Woodcock-Johnson® III

Assessment Service Bulletin Number 2

WJ III® Technical Abstract

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This abstract outlines the procedures followed in developing and validating the WJ III. Throughout the development and the design of associated research studies, test standards as outlined in the Standards for Educational and Psychological Testing *(American Educational Research Association [AERA], American Psychological Association [APA], & National Council on Measurement in Education [NCME], 1999) were followed carefully. This abstract contains a summary of information from the WJ III* Technical Manual *(McGrew & Woodcock, 2001).*

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WJ III® Technical Abstract

The *Woodcock-Johnson® III* (WJ III) (Woodcock, McGrew, & Mather, 2001a) consists of two distinct, co-normed batteries: the *WJ III Tests of Cognitive Abilities* (WJ III COG) (Woodcock, McGrew, & Mather, 2001c) and the *WJ III Tests of Achievement* (WJ III ACH) (Woodcock, McGrew, & Mather, 2001b). Together, these batteries comprise a wide age-range, comprehensive system for measuring general intellectual ability (*g*), specific cognitive abilities, oral language, and academic achievement.

One of the most important features of the WJ III system is that the norms for the WJ III COG and WJ III ACH are based on data from the same sample of subjects. This feature allows direct comparisons among and within a subject's scores that have a degree of accuracy not possible when comparing scores from separately normed tests. The WJ III batteries were designed to provide the most valid methods for determining patterns of strengths and weaknesses based on actual discrepancy norms.

The WJ III is based on current theory and research on the structure of human cognitive abilities. The theoretical foundation of the WJ III is derived from the Cattell-Horn-Carroll theory of cognitive abilities (CHC theory). Two major empirically derived sources of research on the structure of human cognitive abilities informed the development of the WJ III batteries.

The first major source stems primarily from the psychometric factor-analytic studies of Raymond Cattell and John Horn. Historically, this body of research has been called *Gf-Gc* theory (Horn, 1988, 1991; Woodcock, 1990, 1994). *Gf-Gc* is an acronym for fluid (*Gf*) and crystallized (*Gc*) intellectual abilities. A distinction between these two types of intellectual abilities can be traced to Cattell (1941, 1943, 1950). Later, Horn (1965) provided evidence that other distinct, broad cognitive abilities could be identified, including the abilities we now identify as short-term memory (*Gsm*), long-term retrieval (*Glr*), processing speed (*Gs*), and visual-spatial thinking (*Gv*). Horn and Stankov (1982) identified and added auditory processing (*Ga*) to the nomenclature. In 1989, the WJ-R® was published, and included these seven cognitive abilities as factors in the *WJ-R Tests of Cognitive Ability* (Woodcock & Johnson, 1989). After Horn (1988, 1989) conducted additional studies, he included quantitative ability (*Gq*) as a distinct ability in the *Gf-Gc* model. Later, Woodcock (1998) identified a separate reading-writing ability (*Grw*).

The second major source is the secondary analysis of the extant factor-analytic research by John Carroll that resulted in Carroll's three-stratum theory (Carroll, 1993, 1998). His analyses span a wide spectrum of independent-source structural research on human cognitive abilities. Carroll retrieved and then re-factor-analyzed the data from 461 of the major psychometric post-1925 data sets. Carroll drew four of his data sets from the norming data for the first edition of the *Woodcock-Johnson Psycho-Educational Battery* (Woodcock & Johnson, 1977). Using exploratory factor analysis, Carroll developed the thesis that human cognitive abilities could be conceptualized hierarchically. Carroll identified 69 specific, or narrow, abilities and conceptualized them as Stratum I abilities. These narrow abilities are grouped into broad categories of cognitive ability (Stratum II), which he labeled Fluid Intelligence, Crystallized Intelligence, General Memory and Learning, Broad Visual Perception, Broad Auditory

