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WISC-III and CAS: Which Correlates Higher with Achievement for a Clinical Sample?

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The relationships between Wechsler Intelligence Scale for Children-Third Edition (WISC-III) and the Cognitive Assessment System (CAS) with the Woodcock-Johnson Tests of Achievement (WJ-III) were examined for a sample of 119 children (87 males and 32 females) ages 6 to 16. The sample was comprised of children who were referred to a specialty clinic for evaluation. Participants were administered the WISC-III, the CAS, and the WJ-III, in that order. Results indicated that CAS/WJ-III correlations were consistently significantly higher than those found for the WISC-III/WJ-III. The four separate CAS scales added more variance above and beyond the four separate WISC-III scales than the WISC-III added above and beyond the CAS. In addition, the CAS Full Scale accounted for more unique variance and was a stronger predictor of WJ-III Academic Skills Cluster than the WISC-III Full Scale IQ. These results support the validity of the Planning, Attention, Simultaneous, and Successive theory as measured by the CAS in relation to the general intelligence model measured using the WISC-III for explaining variance in achievement for this clinical sample.

Matarazzo (1992) predicted that although psychologists were likely to adhere to the traditional verbal, quantitative, and nonverbal IQ concepts, "the recent knowledge explosion in cognitive psychology, information processing, and developmental psychology" (p. 1012) would have an important influence on the field. He also suggested that research in cognition would lead to the availability of "new forms of individually administered intelligence tests of a type never before available" (p. 1013). Matarazzo illustrated his point citing the work of Das, Kirby, and Jarman (1979) and Naglieri and Das (1990) on the Planning, Attention, Simultaneous, and Successive (PASS) theory, but he noted that competing

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with traditional intelligence tests would not be an easy task for a number of reasons. Traditional tests have the advantages of predictive validity, technological simplicity (Deary, Austin, & Caryl, 2000), and a long established place in psychology and education. As predicted by Matarazzo more than 10 years ago, cognitively based alternatives to traditional IQ are being embraced by practitioners and appear to better meet the future demands on the field (Naglieri, 2003).

In the years since the publication of Matarazzo's paper, researchers have proposed alternatives to traditional IQ that are cognitively based and, as some have argued, offer a better conceptualization of intelligence (e.g., Fagan, 2000; Kaufman & Kaufman, 1983, 2004; Naglieri, 2002; Naglieri & Das, 1997; Sternberg, 1988). Ceci (2000) suggested that these cognitive approaches are a provocative shift in the field that could have greater diagnostic utility, allow for early detection of disabilities which predate academic failure, and provide a way to better understand children's disabilities. Similarly, Das (2002) proposed that a cognitive approach (e.g., PASS theory) offers advantages when assessing individuals with mental retardation, especially minority groups (Naglieri & Rojahn, 2001). Das, Naglieri and Kirby (1994) and Naglieri (2002, 2003) further argued that a cognitive approach to intelligence may have greater relevance to academic intervention (e.g., Naglieri & Gottling, 1995, 1997; Naglieri & Johnson, 2000) and yield smaller differences between race groups (Naglieri, 2003). Finally, Das et al. (1994) and Naglieri (2003) argued that a cognitive processing approach to intelligence can retain the advantages of technological simplicity and ease of administration and be predictive of achievement (Naglieri & Das, 1997).

