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Construct Validity of the WISC-III for White and Black Students from the WISC-III Standardization Sample and for Black Students Referred for Psychological Evaluation

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Abstract. This study used both exploratory (EFA) and confirmatory factor analyses (CFA) to examine the factor structure of the WISC-III among White and Black students from the WISC-III standardization sample and a sample of 348 Black students referred for psychological evaluation. Results of the EFA provided evidence of a large first principal factor as well as the expected Verbal and Performance components across all three groups. Empirical support for the Freedom from Distractibility dimension was provided only from the confirmatory factor analyses. Although the four factor confirmatory model exhibited the best overall statistical fit, inspection of specific factor loadings revealed anomalies with the third and fourth factors, especially for the Referred Black sample. Implications for school psychologists are presented and recommendations for future research are provided.

The issue of nondiscriminatory assessment is a concept of considerable legal and ethical importance to all psychologists (CNPAAEMI, 2000). The selection of test instruments that are free of test bias is paramount for school psychologists who work with ethnically diverse populations. Construct validity is perhaps the most fundamental of all types of measurement validity (Messick, 1989), and often derives from correlational studies and factor analytic research. Empirical support for comparable factor structures across ethnic groups suggests that similar constructs or latent traits are being assessed and provides pre-

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liminary support for the use of a test with those populations. Rogers (1998) emphasized the importance of establishing cross-cultural factorial similarity:

> The construct validity of a test may also be a concern when the test evidences factorial invariance across racial/ethnic minority groups. Test developers and publishers need to report empirical evidence in the test manual that attests to the stability of the factor structure of a test for various majority and minority groups. When such information is not reported either in the manual or in the extant literature, the instrument is considered to be of limited practical utility because it is impossible to independently judge the factorial stability of the measure. (p. 361)

WISC-R Construct Evidence

Historically, the Wechsler Intelligence Scale for Children—Revised (WISC-R; 1974) has been the most commonly used test of intelligence for children referred for psycho-educational evaluation (Hutton, Dubes, & Muir, 1992; Lutey & Copeland, 1982). Despite their popularity, Wechsler tests have been criticized for their lack of a strong theoretical foundation (Macmann & Barnett, 1992, 1994; Witt & Gresham, 1985). Although Wechsler (1939) viewed intelligence as a global capacity, he also believed that two dimensions underlie intelligence; all subsequent tests in the Wechsler family have been constructed to assess Verbal and Performance IQs. Despite a lack of change in the underlying theory this evolution continued such that factor analytic studies of the WISC-R found three factors to be present and the recently introduced Wechsler Intelligence Scale for Children—Third Edition (WISC-III; Wechsler, 1991) measures four IQ factor scores. Further, in using a Gf-Gc framework, McGrew (1997) suggests that the Wechsler tests may actually be measuring as many as 13 broad and narrow cognitive abilities. Because it remains unclear how many "types" of intelligence are being measured by the Wechsler scales there currently exists considerable disagreement among school psychologists regarding their level of diagnostic interpretability (Kush, 1996).

Construct validity for Verbal and Performance IQs as well as for the Verbal Comprehension and Perceptual Organization dimensions of the WISC-R has been well established and shown to be invariant across age (Conger, Conger, Farrell, & Ward, 1979), gender (Reynolds & Gutkin, 1980), and ethnicity (Gutkin & Reynolds, 1981; Reschly, 1978; Taylor, Ziegler, & Partenio, 1984). Considerable empirical support has also been provided for a third WISC-R factor, Freedom from Distractibility. Kaufman (1975) found this third factor to be present in each of the age groups of the WISC-R standardization sample, and the presence of the Freedom from Distractibility factor has been established in independent regular and special education populations (Juliano, Haddad, & Carroll, 1988; Reynolds & Kaufman, 1990; Sattler, 1974), and across diverse ethnic groups (Dean, 1980; Kaufman, 1975).

Development and Construct Evidence of the WISC-III

With the publication of the Wechsler Intelligence Scale for Children-Third Edition (WISC-III; Wechsler, 1991), a new subtest (Symbol Search) was created to strengthen the third Freedom from Distractibility (FD) factor. However, this new subtest caused the Freedom from Distractibility factor to splinter into two smaller factors each consisting of only two subtests. Freedom from Distractibility remained with loadings from two auditory subtests (i.e., Arithmetic and Digit Span), and the newly created factor, Processing Speed, was formed by loadings from Coding and Symbol Search. This structure was replicated in the WISC-III Canadian normative sample (Roid & Worrall, 1997). Keith and Witta (1997) also provided qualified support for a similar four-factor structure. They performed a hierarchical confirmatory factor analysis of the WISC-III standardization data and endorsed a hierarchical solution with four first-order factors and one second-order factor reflecting (*g*) general intellectual ability. Other analyses of the WISC-III standardization data (Allen & Thorndike, 1995; Sattler, 1992; Thorndike, 1992) have concluded that a three-factor solution best describes the data. Similarly, Reynolds and Ford (1994) found stability of three WISC-III factors in the standardization sample across ages and across several factor analytic techniques when Symbol Search was excluded from the analyses. Compounding the problems associated with the instability of the third and fourth WISC-III factors is a lack of clear empirical evidence that either of these factors is clinically interpretable (Anastopoulos, Spisto, & Maher, 1994; Kamphaus, 1993; Riccio, Cohen, Hall, & Ross, 1997).