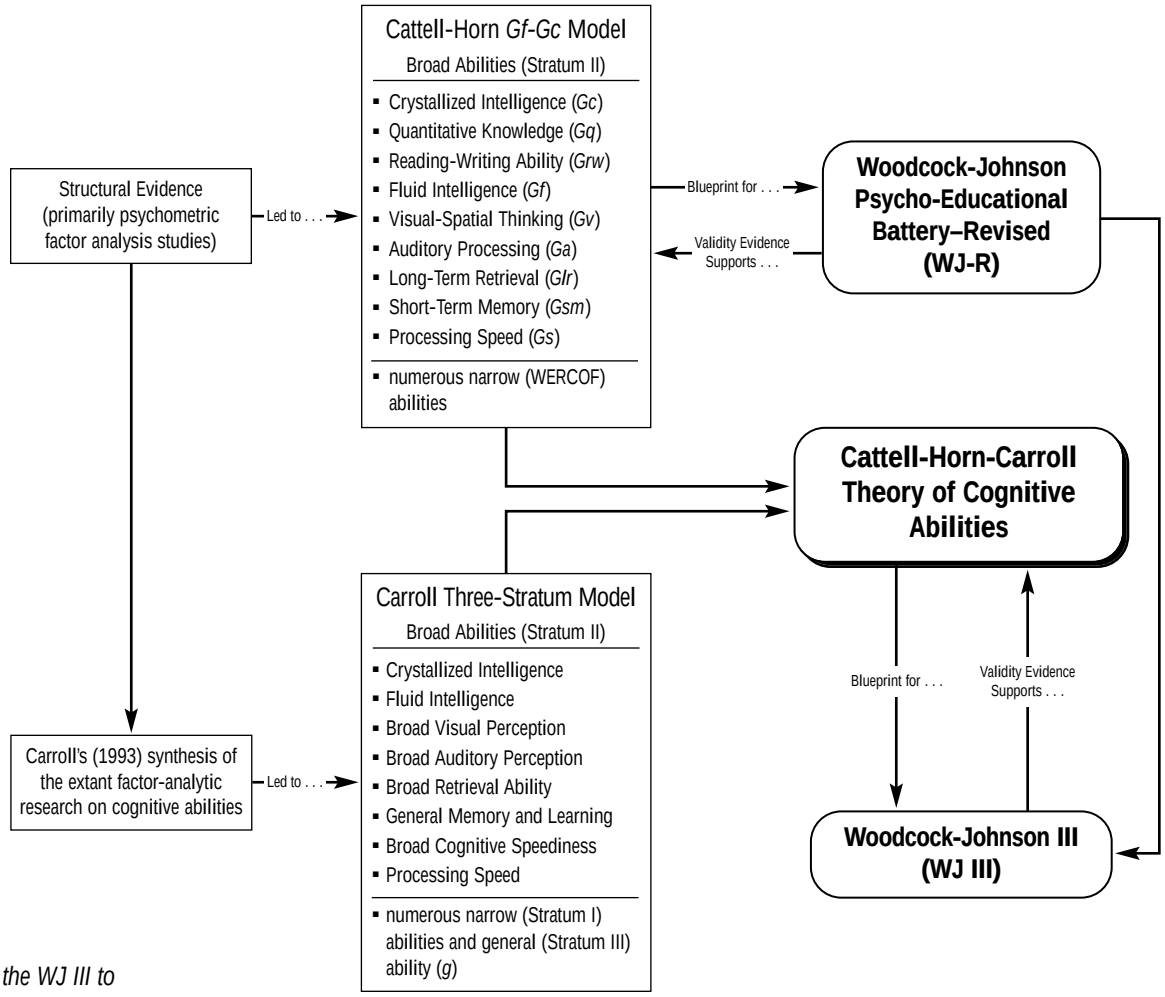

Figure 1.
Relationship of the WJ III to CHC theory.

Perception, Broad Retrieval Ability, Broad Cognitive Speediness, and Processing Speed. At the apex of his model (Stratum III), Carroll identified a general factor which he referred to as General Intelligence, or *g*.

Similarities between these independent knowledge sources provide support for the combined CHC theory. The narrow abilities Carroll identified as Stratum I are similar to the Well Replicated Common Factor (WERCOF) primary abilities discussed by Horn (1991) in the *WJ-R Technical Manual* (McGrew, Werder, & Woodcock, 1991). The Stratum II abilities identified by Carroll are very similar to the *Gf-Gc* abilities identified in the Cattell and Horn sources. Carroll (1993) described the *Gf-Gc* model as the best available model of the structure of human intellect.

> The Cattell-Horn model, as summarized by Horn (1985, 1988), is a true hierarchical model covering all major domains of intellectual functioning. Numerous details remain to be filled in through further research, but among available models it appears to offer the most well founded and reasonable approach to an acceptable theory of the structure of cognitive abilities. The major reservation I would make about it is that it appears not to provide for a third-order *g* factor to account for correlations among the broad second-order factors. (p. 62)

CHC theory provided the blueprint for the WJ III (see Figure 1). The WJ III is a measurement model of CHC theory. The design criteria of the WJ III place emphasis on providing the greatest practical breadth in the Stratum II, or CHC, factors. The wide breadth of measurement in each factor is intended to provide greater generalizability (validity) of the CHC factor score to other situations. For most factors, each broad CHC cluster is comprised of two qualitatively different narrow, or Stratum I, abilities. For example, in the WJ III COG, the *Glr* cluster includes a measure of associative memory (Test 2: Visual-Auditory Learning) and a measure of ideational fluency (Test 12: Retrieval Fluency); the *Gv* cluster includes a measure of visualization (Test 3: Spatial Relations) and a measure of visual memory (Test 13: Picture Recognition). The WJ III ACH also includes a greater breadth of coverage of the narrow abilities. For example, the WJ III ACH includes new measures of reading speed (Test 2: Reading Fluency) and numerical facility (Test 6: Math Fluency). The WJ III ACH incorporates new measures of other narrow abilities, including listening ability (Test 3: Story Recall and Test 4: Understanding Directions) and phonetic coding (Test 20: Spelling of Sounds and Test 21: Sound Awareness). Table 1 lists the broad CHC abilities and narrow Stratum I abilities measured in the WJ III.

