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THE FACTOR STRUCTURE OF ADAPTIVE BEHAVIOR

Kevin McGrew and Robert Bruininks
University of Minnesota

ABSTRACT

This article reviews the factor analytic research published since 1965 which has examined the dimensionality of the adaptive behavior construct. Similar to prior reviews, the construct of adaptive behavior was found to contain a large general factor interpreted as measuring personal independence. Up to five other secondary adaptive factors were also identified, although they are very inconsistent across research studies. The dimensionality of adaptive behavior was found to vary as a function of a number of methodological and scale variables, but does appear to represent a distinct area of functioning in addition to intelligence and achievement measures. Implications are discussed for practice and construct-related adaptive behavior research.

The formal inclusion of adaptive behavior in the definition of mental retardation reflects the increased attention this concept has received during the past 2 decades (Bruininks, Thurlow, & Gilman, 1987; Witt & Martens, 1984). The American Association on Mental Retardation *Manual on Terminology and Classification* (Grossman, 1973, 1977, 1983) includes adaptive behavior as an essential component in the diagnosis of mental retardation, and defined impairments in adaptive behavior as "significant limitations in an individual's effectiveness in meeting the standards of maturation, learning, personal independence, and/or social responsibility that are expected for his or her age level and cultural group" (Grossman, 1983, p. 11). A number of developments can be cited for the increased emphasis on adaptive behavior including, but not limited to, recent court decisions and legislation, the mainstreaming or normalization movement, concerns regarding bias in assessment practices, and the need for increased parent involvement in educational planning (Bruininks et al., 1987; Keith, Fehrmann, Harrison & Pottebaum, 1987; Witt & Martens, 1984).

This increased interest in the construct of adaptive behavior has resulted in further examination of the purposes and procedures of adaptive behavior assessment. The major purposes of adaptive behavior assessment have been identified as: (a) diagnosis and placement — identifying and diagnosing the existence of handicaps for making placement decisions; (b) program planning — providing information on current performance level and skills that require instruction; (c) program evaluation and management — evaluating progress of individuals and overall program effectiveness; and (d) population description and research — to describe better the functioning level of target groups and research samples for use by policy makers, administrators, and researchers (Holman & Bruininks, 1985). Despite the increased interest and discussion surrounding adaptive behavior, difficulty in operationalizing the adaptive behavior definition has hindered use of the construct (Reschly, 1985).

Contributing to the vagueness in definition is the lack of theory-driven research during the past decade; the majority of the research has focused primarily on measurement issues (Heath, 1986). An exception is the presence of a number of research studies which have

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Requests for reprints should be addressed to Kevin McGrew, 20293 Co. Rd. 45, Clearwater, MN 55320.

investigated the factor structure of adaptive behavior. Reviews of this factor analytic research have suggested that adaptive behavior is a multidimensional construct (Harrison, 1987). Based on a review of adaptive behavior factor analytic research from 1965 to 1979, Meyers, Nihira, and Zetlin (1979) concluded that the construct of adaptive behavior consisted of two dimensions; *autonomy* and *responsibility.* Meyers et al. considered the autonomy and responsibility factors to be dimensions that "would universally be determined in any competent studies employing the usual broad-ranged AB [adaptive behavior] scale" (p. 464).

The interpretation of adaptive behavior as a multidimensional construct is not universal. McCarver and Campbell (1987) note that the adaptive behavior factor analytic research is confounded by results which use different adaptive behavior scales, subjects, domains and variables, factor extraction methods, and levels of measurement (i.e., item, subdomain, or domain scores). McCarver and Campbell (1987) concluded that "while various authors... contend that empirical findings support the multidimensionality of adaptive behavior, the empirical evidence for this conclusion is sparse and inconclusive" (p. 201).

Since 8 years have elapsed since the Meyers et al. (1979) review, a period of time which has produced new adaptive behavior factor analytic studies with broader samples and new instruments, it would be informative to reexamine the available research. Such a reexamination could increase our understanding of the adaptive behavior construct, a prerequisite to the appropriate application of adaptive behavior assessment in psychoeducational practices. The current review was designed to reexamine the findings of Meyers et al. (1979) of studies completed before 1979 and newer studies completed since 1979, with the goal to extract systematically as much information as possible from the existing research. Using systematic review procedures (Light & Pillemer, 1984), the current review sought to determine whether the structure of adaptive behavior varied as a function of: (a) research methods, (b) adaptive behavior scale differences, or, (c) sample characteristics such as age, placement and living experiences, handicapped status, or degree of retardation.

Review Methods

Location of Studies

Copies of the manuscripts reviewed by Meyers et al. (1979) were secured. A hand search of the *Psychological Abstracts* was completed to cover the published research from 1979 to 1987 using the following keywords: *behavioral assessment, factor analysis, factor structure, factorial validity, measurement, mental retardation,* and *mentally retarded.* Only factor analysis studies that attempted to identify factors without *a priori* judgments dictated by existing instrument organization were included in the review. For example, Sparrow and Cicchetti's (1978, 1984) factor analyses of the *Behavior Rating Inventory for the Retarded* and the *Behavior Inventory for Rating Development* were excluded since these two studies only attempted to extract a predetermined number of factors that conformed to the *a priori* structure of the instruments. Studies were also selected only if they included a satisfactory number of adaptive behavior variables. A frequently mentioned rule-of-thumb is a minimum of three variables for each factor (Kim & Mueller, 1978a, p. 68). Since Meyers et al.'s (1979) review converged on two adaptive behavior factors, the minimum criterion of at least six adaptive behavior variables was employed. Studies which employ a small number of variables do "not permit the kind of variation and sampling of factor domains that is desirable to provide persuasive evidence for the interpretation of any factors that may be found" (Carroll, 1979, p. 8), and are likely to produce single factor solutions. Nine new sources were located, which when combined with Meyers et al.'s (1979) sources, resulted in the sixteen sources summarized in Table 1. Missing from Table 1 are some of the more recently published adaptive behav-