WISC-III construct evidence in independent samples. Research examining the factor structure of the WISC-III in independent populations has also produced contradictory conclusions. Support for a four-factor solution has been provided for regular education (Roid, Prifitera, & Weiss, 1993), and special education (Konold, Kush, & Canivez, 1997) students. However, Logerquist-Hansen and Barona (1994) reported a three-factor solution in a sample of Hispanic students with learning disabilities. Further, both Kush (1996) and Scardapane (1996) found support for only the Verbal and Performance factors in samples of students with learning disabilities.

Factorial Comparisons Across Ethnic Groups on the Wechsler Scales

Historically, factorial similarity has been shown between Black and White children on Wechsler scales, including the original WISC (Lindsey, 1967), the WISC-R (Taylor & Ziegler, 1987), and the Wechsler Preschool and Primary Scale of Intelligence (WPPSI; Kaufman & Hollenback, 1974). Additional research examining the construct validity of the WISC-R for Black students also found support for Verbal and Performance factors but questioned the validity of the third factor (Greenberg, Stewart, & Hansche, 1986; Gutkin & Reynolds, 1981). Valencia, Rankin, and Oakland (1997) also found WISC-R factorial similarity between White and Black students although the order of the second and third factors was reversed for the Black sample.

Research examining the construct validity of the WISC-III for Black students is sparse. Using a very small sample of Black students ($N = 58$), Slate and Jones (1995) attempted to factor analyze the 10 required subtests plus the optional Digit Span subtest and found support for only the Verbal and Performance factors. In a somewhat larger sample of Black students ($N = 161$), Kush and Watkins (1997) analyzed the 10 mandatory WISC-III subtests and also found support for the Verbal and Performance factors. These results were robust across several extraction and rotation techniques. However, support for the full, four-factor model could not be confirmed, as participants in these studies were not administered all 12 mandatory and supplemental subtests.

Much of the published factorial validity research with the WISC series is difficult to integrate because disparate factoring methods were applied (e.g., exploratory and confirmatory analyses; maximum likelihood, principal factors, and alpha extraction techniques; orthogonal and oblique rotations) to diverse populations. The current study was designed to extend previous WISC-III validity research by utilizing the factor analytic techniques originally applied to the combined WISC-III normative sample (Wechsler, 1991) with the separate White and Black WISC-III standardization samples and with an independent sample of Black students referred for psychological evaluation.

Specifically, the purposes of this study were twofold. Our first goal was to replicate, exactly, the exploratory factor analytic methodology used with the total WISC-III standardization sample, with separate analyses of the White and Black students included in the WISC-III standardization sample, and with an independent sample of Black students completing the WISC-III. Because Black students represent a small percentage of the WISC-III standardization sample (15.4%) additional research examining this population is particularly warranted.

Our second goal was to examine alternative factor analytic models of the WISC-III for possible improvement in fit, within both Black and White samples. Selection of models was derived from previous empirical analyses of the WISC-III and included models with between one and five factors. The selection of models was not exhaustive and other theories of intelligence (e.g., PASS, Gf-Gc) were intentionally not included. Multifactorial theories of intelligence have gained recent popularity; however, there is currently no consensus regarding which theory *best* describes the structure of human intelligence. Given that these debates have yet to be resolved (e.g., it is not yet clear how the Gf factor is substantially unique from the higher-order *g* factor), our goal was to focus on extending previous WISC-III findings:

> Regardless of whether the factors discovered from factor analyzing the scales are true representations of underlying dimensions of intelligence, the psychometric utility of the instruments is derived directly from their ability to measure the composition of these factors across age groups and instruments reliably. (Allen & Thorndike, 1995, p. 648)

Method

Participants

Three samples of students were involved in the present study. The Standardization White sample included all the White students (*N* = 1,543) and the Standardization Black sample contained all the Black students (*N* = 338) in the WISC-III standardization sample (Wechsler, 1991). White students comprise 86% of the standardization sample and Black students comprise 14% of the standardization sample. Demographic data were not available for these students, but they should be adequately described in the test manual (Wechsler, 1991).

The Referred Black sample was composed of 348 Black students who received comprehensive psychological evaluations across 10 states (from three of the four geographic regions reported in the WISC-III standardization sample): AZ, CT, DE, GA, NC, NJ, NY, OH, PA, and VA. These students were selected from archival records contributed from recent psychological evaluations and re-evaluations. One hundred-ninety of these evaluations were part of an initial evaluation process, and 138 occurred at the time of a regularly scheduled, triennial re-evaluation. The remaining 20 cases were conducted intermittently between initial evaluations and re-evaluations. The sample included 254 males and 94 females in Grades kindergarten through 12 (*Mdn* age = 11; *Mdn* grade = 5) with a relatively equal distribution across Grades 2 through 8. Subsequent to these evaluations, special education status was determined to include 206 students with Learning Disabilities, 23 students with Emotional Disabilities, 25 students with Mild Mental Retardation, 2 students with Speech-Language Disabilities, and 11 students categorized as Other Health Impaired. Eighty-one of the students were determined to be ineligible for special education services.

Measures

The WISC-III is an individually administered test of intellectual ability for children aged 6-0 to 16-11 years (Wechsler, 1991). It was standardized on a nationally representative sample of 2,200 children, with 100 boys and 100 girls included at each of 11 age levels. The WISC-III consists of 13 subtests (*M* = 10; *SD* = 3), which combine to yield Verbal, Performance, and Full Scale IQs (*M* = 100; *SD* = 15). Because Mazes is not included in the calculation of any IQ scores it was excluded from all subsequent analyses.