Naglieri (1999) summarized the relationships among various ability tests and achievement. He reported that median correlation among the Wechsler Intelligence Scale for Children—Third Edition (WISC-III; Wechsler, 1991), the WISC-III Full Scale IQ (FSIQ), and all Wechsler Intelligence Achievement Test WIAT scores (Wechsler, 1992) was .59 (N = 1,284 children aged 5–19 years from all regions of the country, each parental educational level, and different racial and ethnic groups). A similar correlation of .60 was found for the Differential Ability Scales (Elliott, 1990) General Conceptual Ability and achievement for a sample of 2,400 children included in the standardization sample. The median correlation was .63 (N = 888 children aged 6, 9, and 13 years) between the Woodcock-Johnson Revised (WJ-R) Broad Cognitive Ability score and WJ-R Achievement Test batteries (McGrew, Werder, & Woodcock, 1991). The median correlation between the Kaufman Assessment Battery for Children (K-ABC; Kaufman & Kaufman, 1983) Mental Processing Composite (MPC) and achievement was .63 for 2,636 children aged 2½ through 12½ years. Finally, the median correlation between the Cognitive Assessment System (CAS; Naglieri & Das, 1997) Full Scale and the WJ-R Test of Achievement (Naglieri & Das, 1997) was .70 (for a representative sample of 1,600 children aged 5–17 years who closely matched the U.S. population). For more details about the methodologies used in these various studies see Naglieri (1999). Despite differences in methods, these results are similar to those presented by Ramsey and Reynolds

(2004) and Naglieri and Bornstein (2003) and suggested that cognitive approaches to ability are substantially related to academic achievement.

Although the results of Naglieri's (1999) summary suggest that cognitive approaches to measuring ability are strongly correlated to achievement, his summary has two important limitations that the present investigation was designed to address. First, all the samples in Naglieri's summary involved different children given different measures of ability and typically different measures of achievement. This is true also of the summaries provided by Ramsay and Reynolds (2004) and Naglieri and Bornstein (2003). To address this limitation the current study compared the correlations between a traditional IQ test (the WISC-III) and a cognitive processing theory (PASS as measured using the CAS) with the same achievement scores (Woodcock-Johnson Tests of Achievement [WJ-III]; Woodcock, Mc Grew, & Mather, 2001) for the same children. The second limitation of Naglieri's study was that it did not specifically examine correlations with referred children (Naglieri & Rojahn; 2004); which the current investigation addresses.

The specific goals of this investigation were to (a) compare the correlations between two tests of ability with the same achievement test scores for the same children; (b) examine the significance of the difference between the WISC/WJ-III and CAS/WJ-III correlations; (c) evaluate the unique contributions of the WISC-III FSIQ and CAS FS scores in predicting achievement; (d) determine if the WISC-III or CAS accounts for more variance in overall achievement ; (e) determine if the WISC-III or CAS accounts for more variance in reading achievement; and (f) determine if either the WISC-III or CAS predicts achievement incrementally above and beyond the other.

METHOD

Participants

Children and adolescents aged 6 to 16 (N = 119) comprised the sample. There were 87 males (73.1%) and 32 females (26.9%). All the participants were Caucasians who lived in the western region of the United States and resided in urban/suburban (84.9%) and rural settings (15.1%). The students were referred for evaluation and treatment primarily by physicians, educators and community mental health providers to a psychoeducational clinic. Parental education levels for the children were as follows for mothers and fathers, respectively: 52.1% and 62.8% were college graduates; 29.1% and 15.9% had some college; 17.9% and 20.4% were high school graduates; and 0.9% and 0.9% attended but did not graduate high school. The majority (88.2%) of participants were from regular education settings, 10.1% attended school in parttime special education, and 1.7% attended special education school programs fulltime. Most of children (96.8%) had a DSM-IV primary diagnosis; of those children, 58% also had a secondary DSM-IV diagnosis. The most frequent primary diagnoses included

ADHD, predominately hyperactive impulsive combined type (23.7%), ADHD NOS (13.1%), and anxiety disorder NOS (11.4%). The most prevalent secondary diagnoses among the participants included oppositional defiant disorder (20.3%), ADHD, predominantly inattentive type (15.9%), and dysthymic disorder (15.9%).

