mental retardation (Heber, 1959; Grossman, 1983; Luckasson et al., 1992). According to this definition, a person with mental retardation should exhibit both subnormal intelligence and significant deficits in adaptive behavior during the developmental period. A second impetus to research on adaptive behavior is the value of such information when characterizing individuals with mental retardation and their behavior. Simply citing relatively low IQ tells little about the behavioral competencies of an individual. In contrast, a profile of scores across several dimensions of adaptive behavior provides a wealth of information that is useful for understanding that person and providing him or her with appropriate life experiences (e.g., placement, employment).

Because of the importance of adaptive behavior for research, theory, and practice in mental retardation, the validity of dimensions of adaptive behavior is an important topic of study (Meyers, Nihira, & Zetlin, 1979). Several related research tactics can be distinguished for investigating the validity of measures of behavioral constructs. One tactic is the validation of the scores provided by a particular instrument, demonstrating that the scores relate to important criteria. Studies of this sort (e.g., Menchetti & Rusch, 1988; Spreat, 1980) support the use of the validated instrument for its intended purposes.

A second tactic focuses on the construct validation (Cronbach & Meehl, 1955) of the dimensions comprising a domain. Factor analytic studies of the adaptive behavior domain (e.g., Bruininks, McGrew, & Maruyama, 1988; Nihira, 1969a, 1969b, 1976; Widaman, Geary, & Gibbs, 1991; Widaman, Gibbs, & Geary, 1987) may be viewed as exemplars of this tactic. Such studies attempt to show that a consistent set of dimensions may be identified across populations of subjects or across measuring instruments, but clear consensus on the structure of adaptive behavior has not yet been reached, as revealed by two recent reviews. In one, McGrew and Bruininks (1989) concluded that a single, general factor of Personal Independence or Functional Autonomy was sufficient to span the domain of adaptive behavior, as other factors appeared inconsistently across studies or samples. However, they explicitly disregarded analyses based on item- or parcel-level data, basing their conclusions only on subscale-level data analyses. In a later review, Widaman, Borthwick-Duffy, and Little (1991) considered all factor analytic studies, regardless of measurement level, and provided a critical commentary on the quality of studies. They argued that (a) at least four factors were required to span the adaptive behavior domain and two additional factors were needed for the maladaptive behavior domain and (b) representing the adaptive behavior domain with only a single, general factor might seriously misrepresent this domain of behavior. Further research is clearly required to resolve such disagreements.

There are at least two additional approaches to the construct validation of dimensions of adaptive behavior. One involves determining whether adaptive behavior scores discriminate significantly among groups of individuals with mental retardation who are expected to differ in their levels of adaptive and maladaptive behavior. For example, Scanlon, Arick, and Krug (1982) found that people with mental retardation in four living situations representing ranges of restrictiveness differed significantly on several forms of maladaptive behavior. Campbell, Smith, and Wool (1982) similarly reported that among individuals with mental retardation living in private settings, maladaptive behaviors were the primary variables discriminating those previously referred for institutionalization from individuals never so referred. In an earlier study, Spreat (1980) found that certain forms of both adaptive and maladaptive behavior discriminated among three groups of individuals with mental retardation who had resided in a state institution—already discharged, referred for discharge, and current residents. More recently, Menchetti and Rusch (1988) compared four groups of individuals with varying levels of mental retardation and employment histories (e.g., mentally retarded with only sheltered workshop experience) and reported that the four groups differed significantly on all eight scales of an instrument assessing vocational and social domains.

However, a more direct approach to construct validation is to investigate the correlations among purported measures of the same constructs, thereby studying the nomological network of relations among measures (Cronbach & Meehl, 1955). In one such study, Pawlarczyk and Schumacher (1983) correlated scores on the AAMD Adaptive Behavior Scale (ABS) with scores from the Behavioral Development Survey. The ABS has two parts; Part I consists of 10 domains of adaptive behavior, and Part II yields scores on 14 domains of maladaptive behavior. The Behavioral Development Survey was developed as a shortened form of the ABS but has a rather different scale structure, providing scores on three dimensions of adaptive behavior and two of maladaptive behavior that were modeled after factors discussed by Nihira (1976). Despite the differences across instruments in dimensional scores obtained, Pawlarczyk and Schumacher concluded that the Behavioral Development Survey had quite high concurrent validity for assessing both adaptive and maladaptive behaviors because the three Behavioral Development Survey adaptive scales correlated highly with the 10 ABS Part I adaptive behavior domain scores, and the two Behavioral Development Survey maladaptive behavior scales correlated highly with many of the 14 maladaptive behavior scales from ABS Part II.

The study of the correlations among measures of the same construct was formalized by Campbell and Fiske (1959), who described the use of the multitrait–multimethod matrix. To use this matrix, one obtains measures for each of two or more constructs employing each of two or more methods of measurement. By arraying constructs in a consistent order within methods, one may gauge the convergent and discriminant validity shown by the observed measures through systematic comparisons of elements of the multitrait–multimethod matrix. Correlations between measures of the same construct obtained using different methods of measurement are termed *validity diagonal elements*. If these elements are large, there is evidence of convergent validation of measures. Conversely, if validity diagonal elements tend to be larger than correlations (a) between measures of different constructs obtained using different methods of measurement and (b) between measures of different constructs using the same method of measurement, then the measures exhibit discriminant validity. During the past 20 years, several researchers (e.g., Bagozzi, 1978; Jöreskog, 1971, 1974; Schmitt, 1978) have described structural modeling approaches designed to represent the notions of convergent and discriminant validation. Widaman (1985) systematized these models into a taxonomy of nested models for multitrait–multimethod data. Regardless of the method of evaluating the data, convergent and discriminant validation using the multitrait–multimethod matrix remains one of the most rigorous approaches to construct validation yet proposed.