Procedure

Procedures used to collect the WISC-III normative data are described in Wechsler (1991). For the Referred Black sample, the WISC-III was administered by state certified school psychologists as part of the multidisciplinary evaluation process to determine eligibility for special education services. The Referred Black sample was extracted from the results of two previous WISC-III data collection surveys. The first survey (Canivez & Watkins, 1998) was of 2,000 NASP practitioners from across the United States. In the second survey (Watkins & Kush, 2000), special education directors of Arizona school districts were asked to provide anonymous WISC-III data. From these two WISC-III data sets, 509 Black students were initially identified; however, Digit Span and Symbol Search subtests were not administered to 161 of these students

Table 1
Components of Five Incremental Fit CFA Models for WISC-III Subtests with Referred Black Students and Black and White Students from the WISC-III Normative Sample

Model One	Model Two	Model Three	Model Four	Model Five
IN	IN	IN	IN	IN
SM	SM	SM	SM	SM
VO	VO	VO	VO	VO
CM	CM	CM	CM	CM
AR	AR	AR	PC	PC
DS	DS	DS	PA	PA
PC	PC	PC	BD	BD
PA	PA	PA	OA	OA
BD	BD	BD	AR	AR
OA	OA	OA	DS	DS
CD	CD	CD	CD	CD
SS	SS	SS	SS	SS

Note. IN = Information, SM = Similarities, AR = Arithmetic, VO = Vocabulary, CM = Comprehension, DS = Digit Span, PC = Picture Completion, CD = Coding, PA = Picture Arrangement, BD = Block Design, OA = Object Assembly, SS = Symbol Search.

who were consequently excluded from the present study. Special education placements were independently determined by a multidisciplinary team based on federal and state special education rules and regulations.

Data Analyses

Exploratory factor analyses. Scaled scores from the 12 WISC-III subtests combined to form a 12 x 12 correlation matrix. Consistent with exploratory factor analyses (EFA) reported in the WISC-III technical manual (Wechsler, 1991) on data comprising the standardization sample, maximum likelihood extraction (using squared multiple correlations) with Varimax rotation was conducted. As recommended by Gorsuch (1983), multiple criteria were used to determine the number of factors to retain, including the scree test (Cattell, 1966) and parallel analysis (Horn, 1965). The scree test plots eigenvalues against factors to visually identify the optimum number of common factors. Parallel analysis compares eigenvalues extracted from the sample data with eigenvalues generated from random normal data containing the same number of subjects and variables. Factors are considered meaningful when they are represented by larger eigenvalues than are produced by this random data (Lautenschlager, 1989).

Confirmatory factor analyses. Although EFA is useful for identifying the latent constructs that could account for the intercorrelations of a set of variables, it produces mathematically indeterminate results (Gorsuch, 1983). That is, no single unique mathematical solution can be identified. Confirmatory factor analysis (CFA) is well suited for testing which of a number of competing models best fits the data. Gerbing and Hamilton (1996) demonstrated that exploratory factor analysis "is a useful tool to aid the researcher in recovering an underlying measurement model that can then be evaluated with CFA" (p. 71), and Carroll (1995) recommended that both exploratory and confirmatory analyses be conducted and reported when studying cognitive abilities.

Confirmatory factor analyses were conducted by the authors on the Referred Black sample using version 5.4 of the statistical software EQS for the Macintosh (Bentler & Wu, 1995). CFA of the Standardization Black and Standardization White WISC-III samples were performed by The Psychological Corporation using AMOS 3.6 (Arbuckle, 1997). A series of five incremental fit models were analyzed. Covariance matrices of the 12 WISC-III subtests served as input for these procedures. Each of the five models was evaluated using maximum likelihood estimation. Subtests that comprise each model are presented in Table 1. These models were based upon previous empirical and theoretical analyses of the WISC-III (Floyd & Widaman, 1995; Kamphaus, Benson, Hutchinson, & Platt, 1994; Kush, 1996; Kush & Watkins, 1997; Roid et al., 1993; Wechsler, 1991; Woodcock, 1990). Model 1 included all 12 subtests in a single factor, whereas Model 2 reflected the traditional WISC-III Verbal (IN, SM, VO, CM, AR, DS; see Table 1) and Performance (PC, PA, BD, OA, CD, SS; see Table 1) factors. Model 3 examined a three-factor model that included a Perceptual Speed factor (Coding and Symbol Search were pulled from their respective Verbal and Performance factors). Model 4 reflected the four-factor model thought to underlie the WISC-III (Verbal Comprehension = IN, SM, VO, CM; Perceptual Organization = PC, PA, BD, OA; Freedom from Distractibility = AR, DS; Processing Speed = CD, SS). Finally, Model 5 examined a five-factor model identical to Model 4 except that Arithmetic and Digit Span were allowed to load as separate factors.

Results

Descriptive statistics for Verbal, Performance, and Full Scale IQs of the WISC-III, the four factor indexes, and individual subtests are presented in Table 2 for all three samples. The 15-point difference between Standardization White and Standardization Black students is consistent with previous research on the WISC-R. And, as would be expected, Referred Black students exhibited slightly lower Full Scale IQ scores than did Standardization Black students. Additionally, the relatively equal Verbal and Performance IQ scores within each sample is congruent with the small differences found in the WISC-R standardization sample for Black children (Kaufman & Doppelt, 1976) and with existing research on the WISC-III involving Black students (Kush & Watkins, 1997; Slate & Jones, 1995). Table 3 presents the WISC-III subtest intercorrelation matrix for the Referred Black children.