Instruments

Wechsler Intelligence Scale for Children—Third Edition. The WISC-III (Wechsler, 1991) is a commonly used measure of general intelligence for children ages 6 to 16 years. The WISC-III is organized into two scales (Verbal and Performance IQ) and a total score (Full Scale IQ). The test is further broken down into four Index scores labeled Verbal Comprehension, Perceptual Organization, Freedom from Distractibility, and Processing Speed. IQ and factor Index scores yield standard scores with a mean of 100 and a standard deviation of 15. The WISC-III is well standardized on a sample of 2,200 children who match the 1988 U.S. Census data and are representative of the U.S. population on a number of important demographic variables including race/ethnicity, geographic region, gender, age, and parent education. The average split-half reliability coefficients for IQ and Index scales are: .95 for the Verbal IQ, .91 for the Performance IQ, .96 for the Full Scale IQ, .94 for the Verbal Comprehension Index, .90 for the Perceptual Organization Index, .87 for the Freedom from Distractibility Index, and .85 for the Processing Speed Index (Kaufman & Lichtenberger, 2000).

Cognitive Assessment System (CAS). The CAS (Naglieri & Das, 1997) is an individually administered test for children ages 5 through 17 years that measures four basic psychological processes described by the PASS theory. The CAS yields standard scores set at a mean of 100 and standard deviation of 15 for the four PASS scales, and the Full Scale is an equally weighted composite of all the subtests. There are two versions of this test: an eight subtest Basic Battery (used in this study) and a 12 subtest Standard Battery. The four PASS scales are described below.

The *Planning subtests* require the child to determine how to develop a plan of action, apply the plan, modify the plan as needed, and control the impulse to act without careful consideration of the demands of each item. These subtests are also best completed when the child develops and uses an efficient strategy (Naglieri & Das, 1997). Matching Numbers requires children to find and underline two numbers that are the same on each row of a page containing eight rows of numbers. Scanning the row and examining the numbers carefully in sequence to find a match are effective strategies that children often use on this test. Children who use these strategies tend to score higher on this test than those who do not use a strategy at all (Naglieri & Das, 1997). The Planned Codes subtest requires the child to use a legend given at the top of the page that includes letters with corresponding codes. The child is to fill in the appropriate codes (e.g., XX, OX) in the empty boxes beneath each letter (e.g., A, B) that appears on the rest of the page. Children are allowed to complete each page in any order they choose to enable the application of strategies such as filling in all the As, then Bs, and so on (Naglieri & Das, 1997).

The *Attention subtests* require the child to cognitively focus and respond to one stimulus, while refraining from responding to competing stimuli. The Expressive Attention task consists of several rows of color words (i.e., BLUE, YELLOW, GREEN, and RED) that are printed in a color that is different from the word (e.g, the word RED printed in blue). Instead of reading the word, the child is told to name the color the word is printed in. Number Detection includes rows of numbers printed in several different formats. For each page, the child is shown letters printed in a specific font (target) which they are to underline. The child is then required to find and underline a specific target stimulus (e.g., the numbers 1, 2, and 3 in an open font) among distractor items (e.g., the same numbers printed in a different font).

The *Simultaneous Processing subtests* require the child to analyze separate stimuli into an interrelated group or whole. Simultaneous processing includes spatial and logical reasoning activities with verbal and nonverbal content. The Nonverbal Matrices subtest is comprised of spatially or logically organized interrelated geometric designs. Children are required to decipher the relationships among the shapes included in the matrix or geometric design and choose one of the six options that best fits into the missing space in the grid. Verbal-Spatial Relations requires children to determine which picture out of several options is arranged in a certain spatial manner that matches a verbal description (e.g., circle in a square above a triangle).

The *Successive Processing* subtests involve the organization of material into a specific linear order in which each element is related and meaning is derived by the elements that precede and follow it. The Successive Processing subtests also involve the comprehension of the serial organization of events. Word Series requires children to repeat a series of single-syllable, high-imagery words in the correct order as the examiner verbally presents them. Sentence Repetition requires children to repeat a sentence comprised of color words (e.g., "The red blued the green.") in the exact order in which the sentence was presented.