In two studies, investigators used the multitrait–multimethod approach to evaluate the construct validity of measures of adaptive behavior. Futterman and Arndt (1983) investigated the convergent and discriminant validity of the constructs of adaptive behavior and mental age (MA) using three methods of measurement—program participation, psychometric ratings or scales, and overall ratings by psychologists or caretakers. Based on data from a sample of 66 institutionalized individuals with mental retardation, adaptive behavior exhibited good convergent validity, whereas MA showed lower and only moderately acceptable convergent validity. However, both adaptive behavior and MA showed only fair to poor discriminant validity, almost certainly a result of the rather crude scales on which certain measures were obtained.

In the second study, Middleton, Keene, and Brown (1990) reported a multitrait–multimethod investigation of six dimensions of adaptive behavior measured using two instruments or methods, the Scales of Independent Behavior (Bruininks, Woodcock, Hill, & Weatherman, 1985), and the revised Vineland Adaptive Behavior Scales (Sparrow, Balla, & Cicchetti, 1984). Based on 53 individuals varying widely in level of mental retardation, convergent validation of the six adaptive behavior constructs was rather good, with five of six validity diagonal elements greater than $r = .75$. However, discriminant validity was a problem, as only two of the six dimensions of adaptive behavior satisfied all of the Campbell and Fiske (1959) rules for discriminant validation. This latter result was likely due to the lack of precisely equivalent construct definition across instruments.

The construct validity of dimensions of adaptive behavior is a significant topic for researchers in mental retardation, given the importance of the adaptive behavior domain for research, theory, and practice in this area. The present study was designed to extend previous multitrait–multimethod investigations of adaptive behavior by (a) including dimensions of both adaptive and maladaptive behavior of individuals with mental retardation; (b) obtaining a larger, more adequate sample size; and (c) utilizing both the Campbell and Fiske (1959) and structural modeling approaches to evaluating the data.

Method

Sample

A sample of 160 residents of a large California state-operated developmental center for individuals with mental retardation was selected randomly from resident lists, 4 residents per living unit from each of 40 units. Due to incomplete data for 3 residents, the final sample consisted of 157 individuals (66 females, 91 males) with moderate ($n = 19$), severe ($n = 44$), or profound ($n = 94$) mental retardation. Their mean age was 31.8 years (standard deviation [SD] = 13.0).

Instruments

Client Development Evaluation Report. We used two instruments for assessing adaptive behavior. The first was the Client Development Evaluation Report (California State Department, 1978), a standardized instrument of adaptive behavior that contains 66 items spanning the domains of adaptive and maladaptive behavior. This measure is a state-mandated instrument that is completed annually for clients receiving services from the Department of Developmental Services of the state of California. Resulting scores are incorporated in a state data bank established to aid in determining accounting and programming needs related to service delivery for individuals with mental retardation. In developmental centers in California, a direct-care staff person who knows the client and his or her behavior well completes the report, supplying information on the person's capabilities and behaviors.

The typical Client Development Evaluation Report item format uses a 4- or 5-point scale. On each item, each scale point is explicitly behaviorally referenced to indicate differences in the quality, severity, or frequency of the referent behavior. Recent studies (Widaman et al., 1987; Widaman et al., 1993) have revealed a highly replicable factorial structure for the Client Development Evaluation Report across 20 samples of individuals with mental retardation. The six factors are Motor Competence (12 items), Independent Living Skills (9 items), Cognitive Competence (14 items), Social Competence (6 items), Social Maladaption (9 items), and Personal Maladaption (7 items). Because the focus of the present study was a multimethod investigation of the Cognitive Competence, Social Competence, Social Maladaption, and Personal Maladaption factors, only the 36 items related to these four dimensions were utilized.

Semantic Differential Rating Scales. The second instrument used to obtain indices of adaptive behavior was comprised of a set of rating scales that were developed for the present study. In order to reflect the domains of behavior covered by each of the four Client Development Evaluation Report factors, we created several item stems for each factor. Associated with each item stem were three 7-point rating scales in semantic differential format (i.e., with polar opposite adjective pairs defining the scale endpoints and with seven unlabeled underscores defining the 7-point rating scale bounded by the endpoints). For the Cognitive Competence factor, three item stems were used, one of which was "This resident's academically-related cognitive skills (for example, writing, reading, arithmetic, and related skills) as displayed over the last year have been ___________." The remaining two items stems inquired about each resident's ability to communicate, covering both receptive and expressive communication, and about the resident's day-to-day cognitive skills, such as abilities in handling money and using transportation facilities. After reading each item stem, the respondent rated the resident's skills on three 7-point scales with the following endpoints: *functional–nonexistent*, *good–poor*, and *strong–weak*.