Exploratory factor analyses (EFA). Results of the maximum-likelihood exploratory factor analyses for all three groups are presented in Table 4. An examination of the first unrotated factor in each of these analyses indicates that a moderate percentage of total WISC-III variance (44% to 53%) was accounted for by a large latent general factor (*g*). This is comparable to the 43% attributed to *g* in the standardization sample. When comparing WISC-III Standardization Black and Standardization White students, a coefficient of congruence (Wrigley & Neuhaus, 1955) of .99

Table 2
Standard Score Means and Standard Deviations for WISC-III VIQ, PIQ, FSIQ, VC, PO, FD, and PS and Subtests for Referred Black Students and White and Black Students from the WISC-III Normative Sample

	White Norm[a]		Black Norm[b]		Black Referral[c]	
Variable	Mean	*SD*	Mean	*SD*	Mean	*SD*
Verbal IQ	103.60	14.18	90.73	12.72	84.49	12.07
Performance IQ	102.94	14.13	88.49	14.12	85.02	13.05
Full Scale IQ	103.45	13.84	88.60	13.05	83.34	12.04
VC Factor	103.65	14.10	90.78	12.69	85.81	12.57
PO Factor	103.41	14.00	87.49	14.20	85.36	13.71
FD Factor	103.12	14.34	95.67	13.66	85.34	10.77
PS Factor	101.94	14.74	95.78	15.28	91.89	13.81
Picture Completion	10.50	3.02	7.86	3.21	7.95	2.93
Information	10.68	3.02	8.27	2.73	7.12	2.76
Coding	10.05	3.28	9.43	3.43	8.19	3.35
Similarities	10.56	2.97	8.22	2.59	7.64	2.96
Picture Arrangement	10.41	3.15	8.18	3.03	7.37	2.92
Arithmetic	10.47	3.01	8.65	2.72	6.91	2.26
Block Design	10.47	3.27	7.32	3.16	6.92	3.12
Vocabulary	10.53	3.02	8.16	2.95	6.99	2.55
Object Assembly	10.44	3.16	7.73	3.16	7.38	2.88
Comprehension	10.58	3.22	8.36	2.91	7.54	3.25
Symbol Search	10.29	3.19	8.54	3.36	8.28	2.76
Digit Span	10.31	3.03	9.47	3.00	7.58	2.46

[a]White Normative WISC-III Sample $N = 1543$. [b]Black Normative WISC-III Sample $N = 338$. [c]Black Referred WISC-III Sample $N = 348$.

indicated an excellent degree of factorial similarity on the *g* factor between the two groups (MacCallum, Widaman, Zhang, & Hong, 1999). Similar findings were found (coefficient of congruence = .99) when Standardization Black students were compared with the Referred Black sample. Factor loadings of the individual subtests on the *g* factor were uniformly positive for all three groups, with all subtests except Coding and Digit Span loading above .50 and with the majority of the 12 subtests showing loadings above .60.

Following examination of the first unrotated factor, several decision rules were applied when determining the number of factors to retain. Although results from the scree test and parallel analysis suggested that only two factors were appropriate for rotation, the less conservative Kaiser (eigenvalue greater than 1) and chi-square test criteria identified three factors. Although the third factors were slightly below (.999) or barely exceeded the Kaiser criteria (eigenvalues = 1.02 to 1.10), and accounted for a small amount of total test variance (6% to 8%), three factors were subsequently rotated due to the exploratory nature of the analysis (Wood, Tataryn, & Gorsuch, 1996).

Following rotation, the first two factors reflected the traditional Wechsler Verbal and Performance dimensions. When combined, these two factors comprised between 44% and 55% of the total test variance, a figure comparable to the 45% total reported for the combined standardization sample. For the most part, subtest loadings were as expected and

Table 3
Intercorrelations among WISC-III Subtests for Referred Black Students (N = 348)

	IN	CD	SM	PA	AR	BD	VO	OA	CM	SS	DS
PC	41	.14	.36	44	.32	.53	.44	48	.40	.33	.20
IN		.05	.51	38	.50	.33	.57	.29	.40	.31	.21
CD			.17	.24	.04	.16	.17	.20	.23	.49	-.03
SM				.39	.33	.39	.60	.30	.31	.38	.20
PA					.31	.48	.51	.44	.42	.48	.10
AR						.24	.44	.30	.41	.20	.24
BD							.35	.60	.33	.38	.20
VO								.38	.67	.36	.13
OA									.37	.43	.23
CM										.31	.18
SS											.16

Note. PC = Picture Completion; IN = Information, CD = Coding, SM = Similarities, PA = Picture Arrangement, AR = Arithmetic; BD = Block Design; VO = Vocabulary; OA = Object Assembly, CM = Comprehension, SS = Symbol Search; DS = Digit Span.

aligned closely with their respective latent dimensions. Although most commonly associated with the Performance subtests, the Picture Arrangement subtest displayed comparable loadings on both the Verbal and Performance factors. The third factor was characterized by strong loadings from only two subtests (Coding and Symbol Search), which correspond to the Processing Speed factor in the standardization sample. No evidence of the Freedom from Distractibility factor emerged, with Arithmetic exhibiting a strong loading on the Verbal factor and Digit Span failing to load on any of the three extracted factors in two of the samples. The Arithmetic subtest exhibited moderate loadings on both the Verbal and Processing Speed factors only for Standardization Black students.

