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A Comparison of Three Adaptive Behaviour Measures in Relation to Cognitive Level and Severity of Autism

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Abstract

Adaptive behaviour (everyday skills in social and practical domains; AAMR, 2002) is vital to the understanding of individuals with developmental disorders, including autism. Several measures of adaptive functioning are available and deciding among them can be difficult for clinicians. Conceptually, there is overlap between adaptive behaviour and other constructs included in assessments of individuals with autism. Previous research has found moderate correlations among adaptive functioning, cognitive level, and severity of autism. These are overlapping concepts, and the degree to which they overlap relates to the understanding and usefulness of the measures. This study examined the utility and construct validity of three widely used measures of adaptive behaviour, as rated by staff: the Vineland Adaptive Behavior Scales-Classroom Edition (VABS-Classroom; Sparrow, Balla, & Cicchetti, 1985), the Scales of Independent Behavior-Revised (SIB-R; Bruininks, Woodcock, Weatherman, & Hill, 1996), and the Adaptive Behavior Scale-School-Second Edition (ABS-S: 2; Lambert, Nihira, & Leland, 1993).

Adaptive behaviour refers to skills in conceptual, social and practical domains that an individual is able to demonstrate on a daily basis (AAMR, 2002). Knowledge about adaptive skills is critical to research, treatment and vocational planning and is required for the diagnosis of an intellectual disability, together with cognitive testing (AAMR, 2002; Fenton et al., 2003; Su, Lin, Wu, & Chen, 2008). However, there is no universally accepted measure of adaptive behaviour suitable for all age groups and diagnostic groups.

Cognitive skills are generally measured by directly testing an individual. The examinee is provided with a series of tasks and questions that are thought to tap into specific cognitive functions. Adaptive functioning, on the other hand, is typically measured via interviews or questionnaires that are given to respondents who are very familiar with the examinee. Skills within the domain of adaptive functioning are those that an individual demonstrates throughout the course of his or her typical routine. Therefore, these skills would not be directly observable to an outside examiner without significant and lengthy intrusion into the person's life. As a result, individuals who are thought to have close knowledge of these skills, such as family members, caregivers, and educators, are asked about the examinee's adaptive skills via interviews or questionnaires.

The present study is concerned with three widely used measures of adaptive behaviour that are suitable for school-aged individuals with autism: the Vineland Adaptive Behavior Scales-Classroom Edition (VABS-Classroom; Sparrow, Balla, & Cicchetti, 1985), the Scales of Independent Behavior-Revised (SIB-R; Bruininks, Woodcock, Weatherman, & Hill, 1996), and the Adaptive Behavior Scale-School-Second Edition (ABS-S: 2; Lambert, Nihira, & Leland, 1993). Table 1 provides a brief summary of the characteristics of each measure.

Vineland Adaptive Behavior Scales-Classroom Edition (VABS-Classroom)

The VABS-Classroom edition is a questionnaire designed to assess adaptive behaviours in school, therefore, it is typically completed by teachers or other school-based support staff (Sparrow et al., 1985). The VABS-Classroom is designed for use with children between the ages of 3 years and 12 years, 11 months, 30 days. The VABS-Classroom is composed of 244 items, each of which falls into one of four domains, which are further separated into 11 subdomains (Sparrow et al., 1985). Table 2 shows the categories found on all three measures of adaptive behaviour examined in this study.

The VABS-Classroom is reported to have high internal consistency, ranging from .80 to .95 for the four domains. Test-retest and inter-rater reliability are not reported for the VABS-Classroom. Satisfactory construct, content, and criterion-related validity are reported in the manual for the VABS-Classroom (Sattler, 2002). Comparisons between the VABS-Classroom and the Kaufman Assessment Battery for Children (K-ABC) revealed correlations typically in the range of .30s to .40s. The authors examined the correlation between the VABS-Classroom (teacher ratings) and the VABS-Survey form (parent interview) and found correlations ranging from .31 to .54 across domains (Sparrow et al., 1985). Cicchetti and Sparrow indicate that the agreement between the VABS-Survey Edition and the VABS-Classroom are at a level of acceptable clinical significance, noting that, "…both the Survey and Classroom editions of the Vineland can be used to compare either normal or handicapped children with the standardization samples…" (1989, p. 621).