Table 1.
Broad and Narrow Abilities Measured by the WJ III COG and WJ III ACH

	WJ III TESTS OF COGNITIVE ABILITIES	
	Standard Battery	**Extended Battery**
Broad CHC Factor	*Primary Narrow Abilities Measured*	*Primary Narrow Abilities Measured*
Comprehension-Knowledge (*Gc*)	Test 1: Verbal Comprehension *Lexical knowledge* *Language development*	Test 11: General Information *General (verbal) information*
Long-Term Retrieval (*Glr*)	Test 2: Visual-Auditory Learning *Associative memory* Test 10: Visual-Auditory Learning–Delayed *Associative memory*	Test 12: Retrieval Fluency *Ideational fluency*
Visual-Spatial Thinking (*Gv*)	Test 3: Spatial Relations *Visualization* *Spatial relations*	Test 13: Picture Recognition *Visual memory* Test 19: Planning *Spatial scanning* *General sequential reasoning*
Auditory Processing (*Ga*)	Test 4: Sound Blending *Phonetic coding: Synthesis* Test 8: Incomplete Words *Phonetic coding: Analysis*	Test 14: Auditory Attention *Speech-sound discrimination* *Resistance to auditory stimulus distortion*
Fluid Reasoning (*Gf*)	Test 5: Concept Formation *Induction*	Test 15: Analysis-Synthesis *General sequential reasoning* Test 19: Planning *Spatial scanning* *General sequential reasoning*
Processing Speed (*Gs*)	Test 6: Visual Matching *Perceptual speed*	Test 16: Decision Speed *Semantic processing speed* Test 18: Rapid Picture Naming *Naming facility* Test 20: Pair Cancellation *Attention and concentration*
Short-Term Memory (*Gsm*)	Test 7: Numbers Reversed *Working memory* Test 9: Auditory Working Memory *Working memory*	Test 17: Memory for Words *Memory span*

Table 1. *(cont.)*
Broad and Narrow Abilities Measured by the WJ III COG and WJ III ACH

	WJ III TESTS OF ACHIEVEMENT	
	Standard Battery Test	**Extended Battery Test**
Broad CHC Factor	*Primary Narrow Abilities Measured*	*Primary Narrow Abilities Measured*
Reading-Writing (*Grw*)	Test 1: Letter-Word Identification *Reading decoding* Test 2: Reading Fluency *Reading speed* Test 9: Passage Comprehension *Reading comprehension* *Verbal (printed) language comprehension* Test 7: Spelling *Spelling ability* Test 8: Writing Fluency *Writing speed* Test 11: Writing Samples *Writing ability*	Test 13: Word Attack *Reading decoding* *Phonetic coding: Analysis and synthesis* Test 17: Reading Vocabulary *Verbal (printed) language comprehension* *Lexical knowledge* Test 16: Editing *Language development* *English usage* Test 22: Punctuation & Capitalization *English usage*
Mathematics (*Gq*)	Test 5: Calculation *Math achievement* Test 6: Math Fluency *Math achievement* *Numerical facility* Test 10: Applied Problems *Quantitative reasoning* *Math achievement* *Math knowledge*	Test 18: Quantitative Concepts *Math knowledge* *Quantitative reasoning*
Comprehension-Knowledge (*Gc*)	Test 3: Story Recall *Language development* *Listening ability* Test 4: Understanding Directions *Listening ability* *Language development*	Test 14: Picture Vocabulary *Language development* *Lexical knowledge* Test 15: Oral Comprehension *Listening ability* Test 19: Academic Knowledge *General information* *Science information* *Cultural information* *Geography achievement*
Auditory Processing (*Ga*)		Test 13: Word Attack *Reading decoding* *Phonetic coding: Analysis* *Phonetic coding: Synthesis* Test 20: Spelling of Sounds *Spelling ability* *Phonetic coding: Analysis* Test 21: Sound Awareness *Phonetic coding: Analysis* *Phonetic coding: Synthesis*
Long-Term Retrieval (*Glr*)	Test 12: Story Recall–Delayed *Meaningful memory*	

Standardization

The data for WJ III norms were collected from a large, nationally representative sample of 8,818 subjects. All subjects were administered tests from both the WJ III COG and WJ III ACH so that normative data for both sections would be based on a common sample.

General Characteristics of the Norming Sample

Normative data for the WJ III were gathered from 8,818 subjects in over 100 geographically diverse U.S. communities (see Figure 2). The preschool sample (2 to 5 years of age and not enrolled in kindergarten) was composed of 1,143 subjects. The kindergarten through 12th grade sample was composed of 4,783 subjects. The college/university sample was composed of 1,165 undergraduate and graduate students. The adult sample was composed of 1,843 subjects. The higher density of subjects in the school-age population reflects the need for more concentrated data during the period of time when the abilities measured by the WJ III undergo the greatest rate of growth.