The CAS was standardized on a sample of children representative of the U.S. on the basis of race, gender, parental education, geographic location, community setting, and educational placement. The standardization sample was comprised of 2,200 children aged 5 to 17 years. The average Basic Battery reliability coefficients are as follows: Full Scale (.87), Planning (.85), Attention (.84), Simultaneous (.90), and Successive (.90) (Naglieri & Das, 1997).

Woodcock-Johnson-III Test of Achievement. The WJ-III is a measure of academic achievement in reading, math, written language, and oral language. The test includes 22 achievement subtests organized into clusters, some of which were included in this study (Broad Reading, Broad Math, Math Calculation, Academic Skills, and Academic Fluency). Each achievement subtest and cluster yields a standard score with a mean of 100 and a standard deviation of 15 (Mather & Woodcock, 2001).

The Broad Reading cluster is comprised of Letter-Word Identification, Reading Fluency, and Passage Comprehension subtests. Broad Math includes Calculation, Math Fluency, and Applied Problems. Math calculation is an aggregate measure of Calculation and Math Fluency. The Academic Fluency cluster is a combination of Reading Fluency, Math Fluency, and Writing Fluency. Academic Skills is intended to be an overall measure of achievement comprised of Letter-Word Identification, Calculation, and Spelling (Mather & Woodcock, 2001).

The reading subtests included in this study were Letter-Word Identification, Reading Fluency, and Passage Comprehension. Letter-Word Identification begins with simple identification of individual letters of the alphabet and increases in difficulty to include pronunciation of whole words. Reading Fluency requires the child to quickly read simple sentences and decide whether the sentence is true or not. Passage Comprehension requires the child to point to a picture represented by a phrase or to read a short passage and identify a missing key word that makes sense in the context of the passage (Mather & Woodcock, 2001).

The WJ-III standardization sample was comprised of a large, nationally representative sample of 8,818 subjects in over 100 geographically diverse U.S. communities including the Northeast, Midwest, South, and West. The sample included children from White, Black, American Indian, Asian, Hispanic, and Pacific Islander racial/Ethnic groups. Median reliability coefficients for the clusters and reading subtests are: Broad Reading (.93), Broad Math (.95), Math Calculation (.90), Academic Skills (.95), and Academic Fluency (.93), Letter-Word Identification (.91), Reading Fluency (.90), and Passage Comprehension (.83) (Mather & Woodcock, 2001).

Procedure

Subjects were referred for an evaluation by community and hospital based physicians, psychologists, and other allied health professionals. The evaluation included the three instruments utilized in this study, which were administered by the third and fourth authors. Some subjects were evaluated by one of two postdoctoral residents and supervised by the third author. All tests were administered in a standardized fashion as prescribed by the test manuals. The tests were not administered in a random order, but instead, the WISC-III was administered on the morning of each full day assessment. The CAS was administered immediately after lunch with the WJ-III completed in the mid-afternoon. All testing was completed on a single day for each subject.

RESULTS

WISC-III, CAS, and WJ-III achievement mean standard scores presented in Table 1 all fall within the average range (90–109). The sample is, therefore, typ-

TABLE 1. Means and Standard Deviations for the WISC-III, CAS, and WJ-III Achievement (*N* = 119)

Instrument	*M*	*SD*
CAS		
Planning	93.7	11.6
Simultaneous	102.6	11.1
Attention	96.4	11.1
Successive	99.1	12.6
Full Scale	97.2	11.6
WISC-III		
Verbal IQ	107.6	13.8
Performance IQ	100.9	13.2
Full Scale IQ	104.5	13.2
Verbal Comprehension	108.7	13.9
Perceptual Organization	102.8	13.8
Freedom From Distractibility	100.9	14.5
Processing Speed	97.5	13.0
WJ-III		
Broad Reading	98.0	12.4
Broad Math	97.8	10.4
Math Calculation	94.4	11.0
Academic Skills	98.5	12.0
Academic Fluency	95.6	12.6