Scales of Independent Behavior-Revised (SIB-R)

The SIB-R is "…designed to measure functional independence and adaptive functioning in school, home, employment and community settings" (Bruininks et al., 1996, p. 1) as well as problem behaviour (not considered in the present study). This measure can be administered either as a questionnaire or structured interview. The SIB-R has been normed for use with individuals from the age of 3 months to over 80 years.

Table 1. Characteristics of VABS-Classroom, SIB-R, and ABS-S: 2

	VABS-Classroom	*SIB-R*	*ABS-S:2*
Administration	Questionnaire	Questionnaire or structured interview	Questionnaire or structured interview
Number of items: adaptive behaviour	244	259	67
Number of items: maladaptive behaviour	0	8	38
Reported completion time	20 minutes	45-60 minutes	15-30 minutes
Minimum age	3 years	3 months	3 years
Maximum age	12 years	80+ years	21 years
Available domain scores	Standard score, percentile, age equivalent	Standard score, percentile, age equivalent	Standard score, percentile, age equivalent

Table 2. Categories of items found on the VABS-Classroom, SIB-R, and ABS-S: 2

VABS-Classroom Domains and Subdomains	*SIB-R Clusters and Subscales*	*ABS-S: 2 Factors and Domains*[1] *(Part One)*
Communication: Receptive, Expressive, Written	Social Interaction and Communication Skills: Social Interaction, Language Comprehension, Language Expression	Personal Self-Sufficiency: Independent Functioning, Physical Development
Daily Living Skills: Personal, Domestic, Community	Personal Living Skills: Eating and Meal Preparation, Toileting, Dressing, Personal Self-Care, Domestic Skills	Personal-Social Responsibility: Prevocational/Vocational Activity, Self-Direction, Responsibility, Socialization
Socialization: Interpersonal Relationships, Play and Leisure Time, Coping Skills	Community Living Skills: Time and Punctuality, Money and Value, Work Skills, Home/ Community Orientation	Community Self-Sufficiency: Independent Functioning, Economic Activity, Language Development, Numbers and Time, Prevocational/Vocational Activity
Motor Skills:[2] Gross, Fine	Motor Skills:[2] Gross, Fine	

[1] *Domains that are listed under two different factors (Independent Functioning and Prevocational/Vocational Activity) have individual items that belong to each of those factors*

[2] *Motor Skills are not represented in ABS-S: 2*

The 259 items of the SIB-R are separated into 14 subscales that are grouped into four adaptive behaviour clusters: Social Interaction and Communication, Personal Living, Community Living, and Motor Skills (Bruininks et al., 1996).

The SIB-R is reported to have high split-half and test-retest reliabilities (Sattler, 2002). The split-half reliabilities range from .70 to .88 for the subscales and .88 to .94 for the cluster scores. Test-retest reliability coefficients range from .83 to .96 across the various scales. Construct validity of the SIB-R has been established by comparing scores on the measure to chronological age (correlations range from .54 to .73) and to the Woodcock-Johnson Broad Cognitive Ability Scale, which produced a correlation of .82.

Adaptive Behavior Scale-School-Second Edition (ABS-S: 2)

According to the manual, the ABS-S: 2 is intended to assess the personal and community independence, and personal and social performance of school-aged children (Lambert et al., 1993). The norms for the ABS-S: 2 range from 3 years to 21 years of age. This measure has separate norms for individuals with and without intellectual disabilities. The ABS-S: 2 is separated into two parts: Part One consists of 67 items (plus one supplemental item for females) and is focused on personal independence (Lambert et al., 1993). Part One has been divided into three factors, nine domains and 18 subdomains. Part Two was not considered in the present study, but is concerned with the individual's maladaptive behaviours.