TABLE 1

Factor Analytic Studies Included in Review

Source/Data	Scale[a]	Level	Number/Type of Samples
Levin & Elzey (1968)	SFVCS	Item	1 — Retarded adult
Nihira (1978)	ABS-Reg	Item	2 — Retarded child 1 — Retarted adult
Silverman, Silver, Lubin & Sersen (1983)	MDPSBS	Item	2 — Retarded child 2 — Retarded adult
Reynolds (1981)	PCS	Item	1 — Retarded adult
Nihira (1976)	ABS-Reg	Parcel	6 — Retarded child 2 — Retarded adult
Widaman, Gibbs, & Geary (1987)	CDER	Parcel	6 — Retarded child 8 — Retarded adult
Owens & Bowling (1970)	PAR	Subscale	1 — Retarded child
Song, Jones, Lippert, Metzgen, Miller, & Borreca (1984)	WBRS	Subscale	1 — Retarded child & adult 1 — Normal child
Nirhira (1969a)	ABCL	Subscale	1 — Retarded adult
Nihira (1969b)	ABCL	Subscale	3 — Retarded child
Gaurnaccia (1976)	ABS-Reg	Subscale	1 — Retarded adult
Lambert & Nicoll (1976)	ABS-Psv	Subscale	2 — Retarded child 1 — Normal child
Katz-Garris, Hadley, Garris, & Barnhill (1980)	ABS-Reg	Subscale	1 — Retarded adult
Hug, Barclay, Collins, & Lamp (1978)	PAR	Subscale	1 — Normal child
Millsap, Thackrey, & Cook (1987)	ABIC	Subscale	1 — Normal child
Bruininks, McGrew, & Maruyama (in press)	SIB	Subscale	4 — Normal child 1 — Normal adult 1 — Retaded child 1 — Retarded adult

[a]*Note:* SFVCS = San Francisco Vocational Compentency Scale; ABS = AAMD Adaptive Behavior Scale (Reg-Regular, Psv-Public School version); MDPSBS = Minnesota Developmental Programming System Behavioral Scales; PCS = Personal Competency Scale; CDER = Client Development Evaluation Report; PAR = Preschool Attainment Record; WBRS = Wisconsin Behavior Rating Scale; ABCL = Adaptive Behavior Checklist; ABIC = Adaptive Behavior Inventory for Children; SIB = Scales of Independent Behavior.

TABLE 2
Summary of Coding System Used in Review of Adaptive Behavior Factor Analytic Research Studies

Date — date of publication

Variable characteristics

Scale — 1 = SFVCS *(San Francisco Vocational Competency Scale);* 2 = MDPSBS *(Minnesota Developmental Programming System Behavioral Scales);* 3 = PAR *Preschool Attainment Record);* 4 = WBRS *(Wisconsin Behavior Rating Scale);* 5 = SIB *(Scales of Independent Behavior);* 6 = ABS *(AAMD Adaptive Behavior Scale);* 7 = ABCL *(Adaptive Behavior Checklist);* 8 = PCS *(Personal Competency Scale);* 9 = CDER *(Client Development Evaluation Report);* 10 = ABIC *(Adaptive Behavior Inventory for Children).*

Domain — 1 = adaptive; 2 = adaptive and maladaptive; 3 = adaptive, maladaptive and other miscellaneous; 4 = adaptive and other miscellaneous.

Total number of variables — Total number of adaptive and/or maladaptive variables included in the study.

Total number of adaptive behavior variables — Total number of adaptive variables included in the study.

Total number of maladaptive behavior variables — Total number of maladaptive variables included in the study.

Level — 1 = Items; 2 = Item parcels; 3 = Subscale/subtests.

Sample characteristics

Sample type — 1 = Samples with retardation; 2 = Samples without retardation.

Sample placement — 1 = Normal; 2 = Community; 3 = Institutional/Community; 4 = Institutional.

Degree of retardation — 1 = Normal; 2 = Mild/Moderate; 3 = Severe/Profound; 4 = Mixture of mild/moderate and severe/profound.

Sample size — The number of subjects in the sample.

Age-range — The difference in years between the youngest and oldest subject in the sample.

Mean chronological age — Mean age of sample in years. If reported, actual mean was recorded. In some studies an estimated mean age was determined by inspecting the distribution or range of ages reported and estimating the middle value.

Factor analysis method characteristics

Extraction — 1 = Principal axes or components; 2 = Other (e.g., key clustering) or unspecified.

Criteria — 1 = Kaiser; 2 = Scree Test; 3 = Kaiser and interpretability; 4 = Scree and interpretability; 5 = Kaiser, Scree, and interpretability; 6 = Other or unspecified.

Rotation — 1 = Orthogonal; 2 = Oblique; 3 = Orthogonal and oblique; 4 = Unspecified.

Salience — The minimum factor loading used to identify variables that loaded on factors (e.g., .40, .45).

Number of Factors

Number of adaptive factors — Number of final adaptive factors that were identified and interpreted in the study.

Number of maladaptive factors — Number of final maladaptive factors that were identified and interpreted in the study.

Number of miscellaneous factors — Number of non-adaptive/maladaptive factors identified in studies that included other variables (e.g., age, sex).

ior scales, which when factor analyzed will add important information to the research literature. Missing are results from the Comprehensive Test of Adaptive Behavior (CTAB; Adams, 1984a), the Normative Adaptive Behavior Checklist (NABC; Adams, 1984b), and the Vineland Adaptive Behavior Scales (VABS; Sparrow, Balla, Cicchetti, 1984). These scales could not be included in this review since they presented no factor analytic data at or since publication, or the results presented in the technical manual were not of sufficient detail for inclusion in this review.