Three stems developed to assess Social Competence inquired about the resident's (a) social interactions with others on a one-to-one basis, (b) social interactions in group settings, and (c) demonstrated ability to establish and maintain friendships over the preceding year. After reading each of these stems, raters recoded their evaluations on three 7-point scales with the following endpoints: *performed easily–performed with difficulty*, *frequent–rare*, and *adaptive–not adaptive*.

To measure the two maladaptive dimensions, we employed five item stems, which covered the following domains: (a) aggressive or abusive behavior toward other individuals; (b) destructive behavior toward the property of others; (c) sexual behavior; (d) behavior characterized as hyperactive, overemotional, or uncooperative; and (e) physically self-abusive behavior. Three 7-point rating scales were associated with each of the five maladaptive behavior item stems. The adjectives marking the scale endpoints varied across stems, as certain polar-opposite adjective pairs were quite appropriate for certain stems but inappropriate for others. A total of 10 of the 15 rating scales assessed socially maladaptive behaviors, and the remaining 5 scales assessed personally maladaptive behaviors.

For the indices of adaptive behavior derived from the rating scales, the Cognitive Competence scale score was a simple sum of the 9 individual ratings, the Social Competence scale score was also a simple sum of 9 ratings, and the Social Maladaption and Personal Maladaption scores were simple sums of 10 and 5 ratings, respectively. On all measures of maladaption, higher scores indicated greater levels of maladaptive behavior.

Procedure

Once the names of the 160 residents were randomly selected from living unit lists, a check of the state data bank was made to ensure that a Client Development Evaluation Report had been completed on each resident within the last year. Then, one day-shift and one evening-shift group leader, usually a psychiatric technician, on each resident's unit who knew the resident well completed the set of semantic differential rating scales describing the resident's behavior. Thus, the set of rating scales was completed on each resident by one day-shift staff member and one evening-shift staff member.

Analyses

A 12 × 12 multitrait–multimethod correlation matrix comprised of correlations among measures of cognitive competence, social competence, social maladaption, and personal maladaption obtained using the Client Development Evaluation Report, day-shift (A.M.) rating, and evening-shift (P.M.) rating methods was the basis for validational analyses.

Campbell and Fiske Procedures. The patterns of intercorrelations among measures were evaluated using two methods. The first consisted of application of the four qualitative rules suggested by Campbell and Fiske (1959): (a) evaluate the statistical significance and magnitude of each validity diagonal value, (b) compare each validity diagonal value to corresponding heterotrait–heteromethod values, (c) compare each validity diagonal value to corresponding heterotrait–monomethod values, and (d) evaluate the consistency of trait interrelations in each heterotrait triangle. Researchers typically simply report the proportion of times that data satisfy each of the four Campbell-Fiske rules.

Structural Modeling Approach. The second method of evaluating relations among measures in the multitrait–multimethod matrix involved the fitting of a number of structural equation models to the matrix. The use of structural modeling requires a priori hypotheses regarding the structures or processes that underlie the observed variables. In multitrait–multimethod studies, the common assumptions are that individual differences, or variability, on observed variables may reflect three sources of variance: (a) trait-related variance, representing individual differences among subjects on the several trait dimensions; (b) method-related variance, reflecting in the present application a combination of measurement scale effects and rater bias processes; and (c) error variance, or random error of measurement. Given these hypothesized processes, one may specify structural models representing the several sources of variance. The ultimate goal is the determination of a parsimonious structural model, with a minimal number of parameter estimates, that adequately explains the covariances among the observed variables.

After reviewing previous contributions to the structural modeling of multitrait–multimethod data (e.g., Bagozzi, 1978; Jöreskog, 1971, 1974; Schmitt, 1978), Widaman (1985) proposed several alternative ways to specify hierarchically nested series of structural models for such data. The approach used in the present study is consistent with procedures outlined by Jöreskog (1971): Start with the simplest, most reasonable model for the data and then add theoretically reasonable parameters as required to account for the data. Once an acceptable model was found that adequately represented the data, additional structural models were fit to the data, allowing valuable model comparisons proposed by Widaman (1985). One of these additional models forced trait factors to correlate perfectly; comparing the fit of this model to that of the most acceptable model provided a test of the discriminant validity of the trait factors. A second additional model fixed trait factor loadings and trait factor intercorrelations at zero; comparing the fit of this additional model to that of the most acceptable model enables a test of the convergent validity exhibited by the set of measures. A more complete, nonmathematical discussion of the rationale for these comparisons is provided by Widaman (1985).

All structural modeling was performed using the LISREL 7 program (Jöreskog & Sörbom, 1988). The fit of structural models was evaluated with regard to both statistical and practical criteria of fit. The likelihood ratio chi-square statistic associated with maximum likelihood estimation permits a determination of statistical fit of a model. If the chi-square value for a model is significant, the model is statistically rejectable in favor of an alternative model with at least one more parameter estimate. On the other hand, if the chi-square value for a model is nonsignificant, the model is a nonrejectable, hence acceptable, representation of the data. The chi-square statistic is, however, dependent on sample size and may, therefore, suggest rejection of a model that provides a fairly good and parsimonious representation of the data if sample size is large. As a result, two measures of practical fit were used. One measure, ρ, was originally proposed by Tucker and Lewis (1973); the second, Δ, was developed by Bentler and Bonett (1980). In a recent Monte Carlo study, Marsh, Balla, and McDonald (1988) found that the ρ index was perhaps the best index of practical fit available at the time; also, Δ has been widely used to evaluate structural models. Bentler and Bonett (1980) stated that models with ρ or Δ values under .90 should not be accepted, as such models can usually be improved substantially; Tucker and Lewis (1973) argued that models should attain ρ values over .95. In the present study, we accepted only models with ρ and Δ values over .95.