The ABS-S: 2 is reported to have high internal consistency reliabilities, ranging from .82 to .99, and test-retest reliabilities ranging from .42 to .79. Content validity, as indicated by correlations with the Weschler Intelligence Scale for Children-Revised (WISC-R), range from .28 to .59 for the domain scores, and .41 to .61 for the factors (Sattler, 2002).

The definitions of adaptive behaviour used by the creators of these measures are similar, but each is slightly different. As a result, the precise construct being assessed, despite the fact that all have been labelled as adaptive behaviour, may be subtly different. This, in turn, could impact the degree of correlation between the adaptive

behaviour measure and other constructs such as cognitive functioning, as suggested by the discrepant correlations with IQ reported above for each adaptive measure and these relationships may differ in autism as compared with general intellectual disabilities.

Adaptive Behaviour in Autism

Knowledge of adaptive behaviour is vital to a comprehensive assessment of individuals who have autism, many of whom also have developmental disabilities. Tomanik et al. (2007) reported that, when a measure of adaptive behaviour was included in the assessment battery along with the ADI-R (Lord, Rutter, & Le Couteur, 1994) and ADOS (Lord, Rutter, DiLavore, & Risi, 1999), diagnostic accuracy improved by 9%. Consequently, Tomanik and colleagues recommend including measures of adaptive behaviour in the assessment of individuals who potentially have autism in order to improve the accuracy of diagnosis, which is relevant to treatment planning.

It has often been reported that, for individuals with autism, adaptive behaviour tends to be more impaired than their cognitive skills would predict (Fenton et al., 2003; Gabriels, Ivers, Hill, Agnew, & McNeill, 2007; Tomanik, Pearson, Loveland, Lane, & Shaw, 2007) but this may not be the case at lower cognitive levels (Perry, Flanagan, Dunn Geier, & Freeman, 2009). It has also been reported that individuals with autism tend to have lower overall adaptive skills than age and IQ matched peers without autism (Gabriels et al., 2007; Perry et al., 2009). Nuovo and Buono (2007) found that the adaptive skills for their sample of individuals with autism co-occurring with mental retardation, were lower than for groups of individuals with mental retardation plus schizophrenia, personality disorders, mood disorders, ADHD, or epilepsy.

Due to some of the traits seen in individuals with autism, such as, difficulties with communication, social interactions, transitions, and motivation, this population is often difficult to assess using traditional cognitive tests. Because adaptive measures are based on informant reports, measures of adaptive behaviour are advantageous in that they do not require the individual to respond to an examiner, or to perform any tasks. Additionally, adaptive behaviour tests measure the skills an individual demonstrates in their natural environment, on a daily basis. However, scales that measure adaptive behaviour also have their disadvantages. Informant information is vulnerable to the biases and point of view of the respondent. As well, reliability between informants (e.g., parents and teachers) is often lower than what one would expect (Cicchetti & Sparrow, 1989), although this is common in other areas of assessment as well because different respondents make ratings based on different samples of behaviour, in different environments, and with different reference groups in mind. Tests of cognitive abilities assess skills in a limited time frame under specific conditions, and may not accurately illustrate the abilities of the individual when in a more natural setting. Because of the flexibility and utility of tests of adaptive behaviour, they are frequently used to inform the course of education and treatment, as well as to document the progress of individuals with autism (Carpentieri & Morgan, 1996; Gabriels et al., 2007).

There is more research on the use of the Vineland with individuals who have autism, than for either the SIB-R or the ABS-S: 2. Some literature has suggested a profile of responses for individuals with autism, the age equivalent scores on the social domain tend to be the lowest, scores on the communication domain tend to be in the middle, and the scores in the daily living domain tend to be the highest (Carter et al., 1998). However, other researchers have found that these patterns were not always consistent, and were dependent upon the level of cognitive ability and severity of autism (Fenton et al., 2003; Perry et al., 2009). Although an updated second edition of the Vineland measure is now available, the first version was used for this study due to the retrospective nature of the project, since the data were collected prior to the release of the second version of the Vineland measures.

