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ABSTRACT

This study investigates the validity of the Stanford Binet Intelligence Scale-Fourth Edition (S-B:4) for use with students with learning disabilities. It compares the performance of 18 elementary-age students on the S-B:4 and the Kaufman Assessment Battery for Children (K-ABC). The subjects were identified by their school as having learning disabilities. Both S-B:4 and K-ABC were administered to each student in counterbalanced order. Correlations between the two scales were strong with global scale correlations ranging from .57 (Quantitative Reasoning-Achievement) to .87 (Verbal Reasoning-Achievement) with the Test Composite-Mental Processing Composite correlation at .74. Strong relationships were noted between Test Composite and K-ABC Mental Processing Composite and Achievement scales. On the K-ABC, the Simultaneous mean was significantly higher than the Sequential mean. On the Stanford-Binet, the mean Test Composite was significantly lower than the Verbal Reasoning and Abstract/Visual Reasoning means, while the Verbal Reasoning mean exceeded the mean score on Short-Term Memory and the Abstract/Visual Reasoning mean surpassed the Quantitative Reasoning mean. (Author/JAZ)

S-B: Fourth Edition and K-ABC: Their Relationships in a LD Sample

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Running head: S-B: 4/K-ABC

Abstract

The Stanford-Binet: Fourth Edition and the Kaufman Assessment Battery for Children were administered in counterbalanced order to 18 elementary-age students (11 males and 7 females), previously identified by their school as having Learning Disabilities. Correlations (corrected for restriction of range) between the two instruments were strong with global scale correlations ranging from .57 (Quantitative Reasoning-Achievement) to .87 (Verbal Reasoning-Achievement) with the Test Composite-Mental Processing Composite correlation at .74. Strong relationships were noted between Test Composite and K-ABC Mental Processing Composite and Achievement scales. On the K-ABC, the Simultaneous mean was significantly higher than the Sequential mean. On the Stanford-Binet, the mean Test Composite was significantly lower than the Verbal Reasoning and Abstract/Visual Reasoning means, while the Verbal Reasoning mean exceeded the mean score on Short-Term Memory and the Abstract/Visual Reasoning mean surpassed the Quantitative Reasoning mean.

The Stanford-Binet Intelligence Scale: Fourth Edition (S-B:4 Thorndike, Hagen & Sattler, 1986) is a recently developed revision of the Stanford-Binet and is designed for use with individuals ages 2 to adult. The scale is organized into four areas: Verbal Reasoning (VR), Abstract/Visual Reasoning (AVR), Quantitative Reasoning (QR) and Short-Term Memory (STM). Standard scores with a mean of 100 and standard deviation of 16 are provided for each area and an overall Test Composite (TC) is provided.

In order to establish validity for the S-B:4 a number of validity studies are described in the Technical Manual. The majority of these studies were with non-handicapped students and compared performance on the S-B:4 with the S-B: Form L-M, Wechsler Intelligence Scale for Children-Revised (WISC-R; Wechsler, 1974) and Kaufman Assessment Battery for Children (K-ABC; A. Kaufman & N. Kaufman, 1983). Correlations with Form L-M ranged from .56 to .81, while correlations of global scales on the S-B:4 and the WISC-R ranged from .60 to .83. K-ABC/S-B:4 global scale correlations ranged from .68 to .89. Three studies were reported with Learning Disabled (LD) students with samples ranging from 14 to 90. Patterns of correlations were similar to the patterns with non-handicapped students, although actual correlations with the K-ABC and WISC-R were lower.

Since major purposes of the S-B:4 are to assist in the identification of LD students and to understand why a particular student is having difficulty learning (Thorndike et al., 1986), it

is important to establish the validity of the S-B:4 with LD students. Although the studies to date suggest the S-B:4 is a reliable and valid instrument, the studies are limited and in some cases have methodological flaws such as a failure to counterbalance test administration and the use of previous test data. Therefore, the present study was designed to compare the performance of LD students on the S-B:4 and the K-ABC.

Method

Subjects

The sample consisted of 18 students (11 males and 7 females) diagnosed as LD in a suburban, midwestern elementary school serving a predominantly middle class population. The parents of all 22 LD students in the program were asked to participate in the study, yielding a participation rate of 82%.

The students ranged in age from 8 years, 6 months to 11 years, 10 months with a mean age of 10 years, 5 months. Each student had been diagnosed previously as LD based on a discrepancy between ability, as measured by an individual intelligence test (the WISC-R in most cases), and achievement. The decision to place students in the LD program was made by a child study team. Each student received LD services on a resource basis for periods ranging from half an hour to two hours per day.