Coding of Study Characteristics

Since an analysis of the structure of adaptive behavior as a function of age and handicapped status was considered important, each individual sample reported in each report was treated as a separate unit for analysis. Fifty-two separate samples were identified from the sources listed in Table 1. In addition to the *date* of each study, each sample was coded according to the 20 study characteristics presented in Table 2.

The *level* variable in Tables 1 and 2 is particularly critical to this review since adaptive behavior scales differ markedly in the number and breadth of subscales present between the individual items and the broad, total, composite score. Different within-instrument subscales, which "sound" as if they are measuring the same breadth of behavior, upon closer examination were found to be markedly different between scales. For example, the AAMD Adaptive Behavior Scale (ABS; Nihira, Foster, Shellhaas, & Leland, 1974) has *sub*domains which sound similar in breadth to *sub*tests or *sub*scales. However, the 25 ABS Part 1 subdomains are based on 66 items (an average of 2.6 items per subdomain), while the 14 *sub*scales from the Scales of Independent Behavior (SIB; Bruininks, Woodcock, Weatherman & Hill, 1984) are drawn from a pool of 226 items (average of 16.1 items per subscale). The 10 ABS domains, which semantically sound like "broader" measures, are even narrower (average of 6.6 items per domain) than the 14 narrow (in a relative semantic sense) SIB subscales. To insure comparability across studies, this review ignored the published scale labels and operationally defined three measurement levels: *items*, *item parcels*, and *subscales*. *Item* level investigations factored individual items. *Item parcel* studies refer to investigations which factored variables which were based on a small combination of items (average of 5 items or less per parcel). *Subscales* were defined as combinations of item parcels or measures with an average number of items higher than item parcels. For practitioners and researchers familiar with intelligence tests, the subscale level is conceptually similar to the familiar intelligence subtests (e.g., 12 Wechsler subtests). The use of this *level* variable allows the current review to: (a) determine if the adaptive behavior factor analytic research is confounded by the methodological characteristic of measurement level, and, (b) examine the results within a possible adaptive behavior structural hierarchy.

One report (Hug et al., 1978) required reanalysis prior to coding. This original Preschool Attainment Record (PAR) factor analysis was based on an intercorrelation matrix which included composite scores as well as subscales which contributed to the composites, a situation which introduces inappropriate singularity into the correlation matrix (Carroll, 1979). A subscale intercorrelation matrix extracted from the research report was refactored by the current investigators. Principal components analysis with Kaiser's objective criterion (as well as the interpretability of the factors) produced one large general factor. The reanalyzed results were coded for the current review.

Finally, although the term adaptive behavior often implies the attainment of those skills necessary for successful adaptation (adaptive behavior) and the reduction or absence of problem behaviors which interfere with adjustment (maladaptive behavior), the more conceptually- and research-oriented literature typically distinguishes between these two components (Bruininks et al., 1987). This adaptive/maladaptive distinction was

used in the coding and interpretation of the studies included in this review.

Results and Analyses[1]

Analysis of Research Across Measurement Levels

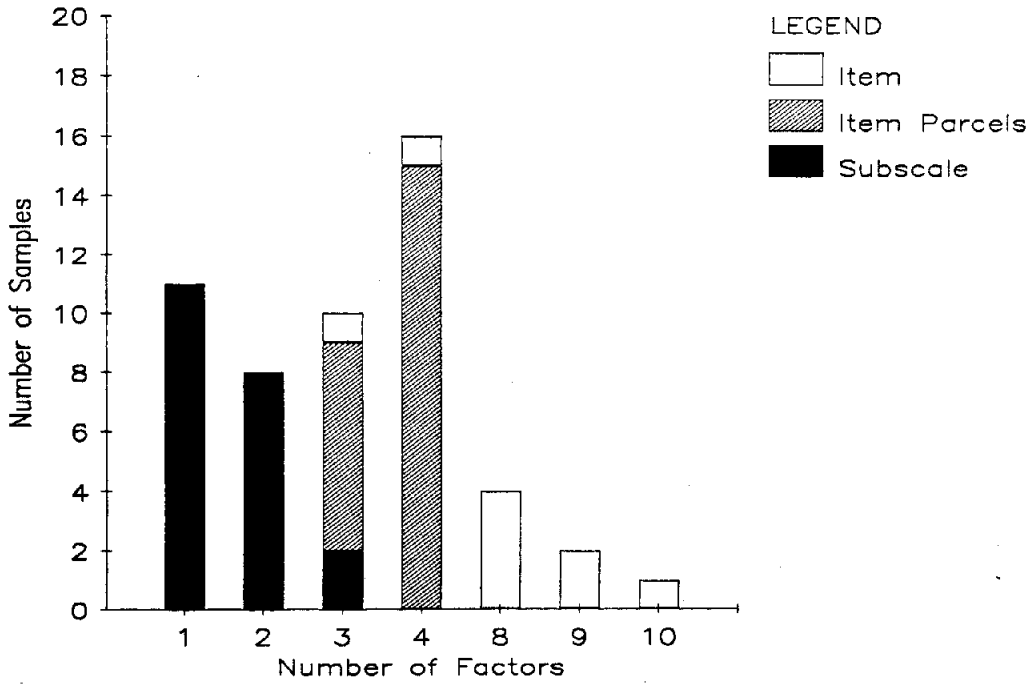
An analysis of adaptive behavior factor analytic research reveals significant variability in the number of adaptive factors which have been identified. More importantly, this variability appears directly attributable to the measurement level of the studies. Item-based studies have identified the largest number of adaptive behavior factors (M = 7.4 factors), followed by item parcel (M = 3.7 factors) and subscale studies (M = 1.6 factors). The mean number of maladaptive factors were 1.9 and 2.0 for the subscale and item parcel studies. These results suggest that the number of adaptive factors is a function of the number of variables included in the factor analysis, which in turn is a function of the three different measurement levels. This relation is highlighted by a correlation of .86 (n = 52, $p < .001$) between the number of adaptive variables included in the factor analyses and the number of identified adaptive behavior factors. This relation between level of measurement and number of adaptive behavior factors is clearly evident in Figure 1.

