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ABSTRACT

The Stanford-Binet: Fourth Edition and Kaufman Assessment Battery for Children were administered in counterbalanced order followed by the Cognitive Domain of the Battelle Developmental Inventory to a sample of 30 nonhandicapped, preschool children (13 males and 17 females). Correlations (corrected for restriction in range) among the three instruments were strong with global scale correlations ranging from .41 (Binet Composite-Battelle Cognitive Total) to .63 (Binet Composite-Kaufman Mental Processing Composite). Repeated measures analyses of variance indicated the Battelle Cognitive Total was significantly lower than the Binet Composite and Kaufman Mental Processing Composite. Similar analyses for global scores measuring similar constructs (memory, nonverbal reasoning and achievement) indicated no significant differences among the tests. Gender differences were indicated on the Sequential Processing Scale and Mental Processing Composite of the Kaufman and the Short-Term Memory Scale of the Binet. The results of the study are supportive of the validity of all three measures with the present sample of preschool students. (Author)

Young Children's Performance on Three Measures of Ability

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Running head: THREE MEASURES

Abstract

The Stanford-Binet: Fourth Edition and Kaufman Assessment Battery for Children were administered in counterbalanced order followed by the Cognitive Domain of the Battelle Developmental Inventory to a sample of 30 nonhandicapped, preschool children (13 males and 17 females). Correlations (corrected for restriction in range) among the three instruments were strong with global scale correlations ranging from .41 (Binet Composite-Battelle Cognitive Total) to .63 (Binet Composite-Kaufman Mental Processing Composite). Repeated measures analyses of variance indicated the Battelle Cognitive Total was significantly lower than the Binet Composite and Kaufman Mental Processing Composite. Similar analyses for global scores measuring similar constructs (memory, nonverbal reasoning and achievement) indicated no significant differences among the tests. Gender differences were indicated on the Sequential Processing Scale and Mental Processing Composite of the Kaufman and the Short-Term Memory Scale of the Binet. The results of the study are supportive of the validity of all three measures with the present sample of preschool students.

In the past few years preschool assessment has assumed greater importance as educational programs for children in the three to five age range have increased. Likewise the function of preschool assessment has changed from identifying children with handicaps only to a dual function of diagnosis and program planning resulting in a "need for assessment instruments capable of providing diagnostic and evaluation information...across all areas of functioning (cognitive, linguistic, perceptual-motor, adaptive behavior, etc.)" (Kelley & Surbeck, 1983, p. 13). Additionally, such tests "must be well normed and used specifically for purposes for which they are intended (validated)" (Reynolds & Clark, 1983, p. 171).

Existing instruments for the assessment of intelligence in preschool children have been criticized on a number of grounds including restrictive age ranges, length of time to administer, insufficient ceilings, overemphasis on verbal skills and difficulty interpreting subtest profiles (Reynolds & Clark, 1983; Thorndike, 1985, August). Largely as a result of these criticisms and others, several new instruments for the assessment of the young child have been developed. These include the Kaufman Assessment Battery for Children (K-ABC; A. Kaufman & N. Kaufman, 1983), the Stanford-Binet Intelligence Scale: Fourth Edition (S-B:4; Thorndike, Hagen & Sattler, 1986) and the Battelle Developmental Inventory (BDI; Newborg, Stock, Wnek, Guidubaldi & Svinicki, 1984).

The K-ABC is designed to measure intelligence and achievement in children ages 2 1/2 to 12 1/2. Intelligence is defined as "an individual's style of solving problems and processing information" (A. Kaufman & N. Kaufman, 1983, p. 2). Two styles as measured by the Simultaneous (SIM) and Sequential (SEQ) processing scales are differentiated along with a separate Achievement (ACH) scale. A Mental Processing Composite (MPC) based on the processing scores is also provided. The S-B:4 is designed for use with individuals ages 2 to adult and is organized into four areas: Verbal Reasoning (VR), Quantitative Reasoning (QR), Abstract/Visual Reasoning (AVR) and Short-Term Memory (STM). In addition, a Test Composite (TC) is provided. The BDI is designed to measure developmental skills in children from birth to eight years of age and is organized into Personal-Social, Adaptive, Motor, Communication and Cognitive Domains which are further divided into subdomains. The Cognitive Domain provides a Cognitive Total (CT) and consists of items organized into Perceptual Discrimination (PD), Memory (MEM), Reasoning and Academic Skills (RAS) and Conceptual Development (CD).