Procedure

Each student was administered the K-ABC and S-B:4 in counterbalanced order during Fall 1985 by school psychologists trained in the administration of both tests. The average length of time between tests was 12 days with a range of 5 to 22 days.

Results and Discussion

Mean scores on the global scales of both instruments were all in the average range with the mean S-B:4 TC 2.06 points lower than the mean K-ABC Mental Processing Composite (MPC). The lowest mean score was QR at 91.06 and the highest was Sequential Processing (SEQ) at 102.33. Mean scores and standard deviations are reported in Table 1.

Insert Table 1 about here

Pearson product moment correlations were calculated separately for each test and for both tests with each other. Due to the restriction in range for both tests, the correlations were corrected using a procedure developed by Guilford (1954). The correlational results are presented in Tables 2, 3 and 4.

Insert Table 2 about here

The results in Table 2 suggest that the Simultaneous (SIM) and SEQ scales are measuring different aspects of intelligence.

Although both scales are highly related to overall intelligence (MPC), their relationship to each other is minimal (r = .06) and lower than the correlations reported for the standardization sample in the Interpretive Manual and for other studies of LD students (e.g. Lyon & Smith, 1985; Naglieri & Haddad, 1984; Smith, Lyon, Hunter & Boyd, 1986). In addition, the ACH scale seems to be measuring behavior that is different from that measured by the mental processing scales as the correlations range from .18 to .48 so that a maximum of 25% of the variance is predicted by the ACH/MPC relationship.

Correlational results for the S-B:4 are presented in Table 3. In the present study correlations of AVR with STM and QR, while statistically significant, are lower than those reported for the standardization sample (.52 vs .65 and .44 vs .73, respectively). At the same time, the VR-STM correlation is higher than reported for the standardization sample (.90 vs .70). Additional studies are needed to explore any possible differences in correlational patterns between LD students and the standardization sample.

For this sample of LD students, the global scales of the S-B: 4 were highly related to overall intelligence (TC) with correlations ranging from .78 to .96 and considerable overlap between and among the global scales, especially VR with AVR (r = .75) and VR with STM (r = .90). The VR-STM correlation suggests that 81% of the variance can be predicted from their correlation,

indicating that the two scales are measuring similar abilities.

Insert Table 3 about here

In comparing performance on the two instruments the most meaningful comparisons are among those scales purportedly measuring similar cognitive skills. These involve TC with MPC (r = .74, p < .001); SEQ with STM (r = .70, p < .001); SIM with AVR (r = .64, p < .01); ACH with QR (r = .57, p < .01); and ACH with VR (r = .87, p < .001). Significant correlations were also indicated for TC-ACH (r = .85, p < .001); ACH-STM (r = .77, p < .001) and MPC-QR (r = .75, p < .001). These results are generally supportive of the construct validity of the two instruments. The overall pattern of correlations is similar to those reported in the Technical Manual for the sample of non-exceptional students. Since three of the S-B:4 global scales (VR, QR, and STM) are somewhat similar to tasks on the ACH scale of the K-ABC, the higher correlations between TC and ACH than between TC and MPC were not unexpected. Although these differences in level of correlation have been interpreted as supportive of the validity of the two instruments, they are not statistically significant and could have occurred by chance.

The K-ABC was designed to minimize the role of previous learning, and especially, verbal skills on the mental processing scales (A. Kaufman & N. Kaufman, 1983). Thus, the higher VR-ACH correlation as compared to the VR-MPC was expected. Similarly, the

STM-ACH correlation exceeding the STM-MPC correlation was not unexpected based on the substantial overlap between the VR and STM scales in this sample of LD students. Likewise, the strong SIM-AVR correlation was anticipated as both scales are purported to measure nonverbal reasoning of a visual/spatial nature. The complete table of correlations is presented in Table 4.

Insert Table 4 about here

Pearson product moment correlations were also calculated for the subtests of each instrument with each other. Significant correlations were obtained for a number of correlations and they are reported in Tables 5 and 6. Due to the restriction in range for subtests on both instruments, the correlations were corrected using a procedure developed by Guilford (1954)

Insert Table 5 about here

Of the 88 correlations among the mental processing subtests of the K-ABC and the subtests of the S-B:4, 19 or 22% were significant ($p < .05$). The Quantitative and Number Series subtests of the S-B:4 did not significantly correlate with any of the K-ABC mental processing subtests. These results in combination with the correlations of the global scales suggest that while there is overlap between the two instruments they also differ to a great

degree in how they measure intellectual ability. Both instruments have a memory or sequencing component and a strong relationship between these components, as evidenced by the high correlations between sequential subtests on the K-ABC (especially, Number Recall and Word Order) and the memory subtests on the S-B:4, is indicated in Table 5. Interestingly, Bead Memory on the S-B:4 and Hand Movements on the K-ABC did not correlate significantly with other subtests purportedly measuring similar abilities. Rather, they correlated significantly with other subtests designed to measure spatial abilities and/or nonverbal reasoning. These results are in accord with data in the Interpretive Manual of the K-ABC and the Technical Manual of the S-B:4 which indicate these subtests do not relate as strongly to the scales on which they are placed as other subtests. The significant correlations between Bead Memory and two K-ABC simultaneous subtests (Triangles and Photo Series) are in agreement with an observation by Scott (1986, August) that Bead Memory is different from the other memory subtests on the S-B:4 due to its simultaneous mode of presentation.