The norming sample was selected to be representative—within practical limits—of the U.S. population from age 24 months to age 90 years and older. Subjects were randomly selected within a stratified sampling design that controlled for the following 10 specific community and subject variables.

Census region—Northeast, Midwest, South, West

Community size—Central City (≥ 50,000) and Urban Fringe, Larger Community (10,000–49,999) and Associated Rural Area, Smaller Community (< 10,000) and Associated Rural Area

Sex—male, female

Race—White, Black, American Indian, Asian and Pacific Islander

Hispanic—Hispanic, non-Hispanic

Type of school (elementary, secondary)—public, private, home

Figure 2.
WJ III norming sites.

Type of college/university—2-year college, 4-year college or university; public, private

Education of adults—less than ninth grade, less than high school diploma, high school diploma, 1 to 3 years of college, bachelor's degree, master's degree or higher

Occupational status of adults—employed, unemployed, not in labor force

Occupation of adults in the labor force—professional/managerial; technical/sales/administrative; service (including Armed Forces or police); farming/forestry/fishing; precision product/craft/repair; operative/fabricator/laborer

Table 2 contains the sampling variables and their distribution both in the U.S. population according to the 2000 census projections and in the WJ III norming sample for the school-age sample (grades K through 12). The WJ III *Technical Manual* (McGrew & Woodcock, 2001) provides similar information for the other major levels (preschool,

Table 2.
Distribution of Sampling Variables in the U.S. Population and in the WJ III Norming Sample—Grades K through 12

Sampling Variable	Percent in U.S. Population	Target Number	Number Obtained	Percent of Target	Subject Weight
Census Region					
Northeast	19.0	552	1,138	206.2	0.797
Midwest	23.1	673	1,041	154.7	1.062
South	35.5	1,035	1,476	142.6	1.152
West	22.4	651	1,129	173.4	0.948
Community Size					
Central City and Urban Fringe	60.6	1,763	2,776	157.5	1.044
Larger Community and Associated Rural Area	19.3	563	907	161.1	1.020
Smaller Community and Associated Rural Area	20.1	585	1,101	188.2	0.873
Sex					
Male	51.2	1,490	2,431	163.2	1.007
Female	48.8	1,421	2,353	165.6	0.992
Race					
White	78.6	2,288	3,759	164.3	1.000
Black	15.7	456	687	150.7	1.091
American Indian	1.2	35	96	274.3	0.599
Asian and Pacific Islander	4.5	132	242	183.3	0.896
Hispanic					
Yes	14.9	434	570	131.3	1.250
No	85.1	2,477	4,214	170.1	0.966
Father's Education					
< High School	14.0	408	534	130.9	1.198
High School	60.1	1,748	2,730	156.2	1.004
> High School	25.9	754	1,300	172.4	0.909
Not Available	—	—	220	—	—
Mother's Education					
< High School	12.2	356	439	123.3	1.272
High School	61.7	1,796	2,933	163.3	0.960
> High School	26.1	760	1,193	157.0	0.999
Not Available	—	—	219	—	—
Type of School					
Public	87.4	2,545	4,155	163.3	1.006
Private	11.1	322	575	178.6	0.920
Home	1.5	44	54	122.7	1.339

college/university, and adult) as well. All variables were not relevant at all levels of the norming sample. For example, occupational information was applied only to the adult sample and type of college or university was applied only to the college/university sample. For the school-age sample, data were gathered from September 1996 to May 1999. College and university data were gathered from September 1996 to March 1999. Preschool (age 2 to 5 years) and adult data were gathered from September 1996 to August 1999.

Norms Construction

Data from the 8,818 norming subjects were summarized for each test and cluster. Individual subject weights were applied so the distribution of WJ III data was exactly proportional to the U.S. population distribution, and derived score norms were calculated from this transformation. Although the distribution of norming subjects approximated the U.S. population distribution, individual subject weighting was applied during data analysis to obtain a distribution of WJ III data that was exactly proportioned to the community and individual sampling variables. This adjustment removed any potential bias effects that might have resulted from having approximate, rather than proportional, representation in each cell of the sampling design. Each norming subject was assigned a weight based on that person's required contribution to the database. If a subject belonged to any subcategory that had a percentage in the norming sample greater than the proportion in the U.S. population for that subcategory, the subject was assigned a weight of less than 1.0. Subjects from subcategories having a lower percentage in the WJ III sample than in the U.S. population were assigned weights greater than 1.0. Table 2 shows that readjusting the contribution of oversampled categories provided a distribution of norming data that matched the distribution in the U.S. population for all 10 norming variables.