Figure 1 reveals the presence of three different distributions which are directly attributable to the measurement level of the adaptive behavior scales. It is clear that item samples produced the largest number of factors (typically 8-10). Item parcel studies typically produced three to four factors, and subscale factor analysis produced solutions with one to three factors, with 19 of the 21 studies producing either a one- or two-factor solution.

The relation between scale level, number of factored variables, and number of adaptive behavior factors was verified with two additional analyses. First, one scale (i.e., ABS) was identified that had been factored across all three levels. Although factoring the same scale, more factors were found in the ABS item studies (2 nine-factor and 1 ten-factor solutions) than ABS item-parcel studies (7 three-factor and 1 four-factor solutions), which in turn was followed by even fewer factors in the ABS subscale studies (1 one-factor, 3 two-factor, 1 three-factor solutions). Second, a stepwise multiple regression analysis was completed with the number of adaptive factors as the dependent variable. Independent variables in the regression were the date of each study, sample type (with or without retardation; dummy coded), sample size, mean chronological age, number of adaptive behavior variables, and measurement level (item, item parcel, or subscale).[2] Highly significant results were obtained using an alpha level of .15 to determine when to enter or remove variables (Bendel & Afifi, 1977). The first variable to enter the regression equation was the number of adaptive behavior variables (R = .86), followed by the measurement level variables (R = .92). Sample "date" entered last, but only increased the R to .93. The final R^2 of .87 was highly significant, F (4,47) = 80.23; $p < .001$. Thus, the highly related (and confounded) characteristics of number of adaptive variables and measurement level appeared to account for almost all of the variance in the number of adaptive behavior factors identified across studies. This relation could be interpreted as evidence that adaptive behavior may have a hierarchical structure of specific skills (items) which in turn reflect a smaller number of more general skills (item parcels), which in turn reflect a smaller number of more general traits (subscales), which in turn all reflect general adaptive functioning. However, these results could also indicate that the interpretation of the factor analytic literature is complex and confounded by methodological factors, and if not approached with appropriate methodological awareness, may lead to inappropriate conclusions.

Although a hierarchical interpretation of adaptive behavior is intriguing, the current literature does not allow an appropriate evaluation of this possibility. A review of the item-based studies (which could be interpreted as investigating the

FIGURE 1
Frequency of Samples Identifying Number of Adaptive Behavior Factors by Level of Scale Measurement



lowest level of the hierarchy) suggests that most researchers have not been cognizant of certain methodological problems inherent in the factoring of individual items. Thorndike (1982, p. 90) notes that the factoring of items "tend to produce unwanted 'difficulty' or 'popularity' factors that have nothing to do with the content of the items." Kim and Mueller (1978b, p. 74-75) also note that item factoring is inconsistent with the underlying assumptions of factor analytic methods. Although item factoring problems are typically discussed in the context of dichotomously scored items, the same problems are evident with variables that contain a limited number of categories, such as the multiple-point rating items present in many adaptive behavior scales (Kim & Mueller, 1978b, p. 74-75; See Bruininks and McGrew's, 1987, example with the SIB). If item factor analyses is necessary both Thorndike (1982) and Kim and Mueller (1978b) suggest the factoring of tetrachoric intercorrelation matrices rather than Pearson product-moment matrices, and then only for heuristic purposes.

A review of the item studies suggests that these methodological issues have been largely ignored in most item-based adaptive behavior factor analytic research. Of the four item sources listed in Table 1 (Levine & Elzey, 1968; Nihira, 1978; Reynolds, 1981; Silverman et al., 1983), only one (Silverman et al., 1983) acknowledged the presence of difficulty factors. All item studies either factored the product-moment correlation matrices or failed to report the type of correlation matrix which was factored. None of the sources reported the use of the recommended item-based factoring procedures. As a result, the item-based adaptive behavior factor analytic research appears to have ignored these important methodological issues. Although interpretation of factor analytic research across measurement levels within a hierarchical framework could be potentially impor-

tant, the above problems with the current existing item research does not allow for such interpretation at this time. Thus, it was decided that further analysis of adaptive behavior studies would focus exclusively on subscale level factor analytic research. As a result, this review analyzes the structure of adaptive behavior at the same level at which intelligence tests have been extensively factor analyzed.

The Dimensionality of Adaptive Behavior

The number of adaptive factors. As noted previously, subscale adaptive behavior factor analytic research has consistently suggested the presence of one to three factors. Nineteen of the 21 research samples produced either one- (11 samples) or two-factor (8 samples) solutions. The larger number of one-factor solutions is discrepant from Meyers et al. (1979, p. 464) conclusion that a two-factor solution "would universally be determined in any competent studies employing the usual broad-ranged AB scale". Since the current review questions this conclusion of Meyers et al., it was deemed important to investigate whether any study characteristics accounted for the difference.