It is of interest that the Vocabulary subtest of the S-B:4 correlated significantly with only one K-ABC mental processing subtest, Number Recall. Overall Vocabulary is the best single measure of ability on the S-B:4, illustrating a possible difference in the perspective of the two instruments.

Significant correlations among the achievement subtests of the K-ABC and the subtests of the S-B:4 are presented in Table 6. Of

the 55 correlations among the K-ABC achievement subtests and the S-B:4, 21 or 38% were significant ($p < .05$). Vocabulary correlated highly with Faces & Places, Riddles and Reading/Understanding, while Number Series correlated highly with Arithmetic. Two subtests, Reading/Decoding on the K-ABC and Memory for Digits on the S-B: 4 did not produce any significant correlations, while Pattern Analysis on the S-B:4 produced the highest number of correlations (7) with K-ABC subtests.

Insert Table 6 about here

The correlations presented in Tables 5 and 6 strongly suggest that for this sample of LD students the skills measured by the S-B:4 subtests are more similar to the skills measured by the ACH scale of the K-ABC. In addition, the definitions of intelligence and its components, as provided by the authors of the two instruments, are consistent with this interpretation.

T-tests for related samples were also performed on the global standard scores of the K-ABC and S-B:4 to ascertain significant differences in performance patterns. Significant differences on the K-ABC were noted for SIM-SEQ (t (17) = 2.56, $p < .05$) with the mean SIM score 9 points higher than the mean SEQ score. On the S-B:4, significant differences were noted for TC-VR (t (17) = 4.25, $p < .001$), TC-AVR (t (17) = 2.17, $p < .05$), TC-QR (t (17) = 2.72, $p < .05$, VR-STM (t (17) = 3.85, $p < .001$), and AVR-QR (t (17) = 3.00,

$p < .01$). The mean TC was significantly lower than the mean VR and AVR scores and higher than the mean QR score, while the mean VR score exceeded the mean STM score and the mean AVR score exceeded the mean QR score. Both a SIM > SEQ pattern (e.g. Kaufman & McLean, 1986) and a SEQ > SIM pattern (e.g. Klanderman, Perney & Kroeschell, 1985; Naglieri & Haddad, 1984) have been found in studies of LD students. While the differences were not significant in previous studies, the difference is significant in the present study.

The LD students in the present study presented a more variable pattern on the S-B:4, as compared to the K-ABC, with relative strengths displayed on AVR and VR and relative weaknesses on QR and STM. Highest mean scores were on Bead Memory (51.1) and Pattern Analysis (50.9) and lowest mean scores were on Quantitative (45.6) and Memory for Objects (46.2).

Higher mean SIM scores than mean SEQ scores were produced on the K-ABC. Highest mean scores were on Gestalt Closure (11.8) and Photo Series (10.6) with lowest mean scores on Hand Movements (8.8) and Word Order (8.5). On the Achievement Scale, the highest mean scores were on Riddles (100.7) and Reading/Understanding (97.1) with lowest mean scores on Arithmetic (93.8) and Reading/Decoding (94.6). For the most part these results are consistent with the LD profile presented in the Interpretive Manual of the K-ABC.

For this group of school identified LD students, the pattern presented is one of relative strength in reasoning (verbal and

abstract/visual/simultaneous) and relative weakness in achievement and memory/sequential processing. Both tests are supportive of this profile and their overall correlations are indicative of not only substantial overlap in the constructs measured but also important differences in the perspectives forming the basis for each test. In some instances, similar constructs are measured but different terms are used to describe them. Clearly, additional studies are needed to determine the generalizability of these results for other samples of LD students.

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Table 1

Means, Standard Deviations and Ranges for Global Scales on the K-ABC and S-B:4

Variable	Mean	Standard Deviation	Range
K-ABC			
Mental Processing Composite (MPC)	98.67	8.98	79-118
Simultaneous Processing (SIM)	102.33	10.12	85-121
Sequential Processing (SEQ)	93.61	10.66	64-110
Achievement (ACH)	95.78	9.93	81-114
S-B:4			
Test Composite (TC)	96.61	9.63	78-114
Verbal Reasoning (VR)	101.11	10.65	85-120
Abstract/Visual Reasoning (AVR)	100.89	12.85	75-129
Quantitative Reasoning (QR)	91.06	9.63	78-110
Short-Term Memory (STM)	94.94	11.15	69-110

Note. Sample size was 18 for all variables.