Also, we considered differences between models in ρ and Δ greater than .01 to be practically significant, a rule of thumb proposed by Widaman (1985) that aided in the identification of important changes in model fit in that study and in later research (Widaman et al., 1987; Widaman et al., 1993).

Results

The multitrait–multimethod matrix of correlations among the 12 observed measures is presented in Table 1. To provide comparability of scale scores, we divided each scale score by the number of items in the scale. The resulting means and *SD*s of the scale scores are presented as the last two lines of Table 1. In addition, coefficient alpha estimates of internal consistency reliability for each of the 12 scales are presented in parentheses along the diagonal of Table 1.

Campbell and Fiske Comparisons

The four rules for evaluating multitrait–multimethod matrices described by Campbell and Fiske (1959) were first applied to the data. The first rule concerns the convergent validities, or validity diagonal elements, and was well-satisfied by these data. All 12 convergent validity coefficients were highly significant, $p < .0001$, and were rather large, with a median of .616 and a range from .462 to .764. Thus, the data evidence fairly strong levels of convergent validity.

The second and third Campbell-Fiske rules relate to discriminant validity. The second rule holds that validity diagonal elements should be greater than corresponding elements in heterotrait–heteromethod triangles. In each of the 72 resulting comparisons, the second rule was satisfied. The third rule states that validity diagonal elements should be greater than corresponding heterotrait–monomethod values; in 57 of the 72 relevant comparisons, this third rule was satisfied. Therefore, the multitrait–multimethod matrix was clearly consistent with the second rule and was moderately consistent with the third rule, demonstrating clear discriminant validity of the observed measures.

The fourth rule concerns the consis-

Table 1
Multitrait–Multimethod Matrix of Correlations Among Measures of Adaptive Behavior by Rating Method

	CDER[a]				A.M. rating				P.M. rating			
Measure	Cog. Comp.	Soc. Comp.	Soc. Mal.	Pers. Mal.	Cog. Comp.	Soc. Comp.	Soc. Mal.	Pers. Mal.	Cog. Comp.	Soc. Comp.	Soc. Mal.	Pers. Mal.
CDER												
Cog. Comp.	(.929)											
Soc. Comp.	.599	(.873)										
Soc. Mal.	.002	−.146	(.690)									
Pers. Mal.	−.158	−.282	.679	(.728)								
A.M. rating												
Cog. Comp.	.741	.421	−.006	−.242	(.909)							
Soc. Comp.	.330	.462	−.069	−.280	.453	(.955)						
Soc. Mal.	.047	.006	.573	.417	−.054	−.170	(.869)					
Pers. Mal.	−.054	−.103	.471	.563	−.184	−.298	.715	(.805)				
P.M. rating												
Cog. Comp.	.688	.452	−.048	−.196	.764	.454	−.003	−.172	(.912)			
Soc. Comp.	.315	.495	−.100	−.227	.387	.699	−.061	−.216	.504	(.960)		
Soc. Mal.	.098	.046	.560	.365	.098	.017	.571	.470	.067	−.013	(.899)	
Pers. Mal.	−.057	−.045	.433	.501	−.122	−.118	.441	.639	−.100	−.177	.652	(.776)
Mean	1.812	1.587	2.661	3.655	6.017	5.162	3.427	3.251	5.904	4.892	3.262	3.060
SD	.667	.579	.711	.752	1.059	1.586	1.350	1.626	1.117	1.643	1.415	1.438

Note. For all correlations, $N = 157$. Parenthesized values are coefficient alpha reliability coefficients for each scale. Underscored values are validity diagonal elements, representing convergent validities. Cog. Comp. = Cognitive Competence, Soc. Comp. = Social Competence, Soc. Mal. = Social Maladaption, Pers. Mal. = Personal Maladaption.
[a]Client Development Evaluation Report.

tency of trait interrelations. In all nine heterotrait triangles, the same pattern of trait intercorrelations generally held: the Social Maladaption and Personal Maladaption scales were fairly highly correlated, the Cognitive and Social Competence scales tended to correlate at a somewhat lower level, Personal Maladaption correlated at still lower, but nonzero, levels with the two competence scales, and Social Maladaption correlated approximately zero with the two competence dimensions.

Overall, the multitrait–multimethod matrix satisfied quite well the four rules proposed by Campbell and Fiske (1959), exhibiting fairly strong levels of convergent validity and rather clear and consistent patterns of discriminant validity.

Structural Modeling Results

Specification of Structural Models. A series of structural equation models were next fit to the covariances among the observed measures, covariances computed using the correlations and *SD*s reported in Table 1. A summary of the results of model fitting is presented in Table 2.