A comparison of the subscale studies included in the current review with that of Meyers et al. (1979) found significant differences. Eighty-nine percent (eight of nine) of Meyers et al.'s subscale studies used the ABS or the ABCL (the predecessor of the ABS). In contrast, 92% (11 of 12) of the new samples added by the current review to those reviewed by Meyers et al. used scales other than the ABS/ABCL. Furthermore, the samples available for Meyers et al. were primarily mentally retarded (only one normal sample) and institutionalized samples (five of nine); the newer studies focused on a broader range of samples, including both normal (eight) samples and retarded (four) samples residing primarily in community settings (only 2 of the 10 new samples were classified as institutional). The addition of the 12 new subscale studies to those of Meyer's et al. greatly expands the diversity of samples and life experiences upon which to examine the construct of adaptive behavior.

Correlations between quantitatively coded study characteristics (Table 2) and the number of adaptive factors identified in each sample revealed no significant relation ($p > .05$) between the number of adaptive behavior factors and publication date (r = .11), total number of adaptive (r = .06) or maladaptive factored variables (r = .06), sample size (r = -.12), sample age characteristics (age range r = .01; mean CA r = -.18) or factor loading salience (r = .46) employed in factor interpretation. However, caution should be exercised when interpreting these correlations due to the restriction of range in the number of adaptive behavior factors.

The relation between number of adaptive behavior factors and scale and selected sample characteristics is presented in Table 3. The similar distribution of one-, two-, or three-factor solutions for the samples with and without retardation (i.e., breakdown by sample type) suggests no difference in the number of adaptive behavior factors in these two populations. The relatively similar distribution of one-, two-, and three-factor solutions in normal and institutional samples (i.e., breakdown by placement), and normal and heterogeneous samples with mental retardation (i.e., breakdown by degree of retardation), also suggests no apparent difference in number of adaptive factors in samples with and without retardation.

Table 3 also suggested the possibility that individuals with mild to moderate retardation (who live primarily in community settings) demonstrate more diverse adaptive behavior dimensions than nonretarded individuals. This was suggested by the observation that four of the five community samples displayed two to three factors and all three mild/moderate samples displayed two to three factors, while in comparison five of the nine normal samples displayed single factor solutions. However, closer inspection found that three of the four community samples with two to three factors used the ABS (Gaurnaccia, 1976; Lambert & Nicoll, 1976) and were the same as the

mild/moderate samples with two to three factors. In contrast, none of the single-factor solutions in normal samples used the ABS. In addition, the lack of a sufficiently large number of severe/profound samples, and the preponderance of studies where degrees of retardation were confounded (8 of the 12 samples with retardation were classified as mixed), made it impossible to investigate systematically the relation between levels of retardation and the dimensionality of adaptive behavior. Thus, with the limited factor analytic research available, one cannot definitively conclude that adaptive behavior is more multidimensional in samples of persons with mild to moderate retardation. At this time the differences in the number of factors identified in these samples appears more likely to be a function of different adaptive behavior scales.

The remaining breakdown by adaptive behavior scales suggests that the number of adaptive behavior factors identified in the literature is strongly influenced by differences in adaptive behavior scales. The breakdown by scales indicated that the majority of research samples factored either the SIB (seven) or the ABS (five). Although both the SIB and ABS display one-, two-, and three-factor solutions, there was a tendency for the SIB to produce more single-factor

TABLE 3

Analysis of Number of Adaptive Behavior Factors by Scale and Select Sample Characteristics for Subscale Level Studies (n = 21)

	Number of adaptive factors		
Breakdown	**1**	**2**	**3**
Scale			
Adaptive Behavior Inventory for Children	1	0	0
Preschool Attainment Record	1	1	0
Wisconsin Behavior Rating Scale	0	2	0
Scales of Independent Behavior	4	2	1
AAMD Adaptive Behavior Scale	1	3	1
Adaptive Behavior Checklist	4	0	0
Sample type			
With retardation	6	5	1
Without retardation	5	3	1
Placement			
Normal	5	3	1
Community	1	3	1
Institution/community	0	0	0
Institution	5	2	0
Degree of retardation			
Normal	5	3	1
Mild/moderate	0	2	1
Severe/profound	0	1	0
Mixed	6	2	0

solutions (i.e., four of the seven SIB solutions were single-factor) while the ABS produced more two-factor solutions (i.e., three of the five ABS solutions were two-factor). Another finding of interest was the apparent change in ABS factor structure from its earlier version (i.e., ABCL). The ABCL produced only one-factor solutions while its later version, the ABS, produced both two- and three-factor solutions.

Instead of reflecting scale differences, the very real possibility exists that the variation in number of adaptive behavior factors is a function of variability in factor analytic methods. Although almost all investigations (18 of the 21 samples) rotated the factors to be uncorrelated (i.e., orthogonal rotation), variability was noted in the use of traditional (viz., principal axes or components) versus nontraditional (e.g., use of key-clustering procedure by Lambert & Nicoll [1976]) extraction methods, and the specific criterion used to determine the number of factors to retain for interpretation. For example, Lambert and Nicoll's (1976) key-clustered studies all produced two-factor solutions, while the preponderance of principal axes/components studies (11 of 16 samples) produced single-factor solutions. Does this suggest that the adaptive behavior construct research is confounded by factor method differences? Furthermore, 16 of the samples used some variation of the Kaiser-Guttman rule (i.e., retaining only those factors with eigenvalues greater than one), a factor extraction criterion that according to some factor analytic experts may underestimate the number of factors (Carroll, 1983; Cliff, 1988). Does this mean that many of the factor analytic studies may underestimate the dimensions of adaptive behavior? As noted by Carroll (1983) and Cliff (1988), determining the number of "correct" factors to retain is one of the more fundamentally unresolved issues in factor analysis. Although it is impossible to answer the two factor-method questions raised in this review, they do serve to remind us that the adaptive behavior factor analytic research results may be confounded by variation in factor analytic methods. The current analysis of the number of adaptive factors that have been identified in the factor analytic research must be interpreted with great care.