Table 2

Intercorrelations among the K-ABC Global Scales

	SEQ	SIM	ACH
K-ABC			
MPC	.59(.77)*	.82(.92)*	.31(.48)***
SEQ		.04(.06)	.12(.18)
SIM			.32(.45)***

Note. Correlation coefficients reported in parentheses are corrected for restriction in range via Guilford's formula (Guilford, 1954). Sample size was 18 for all variables.

*p < .001

**p < .01

***p < .05

Table 3

Intercorrelations among the S-B:4 Global Scales

	VR	AVR	QR	STM
S-B:4				
TC	.91(.96)*	.76(.89)*	.60(.78)*	.81(.92)*
VR		.60(.75)*	.37(.55)*	.81(.90)*
AVR			.26(.41)***	.39(.52)***
QR				.31(.47)***

Note. Correlation coefficients reported in parentheses are corrected for restriction in range via Guilford's formula (Guilford, 1954)

*p < .001

**p < .01

***p < .05

Table 4

Intercorrelations among the Global Scales of the K-ABC and S-B:4

	K-ABC			
	MPC	SEQ	SIM	ACH
S-B: 4				
TC	.55(.74)*	.43(.60)**	.40(.59)**	.70(.85)*
VR	.35(.53)**	.42(.55)**	.17(.26)	.76(.67)*
AVR	.37(.55)**	.01(.01)	.49(.64)**	.39(.54)**
QR	.56(.75)*	.36(.54)**	.41(.60)**	.38(.57)*
STM	.44(.63)*	.57(.70)*	.15(.22)	.63(.77)*

Note. Correlation coefficients reported in parentheses are corrected for restriction in range via Guilford's formula (Guilford, 1954).

*p < .001

**p < .01

***p < .05

Table 5

Intercorrelations among Mental Processing Subtests of the K-ABC and Subtests of the S-B:4

	K-ABC							
	HM	GC	NR	T	WO	MA	SM	PS
S-B:4								
VOC		.42(.56)**						
COMP					.70(.87)*	.51(.73)*		
ABS						.66(.72)*	-.49(.63)**	
PA	.47(.63)**	.51(.68)**		.70(.83)*		.42(.58)**		
Q								
NS								
MAT	.39(.50)***							
BM			.44(.59)**					.54(.72)*
MFS		.59(.67)*		.62(.70)*				
MFD		.45(.61)**		.73(.85)*				
MFO		.47(.54)**		.54(.61)**				

Note. Correlation coefficients reported in parentheses are corrected for restriction in range via Guilford's (1954) formula. Key to abbreviations: HM-Hand Movements; GC-Gestalt Closure; NR-Number Recall; T-Triangles; WO-Word Order; MA-Matrix Analogies; SM-Spatial Memory; PS-Photo Series; VOC-Vocabulary; COMP-Comprehension; ABS-Absurdities; PA-Pattern Analysis; MAT-Matrices; BM-Bead Memory; MFS-Memory for Sentences; MFD-Memory for Digits; MFO-Memory for Objects.

*p < .001; **p < .01; ***p < .05

Table 6

Intercorrelations among the Achievement Subtests of the K-ABC and the Subtests of the S-B:4

	F&P	A	Riddles	R/D	R/U
S-B:4					
VOC	.59(.73)*		.69(.81)*		.69(.81)*
COMP		.71(.87)*			
ABS	.71(.79)*	.42(.48)***	.73(.79)*		.58(.72)*
PA	.49(.66)**		.58(.74)*		.40(.51)***
MAT		.48(.55)**			
Q	.42(.54)**	.46(.58)**			
NS		.59(.77)*			
BM	.62(.76)*	.42(.56)**	.70(.82)*		
MFS		.42(.49)***	.70(.76)*		
MFD					
MFO			.46(.53)**		

Note. Correlation coefficients reported in parentheses are corrected for restriction in range via Guilford's (1954) formula. Key to abbreviations: F&P-Faces and Places; A-Arithmetic; R-Riddles; R/D-Reading Decoding; R/U-Reading Understanding; VOC-Vocabulary; COMP-Comprehension; ABS-Absurdities; PA-Pattern Analysis; MAT-Matrices; BM-Bead Memory; MFS-Memory for Sentences; MFD-Memory for Digits; MFO-Memory for Objects.

*p < .001; **p < .01; ***p < .05