Table 2
Goodness-of-Fit Indices for Structural Models Representing Multitrait–Multimethod Data

Model	Statistical fit[a]		Practical fit	
	χ^2	*df*	ρ	Δ
0. Null model	1,152.63	66	—	—
1. Correlated traits only	240.38	48	.757	.791
2. Correlated traits plus three orthogonal methods	81.89	36	.923	.929
3. Correlated traits plus six methods	46.32	39	.989	.960
4. Model 3, but with only one maladaptive trait factor	145.88	42	.850	.873
5. Model 3, but with only a single, general trait factor	383.16	45	.544	.668
6. Model 3, but deleting all trait factors	730.38	57	.282	.366

[a]All *p*s < .0001 except Model 3, for which $p = .196$.

The null model, Model 0, entailed the hypothesis of an absence of covariation among the observed measures and was an easily rejectable model, as shown in Table 2, $p < .0001$. The first substantive model considered was Model 1, a model that represented the hypothesis that covariances among the 12 observed measures were due solely to the influence of four correlated trait factors, representing Cognitive Competence, Social Competence, Social Maladaption, and Personal Maladaption. As shown in Table 2, Model 1 was also an easily rejectable model, based on both statistical significance, $p < .0001$, and level of practical fit, with both ρ and $\Delta < .80$.

Due to the lack of fit of a model employing only trait factors, a reasonable respecification of Model 1 involved the introduction of method factors, reflecting variance associated with the Client Development Evaluation Report, A.M. rating, and P.M. rating methods (see Jöreskog, 1971; Widaman, 1985). In Model 2, three orthogonal method factors were specified, each method factor allowing loadings for the four measures gathered using that method. The statistical fit of Model 2 was rather poor, $p < .0001$, and the practical fit of the model was of only borderline acceptability, $\rho = .923$ and $\Delta = .929$. A further respecification (not reported in Table 2), allowing correlations among the three method factors, failed to improve the fit of Model 2.

Because Model 2 had unacceptable levels of fit, we attempted a respecification of the method factors. Although each of the three methods of measurement utilized ratings of the behavior of an individual with mental retardation made by someone who knew that person well, it seemed reasonable that a rater might employ a certain mental set when rating such adaptive behavioral competencies and a rather different set when rating the person's tendencies toward maladaptive behavior. To allow for this, we specified six domain-specific method factors. That is, the two adaptive scales from the Client Development Evaluation Report loaded on one method factor, the two maladaptive scales on the next method factor, and similar method factors were specified for the A.M. and P.M. rating scale methods. The two Client Development Evaluation Report method factors were allowed to correlate as were the two A.M. method factors and the two P.M. method factors, but no other correlations among method factors were estimated. Finally, because each of the six method factors had only two loadings, loadings on each method factor were constrained to equality to improve the mathematical identification of the parameter estimates. When this model was fit to the data, one parameter estimate attained an unacceptable value; the correlation between the two A.M. method factors was estimated at -1.56. When the preceding correlation was fixed at the maximal allowable value (-1.0), the result was Model 3. (Because the correlation between the A.M. rating method factors was fixed at -1.0, the LISREL program reported that Model 3 had 40 *df*. However, because this correlation was initially estimated, its final value [-1.0] departed from zero, and this value enabled better fit of the model to the data, we assessed our Model 3 one additional *df*, leading to 39 *df* for the model. This is a conservative procedure, leading to somewhat poorer measures of statistical and practical fit than if the program-supplied figure of 40 *df* had been used.) As shown in Table 2, Model 3 was quite acceptable both statistically, $p = .196$, and practically, with $\rho = .989$ and $\Delta = .960$.

Given the goodness of fit of Model 3 to the data, no further model modifications designed to improve the fit of the model were attempted. However, three additional models were fit to the data to allow model comparisons of interest, described by Widaman (1985). Due to the rather high correlation between the Social Maladaption and Personal Maladaption factors, Model 4 was identical to Model 3 except that a single Maladaption factor was estimated, forcing all six maladaption measured variables to load on a single factor. As shown in Table 2, Model 4 was unacceptable on both statistical, $p < .0001$, and practical grounds, ρ and $\Delta <$ .9. Going further and forcing perfect correlations among all four trait factors resulted in Model 5, which had quite poor levels of fit to the data. The final model, Model 6, had method factors specified as in Model 3, but trait factor loadings and factor intercorrelations were fixed at zero. As shown in Table 2, Model 6 had very low levels of fit to the data, both statistically and practically.

Comparisons Among Nested Models. One major advantage accompanying the use of structural modeling of multitrait–multimethod data is the opportunity to compare the fit of nested structural models (see Bentler & Bonett, 1980, for discussion of nested models). Basically, one model, A, is nested within a second model, B, if Model B includes estimates of all parameters in Model A plus one or more additional parameters. If one model is nested within another, the difference in chi-square values for the two models is distributed as a chi-square variate with *df* equal to the difference in *df* for the two models.