Six studies with nonhandicapped preschool children are described in the K-ABC Interpretive Manual. Sample sizes ranged from 28 to 45 and the results of the studies are generally supportive of the instrument as a measure of cognitive functioning for preschool children. Correlations with the Wechsler Preschool and Primary Scale of Intelligence (WPPSI) were .55 and with the Stanford-Binet: Third Edition they ranged from .36 to .72.

Several studies involving the S-B:4 are described in the Technical Manual for the test. These studies involved either the WPPSI or K-ABC. In the WPPSI studies a total sample of 75 was obtained and the overall correlation between the TC of the S-B:4 and the WPPSI Full Scale IQ (FSIQ) was .80. K-ABC/S-B:4 results were not broken down by age group. The mean age was seven years and the TC-MPC correlation was .89. Studies with the BDI and the Stanford-Binet: Third Edition "are moderate and positive in the .40 to .61 range" (Harrington, 1985). Studies comparing the Cognitive Domain with either the K-ABC or S-B:4 are lacking.

These instruments (K-ABC, S-B:4, BDI) have been designed so that they are appropriate for use with preschool children. However, studies examining the relationships of these three tests in a preschool sample are lacking. Therefore, the present study was designed to examine the relationships among the S-B:4, K-ABC and Cognitive Domain of the BDI in a preschool sample.

Method

Subjects

The sample consisted of 30 children (17 males and 13 females) from midde class families attending a daycare center located in a suburban area of a large midwestern city. The parents of 40 children were randomly selected and asked to participate in the study. The parents of 30 children agreed to participate for a participation rate of 75%. The children ranged in age from 3 years, 11 months to 6 years, 2 months with a mean age of 4 years, 11 months.

<u>Procedure</u>

Each child was administered the K-ABC, S-B:4 and Cognitive Domain of the BDI by school psychologists trained in the administration of the three tests. The K-ABC and S-B:4 were administered in counterbalanced order during Fall 1985 with 15 children receiving the K-ABC followed by the S-B:4 and 15 children receiving the S-B:4 followed by the K-ABC. The average length of time between tests was 11 days with a range of four to 21 days. The Cognitive Domain of the BDI was administered to each child following the K-ABC and S-B:4 testing.

Results and Discussion

Mean scores on the global scales of the K-ABC, S-B:4 and the Cognitive Domain of the BDI were all in the average range. The mean S-B:4 TC and K-ABC MPC were within one point of each other while the mean CT of the BDI was about ten points lower. Mean scores ranged from 105.23 to 110.23 on the K-ABC, 104.33 to 111.13 on the S-B:4 and from 98.97 to 104.20 on the BDI Cognitive Domain. Mean scores, standard deviations and range are reported in Table 1.

Insert Table 1 about here

Pearson product moment correlations were calculated separately for each test and for all three tests with each other. Due to the restriction in range for the tests, the correlations were corrected using a procedure developed by Guilford (1954). The correlational results are presented in Tables 2, 3, 4, 5 and 6.

The results in Table 2 suggest that the 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 = .16) and lower than the correlations reported for the standardization sample. At the same time, the ACH scale seems to be measuring behavior that is different from that measured by the mental processing scales as the correlations range from .36 to .55 so that a maximum of 30% of the variance can be predicted by the ACH/MPC relationship.

Insert Table 2 about here

Correlational results for the S-B:4 are presented in Table 3. In the present study all global scales correlate significantly with the TC at a level consistent with the correlations reported for four year olds in the standardization sample. Correlations of the AVR scale with the STM and VR scales are considerably lower than those reported for the standardization sample (.24 vs .62 and .19 vs .62, respectively). Substantial overlap is noted between the STM and VR scales as indicated by their correlation of .81 from which 66% of the variance can be predicted.

Insert Table 3 about here

As indicated in Table 4, all correlations among the subscales of the BDI Cognitive Domain are significant and range from .33 to .63. For this sample of preschoolers the subscale correlations with the CT are somewhat lower than the global scale correlations with MPC for the K-ABC (Table 2) and the global scale correlations with TC for the S-B:4 (Table 3). One explanation for this may be the fewer number of items administered on each subdomain of the BDI as compared to the other tests. The results, however, do suggest moderate overlap among the subdomains of the BDI Cognitive Domain.