ical on the basis of ability and academic skills. There were some anticipated differences between the CAS and WISC-III mean scores. The values for WISC-III were typically higher than the mean scores for the CAS, presumably due to the fact that the WISC-III standardization sample is outdated and old norms consistently yield inflated values by about 3 points per decade (Flynn, 1999). The WISC-III means ranged from 97.5 to 108.7 and the CAS means ranged from 93.7 to 102.6. In addition, both sets of scores were restricted as evidenced by standard deviations (SDs) that were less than the normative value of 15. For example, the WISC-III SDs ranged from 13.0 to 14.5 and the CAS SDs ranged from 11.1 to 12.6. Restriction in range has the effect of reducing the magnitude of the obtained Pearson correlation coefficients. Therefore, obtained correlations as well as correlations that were corrected for restriction in range (Guilford & Fruchter, 1978) are reported (Table 2).

Table 2 presents both the obtained Pearson and corrected correlations for the WISC-III with achievement and the CAS with achievement. The WISC-III/WJ-III obtained correlations ranged from .23 to .68 (median across all achievement scores = .50). When corrected for restriction in range, the values ranged from .32 to .81 (median across all achievement scores = .62). The obtained correlations between the CAS/WJ-III achievement scores ranged from .32 to .70 (median across all achievement scores = .51). The CAS/WJ-III corrected correlations

TABLE 2. Obtained (O) and Corrected (C) Pearson Correlations for WISC-III and CAS Variables with WJ-III Achievement Clusters (N = 119)

	WJ-III Clusters											
	Broad Reading		Broad Math		Math Calculation		Academic Skills		Academic Fluency		Median	
	O	C	O	C	O	C	O	C	O	C	O	C
WISC-III												
VCI	.50**	.61**	.52**	.69**	.43**	.58**	.47**	.58**	.43**	.52**	.45**	.58**
POI	.44**	.54**	.48**	.65**	.41**	.56**	.39**	.50**	.37**	.45**	.40**	.52**
FDI	.57**	.66**	.68**	.81**	.58**	.71**	.62**	.71**	.51**	.59**	.58**	.69**
PSI	.38**	.50**	.42**	.61**	.41**	.57**	.23	.32**	.50**	.62**	.40**	.54**
VIQ	.52**	.63**	.61**	.77**	.51**	.65**	.51**	.63**	.44**	.54**	.51**	.63**
PIQ	.47**	.59**	.51**	.70**	.45**	.62**	.37**	.53**	.45**	.57**	.45**	.58**
FSIQ	.57**	.69**	.64**	.81**	.55**	.72**	.51**	.65**	.52**	.63**	.53**	.67**
CAS												
Full Scale	.64**	.79**	.70**	.88**	.66**	.84**	.63**	.80**	.69**	.83**	.65**	.82**
Planning	.48**	.65**	.51**	.74**	.50**	.71**	.43**	.61**	.61**	.77**	.49**	.68**
Simultaneous	.51**	.69**	.63**	.84**	.58**	.79**	.56**	.75**	.47**	.62**	.53**	.72**
Attention	.36**	.54**	.39**	.63**	.39**	.62**	.32**	.49**	.52**	.65**	.37**	.58**
Successive	.50**	.64**	.51**	.71**	.45**	.64**	.53**	.68**	.44**	.57**	.48**	.64**

** = $p < .01$

ranged from .49 to .88 with a median of .69. These results suggest that the CAS correlations with achievement were consistently higher than those found for the WISC-III.