Several interesting comparisons among nested models for the present data are presented in Table 3. The first comparison, between Models 0 and 1, revealed that addition of the four trait factors to the null model led to a great improvement in fit, both statistically and practically. The next two comparisons involve contrasts of Model 1 with alternate models incorporating method factors. Specification of three method factors in Model 2 resulted in highly significant improvements in fit over that of Model 1, with $\chi^2(12, N = 157) = 158.49, p < .0001$, and changes in ρ and $\Delta > .13$. However, specification of the six domain-specific method factors in Model 3 led to greater improvements in fit than did Model 2, $\chi^2(9, N = 157) = 194.06, p < .0001$, and changes in ρ and $\Delta > .16$, even though fewer additional parameters were estimated in Model 3 than in Model 2, 9 additional parameters versus 12, respectively. Because neither Model 2 nor Model 3 is nested within the other, comparison of

Table 3
Indices of Difference in Fit Between Structural Models Representing Multitrait–Multimethod Data

Model comparison	Model components tested	Difference in statistical fit[a]		Difference in practical fit	
		χ^2	*df*	ρ	Δ
Model 0 vs. 1	4 trait factors	912.25	18	.757	.791
Model 1 vs. 2	3 method factors	158.49	12	.166	.138
Model 1 vs. 3	6 method factors	194.06	9	.232	.169
Model 3 vs. 4	Discriminant validity of maladaptive factors	99.56	3	.139	.087
Model 3 vs. 5	Discriminant validity of all trait factors	336.84	6	.445	.292
Model 3 vs. 6	Convergent validity	684.06	18	.707	.594

[a]All *ps* < .0001.

Models 2 and 3 using the chi-square difference test is not possible. However, the better fit of Model 3 as against Model 2, coupled with the smaller number of estimates associated with Model 3, suggest that Model 3 is preferable to Model 2 as a structural model for the data.

Because Model 3 was an acceptable representation of the multitrait–multimethod data, the remaining three model comparisons allowed the estimation and testing of sources of variance crucial to the evaluation of the patterns of covariation in the data. For example, comparison of Model 3 with Model 4, in which only a single maladaptive factor was hypothesized, offered a test of the discriminant validity between, or the empirical discriminability of, Social Maladaption and Personal Maladaption. The resulting significant and large differences in statistical and practical fit between Models 3 and 4 indicated that the distinction between Personal and Social Maladaption is necessary for modeling the data adequately. Given the rather poor fit of Model 4, it is not surprising to find that the discriminant validity of the set of four trait factors, represented by the comparison of Model 3 with Model 5, was highly significant, with all measures of fit falling to dramatically lower levels if only a single trait factor, spanning both adaptive and maladaptive behaviors, was allowed. As a result, the model comparisons demonstrated the high degree of discriminant validity among the four trait factors.

To estimate and test the degree of covariation among measured variables due uniquely to convergent validation of measures required a comparison between Model 3, the acceptable model for the data, and Model 6, in which trait factors and their intercorrelations were deleted. As shown in Table 3, there was a great difference in fit between Models 3 and 6. All measures of fit were significantly poorer for Model 6 than for Model 3, attesting to the magnitude of convergent validity among the observed measures.

An estimate of method-related variance was obtained by comparing Model 3 with Model 1, as the latter model was identical to Model 3 except for the absence of method factors. As noted previously, the difference in fit between Models 1 and 3 was highly significant statistically and practically. Overall, the model comparisons reported in Table 3 suggest that there was strong convergent validation of measures and rather clear discriminant validity among the trait factors, albeit in the presence of a significant amount of method variance in the measures.

Parameter Estimates of Model 3. The parameter estimates for Model 3 are of interest, as Model 3 was the most acceptable representation of the multitrait–multimethod data. Parameter estimates, accompanied by their standard errors, for Model 3 are presented in Table 4. The first four columns of the factor loading matrix, shown in the top part of Table 4, correspond to the four trait factors. The loadings on these four factors were rather large and were all significant, lying between 8 and 14 standard errors from zero, $p < .0001$. The next six factors represent the domain-specific method factors. The factor loadings on the method factors tended to be rather lower than loadings on the trait factors but were still statistically significant, falling from 3 to 10 standard errors from zero, $p < .01$ to $p < .0001$. In the final column in the top half of Table 4, the unique variances of the observed variables are reported. The unique variance estimates tended to be rather small, but each was statistically significant.

In the bottom half of Table 4, correlations among the trait and method factors are reported. The highest correlation between trait factors was that between Social Maladaption and Personal Maladaption. Although the correlation between the two maladaptive factors was rather large, $r = .76$, the standard error was small, .05. As a result, the correlation between the maladaptive factors was approximately 5 standard errors from 1.0, echoing the model comparison reported previously revealing significant discriminant validity for the two maladaptive factors. The Cognitive Competence and Social Competence factors were also moderately correlated, $r = .58$, but the correlations among Maladaptive and Competence factors were fairly low. It is interesting that this pattern of correlations among the four factors is very similar to that found by Widaman et al. (1987) in factor analyses of parcels of items from the Client Development Evaluation Report.

The correlations among the domain-specific method factors provided an interesting pattern: The two Client Development Evaluation Report method factors and the two P.M. rating method factors were nonsignificantly correlated, whereas the two A.M. rating method factors were perfectly negatively correlated. (Because the freely estimated correlation of -1.56 [an unacceptable value] between the two A.M. rating method factors did not differ significantly from zero [due to its standard error of 3.24], a model constraining all method factors correlations to zero was specified. This model provided fairly good fit to the data, $\chi^2[2, N = 157] = 58.07, p = .051$, with $\rho = .975$ and $\Delta = .955$. Comparisons among properly specified models for assessing convergent and discriminant validity and the degree of method-related variance provided estimates consistent with comparisons involving Model 3, reported in Table 4.) Because correlations among method factors were hypothesized a priori, estimates from such a model are presented in Table 4. Specification of zero correlations among all method factors would, however, leave unaffected all substantive conclusions made on the basis of Model 3, shown in Table 4. The result is a model in which there were five effective sources of method-related variance.