General Intellectual Ability Scores

The two WJ III General Intellectual Ability (GIA) scores (GIA–Std and GIA–Ext) are general intelligence (*g*) scores; they represent the first principal component obtained from principal component (PC) analyses. A PC analysis determines the first component (similar to a factor in factor analysis) by finding the best weighted combination of tests that account for the largest portion of the variance in a collection of tests. Using weights based on PC analyses means that all subtest weights are optimal. In contrast, tests like the Wechsler intelligence scales weight all subtests equally. Using PC analyses of cognitive measures as a basis for prescribing different test weights also gives the best statistical estimate of general intelligence.

The *WJ III Compuscore® and Profiles Program* (Schrank & Woodcock, 2001) calculates first principal component General Intellectual Ability scores according to a table of test weights. Table 3 presents the average GIA weights by technical age group.[1] A review of the weights in Table 3 reveals that the weights for individual tests do not vary much as a function of age. For example, the GIA–Std weights for Visual-Auditory Learning range from 0.16 to 0.17. In general, within each age group, the tests that measure *Gc* (Verbal Comprehension and General Information) and *Gf* (Concept Formation and Analysis-Synthesis) are among the highest weighted tests, a finding consistent with the extant factor-analytic research on *g* (Carroll, 1993).

[1] A technical age group is a one-year grouping of subjects centered on a whole-numbered age. For example, subjects aged 11.6 and 12.3 would both be part of the 12-year-old technical age group. Above age 19, each technical age group spans 10 years (e.g., 20–29, 30–39).

Table 3.
General Intellectual Ability (GIA) Average (Smoothed) g *Weights by Technical Age Group*

	AGE												
	2	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
General Intellectual Ability–Std													
Verbal Comprehension	0.19	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Visual-Auditory Learning	0.16	0.16	0.16	0.16	0.16	0.16	0.17	0.17	0.17	0.17	0.17	0.17	0.17
Spatial Relations	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Sound Blending	0.11	0.11	0.11	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
Concept Formation	0.17	0.17	0.18	0.18	0.18	0.18	0.18	0.19	0.19	0.19	0.19	0.19	0.19
Visual Matching	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Numbers Reversed	0.17	0.16	0.16	0.15	0.15	0.14	0.14	0.13	0.13	0.13	0.13	0.13	0.13
General Intellectual Ability–Ext													
Verbal Comprehension	0.11	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.13	0.13	0.13	0.13	0.13
Visual-Auditory Learning	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Spatial Relations	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Sound Blending	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.07
Concept Formation	0.08	0.08	0.09	0.09	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.11
Visual Matching	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Numbers Reversed	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
General Information	0.09	0.09	0.09	0.10	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.11	0.11
Retrieval Fluency	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.06	0.06	0.06	0.06	0.06
Picture Recognition	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Auditory Attention	0.07	0.06	0.06	0.05	0.05	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03
Analysis-Synthesis	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Decision Speed	0.08	0.08	0.08	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.05	0.05	0.05
Memory for Words	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06

WJ III Discrepancy Norms

One benefit of co-norming in the WJ III COG and WJ III ACH is the capability to compute discrepancy scores for each individual in the norming sample and then use that information to prepare discrepancy norms. In practice, any identified discrepancy is evaluated for statistical significance by comparing it to the distribution of discrepancies in the norming sample.

The scoring algorithms for the WJ III ability/achievement discrepancies were obtained through the use of a regression-based procedure similar to those used by many states to build estimated discrepancy tables. However, in the WJ III, *actual* ability/achievement discrepancy scores were produced for all subjects in the WJ III norming sample by subtracting the subjects' predicted standard scores from their achievement standard scores. The standard deviation of these norm-based ability/achievement discrepancy score distributions was calculated by age or grade. This standard deviation is used to determine the statistical significance of a subject's discrepancy score when it differs from the mean discrepancy score of others of the same ability and at the same age or grade level.

Table 3. *(cont.)*
General Intellectual Ability (GIA) Average (Smoothed) g *Weights by Technical Age Group*