Comparisons of the WISC-III FSIQ and CAS FS correlations to achievement were tested using *t* tests for the difference between correlations (Guilford & Fruchter, 1978). In order to maintain an experimentwise error rate of .05, t values had to be significant at $p < .01$. The WISC-III FSIQ Academic Skills cluster correlation was significantly lower than the CAS FS correlation with Academic Skills ($t = 3.68$, $p < .01$). In addition, the WISC-III FSIQ and CAS FS correlations with each of the remaining WJ-III clusters were significantly different. The WISC-III FSIQ was significantly lower than the CAS FS for Broad Reading ($t = 2.46$, $p < .01$), Broad Math ($t = 2.52$, $p < .01$), Math Calculation ($t = 3.36$, $p < .01$), and Academic Fluency ($t = 5.21$, $p < .01$). These findings indicate that the CAS Full Scale consistently correlated significantly higher than the WISC-III with the WJ-III achievement test scores.

In order to compare the correlations between WISC-III FSIQ and CAS FS to an overall measure of achievement, simultaneous regression analyses were conducted. This procedure allowed for the determination of the unique contribution of each measure in the prediction of WJ-III achievement scores. The results of these regression analyses are conservative estimates because they are not corrected for restriction in range. The Academic Skills cluster was selected because it is considered an overall measure of academic achievement (Mather & Woodcock, 2001). When both the WISC-III FSIQ and CAS FS were entered simultaneously into the regression model, results indicated that both the WISC-III and CAS scores contributed to the prediction of academic achievement, $F(2, 119) = 44.25$, $p < .01$. In addition, the CAS FS standard score ($sR^2 = .410$) was a stronger predictor of Academic Skills than the WISC-III FSIQ standard score ($sR^2 = .178$). These results indicate that the CAS FS score predicts 17 percent and the WISC-III FSIQ predicts 3 percent of the variance in a total academic achievement measure (Academic Skills cluster on the WJ-III).

The relationships between the WISC-III Index and PASS scales with reading on the WJ-III were more closely examined to address concerns raised by Vellutino, Scanlon, and Lyon (2000) that measures of intelligence are poorly related to reading achievement. First we determined if the WISC-III Index and CAS PASS scales contributed significantly to the prediction of each reading subtest. The results showed that the WISC-III significantly predicted Letter-Word Identification, $F(4, 118) = 15.90$, $p < .01$; Reading Fluency, $F(4, 118) = 18.73$, $p < .01$; and Passage Comprehension, $F(4, 118) = 18.97$, $p < .01$). Similarly, the CAS significantly predicted Letter-Word Identification, $F(4, 118) = 18.79$, $p < .01$); Reading Fluency, $F(4, 118) = 25.16$, $p < .01$; and Passage Comprehension, $F(4, 118) = 14.82$, $p < .01$. Next, obtained and corrected Pearson correlations and Beta coefficients among the WJ-III Reading subtests (Letter-Word Identification, Reading Fluency, and Passage Comprehension) and the four WISC-III as well as the four CAS scales were separately computed and are provided in Table

3. These analyses help explain the shared variance and predictive value between the WISC-III and CAS and specific reading tasks. Overall, WISC-III/WJ-III reading subtest correlations ranged from .20 to .58 (obtained) and .33 to .77 (corrected). The CAS/WJ-III reading subtest correlations ranged from .17 to .58 (obtained) and .33 to .79 (corrected).

When the WISC-III Index and PASS scales were examined as predictors of reading achievement using WJ-III reading subtests, results indicated that the WISC-III Verbal Comprehension (β = .25, $p < .01$) and Freedom from Distractibility (β = .44, $p < .01$) Index scores were significant predictors of Letter-Word Identification. Results for the CAS indicated that the Simultaneous (β = .30, $p < .01$) and Successive (β = .36, $p < .01$) scale scores significantly predicted Letter-Word Identification. Predictors of Reading Fluency for the WISC-III included Freedom from Distractibility (β = .27, $p < .01$) and Processing Speed Index (β = .32, $p < .01$); for the CAS, Planning (β = .35, $p < .01$) and Successive (β = .21, $p < .01$) scales. Finally, predictors of Passage Comprehension were the Verbal Comprehension Index (β = .40, $p < .01$) from the WISC-III and the CAS Simultaneous (β = .34, $p < .01$) and Successive (β = .37, $p < .01$) scales. These results suggest the most important predictor of reading achievement varies, depending on the reading task.