As expected, good to excellent (MacCallum et al., 1999) factorial similarity was found between Standardization White and Standardization Black students for both the Verbal and Performance factors (coefficients of congruence = .99 and .92, respectively). Similar congruence emerged when Verbal and Performance factors from the Referred Black and Standardization Black samples were examined (coefficients of congruence = .98 and .92, respectively). Good congruence was also evidenced between Standardization White and Standardization Black samples (coefficient of congruence = .94) on the PS factor; however, the degree of similarity was borderline (coefficient of congruence = .87) when Referred Black and Standardization Black samples were compared.

Confirmatory factor analyses (CFA). No index of model fit has been generally accepted as superior, so several were applied to ensure that multiple aspects of model fit could be captured (Hu & Bentler, 1995). Model evaluation statistics are presented in Table 5.

Table 4
Exploratory Maximum Likelihood/Varimax Factor Loadings of the WISC-III for Referred Black (RB) Students, Black Students from the WISC-III Standardization Sample (SB), and White Students from the WISC-III Standardization Sample (SW)

	g Loading			Factor I			Factor II			Factor III		
Subtest	RB	SB	SW	RB	SB	SW	RB	SB	SW	RB	SB	SW
PC	.63	.65	.60	.36	.34	.34	.55*	.60*	.47*	.13	.14	.01
IN	.63	.73	.76	.62*	.70*	.73*	.28	.22	.30	.03	.18	.01
CD	.32	.48	.46	.05	.11	.12	.02	.14	.10	.77*	.66*	.82*
SM	.67	.74	.76	.62*	.68*	.72*	.26	.31	.30	.18	.14	.01
PA	.67	.61	.54	.41*	.35	.29	.44*	.31	.32	.31	.32	.24
AR	.51	.70	.72	.51*	.52*	.51*	.24	.22	.38	-.01	.35	.21
BD	.64	.74	.70	.20	.33	.25	.77*	.62*	.76*	.17	.35	.19
VO	.81	.78	.76	.84*	.76*	.79*	.21	.29	.20	.17	.17	.17
OA	.63	.61	.63	.23	.20	.22	.66*	.70*	.63*	.23	.18	.18
CM	.70	.72	.67	.68*	.70*	.65*	.21	.20	.18	.22	.20	.18
SS	.58	.59	.60	.24	.20	.20	.34	.20	.34	.61*	.70*	.61*
DS	.25	.59	.49	.16	.38	.30	.27	.17	.29	-.04	.39	.19
Eigenvalue				4.87	5.35	5.04	1.35	1.21	1.28	1.10	1.02	.999
% Variance	44	53	51	37	45	42	7	10	11	6	8	8

Note. RB $N = 348$, SB $N = 338$, SW $N = 1543$. PC = Picture Completion; IN = Information; CD = Coding; SM = Similarities; PA = Picture Arrangement; AR = Arithmetic; BD = Block Design; VO = Vocabulary; OA = Object Assembly; CM = Comprehension; SS = Symbol Search; DS = Digit Span.
* Significant Factor Loading

Table 5
WISC-III CFA Model Evaluation Statistics Across Three Samples

Model/Sample[a]	X^2	*df*	GFI	CFI	RMSEA	90% CI RMSEA	X^2 Diff	*df*
One Factor								
Black Referred	366.1**	54	.837	.792	.129	.116-.141	-	-
Black Norm	261.9**	54	.869	.867	.107	.094-.120	-	-
White Norm	1234.1**	54	.865	.828	.119	.113-.125	-	-
Two Factor								
Black Referred	225.1**	53	.902	.885	.097	.084-.110	141**	1
Black Norm	159.8**	53	.920	.932	.077	.064-.091	102**	1
White Norm	712.5**	53	.924	.904	.090	.084-096	522**	1
Three Factor								
Black Referred[b]	160.1**	52	.927	.928	.077	.064-.091	65**	1
Black Norm	112.3**	51	.947	.961	.060	.045-.075	48**	2
White Norm	386.9	51	.956	.951	.065	.059-.071	326**	2
Four Factor								
Black Referred[b]	151.5**	49	.932	.932	.078	.064-.092	8.6*	3
Black Norm	79.1*	48	.963	.980	.044	.026-.061	33**	3
White Norm	212.4**	48	.977	.976	.047	.041-.054	175**	3

[a]N = 348, 338, and 1543 for Black Referred, Black Norm, and White Norm samples, respectively.
[b]Negative error variance for Symbol Search required that it be fixed to allow model to be estimated.
*$p < .05$. **$p < .001$.

None of the models could be accepted based upon the population X^2 because the X^2 measure is extremely sensitive to large sample sizes (Crowley & Fan, 1997).

Given this limitation of the X^2, it is prudent to look at competing models (Loehlin, 1992) and alternative fit indices (Byrne, 1994). Competing models can be judged by calculating the difference in their X^2 values. A statistically significant change in X^2 between two models indicates that one model provides a significantly better fit than the other.

Three alternative fit indices are presented in Table 5: the goodness of fit index (GFI), the comparative fit index (CFI), and the root mean square error of approximation (RMSEA). The CFI assesses fit relative to a baseline null model. The GFI is an index of the relative amount of the variances and covariances jointly accounted for by the model and is analogous to R^2 in multiple regression. The RMSEA reflects the covariance residuals adjusted for degrees of freedom. Thus, it is a measure of *badness of fit*, whereas the GFI and CFI indexes reflect *goodness of fit*. Only RMSEA has a known sampling distribution and can, therefore, be used to judge competing models (MacCallum, Browne, & Sugawara, 1996; Rigdon, 1996) as well as absolute (mis)fit.