To summarize, the limited number of subscale level adaptive behavior factor analytic research studies argues for cautious interpretation of these findings. This review tentatively suggests that adaptive behavior, as *operationalized by available assessment instruments and identified with a variety of factor analytic methods*, is typically found to be one- or two-dimensional. There does not appear to be a significant relation between the number of reported factors and characteristics of the samples (i.e., age, degree of retardation, type of sample). However, there does appear to be a relation between the number of adaptive behavior factors and the scale which was factored. In addition, comparisons of the number of factors across studies may be confounded by factor analytic method differences. It was impossible to disentangle these confound scale and method variables to determine if the research differences are due to different scales, the use of different factor extraction procedures, or both.

The type of adaptive factors. Meyers et al. (1979) concluded that adaptive behavior is a two-factor construct defined by autonomy and responsibility dimensions. The autonomy dimension was the first general factor to emerge in most studies reviewed by Meyers et al. Although investigators have used different terms to label this general dimension (e.g., functional autonomy, self-sufficiency, and personal independence), Meyers et al. concluded that this general factor represented the same dimension across studies. Since the current review has extended the work of Meyers et al. (1979), an analysis of the type of factors identified by assessment scales and type of sample was completed (Table 4).

The six factor categories presented in Table 4 are those which represent the most frequently mentioned (although often using different terminology) general domains of adaptive behavior (Gresham & Elliott, 1987; Reschly, 1982, 1987). The

TABLE 4

Type of Adaptive Behavior Factors Identified by Scales and Sample Types

Factors	Scales*				
	PAR	WBRS	ABCL/ABS	ABIC	SIB
Personal Independence	CR (1) CN (1)	CAR (1) CN (1)	CR (5) CN (1) AR (3)	CN (1)	CR (1) CN (4) AR (1) AN (1)
Responsibility					
Personal Social			AR (1) CR (2) CN (1) AR (1)		CN (1)
Functional Academic/ Cognitive					CR (1) CN (1)
Vocational/Community					AN (1)
Physical/Developmental	CR (1)	CAR (1) CN (1)			

Note: Samples abbreviated as: CR — Childhood with retardation; CN — Normal childhood; AR — Adolescent or adult with retardation; AN — Normal adolescent or adult; CAR — Combined childhood and adolescent/adult with retardation. Values in parentheses indicate the number of research samples in which factors were identified.

* Scale abbreviations: PAR — Preschool Attainment Record; WBRS — Wisconsin Behavior Rating Scale; ABCL — Adaptive Behavior Checklist (a forerunner of the ABS); ABS — AAMD Adaptive Behavior Scale; ABIC — Adaptive Behavior Inventory for Children; SIB — Scales of Independent Behavior.

Personal Independence or independent functioning category (Reschly, 1987) represents the most widely accepted component of adaptive behavior. Typically this dimension is the first large factor extracted in factor analytic studies, although investigators have often used different terms. Clearly similar in nature are the Personal Independence (Bruininks et al., in press; Gaurnaccia, 1976; Nihira, 1969a, 1969b), Functional Autonomy (Lambert & Nicoll, 1976), and General Adaptive Ability or Functioning (Hug et al., 1978; Millsap et al., 1987) factors. Although some factor labels initially suggest other dimensions — Song et al.'s (1984) Cognition factor, Katz-Garris et al.'s (1980) Social Desirability factor, and Owens and Bowlings (1970) Social Intelligence factor — all represent the large first factor extracted in each instrument and have been described by the investigators or others (Meyers et al., 1979) as conceptually similar to the Personal Independence factor.

A review of Table 4 reveals that the Personal Independence factor is the most consistently identified dimension across adaptive behavior scales and samples. An important question is whether the Personal Independence factor identified in different scales is the same dimension or whether each instruments Personal Independence factor is different. Interpretation of a common Personal Independence dimension across scales would require research which subjects a combined variable pool of a number of adaptive behavior scales to multivariate latent variable methods (i.e., joint factor analysis,

canonical correlation, structural equation modeling, multidimensional scaling [cf. Estabrook, 1984; Kaufman & McLean, 1986; McGrew, 1987; in these studies the *g* or general intelligence factor identified within two different intelligence tests was found to be similar to the *g* factor identified in joint test analyses]).

The other factor categories presented in Table 4 display considerable variability across adaptive behavior scales. The most frequent factors after the Personal Independence factor are those in the *Responsibility* category (Bruininks et al., in press; Gaurnaccia, 1976; Lambert & Nicoll, 1976). A clear definition of these factors is difficult to extract across studies, although these factors appear to define some aspect of "motivation and autonomy to manage one's own affairs as well as those of others" (Meyers et al., p. 454) and "meeting the expectations of others within a particular cultural context" (Reschly, 1982, p. 223). However, an alternative interpretation of Gaurnaccia (1976) and Lambert and Nicoll's (1976) Social Responsibility factors would be to place greater emphasis on the "social" half of the factor label (these reported factors do contain loadings on both responsibility and socially oriented variables). Such an alternative interpretation would suggest the presence of a category of *Social/Interpersonal* factors. This factor category reflects those interpersonal behaviors important for getting along with others (Reschly, 1982; 1987) and is consistent with the recent research which has investigated the relation between adaptive behavior and social skills (Gresham & Elliott, 1987). Such an interpretation is consistent with Gresham and Elliott's recent item-by-item analysis of the ABS (the only scale to report this type of factor in Table 4) which found that a substantial portion of the ABS concerns social behavior.