Variance Estimates. Because trait factors were uncorrelated with method factors, squaring the common factor loadings provides estimates of variance related to trait and method factors. Estimates of the variance of each observed measure related to trait, method, and unique factors are presented in Table 5. Inspection of Table 5 reveals that trait-related variance far outweighed method-related variance for all measures. Furthermore, error variance tended to represent a rather small portion of the variance of each observed measure.

Discussion

The construct validity of four dimensions of adaptive behavior—Cognitive Competence, Social Competence, Social Maladaption, and Personal Maladaption—was strongly supported using the multitrait–multimethod matrix, a technique proposed by Campbell and Fiske (1959). Applying the four rules-of-thumb they developed, we found that rather high levels of convergent validity and quite acceptable levels of discriminant validity were exhibited by all measures of the four dimensions of adaptive behavior. In fact, the patterns of convergent and discriminant validation obtained in the present study appear to rival those shown in the best examples

Table 4
Parameter Estimates From Structural Model 3 for Multitrait-Multimethod Matrix

	Trait factors				Method factors						
Variable	Cog. Comp.	Soc. Comp.	Soc. Mal.	Pers. Mal.	CDER[a] Comp.	CDER Mal.	A.M. Comp.	A.M. Mal.	P.M. Comp.	P.M. Mal.	Unique variance
CDER											
Cog. Comp	.51(04)	.0*	.0*	.0*	.32(03)	.0*	.0*	.0*	.0*	.0*	.06(02)
Soc. Comp.	.0*	.35(04)	.0*	.0*	.32(03)	.0*	.0*	.0*	.0*	.0*	.11(02)
Soc. Mal.	.0*	.0*	.54(05)	.0*	.0*	.41(04)	.0*	.0*	.0*	.0*	.06(03)
Pers. Mal.	.0*	.0*	.0*	.50(06)	.0*	.41(04)	.0*	.0*	.0*	.0*	.15(03)
A.M. rating											
Cog. Comp.	.96(07)	.0*	.0*	.0*	.0*	.0*	.18(07)	.0*	.0*	.0*	.17(05)
Soc. Comp.	.0*	1.32(11)	.0*	.0*	.0*	.0*	.18(07)	.0*	.0*	.0*	.71(16)
Soc. Mal.	.0*	.0*	1.02(10)	.0*	.0*	.0*	.0*	.71(09)	.0*	.0*	.26(08)
Pers. Mal.	.0*	.0*	.0*	1.34(12)	.0*	.0*	.0*	.71(09)	.0*	.0*	.34(12)
P.M. rating											
Cog. Comp.	.95(08)	.0*	.0*	.0*	.0*	.0*	.0*	.0*	.41(08)	.0*	.19(07)
Soc. Comp.	.0*	1.34(12)	.0*	.0*	.0*	.0*	.0*	.0*	.41(08)	.0*	.69(16)
Soc. Mal.	.0*	.0*	1.09(11)	.0*	.0*	.0*	.0*	.0*	.0*	.66(09)	.40(10)
Pers. Mal.	.0*	.0*	.0*	1.12(11)	.0*	.0*	.0*	.0*	.0*	.66(09)	.41(10)
					Factor intercorrelations						
Cog. Comp.	1.0*										
Soc. Comp.	.58(06)	1.0*									
Soc. Mal.	.07(09)	–.08(10)	1.0*								
Pers. Mal.	–.19(09)	–.32(09)	.76(05)	1.0*							
CDER Adapt.	.0*	.0*	.0*	.0*	1.0*						
CDER Mal.	.0*	.0*	.0*	.0*	–.23(12)	1.0*					
A.M. Adapt.	.0*	.0*	.0*	.0*	.0*	.0*	1.0*				
A.M. Mal.	.0*	.0*	.0*	.0*	.0*	.0*	–1.0*	1.0*			
P.M. Adapt.	.0*	.0*	.0*	.0*	.0*	.0*	.0*	.0*	1.0*		
P.M. Mal.	.0*	.0*	.0*	.0*	.0*	.0*	.0*	.0*	.13(20)	1.0*	

Note. Tabled values are parameter estimates; standard errors (with decimal points omitted) are given in parentheses. All asterisked parameters were fixed at reported values to identify model. See Table 1 for explanation of abbreviations.
[a]Client Development Evaluation Report.

Table 5
Estimates of Trait, Method, and Error Variance Based on Structural Model 3 for Measures in Multitrait–Multimethod Matrix

	Variance		
Measure	Trait	Method	Error
CDER[a]			
Cognitive Competence	.608	.243	.149
Social Competence	.367	.303	.330
Social Maladaption	.562	.320	.118
Personal Maladaption	.445	.289	.266
A.M. rating			
Cognitive Competence	.818	.030	.152
Social Competence	.698	.014	.288
Social Maladaption	.578	.278	.143
Personal Maladaption	.680	.190	.129
P.M. rating			
Cognitive Competence	.718	.133	.148
Social Competence	.676	.064	.260
Social Maladaption	.583	.217	.199
Personal Maladaption	.594	.210	.196

[a]Client Development Evaluation Report.

presented by Campbell and Fiske (e.g., Table 12).