The present study involves participants with autism and intellectual disabilities. It is important to know the degree of correlation of different measures of adaptive behaviour with both measures of severity of autism and with cognitive functioning because treatment and educational programming decisions are often made based on the needs of the client, as determined by his or her strengths and weaknesses in adaptive functioning. The use of different measures has the potential to impact the scope and

focus of intervention. If a measure of adaptive behaviour correlates too highly with measures of cognitive functioning, the measure may simply be a proxy for IQ and be omitting important features of adaptive behaviour that distinguish it from cognition. Conversely, we know from previous research that adaptive behaviour is, at least, moderately correlated with cognitive functioning (Freeman et al., 1999; Perry et al., 2009; Sparrow et al., 1985). As such, if a measure of this construct is not correlated with cognitive functioning, likely important features of adaptive behaviour are not being tested (Carpentieri & Morgan, 1996). Similarly, some research has shown that a test of adaptive behaviour is likely to have a moderate negative correlation with severity of autism (Perry, Condillac, Freeman, Dunn-Geier & Belair, 2005; Perry et al., 2009), which is not surprising since socialization and communication comprise major domains of the measure and deficits in these areas are characteristic of autism.

This study focused on the extent to which the VABS-Classroom, SIB-R, and the ABS-S: 2, completed by staff, correlate with measures of cognitive functioning and severity of autism. There has been very little research to date looking at different measures of adaptive behaviour and examining their relationships to these constructs in a comparative way.

Method

This was a file review study that utilized data collected over a period of 13 years, between 1993 and 2005 at the Treatment, Research and Education for Autism and Developmental Disorders (TRE-ADD) program at Thistletown Regional Centre. A client's file was included in the study if it contained one or more of the VABS-Classroom, SIB-R, or the ABS-S: 2, whichever was current best practice at the time of the assessment. All measures were completed as questionnaires by TRE-ADD staff, concurrently (within four months) with the completion of a test of cognitive functioning and a measure of severity of autism. Based on these criteria, 82 assessments were located from 50 client files. In some cases, an individual had more than one assessment (at different times) using different measures. All participants had a diagnosis of autism according to the criteria of the DSM version applicable at the time of assessment.

All groups had similar gender ratios and levels of autism severity. The participants in each of the groups had a wide age range, although the mean age was highest for the SIB-R group. The cognitive levels within each group were comparable, although they were somewhat higher in the SIB-R group. A summary of the participant characteristics can be found in Table 3.

The measure of severity of autism used in this study was the Childhood Autism Rating Scale (CARS; Schopler, Reichler, & Renner, 1988). The CARS is an observational measure consisting of 15 items, each of which is rated on a 7-point scale by a trained observer. The scores produced by the CARS range from 15 to 60, with higher scores signifying increasingly severe autism symptomology. The CARS is reported to have high inter-rater reliability, internal consistency, and discriminant validity in this population (Perry et al., 2005).

A variety of tests were used to evaluate cognitive functioning, including: the Mullen Scales of Early Learning (Mullen, 1995), the Bayley Scales of Infant Development (Bayley, 1993), the Weschler Intelligence Scale for Children: Third Edition (WISC-3; Weschler, 1991) and the Stanford-Binet Intelligence Scale: Fourth Edition (SB: IV; Thorndike, Hagan, & Sattler, 1986). The scores that were used from these measures were the overall cognitive level scores, typically Mental Age (MA). IQs, if even available, are often at the floor of the test in this sample. Therefore, if the test reported an IQ rather than an MA, MA was then calculated based on the participant's chronological age (CA) at the time of the test and the overall IQ score (MA= IQ x CA / 100). For participants 12 and older, 12 years was used as their CA. It has been noted that the growth curve of cognitive development tends to flatten between the ages of 10 and 12 years for individuals with severe and profound cognitive impairment (Grossman, 1983). Using a maximum CA of 12 years when calculating participants' Ratio IQ prevents older individuals from receiving significantly lower IQ scores simply because they are older, when in fact, their MA has remained relatively stable.