Multiple regression analysis using a model comparison approach was conducted to determine (a) which model (WISC-III Indexes or CAS PASS Scales) explained and predicted more variance in achievement; and (b) which model predicted academic achievement incrementally above and beyond the other. Two hierarchical (sequential) regression models were tested. First, the WISC-III scales were then put in the regression model as a set, then the CAS scales were added as a set. The results using the opposite sequence were examined (CAS first and the WISC-III second). This approach was used to determine if one set of scales explained more incremental variance above and beyond the other in academic achievement. When the four Index scales of the WISC-III were entered into the regression model first, results indicated that the WISC-III accounted for 41% (R^2 = .41) of the variance in academic achievement. CAS accounted for 12% of variance beyond the WISC-III ($R^2\Delta$ = .12, $F\Delta$ = 7.04, $p < .01$). When the four CAS scales were entered into the regression model first, the set of CAS variables accounted for 47% (R^2 = .47) of the variance in academic achievement, and the WISC-III variables accounted for 7% of the variance in academic achievement above and beyond the CAS ($R^2\Delta$ = .07, $F\Delta$ = 4.00, $p < .01$). The WISC-III and CAS variable models together as a whole model accounted for 53% (R^2 = .53) of the variance in academic achievement. Thus, both sets of variable models add to the prediction of achievement; however, the CAS model added to the prediction of achievement and explained more variance (12%) after the WISC-III was accounted for in the model and the WISC-III accounted for less of the variance in achievement (7%) after the CAS scales were accounted for in the model. These results indicate that although the difference between 7 and 12 percent is most likely not significant it is clear that these two sets of

TABLE 3. Obtained (O) and Corrected (C) Pearson Correlations and Beta among WJ-III Reading Subtests, CAS, and WISC-III Variables (N = 119)

	WJ-III Reading Subtests								
	Letter Word Identification			Reading Fluency			Passage Comprehension		
	O	C	Beta	O	C	Beta	O	C	Beta
WISC-III									
FSIQ	.48	.65	–	.55	.63	–	.58	.77	–
VCI	.47	.61	.25**	.44	.50	.22*	.58	.75	.40**
POI	.36	.49	–.01	.43	.50	.02	.47	.66	.16
FDI	.56	.69	.44**	.52	.57	.27**	.48	.65	.21*
PSI	.24	.36	.01	.49	.58	.32**	.20	.33	–.05
CAS									
Full Scale	.58	.78	–	.67	.79	–	.48	.72	–
Planning	.38	.58	.20*	.58	.71	.35**	.24	.43	.05
Attention	.26	.44	–.06	.50	.65	.17*	.17	.33	–.08
Simultaneous	.50	.73	.30**	.47	.62	.19*	.48	.74	.34**
Successive	.52	.70	.36**	.43	.53	.21**	.49	.71	.37**

Note: LWI = Letter-Word Identification; RF = Reading Fluency; PC = Passage Comprehension.
* = $p < .05$; ** = $p < .01$,

scales are not measuring identical constructs because they each contribute incrementally above and beyond the other.