Procedures developed by Widaman (1985) for fitting structural models to multitrait–multimethod data were also applied to data from the present study. Structural modeling provides an advance beyond the rules proposed by Campbell and Fiske (1959) by allowing the determination of the goodness of fit of explicit mathematical/statistical models to the empirical data. When structural models were fit to data from the present study, the resulting model comparisons confirmed the high degrees of convergent and discriminant validity among the four dimensions of adaptive behavior and permitted the estimation of the significant amounts of method-related variance. Consideration of parameter estimates and associated estimates of variance components revealed the general predominance of trait-related, or construct-related, variance, although some measures also had substantial amounts of method and error variance. Though agreeing on the clarity of patterns evident in the data, the results of the structural modeling of the data provided a more explicit, detailed, and extensive representation of the patterns of convergent and discriminant validation of measures than did application of the Campbell and Fiske (1959) rules-of-thumb.

The results of the present study support the construct validity of the four dimensions of behavior as assessed by the Client Development Evaluation Report. The four Client Development Evaluation Report scales had somewhat lower estimates of construct-related variance than did the rating scale measures, but two aspects of the study may have contributed to this result. First, the Client Development Evaluation Report scores used in the study were based on regularly scheduled assessments of the individuals included in the study, assessments that were retrieved from the state data bank; these scores were, therefore, based on assessments that took place from 3 to 15 months prior to those on which the A.M. and P.M. ratings were based. Due to the well-known decay over time of reliable variance in measures, the estimates of trait-related variance for the Client Development Evaluation Report scales almost certainly represent lower bound estimates of validity. Future researchers should examine the convergent validity of Client Development Evaluation Report scales with other measures obtained at the same time of measurement. However, the time-lag in assessments was a central aspect of the present study in order to demonstrate the validity of the annual assessments of adaptive behavior residing in the state data bank, assessments that have been used in investigations of the structure of adaptive behavior (Widaman et al., 1987; Widaman et al., 1993) and of the growth and development of adaptive behavior over the life span (Eyman & Widaman, 1987). Second, the identical rating scale format was used for the A.M. and P.M. ratings. It is possible that method, or format, effects of the rating scales were represented as trait-related variance in the structural modeling, by enabling more similar score distributions on each scale relative to the comparable Client Development Evaluation Report scale. Further research could test such an hypothesis. However, given the considerations just discussed, the construct validity exhibited by the Client Development Evaluation Report measures was quite impressive.

Because identical forms of the rating scale instrument were used for the A.M. and P.M. ratings and because there may have been some overlap in the samples of individuals providing the Client Development Evaluation Report and A.M. or P.M. ratings, some may question whether the present study involved construct validation or, rather, some nonstandard form of reliability assessment of the observed measures. Supporting the labeling of the results as multitrait–multimethod construct validation, the design of the present study is virtually identical to several of the studies to which Campbell and Fiske (1959) applied the term *validation* (see especially Tables 11 and 12). In addition, previous investigators have had difficulty demonstrating high levels of agreement on assessments of forms of adaptive and maladaptive behavior gathered from day- and evening-shift personnel (see, e.g., Nihira et al., 1974). Because lack of day shift–evening shift agreement is often attributed to the lack of stability across the two work shifts of behavior exhibited by individuals with mental retardation, such studies appear to reflect more centrally the rubric of validity of measurement than that of reliability of measurement. Regardless, inclusion of more distinct and objective methods of measurement (e.g., use of critical incident reports to assess forms of maladaptive behavior) as well as other, well-standardized measures of adaptive behavior (e.g., the Vineland Adaptive Behavior Scales—Sparrow et al., 1984) would be a useful direction for future research.

The congruence of day-shift and evening-shift reports of behavior was reflected in the high levels of trait-related variance of these measures, but a divergence was noted in the rather different correlations between the two A.M. and the two P.M. method factors, -1.00 and .13, respectively. The difference in method factor correlations may represent a behavioral phenomenon requiring explanation. That is, the greater structure of activities and the greater number of service personnel during the day shift may affect the behavior of individuals with mental retardation, making their levels of adaptive behavior more consistent with their levels of maladaptive behavior. Or, evening-shift personnel may be more well-acquainted with all aspects of the behavior of a specific individual and may, therefore, have a more differentiated judgmental set when evaluating that person's behavior. Alternatively, the difference in method factor correlations may be artifactual. Estimation of values close to zero frequently leads to problems of empirical underidentification when using maximum likelihood estimation (van Driel, 1978); the very large standard error for the freely estimated A.M. method factor correlation was evidence of problematic estimation. Further research is required to determine whether the difference between A.M. and P.M. method factor results represents a reliable, valid behavioral phenomenon or an artifactual statistical one.

In summary, the present investigation provided substantial evidence for the construct validity of the four dimensions of adaptive and maladaptive behavior included in the study. The results of structural modeling of the data confirmed the substantial levels of trait-related variance, or convergent validation, of measures; the considerable levels of discriminant validity; and the lower, but still significant, levels of method variance. The present study is the first multitrait–multimethod study of dimensions of both adaptive and maladaptive behavior. Given the success with which the aims of the study were satisfied, the present investigation provides important, vital information regarding the construct validity of dimensions of adaptive and maladaptive behavior, as well as suggesting several fruitful avenues for future research on these dimensions of the behavior of individuals with mental retardation.

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