	AGE											
	15	**16**	**17**	**18**	**19**	**20–29**	**30–39**	**40–49**	**50–59**	**60–69**	**70–79**	**80+**
General Intellectual Ability–Std												
Verbal Comprehension	0.20	0.20	0.19	0.19	0.19	0.18	0.17	0.17	0.17	0.17	0.17	0.17
Visual-Auditory Learning	0.17	0.17	0.16	0.16	0.16	0.16	0.16	0.16	0.17	0.17	0.17	0.17
Spatial Relations	0.09	0.10	0.10	0.11	0.11	0.13	0.12	0.11	0.11	0.10	0.10	0.10
Sound Blending	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.11	0.11	0.10
Concept Formation	0.19	0.19	0.19	0.19	0.18	0.18	0.17	0.17	0.16	0.15	0.15	0.15
Visual Matching	0.10	0.10	0.10	0.10	0.10	0.11	0.13	0.14	0.14	0.15	0.15	0.15
Numbers Reversed	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.14	0.14	0.14	0.15	0.16
General Intellectual Ability–Ext												
Verbal Comprehension	0.13	0.12	0.12	0.12	0.12	0.12	0.11	0.10	0.10	0.10	0.10	0.10
Visual-Auditory Learning	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.09
Spatial Relations	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.06
Sound Blending	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.06	0.06	0.06	0.06	0.06
Concept Formation	0.11	0.11	0.11	0.11	0.11	0.10	0.09	0.09	0.08	0.08	0.08	0.07
Visual Matching	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.08	0.08	0.08	0.08	0.09
Numbers Reversed	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.08
General Information	0.11	0.11	0.11	0.11	0.11	0.10	0.10	0.09	0.09	0.09	0.09	0.09
Retrieval Fluency	0.06	0.05	0.05	0.05	0.05	0.05	0.07	0.08	0.07	0.07	0.06	0.06
Picture Recognition	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.05	0.05	0.05	0.05
Auditory Attention	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.05	0.05	0.05	0.05	0.05
Analysis-Synthesis	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.09	0.09
Decision Speed	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.07	0.08	0.08	0.08
Memory for Words	0.06	0.06	0.06	0.06	0.06	0.07	0.06	0.06	0.05	0.04	0.04	0.04

The distribution of discrepancy scores in the norming sample provides the data for computing discrepancy *SD* scores and discrepancy percentile ranks. These numbers are identified in the Compuscore and Profiles Program as DISCREPANCY SD and DISCREPANCY PR, respectively. A discrepancy *SD* score is a standardized *z* score that reports the number of standard deviation units an individual's discrepancy score is from the average discrepancy score for individuals with the same ability score and who are at the same age or grade level in the norming sample. The discrepancy percentile rank reports this information as the percent of similar individuals in the norming sample with the same or greater discrepancy score.

The WJ III provides two sets of discrepancy information—ability/achievement discrepancies and intra-ability discrepancies. Intra-ability discrepancies include intra-cognitive discrepancies, intra-achievement discrepancies, and intra-individual discrepancies (discrepancies both within and across the cognitive and achievement batteries). The steps used to calculate the WJ III intra-cognitive, intra-achievement, and intra-individual discrepancy norms parallel those described for the WJ III ability/achievement discrepancy

norms. The major difference from the ability/achievement discrepancy procedure is the use of a within-individual average score from a defined set of "other" cognitive or achievement areas as the predicted score in the calculation of discrepancy norms.

Advantages of the WJ III Discrepancy Norms

When examiners do not use a co-normed instrument with discrepancy norms, they must estimate the amount of regression by using a regression equation or a table based on the equation. These equations are typically based on a very few correlation coefficients and on samples of limited size. Consequently, tables of estimated discrepancies contain more sources of error. (Such tables are only substitutes for actual discrepancy norms, they do not replace or supercede better psychometric procedures.) In contrast, the procedure used in the WJ III is based on a large, nationally representative sample of 8,818 subjects who were administered both the ability and achievement batteries. Furthermore, because all tests in the WJ III are co-normed, the discrepancy scores do not contain errors from the unknown differences that exist when using two tests based on different norming samples.

Another advantage of the WJ III discrepancy norms is that examiners can evaluate the significance of a discrepancy in the population by inspecting either the percentile rank of the discrepancy (DISCREPANCY PR) or the difference between the achievement score and the predicted achievement score in standard error of estimate units (DISCREPANCY SD). This feature allows a professional, school district, or state to define a criterion of significance in terms of either the standard error of the estimate or the discrepancy percentile rank. The standard error of the estimate allows the criterion to be defined in terms of the distance that a subject's score is above or below the average score for the subgroup of the norming sample (same age or same grade) with which the comparison is being made. The discrepancy percentile rank allows the criterion to be defined in terms of the percentage of the population identified as possessing a severe discrepancy.

Test and Cluster Reliabilities

Reliability statistics were calculated for all WJ III tests across their range of intended use and included all norming subjects tested at each technical age level. The reliabilities for all but the speeded tests and tests with multiple-point scoring systems were calculated using the split-half procedure.[2] The calculation of the split-half coefficients used data provided by odd and even test items. All split-half coefficients were corrected for length of the published test using the Spearman-Brown correction formula.

Because the split-half procedure was inappropriate for some tests, the reliabilities for the WJ III speeded tests (Visual Matching, Retrieval Fluency, Decision Speed, Rapid Picture Naming, Pair Cancellation, Reading Fluency, Math Fluency, and Writing Fluency) and tests with multiple-point scored items (Spatial Relations, Retrieval Fluency, Picture Recognition, Planning, Story Recall, Story Recall–Delayed, Writing Samples, and Spelling of Sounds) were calculated using Rasch analysis procedures.