GFI and CFI are normed to fall within a range of 0.0 to 1.0, with larger values indicating better fit. RMSEA values also range from 0.0 to 1.0. However, in contrast, smaller values represent a better fit. Generally, GFI and

CFI values greater than .90 and RMSEA values of .05 or less indicate an acceptable fit to the data (Bentler, 1992; Tabachnick & Fidell, 1996). However, Hu and Bentler (1998, 1999) recommended a combination rule that requires both a CFI cutoff value close to .95 *and* an RMSEA value near .06 to minimize Type I and Type II error rates.

Analysis of the five-factor model was attempted, but resulted in numerous negative error variance estimates. Thus, Model 5 was determined to be problematic (Velicer & Fava, 1998) and was excluded from further consideration (Bentler & Chou, 1987). GFI, CFI, and RMSEA indices suggested that the three- and four-factor models were relatively equivalent for all three samples (see Table 5). The four-factor solution for both Standardization White and Standardization Black samples clearly met Hu and Bentler's (1998, 1999) combinatorial fit criterion of CFI $\geq$ .95 and RMSEA $\leq$ .06. RMSEA 90% confidence intervals (MacCallum et al., 1996) revealed that (a) there was no clear distinction between two-, three-, and four-factor solutions for the Referred Black sample; (b) there was no clear distinction between three- and four-factor solutions for the Standardization Black sample; and (c) there was a clear superiority of the four factor solution for the Standardization White sample. However, X^2 difference analyses indicated statistically significant improvements in successive model fit between Models 1, 2, 3, and 4 for all three samples. That is, the addition of a second factor improved model fit over the one-factor model, the addition of a third factor improved over the two-factor model, and the addition of a fourth factor improved over the three-factor model. When overall Type I error was controlled while examining this sequence of nested model tests (Bentler, 2000), however, the four-factor solution was statistically superior for the Standardization Black and Standardization White samples but not for the Referred Black sample. Thus, it appears that the four-factor model exhibits the best overall fit for the Standardization White and Standardization Black samples whereas there was no clear distinction between three- and four-factor models for the Referred Black sample. Four-factor solutions for all three samples are provided in Table 6. Standardized structural coefficients for the four-factor model based on the Referred Black sample are also presented in Figure 1.

Discussion

Full Scale, Verbal, and Performance IQs

These results provide qualified support for the construct validity of WISC-III scores when comparing Standardization White and Standardization Black students and Black students referred for psychological evaluation. As expected, results of the present study indicated that subtests from the WISC-III produced substantial *g* loading across all three samples of students. Results of this study, considered within the context of other research (Kush & Watkins, 1997; Slate & Jones, 1995) further indicate that school psychologists can reasonably conclude that the WISC-III Verbal and Performance indices can be thought of as relatively robust indicators of intelligence for both White and Black children. Although school psychologists who work with these populations of children had previously assumed the similarity of factor structure across ethnic groups, our study is the first to provide empirical evidence to support this claim. Additionally, our study suggests that these findings can be extended to both referred and nonreferred Black students.

Factor Score Indices

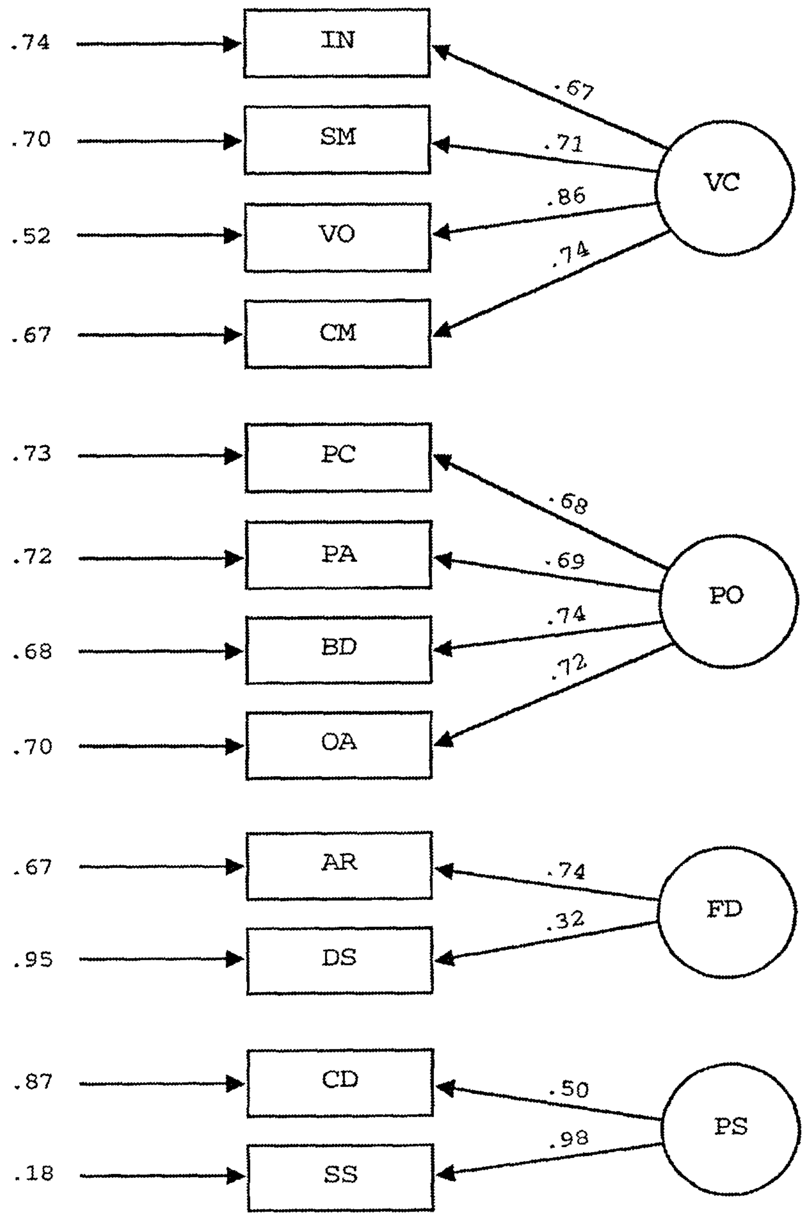
Empirical support is less definitive for the existence of the two smaller factor scores, Freedom from Distractibility and Processing Speed. Across all three samples, EFA suggested that only three factors could best account for the pattern of correlations found between WISC-III subtests: Verbal Comprehension (VC), Perceptual Organization (PO), and Processing Speed (PS). Arithmetic (AR) consistently loaded on the VC factor but Digit Span (DS) failed to show a strong salient loading on any single factor. The PS factor accounted for a very small proportion of the total WISC-III variance (6-8%) and when Standardization Black students were compared with Referred