Table 3. Participant characteristics[1]

		VABS-Classroom (n = 39)	*SIB-R (n = 28)*	*ABS-S: 2 (n = 15)*
Gender	Male (n)	71.8% (28)	71.8% (20)	66.7% (10)
Total CARS Score	Mean (SD)	35.99 (3.84)	35.25 (3.98)	35.85 (3.39)
Age	Mean (years-months)	14-0	20-4	14-5
	SD (years-months)	4-8	8-3	8-6
	Range (years-months)	6-8 to 30-10	8-7 to 37-10	5-6 to 37-10
MA (months)	Mean	29.50	46.36	34.71
	SD	19.60	28.02	18.89
	Range	9 to 106	11 to 96	16 to 77

[1] *A total of 50 participants took part in this study. Twenty-five contributed one adaptive measure, 18 contributed two different measures, and 7 contributed all three (typically done at different points in time).*

Domain, subdomain, and overall age equivalent scores from each of the three measures of adaptive behaviour were correlated with MA, and severity of autism in order to evaluate the relationship between each of these constructs. Age equivalent scores, although they have certain limitations (Sattler, 2008) were chosen because they are the most comparable scores across measures and are less subject to floor effects in individuals with low skill levels. Unlike the other two adaptive behaviour measures, the ABS-S: 2 does not provide a general, overall score. The VABS-Classroom provides the user with the Adaptive Behavior Composite Score and the SIB-R generates the Broad Independence Score, but there is nothing comparable produced in the ABS-S: 2. For the purposes of this study, an overall adaptive functioning score was produced for the ABS-S: 2 by taking the average of the Part One Factor scores.

Results

The correlation between MA and the Adaptive Behavior Composite of the VABS-Classroom produced an r value of .82 ($p < .001$). For the Broad Independence Score of the SIB-R, $r = .68$ ($p < .001$), and for the overall score of the ABS-S: 2, $r = .76$ ($p = .001$), indicating strong and significant correlations for all of these measures. In addition to the overall adaptive behaviour scores, the relationship of selected scales from each measure to MA was also examined. The results of these analyses can be found in Table 4.

The correlation between severity of autism, based on the total CARS score, and the Adaptive Behavior Composite of the VABS-Classroom produced an r value of -.53 ($p = .001$). For the Broad Independence Score of the SIB-R, $r = -.53$ ($p = .004$), and for the overall score of the ABS-S: 2, $r = -.45$ ($p = .124$, *ns*), indicating a similar moderate inverse correlation for all of these measures (i.e., as severity of autism increases, adaptive behaviour levels decrease). The relationship of selected subscales from each measure to the severity of autism was also examined, the results can be found in Table 5.

Discussion

This study compared the relationship between three measures of adaptive behaviour on the one hand, and cognitive level and severity of autism on the other. Strong positive correlations were found between MA and adaptive skills on

Table 4. Correlation between selected scales of three adaptive behaviour measures and mental age

	SIB-R		*VABS-Classroom*		*ABS-S:2*
Communication	.51** Comprehension	.60** Expression	.83** Receptive	.75** Expressive	.64* Language Development
Socialization	.47* Social Interaction		.61** Socialization		.52 Personal-Social Responsibility
Activities of Daily Living	.71** Personal Living Skills		.87** Daily Living Skills		.68** Independent Functioning
Overall	.68** Broad Independence		.82** Adaptive Behavior Composite		.76** Average of Factor Scores

** p <.05 level (2-tailed)*
*** p <.01 level (2-tailed)*

all three measures. Moderate negative correlations between severity of autism and adaptive behaviour level on all three measures were also found. The shared variance between Adaptive Behaviour and both MA and severity of autism was similar to that found in previous research (Perry & Factor, 1989; Perry et al., 2005). When compared to the other measures of adaptive behaviour, the ABS-S: 2 had a slightly lower correlation with severity of autism. The SIB-R had a slightly lower correlation with MA. With the exception of the receptive language scale, the VABS-Classroom had slightly stronger correlations with both MA and severity of autism than did the other two measures.