Table 4 reports the median reliability coefficients (r_{11}) and the standard errors of measurement (*SEM*) obtained using the procedures described above. A review of the

[2] Internal consistency reliability methods are based on the assumption that the average correlation between items within a test is the same as the average correlation between items from the hypothetical alternative forms which are created via the splitting of the test into two smaller tests (e.g., one test based on odd items, one test based on even items). This assumption is violated when tests contain items that produce a range of different scores for each item. The splitting of the test in half can produce tests that are no longer equivalent—one test may have more items with maximum scores that are much higher than the alternate set of items.

Table 4.
Median Test Reliability Statistics—WJ III Tests of Cognitive Abilities and WJ III Tests of Achievement

WJ III TESTS OF COGNITIVE ABILITIES			*WJ III TESTS OF ACHIEVEMENT*		
Test	**Median r_{11}**	**Median *SEM (SS)***	**Test**	**Median r_{11}**	**Median *SEM (SS)***
Standard Battery			**Standard Battery**		
Test 1: Verbal Comprehension	0.92	4.24	Test 1: Letter-Word Identification	0.94	3.81
Test 2: Visual-Auditory Learning	0.86	5.56	Test 2: Reading Fluency	0.90	4.79
Test 3: Spatial Relations	0.81	6.51	Test 3: Story Recall	0.87	5.44
Test 4: Sound Blending	0.89	5.04	Test 4: Understanding Directions	0.83	6.20
Test 5: Concept Formation	0.94	3.64	Test 5: Calculation	0.86	5.65
Test 6: Visual Matching	0.91	4.60	Test 6: Math Fluency	0.90	4.83
Test 7: Numbers Reversed	0.87	5.38	Test 7: Spelling	0.90	4.80
Test 8: Incomplete Words	0.81	6.61	Test 8: Writing Fluency	0.88	5.15
Test 9: Auditory Working Memory	0.87	5.37	Test 9: Passage Comprehension	0.88	5.12
Test 10: Visual Auditory Learning–Delayed	0.94	3.73	Test 10: Applied Problems	0.93	4.08
Extended Battery			Test 11: Writing Samples	0.87	5.40
Test 11: General Information	0.89	4.97	Test 12: Story Recall–Delayed	0.81	6.62
Test 12: Retrieval Fluency	0.85	5.87	**Extended Battery**		
Test 13: Picture Recognition	0.76	7.36	Test 13: Word Attack	0.87	5.36
Test 14: Auditory Attention	0.88	5.21	Test 14: Picture Vocabulary	0.81	6.61
Test 15: Analysis-Synthesis	0.90	4.74	Test 15: Oral Comprehension	0.85	5.85
Test 16: Decision Speed	0.87	5.33	Test 16: Editing	0.90	4.67
Test 17: Memory for Words	0.80	6.63	Test 17: Reading Vocabulary	0.90	4.86
Test 18: Rapid Picture Naming	0.97	2.47	Test 18: Quantitative Concepts	0.91	4.50
Test 19: Planning	0.74	7.65	Test 19: Academic Knowledge	0.90	4.74
Test 20: Pair Cancellation	0.81	6.56	Test 20: Spelling of Sounds	0.76	7.30
			Test 21: Sound Awareness	0.81	6.55
			Test 22: Punctuation & Capitalization	0.79	6.95

median reliabilities reported for each test in Table 4 reveals the extent to which the test reliabilities fall at the desired level of .80 or higher. Of the 42 median test reliabilities reported, 38 are .80 or higher and 15 are .90 or higher. Although these are strong reliabilities for individual tests, the WJ III cluster scores are the recommended scores for interpretation, particularly when important decisions are being made about an individual. Cluster scores are based on combinations of two or more tests and, as a result, possess consistently higher reliabilities.

Table 5 reports median reliabilities and standard errors of measurement for the clusters across their range of intended use at each technical age level. The *SEM* values are in standard score (SS) units. A review of the median reliabilities for each cluster reveals that most are .90 or higher.

Test-Retest Reliabilities: Speeded Tests

A special test-retest study was completed with the eight WJ III speeded tests (Visual Matching, Decision Speed, Retrieval Fluency, Rapid Picture Naming, Pair Cancellation, Reading Fluency, Math Fluency, and Writing Fluency.) These eight tests were administered

Table 5.
Median Cluster Reliability Statistics—WJ III Tests of Cognitive Abilities and WJ III Tests of Achievement