Table 6
Standardized Structural Coefficients for Model Four of the WISC-III for Referred Black Students and White and Black Students from the WISC-III Normative Sample

	Factor I			Factor II			Factor III			Factor IV		
Subtest	White Norm	Black Norm	Black Referral	White Norm	Black Norm	Black Referral	White Norm	Black Norm	Black Referral	White Norm	Black Norm	Black Referral
IN	.80	.75	.67									
SM	.79	.77	.71									
VO	.82	.83	.86									
CM	.69	.75	.74									
PC				.59	.68	.68						
PA				.50	.57	.69						
BD				.78	.79	.74						
OA				.69	.67	.72						
AR							.83	.71	.74			
DS							.52	.59	.32			
CD										.61	.63	.50
SS										.91	.80	.98

Note. PC = Picture Completion; IN = Information; CD = Coding; SM = Similarities; PA = Picture Arrangement; AR = Arithmetic; BD = Block Design; VO = Vocabulary; OA = Object Assembly; CM = Comprehension; SS = Symbol Search; DS = Digit Span.

Figure 1. Four-factor model fit and standardized loadings of the WISC-III for referred Black students.



	PO	FD	PS
VC	.71	.73	.46
PO		.58	.58
FD			.29

Black students, the resultant borderline coefficient of congruence on the PS factor was indicative of low factorial similarity between the two groups. Because the goal of the present study was to replicate the analyses utilized on the entire WISC-III standardization sample, Varimax rotation was performed on all three samples in the present study. However, when too many factors are rotated with the Varimax method there is a tendency for the variance of small, unimportant variables to be inflated, which subsequently has the effect of "robbing" larger factors of their share of appropriate variance (Comrey & Lee, 1992).

Confirmatory Analyses

The confirmatory factor analyses indicated that, overall, a four-factor model exhibited a statistically better fit to the data for the Standardization Black and Standardization White samples, but there was no clear distinction between the three- and four-factor models for the Referred Black sample. Inspection of specific CFA structure loadings from the four-factor model reveals anomalies in the third and fourth factors, especially for the Referred Black sample. For example, only 10% of the variance associated with DS and 25% of the variance associated with CD were explained. Irregularities with the third and fourth factors have been reported in previous studies with nonexceptional students (Allen & Thorndike, 1995; Sattler, 1992; Thorndike, 1992; Woodcock, 1990), but these problems have been especially prevalent with samples of exceptional students (Grice, Krohn, & Logerquist, 1999; Kush, 1996; Ravert, 1999). Tabachnick and Fidell (1983) made the following observation:

> A variable with a low squared multiple correlation with all other variables or low correlations with all factors does not share variance with either variables or factors and has not participated in the analysis... the dimension represented by the outlying variable may represent either a promising lead for future work or (probably) error variance, but its interpretation awaits clarification by more research. (p. 380)

Contradictory factor analytic results may partially be attributed to statistical artifacts. According to Gorsuch (1983), "it is generally difficult to replicate factors with fewer than five or six salient variables per factor" (p. 332). Velicer and Fava (1998) also noted that three variables per factor in a sample are a bare minimum requirement for recovering a population factor pattern. Another statistical consideration is especially pertinent for CFA results because "For any given model, there will generally be alternative models, represented by different patterns of relations among the variables, that are indistinguishable from the original model in terms of goodness of fit to sample data" (MacCallum, Wegener, Uchino, & Fabrigar, 1993, p. 185).

Reise, Widaman, and Pugh (1993) indicated that "no CFA model should be accepted or rejected on statistical grounds alone; theory, judgment, and persuasive argument should play a key role in defending the adequacy of any estimated CFA model" (p. 554). Wechsler (1939, 1991) provided no underlying theoretical explanation for why these additional dimensions of intellectual ability (FD and PS) should exist (Macmann & Barnett, 1992, 1994; Witt & Gresham, 1985) and there is evidence that the third and fourth factors show little incremental validity in predicting academic achievement (Glutting, Youngstrom, Ward, Ward, & Hale, 1997) and behavioral dysfunction (Riccio, Cohen, Hall, & Ross, 1997). Nor do they contribute to diagnostic accuracy with exceptional students (Watkins, Kush, & Glutting, 1997). Further, their long-term stability is unsatisfactory (Canivez & Watkins, 1998). Given the lack of theoretical support, weak factorial invariance, inadequate long-term stability, and trivial incremental validity of the FD and PS factors, we recommend that interpretation of WISC-III scores beyond global, verbal, and performance dimensions should be undertaken with extreme caution. Thus, we agree with Keith and Witta's (1997) assertion that the WISC-III is first and foremost a measure of general intelligence or *g*, but we disagree with their suggestion that interpretations beyond the Full Scale IQ will be more valid if based on the four optional index scores than on the Verbal and Performance IQs.