DISCUSSION

The PASS theory as operationalized by the CAS provides a way to reconceptualize intelligence as four basic psychological processes that are strongly correlated with achievement (Naglieri, 2003). In this study we found a substantial relationship between achievement as measured by the WJ-III and the various processing scales of the CAS. The correlation between the CAS FS and the WJ-III Academic Skills scale was .80. These results also suggest that a cognitive approach to reconceptualizing intelligence offers a viable alternative to a traditional general intelligence approach (WISC-III correlation with WJ-III Academic Skills scale was .65). The findings that the PASS scales were important predictors of academic scores as measured by the WJ-III, that the correlations were consistently and significantly higher than traditional IQ tests and that the PASS scales accounted for more variance in reading than did the WISC-III for this sample supports the construct validity of the CAS. It can be concluded from these results, therefore, that when tests for ability in these children were assessed in two different ways, the cognitive processing approach was advantageous insofar as correlations to achievement are concerned. This finding in relation to previous studies (Naglieri, 1999; Naglieri & Bornstein, 2003; Ramsey & Reynolds, 2003) support Ceci's (2000) suggestion that a cognitive approach to conceptualizing intelligence may provide a better way to understand children's academic performance. The present findings in combination with previous research studies also suggest that Matarazzo's (1992) statement that traditional IQ tests have the advantage of predictive validity may no longer be true.

Our aim in he present study was to directly compare cognitive processing and traditional IQ approaches to conceptualizing and measuring intelligence in a way that extends previous research findings (Naglieri, 1999; Naglieri & Bornstein, 2003; Ramsey & Reynolds, 2003) using a methodology that addresses limitations of previous research. The results are particularly important because the PASS scales do not use achievement-like subtests (e.g., Vocabulary and Arithmetic) that would inflate the correlation between tests of ability and achievement (Naglieri & Bornstein, 2003). The more similarity in content between ability and achievement tests, the more contaminated the correlation between the two. Moreover, measures of cognitive processing without achievement-like subtests are more appropriate than achievement-laden tests for children with a history of school problems and especially for culturally and linguistically diverse populations (Suzuki & Valencia, 1997).

A secondary goal of the present study was to assess the relationship between ability and reading achievement in response to Vellutino et al. (2000), who stated that the correlation between intelligence and reading is low. In contrast, the data presented here, like the data provided by others (Naglieri, 1999;

Naglieri & Bornstein, 2003; Naglieri & Rojahn, 2004; Ramsey & Reynolds, 2003), indicate that the correlations between PASS processing scores and reading achievement is substantial. For example, the CAS FS score correlated .78 with Letter-Word Identification, .79 with Reading Fluency, and .72 with Passage Comprehension. These results offer evidence that ability, as measured by either a traditional IQ test or a cognitive processing approach accounts for more than the 10–20% of variance in reading scores as suggested by Vellutino et al. (2000).

This study has limitations that need to be recognized and should be considered when designing future research in this area. First, although the sample size was adequate, it was restricted in range and composed of children with clinical diagnoses from one area of the country. The comparison of the two tests should be replicated with much larger samples of typical children as well as those referred for evaluation, and who are more representative of the country. This study should also be replicated using a carefully counterbalanced research design. Future research should examine the comparative predictive utility of traditional IQ tests and a cognitive processing approach for children of different ages to determine if the results are different for children who are learning to read as opposed to those that have been exposed to reading instruction. Researchers should also study children who have specific learning disabilities, attention deficits, and other disabling conditions as well as various race and ethnic groups. Finally, this study should be replicated with the WISC-IV (Wechsler, 2003), although the findings are not likely to be very different given that the third and fourth editions are so highly correlated (.89; Wechsler, 2003, p. 62).

In summary, this study provides support for the construct validity of the PASS theory as operationalized by the CAS. The CAS FS was substantially correlated with achievement, and the correlations were significantly higher than those obtained using a measure of general intelligence. These findings also cast doubt on arguments made by Velluntino et al. (2000) that ability, as measured by both traditional and processing tests, are poorly related to achievement. Finally, these findings support researchers (e.g., Ceci, 2000; Das, 2002; Fagan, 2000; Kaufman & Kaufman, 1983, 2004; Naglieri, 2002; Naglieri & Das, 1997; Sternberg, 1988) who have suggested that a cognitive approach to defining and measuring intelligence could provide a way to better understand children's abilities and disabilities and related academic successes and failures.

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