Insert Table 4 about here

The results of the correlational analyses among the scales of the three instruments are reported in Tables 5 and 6. These correlations ranged from a low of -.35 (SIM-VR) to a high of .80 (AVR-PD). The correlations among the TC, MPC and CT were .57 ($p < .01$) for TC-MPC, .63 ($p < .01$) for TC-CT and .41 ($p < .05$) for MPC-CT. The ACH/TC and ACH/CT correlations were .65 ($p < .01$) and .54 ($p < .05$), respectively. The ACH scale correlations with the CT and TC were somewhat higher than the MPC correlations with the same scales. This result is consistent with the Kaufmans' (1983) assertion that the ACH scale of the K-ABC contains items which are often found on other intelligence tests.

Insert Table 5 about here

Insert Table 6 about here

In comparing performance on the three instruments the most meaningful comparisons are among those scales purportedly measuring similar cognitive skills. These involve SEQ with STM with MEM; SIM with AVR with PD; ACH with QR with VR with RAS; and CD with MPC with TC. Those correlations are: .62 ($p < .01$) for SEQ-STM, .62 ($p < .01$) for SEQ-MEM, and .32 ($p < .05$) for STM-MEM; .37 ($p < .05$) for SIM-AVR, .30 ($p < .05$) for SIM-PD, and .80 ($p < .001$) for AVR-PD; .44 ($p < .05$) for ACH-QR, .57 ($p < .05$) for ACH-VR, .72 ($p < .001$) for ACH-RAS, .72 ($p < .001$) for QR-RAS, .51 ($p < .05$) for VR-RAS and .55 ($p < .05$) for QR-VR; .63 ($p < .01$) for CD-MPC and .65 ($p < .01$) for CD-TC.

These results suggest that the three instruments have considerable overlap in the constructs that are measured. The scales purportedly measuring memory (SEQ, STM, MEM) correlate significantly with each other as do the scales measuring nonverbal or spatial reasoning (SIM, PD, AVR) and achievement (ACH, QR, VR, RAS). Indeed, of the 65 possible correlations among the scales of the three instruments, 54 or 83% were significant. Although different names are provided for the scales of each instrument, there is great similarity and overlap among them.

In order to determine if global scores significantly differed from each other, a repeated measures analysis of variance was conducted. Significant results were obtained ($F(2,58) = 5.45$, $p < .01$) with the mean CT significantly lower than the mean MPC and TC, using the protected t-test. Although the global scales of the three instruments correlate significantly and strongly with each other, these results suggest the scores may not be interchangeable, as the mean CT score was approximately 10 points lower than the mean MPC or TC.

Similar repeated measures ANOVAs were conducted for global scores measuring similar constructs: memory (SEQ, STM, MEM); nonverbal reasoning (SIM, AVR, PD); and achievement (ACH, QR, VR, RAS). In each case the results were not significant, indicating the mean scores did not significantly differ from each other.

In order to determine possible gender differences in performance, a series of one way analyses of variance were conducted with scores on the K-ABC, S-B:4 and BDI as dependent variables and gender (male, female) as the independent variable. Significant results were indicated on the SEQ and MPC scales of the K-ABC with $F(1,28) = 10.16$, $p < .01$ and $F(1,28) = 7.28$, $p < .02$, respectively, and on the STM scale of the S-B:4 with $F(1,28) = 5.38$, $p < .03$. In each case, mean scores for females (112.77, 114.38 and 111.15, respectively) exceeded the mean scores for males (99.47, 104.71 and 100.88, respectively). No significant differences were indicated on the other global scales of the three tests. Significant differences were noted on three subtests of the K-ABC: Hand Movements with $F(1,28) = 9.60$, $p < .01$; Gestalt Closure with $F(1,28) = 5.85$, $p < .03$ and Word Order with $F(1,28) = 7.44$, $p < .02$ with the mean scores of females (12.00, 12.62 and 12.23, respectively) greater than the mean scores of males (9.24, 10.71 and 10.31, respectively). No significant differences were indicated for any subtests of the S-B:4 or subdomains of the BDI Cognitive Domain.