Challenges to the Cultural Relativism View of Intelligence

Our results also challenge proponents of the cultural relativism view of the nature of intelligence (Helms, 1992, 1997; Ogbu, 1994). This position posits that intelligence is culturally determined and that what constitutes intelligence for one subgroup (e.g., male vs. female; Black vs. White vs. Hispanic) might be something quite different from what constitutes intelligence for another subgroup. Frisby (1999) characterized this ideological position as the belief that "Lower-scoring American minority groups are *exotic*, having cultural traits and background experiences that are so unusual as to lay waste to traditional interpretations of cognitive abilities and its measurement with traditional instruments..." (p. 199). Helms (1992), for example, maintained that most *g*-related tasks are European centered, emphasizing (among other things) "action orientation" and "competition." "African-centered" values, in contrast, emphasize "spirituality," "harmony," and "social time." Similarly, Ogbu (1994) contended that research examining ethnic differences in IQ tests must recognize a distinction between voluntary or immigrant minorities and involuntary or nonimmigrant minorities. Ogbu posits that voluntary and involuntary minorities develop different cognitive frames of reference toward many things, including IQ test performance, depending on whether they or their ancestors freely chose to come to their new country or whether they were forced to immigrate.

Our finding of invariant latent intellectual traits between Black and White children directly challenges this position. This study provides empirical data that contradict unsubstantiated and speculative hypotheses typified by Helms's (1997) suggestion of the possible differential impact socioeconomic status, culture, and race may have on measures of intellectual performance. She argues that racial bias may exist on Wechsler subtests such as Comprehension, where "Exposure to racism may mean that different social rules are operative (e.g., banks may not lend money to Blacks)" (p. 522) or that being timed on subtests such as Arithmetic or Digit Symbol might reflect a type of cultural bias. In this regard we agree with Frisby's (1999) assertion that best practice advances in the assessment of culturally, racially, and ethnically diverse children will only occur when "indiscriminate talk" (i.e., the voicing of every opinion without regard to the critical evaluation or the relative worth of these opinions) begins to be challenged. Despite our frustration at the pace at which the test-fairness debate is evolving (and often not evolving), it is important to remember that ultimately psychology as a science must be supported by thoughtful, empirically replicated research rather than politically motivated advocacy positions.

Limitations and Directions for Future Research

As with all research, limitations of the present study must be considered. First, the current sample is heterogeneous in terms of exceptional classification. It is possible that more homogeneous disability groupings could produce different solutions. Second, concern over sampling is also appropriate with respect to consistency and uniformity of identification and placement. The current sample was drawn from 10 states where regulations vary and there was no attempt to verify or control that existing regulations were implemented. Unfortunately, the sample size was insufficient to allow cross validation. Given the complexity and importance of the issue, additional research is needed to examine the factor structure of the WISC-III across ethnic groups and special education classifications. Finally, previous research has shown that many psychologists do not administer the optional WISC-III subtests (Blumberg, 1995; Konold, Glutting, McDermott, Kush, & Watkins, 1999; Ward, Ward, Hatt, Young, & Mollner, 1995), and the contribution of selection bias between students who receive the full WISC-III battery and students who only receive the 10 required subtests is unknown.

We recognize that IQ test "bashing" is becoming more fashionable among school psychologists and that an "anti-testing" sentiment is increasingly becoming the rallying cry of the academic school psychologist (McGrew, Keith, Flanagan, & Vanderwood, 1997). We do not subscribe to that position, however, and believe that measures of intelligence, when used and interpreted appropriately, have much to offer the profession and can ultimately be of great benefit to the children who complete the measures. One aspect of a strong program of construct validation (Benson, 1998) would be an examination of the predictive efficiency and clinical utility of WISC-III factorial components within diverse populations to determine the practical utility of these constructs (Lopez, 1997). An increased knowledge of the interrelationships among these factors will be critical for psychologists who work with ethnically diverse populations. Tests of intellectual ability, like the WISC-III, are traditionally used to predict many types of child functioning and are often the best predictors of school success available to psychologists. However, attempts to include WISC-III factor scores as predictors of academic achievement, beyond the Verbal and Performance levels, have not been successful (Glutting et al., 1997). Although beyond the scope of this article, future research should begin to examine how well these global measures of verbal and performance functioning are able to forecast academic achievement for general education students as well as for diverse populations such as represented in the present study. Keith (1999) provides an example of such research using the Woodcock-Johnson Battery in predicting reading and mathematics achievement across three ethnic groups.

Until this research is completed, our study provides the most conclusive empirical evidence to date of the construct equivalence of the WISC-III for Black and White children, as well as for Black children referred for psychological evaluation. Until now, school psychologists could only assume that similar underlying traits were being assessed when the WISC-III was used with minority populations. Our results allow more confident conclusions to be made about the factorial validity of the test. This confidence extends, however, only to thoughtful school psychologists who are careful to limit their WISC-III interpretation to Full Scale, Verbal, and Performance dimensions. In our opinion, school psychologists who choose to make interpretations involving the Processing Speed or Freedom From Distractibility factors will not be operating under a "best practice" approach, as their interpretations will not be supported by empirical evidence.

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