The correlation between the VABS-Classroom receptive language scale and the CARS was lower than expected. This likely relates to a ceiling effect coupled with the small number of items on this scale. Similarly, the lack of a relationship between the socialization on the ABS-S: 2 and the CARS may be due to a floor effect on the ABS-S: 2, which is normed for children three years of age and older. Many of the participants in this study had cognitive skills below the three-year level.

This study does not suggest any one of the measures to be strongly preferable nor any one to be problematic in terms of their relationship with other constructs. Selecting a measure of adaptive behaviour must be made on an individual basis, taking into account a variety of factors. The age of the client, the specific purpose of the assessment, and the amount of time available must always be taken into consideration, but a number of other factors must also be considered, particularly when working with children who have autism. For instance, when testing individuals with a low level of functioning, a measure normed on a younger sample, with lower standard and age equivalent scores would be the most useful. Of the three measures examined here, the SIB-R has the lowest floor. If maladaptive information is particularly relevant for a given assessment, the SIB-R or the ABS-S: 2 may be more appropriate measures than would the VABS-Classroom which does not have a maladaptive behaviour scale. The ABS-S: 2, has a particularly expansive section on maladaptive behaviours.

Of the three measures examined, this study found that the VABS-Classroom has the highest correlation with MA. In fact, about two-thirds of the variance in the VABS-Classroom scores for this sample can by accounted for by MA. This may suggest that for the lower functioning individuals in our sample the VABS-Classroom may essentially be measuring developmental level rather than adaptive behaviour as a separate construct. Consequently, for such a population it may be preferable to use the SIB-R or the ABS-S: 2, which do not overlap with MA to quite the same degree as the VABS-Classroom. The correlation between each measure with the severity of autism was very comparable.

Table 5. Correlation between selected scales of three adaptive behaviour measures and severity of autism

	SIB-R		*VABS-Classroom*		*ABS-S:2*
Communication	-.53** Comprehension	-.52** Expression	-.27 Receptive	-.55** Expressive	-.16 Language Development
Socialization	-.45* Social Interaction		-.58** Socialization		(n/a) Personal-Social Responsibility[1]
Activities of Daily Living	-.41* Personal Living Skills		-.46** Daily Living Skills		-.19 Independent Functioning
Overall	-.53** Broad Independence		-.53** Adaptive Behavior Composite		-.45 Average of Factor Scores

* *p* <.05 level (2-tailed)
** *p* <.01 level (2-tailed)
[1] *Cannot be computed because of a lack of variability*

Some limitations of this study should be noted. This study involved a review of clinical files and in some cases two or even three of the measures included in this study were administered to the same client at various points in time. It was felt that it was important to include as many measures as possible in order to increase the sample size and power of the study. As a result, in some cases the same client contributed more than one measure to the study. This may have the effect of making the patterns of correlations more similar across the measures, if we assume that cognitive skills, adaptive behaviour remain stable within an individual over time. Fewer ABS-S: 2 questionnaires (n = 15) were used in the study, than were VABS-Classrooms (n = 39) and SIB-Rs (n = 28). Another limitation of the present study is that age equivalent scores were used, which may be problematic. Age equivalent scores may not have equivalent meaning at different ages, are based on an ordinal scale, and each score may not represent an equal unit, making comparisons difficult (Sattler, 2008). However, they were the only comparable score across the different measures; they are not confounded by the floor effects which render standard scores almost meaningless (Perry et al., 2009); and they are commonly used in research with this population. Finally, it should be noted that there was a limited variance in mental age for the participants in this study. The majority of participants in this study had severe intellectual disabilities. Future studies may look to expand the mental age range of the sample. In addition, it would be advantageous to administer the three measures concurrently to a group of participants and compare the profiles generated by each (similar to Perry & Factor, 1989 but with additional and current versions). Another potential future direction for research is to examine the relationship of the constructs examined here; MA, adaptive behaviours, and severity of autism, with maladaptive behaviours. Finally, the correlation with MA and severity of autism should be investigated with the Vineland-Classroom, 2nd edition (Sparrow, Cicchetti, & Balla, 2006) now that it is available.

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