The results of the present study suggest that the global scales of all three instruments are measuring similar constructs, although less consistency across instruments is indicated for the subscales. The ACH scale correlations with the CT and TC were somewhat higher than the MPC correlations with the same scales. In addition, the CT mean was significantly lower than the MPC and TC and it had a much larger standard deviation suggesting a greater variability of scores, at least in the present sample. In conclusion, the results of the present study are supportive of the validity of all three tests with the preschool age range. Additional studies utilizing other samples are needed to verify these results.

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Table 1

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

	Mean	Standard Deviation	Range
K-ABC			
Mental Processing Composite (MPC)	108.90	10.74	87-138
Simultaneous Processing (SIM)	110.23	11.31	86-131
Sequential Processing (SEQ)	105.23	12.99	74-135
Achievement (ACH)	106.60	10.94	88-124
S-B:4			
Test Composite (TC)	108.37	11.09	81-128
Verbal Reasoning (VR)	111.13	9.10	90-132
Abstract/Visual Reasoning (AVR)	107.27	13.89	77-132
Quantitative Reasoning (QR)	104.33	13.29	74-130
Short Term Memory (STM)	105.33	12.89	85-141
BDI Cognitive Domain			
Cognitive Total (CT)	98.97	22.98	65-126
Perceptual Discrimination (PD)	104.20	9.07	75-119
Memory (MEM)	102.90	12.12	65-126
Reasoning & Academic Skills (RAS)	103.10	15.16	78-131
Conceptual Development (CD)	94.53	15.81	65-119

Table 2

Intercorrelations among the K-ABC Global Scales

	SEQ	SIM	ACH
MPC	.73(.83)*	.77(.85)*	.44(.55)**
SEQ		.12(.16)	.43(.55)**
SIM			.27(.36)***

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

*p < .001

**p < .01

***p < .05

Table 3

Intercorrelations among the S-B:4 Global Scales

	VR	AVR	QR	STM
TC	.66(.83)*	.61(.76)*	.82(.90)*	.82(.90)*
VR		.11(.19)	.35(.55)**	.62(.81)*
AVR			.41(.49)**	.19(.24)
QR				.58(.66)*

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

*$p < .001$

**$p < .01$

***$p < .05$

Table 4

Intercorrelations among the BDI Cognitive Scales

	PD	MEM	RA	CD
CT	.37***	.43**	.52**	.63*
PD		.57*	.51**	.60*
MEM			.48**	.33***
RA				.48**

*p < .001

**p < .01

***p < .05

Table 5

Intercorrelations among the K-ABC and S-B:4

	MPC	SEQ	SIM	ACH
S-B:4				
TC	.44(.57)*	.63(.75)*	.06(.08)	.52(.65)*
VR	.12(.21)	.42(.63)*	-.22(-.35)***	.39(.57)*
AVR	.44(.56)*	.36(.40)**	.29(.37)***	.23(.31)
QR	.36(.47)**	.51(.54)*	.06(.08)	.34(.44)**
STM	.32(.43)**	.56(.62)*	-.02(-.03)	.55(.67)*

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

*p < .001

**p < .01

***p < .05

Table 6

Intercorrelations between the BDI Cognitive Domain and the K-ABC and S-B:4

	CT	PD	MEM	RAS	CD
K-ABC					
MPC	.31(.41)***	.44(.63)*	.31(.41)***	.69(.79)*	.50(.63)*
SEQ	.31(.35)***	.48(.67)*	.53(.62)*	.65(.70)*	.29(.33)***
SIM	.15(.20)	.19(.30)***	-.02(-.03)	.42(.52)**	.44(.54)**
ACH	.42(.54)**	.15(.30)***	.39(.50)**	.60(.72)*	.17(.23)
S-B:4					
TC	.48(.63)*	.43(.62)*	.49(.65)*	.65(.79)*	.49(.65)*
VR	.26(.43)***	.19(.30)***	.34(.54)**	.32(.51)**	.05(.09)
AVR	.26(.32)***	.63(.80)*	.35(.43)***	.41(.47)**	.60(.67)*
QR	.55(.62)*	.39(.57)*	.50(.57)*	.64(.72)*	.58(.67)*
STM	.31(.37)***	.05(.08)	.27(.32)***	.50(.58)*	.14(.17)

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

*p < .001

**p < .01

***p < .05