The remaining three factor categories are more clearly defined. The *Functional Academic/Cognitive* factors (Bruininks et al., in press) typically reflect fundamental literacy skills, time and number concepts, or language and conceptual competencies (Reschly, 1981, 1987). The *Vocational/Community* category reflects factors (Bruininks et al., in press) that assess the knowledge, attitudes, and skills considered prerequisites for successful adjustment in careers, jobs, work, and the community (Reschly, 1987). Finally, although possibly reflecting a dimension different from adaptive behavior (Greenspan, 1979; Reschly, 1987), *Physical/Developmental* factors, which reflect the physical aspects of ambulation, locomotion, perceptual development, and fine and gross motor coordination (Meyers et al., 1979), have been identified in certain scales (Owens & Bowling, 1970; Song et al., 1984).

Visual inspection of Table 4 leads to the conclusion that most adaptive behavior scales tap a general personal independence or adaptive functioning dimension across both young/old and retarded/nonretarded samples (although it has yet to be demonstrated that this is the same factor across instruments). However, marked differences are noted between and within scales in the extent to which they tap other adaptive dimensions at different ages and in different samples. The ABS and SIB appear to tap the largest number of dimensions, with the ABS appearing to have a greater representation of the responsibility or social/interpersonal aspects of adaptive behavior, while the SIB appears to provide for better coverage of functional academic/cognitive and vocational/community dimensions. However, even for these two scales the factors identified beyond the Personal Independence factor have only been reported for a very small number of samples. The numerous gaps in Table 4 highlights the fact that much is yet to be learned about the dimensionality of the adaptive behavior construct and the extent to which different scales consistently measure more than a personal independence dimension. The presence of up to five different types of factors suggests that the construct of adaptive behavior may be multidimensional (e.g., in the broadest case defined by personal independence, social functioning or responsibility, functional academic/cognitive, vocational/community, and physical/

developmental dimensions), although our current collection of instruments are inconsistent in coverage of these dimensions.

The Dimensionality of Maladaptive Behavior

Although the analysis of the maladaptive behavior domain was less complex than that for adaptive behavior it must be interpreted cautiously for a number of reasons. First, only seven research samples (Lambert & Nicoll, 1976; Nihira, 1969a, 1969b) were available and all used the same scale (the ABS or its predecessor, the ABCL). Second, all studies factored item parcels or a combination of items and item parcels. Although the nondevelopmental nature of maladaptive behavior items reduces the methodological concern of item difficulty factors, the use of item parcel measures suggests that the maladaptive behavior research is based on narrower samples of behavior than the subscale level adaptive behavior research.

With one exception (Nihira, 1969b) all samples produced two-factor solutions. Meyers et al. considered these factors analogous to the extra vs. intra-personality or adjustment dimensions frequently described in psychology (e.g., Schaefer, 1975), and were labeled social and personal maladaption. *Personal Maladaption* typically describes behavior directed inward in an autistic-like, self-abusive, or stereotypic manner, while *Social Maladaption* includes aggressive, destructive, antisocial behavior directed toward other people or objects in the environment (Bruininks et al., 1987). Further analysis of the maladaptive factors was not possible since only a limited number of samples were available, and more importantly, the results revealed little variability which could be investigated. In the absence of additional research since the Meyers et al. (1979) review, no new insights concerning the structure of maladaptive behavior are possible. Meyers et al.'s interpretation of a two-dimensional maladaptive construct must be viewed cautiously since only one scale was used in this research. The absence of factor analytic research with other maladaptive scales reveals a strong need for new research in this area.

Discussion

The current review provides a comprehensive synthesis of the adaptive behavior factor analytic research since 1965. A synthesis of this literature reveals a number of significant substantive and methodological conclusions.

Methodological Issues

The number of adaptive behavior factors which have been identified appears attributable to methodological variables. Item-based studies have identified the largest number of adaptive behavior factors (8-10). In contrast, item parcel and subscale studies have identified three to four and one to two factors, respectively. These results suggest that when attempting to analyze the adaptive behavior construct from a review of factor analytic research, investigators must consider the measurement level (i.e., items, item parcels, subscales) of the factored variables. Failure to recognize the importance of the measurement level of the factored variables may lead to inaccurate conclusions concerning the structure of adaptive behavior. An interesting hypothesis is that the relation between number of factors and measurement level is an indication of a hierarchical adaptive behavior structure. Although an interesting possibility, due to significant problems with the existing item-based factor research, it is argued that the current research base cannot appropriately evaluate this possibility. Because of the problems inherent in item-based factor analytic research (e.g., difficulty factors), which have largely been ignored in most research, it is argued that subscale level research currently provides the most solid foundation from which to evaluate the theoretical structure of adaptive behavior.

The Dimensionality of Adaptive and Maladaptive Behavior

A review of the subscale studies suggests that as many as five different types of adaptive behavior factors have been identified, although the majority of factor analytic research has identified one to two dimensions. In general, analysis of the research suggests that the number of adaptive behavior factors does not appear related to differences in sample types (i.e., young vs. old; samples with and without retardation; placement/living environments). However, there does appear to be a relation between the number of adaptive behavior factors and the scale which is factored. There may also be a relation between the number of factors and factoring method which is employed.

A review of 21 subscale-level samples suggests that the construct of adaptive behavior, as measured by existing scales, is currently partially defined. The most consistent finding was the presence of a personal independence dimension in most instruments, although it is currently impossible to determine whether this dimension is the same across instruments. Beyond this personal independence dimension a number of other factors were inconsistently identified and appear related to scale differences. Although some form of responsibility (or social) factor was the most frequent second or third factor, the specific nature of these secondary factors depended on the adaptive behavior scale being investigated. The presence of up to five different factors could be viewed as support for a multidimensional adaptive behavior construct (Harrison, 1987). The argument could be made that adaptive behavior is indeed multidimensional (i.e., including personal independence, physical/developmental, functional academic/cognitive, vocational/community, and social or responsibility dimensions), but we are limited in the measurement of these dimensions by inadequacies in our current collection of adaptive behavior instruments. Thus, practitioners should carefully select adaptive behavior scales that match the purposes of the assessment. Often more than one scale, or portions of different scales, may need to be used to provide the necessary information to answer specific referral questions. Practitioners will need to review the information in Table 4, as well as other adaptive behavior scale content analyses (Holman & Bruininks, 1985; Meyers et al., 1979; Reschly, 1982, 1987; Witt & Martens, 1984) when selecting adaptive behavior scales.

Analysis of the maladaptive behavior domain was less complex than that for adaptive behavior. With only one exception (Nihira, 1969b), all samples produced a two-factor solution. Meyers et al. considered these two factors to be analogous to the extra- versus intra-personality or adjustment dimensions frequently described in psychology; the factors were labeled social and personal maladaption. The absence of additional research since Meyers et al.'s review, as well as the fact this research is largely scale specific (viz., the ABS), suggests that Meyers et al.'s conclusion must be interpreted cautiously. A clear understanding of the structure of the maladaptive construct will only occur through additional research using a wider variety of instruments and samples.

An important issue in psychoeducational assessment is whether adaptive behavior measures add a significant dimension to the assessment of performance. While such measures are probably not highly multidimensional, they do appear to add significant information on the functioning of individuals, particularly in nonschool environments. Available research does suggest that adaptive and maladaptive behavior are separate, albeit conceptually related constructs. Other studies (Keith et al., 1987; McGrew & Bruininks, 1988), using a variety of multivariate procedures, suggest that such measures assess components of personal competence quite separate from those assessed by measures of intellectual functioning and academic achievement. While additional research is needed in this area, it does appear that measures of adaptive and maladaptive behavior add significant and independent information

in the assessment of personal competence and performance.

Implications for Research

A multidimensional interpretation of adaptive behavior, as well as the finding that the largest number of research investigations have identified one and not two adaptive factors, is discrepant from Meyers et al.'s (1979) conclusion that adaptive behavior is characterized by two dimensions. The discrepancy between the two reviews is related to the fact that most adaptive behavior research available at the time of Meyers et al.'s review was conducted primarily with one scale (i.e., AAMD Adaptive Behavior Scale — ABS). The current review includes seven additional years of research, and, as result, a greater variety of adaptive behavior scales and samples. The current review suggests that the structure of the adaptive behavior construct is still unclear and research in this area is confounded by certain methodological variables (viz., scale differences and factor extraction procedures). Advances in our understanding of the theoretical structure of adaptive behavior will require research in a number of areas.

First, research is needed which includes a broader range of samples (e.g., different placement/living settings; different degrees of retardation) and instruments. Research which analyzes a pool of variables from a number of different adaptive behavior instruments with multivariate latent variable methods (i.e., joint factor analysis, canonical correlation, structural equation modeling, multidimensional scaling) would be very helpful in determining if the personal independence factor and other similar-appearing factors are the same across instruments. Investigations with the newer adaptive behavior scales (viz., Comprehensive Test of Adaptive Behavior, Normative Adaptive Behavior Checklist, Scales of Independent Behavior, Vineland Adaptive Behavior Scales) is a high priority. Second, studies are needed where indicators of more than one construct (e.g., motor, adaptive behavior, maladaptive behavior, intelligence, achievement, and affective behaviors) are analyzed simultaneously. Such studies would likely clarify the nature of adaptive behavior in the context of broader personal competence measures. Third, the exploration of adaptive behavior in the context of other constructs needs to use a variety of sound research methods and analytical procedures. The development and testing of theoretical models (Greenspan, 1979) through confirmatory factor and covariance structure modeling procedures could be particularly helpful (e.g., Keith et al., 1987). Fourth, additional research needs to explore the structure of the maladaptive behavior construct in combination with adaptive behavior and other measures of personal competence. Exploratory research of the maladaptive domain has been limited to a handful of studies which have used a small number of scales. Finally, efforts should be made to develop and explore assessment scales which measure dimensions of personal competence which are lacking in current adaptive behavior scales (e.g., physical competence, social intelligence, motivational orientation) (Greenspan, 1979; Meyers et al., 1979), or, which are important (e.g., vocational/community dimension during adulthood, personal responsibility, social/interpersonal skills) but are typically scale dependent.

Finally, it is important to recognize that this body of literature rests on the use of methods among which experts within the field often disagree. Carroll (1979, p. 7) reminds us that "factor analysis is a very tricky technique; in some ways it depends more on art than science, that is, more in intuition and judgment than on formal rules of procedure". The numerous problems in factor analytic studies which result from inappropriate design and poorly chosen computational methods (Carroll, 1983) can result in inaccurate judgments regarding the structure of personal competence measures. This point should serve as a caveat that the derivation of theoretically pure information (unconfounded by variation in the use of factor methods by different investigators) regarding the construct of adaptive behavior is difficult to extract

from the factor analytic literature. Furthermore, parallels with the factor analytic research in the domain of intelligence indicates that the adaptive behavior research is in its stage of infancy. Although there have been decades of intense factor analytic investigations in the domain of intelligence, experts in the field still feel that the "mapping of the terrain" of intelligence is far from complete (Carroll, 1983, p. 30). In the domain of adaptive behavior, we are still at the stage of developing a working legend from which to start the initial mapping of the terrain.

FOOTNOTES

[1]The detailed coding of each sample by 20 characteristics produced much more data than could be reported in this report. More detailed individual sample descriptions and summary analysis across studies and measurement levels can be obtained by contacting the first author.

[2]The possibility of including the 10 different adaptive behavior scales, as well as other sample and factor method characteristics in the regression was considered but not completed. The inclusion of these additional variables would have required considerably dummy coding which would have increased the number of independent variables beyond a reasonable number for regression analyses in this size sample.

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