WJ III TESTS OF COGNITIVE ABILITIES			*WJ III TESTS OF ACHIEVEMENT*		
Cluster	**Median r_{cc}**	**Median *SEM (SS)***	**Cluster**	**Median r_{cc}**	**Median *SEM (SS)***
Standard Battery			**Standard Battery**		
General Intellectual Ability–Std	0.97	2.60	Total Achievement	0.98	2.36
Brief Intellectual Ability	0.95	3.35	Oral Language–Std	0.87	5.41
Verbal Ability–Std	0.92	4.24	Broad Reading	0.94	3.67
Thinking Ability–Std	0.95	3.35	Broad Math	0.95	3.35
Cognitive Efficiency–Std	0.92	4.24	Broad Written Language	0.94	3.67
Phonemic Awareness	0.90	4.86	Academic Skills	0.96	3.00
Working Memory	0.91	4.50	Academic Fluency	0.93	3.97
Extended Battery			Academic Applications	0.95	3.35
General Intellectual Ability–Ext	0.98	2.12	**Extended Battery**		
Verbal Ability–Ext	0.95	3.35	Oral Language–Ext	0.92	4.24
Thinking Ability–Ext	0.96	3.00	Oral Expression	0.85	5.81
Cognitive Efficiency–Ext	0.93	3.97	Listening Comprehension	0.89	4.97
Comprehension-Knowledge (*Gc*)	0.95	3.35	Basic Reading Skills	0.95	3.35
Long-Term Retrieval (*Glr*)	0.88	5.20	Reading Comprehension		
Visual-Spatial Thinking (*Gv*)	0.81	6.54	Math Calculation Skills	0.91	4.50
Auditory Processing (*Ga*)	0.91	4.50	Math Reasoning	0.95	3.35
Fluid Reasoning (*Gf*)	0.95	3.35	Basic Writing Skills	0.94	3.67
Processing Speed (*Gs*)	0.92	4.24	Written Expression	0.91	4.62
Short-Term Memory (*Gsm*)	0.88	5.20	Phoneme/Grapheme Knowledge	0.90	4.74
Broad Attention	0.92	4.24			
Cognitive Fluency	0.96	3.00			
Executive Processes	0.93	3.97			
Delayed Recall					
Knowledge	0.94	3.67			
Phonemic Awareness 3	0.91	4.62			

in a counter-balanced order to 165 subjects in three age-differentiated samples. Given that traditional test-retest studies typically produce confounded test reliability estimates that fail to account for trait stability (McGrew et al., 1991), the retest interval in this study was set at one day to minimize (but not entirely eliminate) changes in test scores due to changes in the subjects' states or traits. Table 6 reports summary statistics and test-retest reliabilities for the speeded tests.

In general, the reliabilities reported for the WJ III speeded tests in Table 6 are lower than the reliabilities reported for the same tests in Table 4. For example, the median reliability (calculated from the Rasch error scores) for Retrieval Fluency is reported as .85 in Table 4. In Table 6 the reliabilities for Retrieval Fluency range from .81 to .85. The reliabilities reported in Table 4 and Table 6 should be interpreted as representing the upper- and lower-bound reliabilities for the eight WJ III speeded tests.

Table 6.
Summary Statistics and Test-Retest Reliabilities for WJ III Speeded Tests

	AGE 7–11		AGE 14–17		AGE 26–79	
Test	***n***	r_{12}	***n***	r_{12}	***n***	r_{12}
Visual Matching	59	0.87	50	0.76	54	0.70
Decision Speed	55	0.80	48	0.73	54	0.73
Retrieval Fluency	59	0.81	51	0.85	54	0.82
Rapid Picture Naming	59	0.78	52	0.78	53	0.86
Pair Cancellation	59	0.84	50	0.78	52	0.69
Reading Fluency	30	0.94	28	0.80	23	0.94
Math Fluency	59	0.95	52	0.89	53	0.96
Writing Fluency	57	0.76	51	0.84	53	0.87

Validity

Validity is the most important consideration in test development, evaluation, and interpretation. The WJ III is based on several sources of empirically sound validity evidence, including CHC theory.

Content Validity

Content validity was addressed through specification of a master test- and cluster-content revision blueprint according to CHC theory. In the WJ III COG, particular attention was paid to the distinction, formalized by CHC theory, between broad and narrow abilities. Each WJ III COG test was designed to be a primary measure of a narrow ability (or Stratum I ability in CHC theory). To ensure that all items in a test measured the same narrow ability or trait, stringent fit criteria based on the Rasch model were employed during the process of item selection. Each WJ III COG cluster was designed to increase breadth of measurement by providing two qualitatively different narrow abilities subsumed in the broad ability, as defined by CHC theory. Table 7 outlines the broad and narrow abilities measured by each of the WJ III COG tests. The WJ III ACH was also informed by CHC theory. However, to increase the applicability of the WJ III ACH battery, test and cluster content was aligned with core curricular areas and domains specified in federal legislation.

Table 7.
WJ III COG Construct and Content Coverage

Test	**Primary Broad CHC Factor** *Narrow CHC Ability*	**Stimuli**	**Test Requirement**	**Response**
Test 1: Verbal Comprehension	Comprehension-Knowledge (*Gc*) *Lexical knowledge* *Language development*	Visual (pictures); Auditory (words)	Identifying objects; knowledge of antonyms and synonyms; completing verbal analogies	Oral (word)
Test 2: Visual-Auditory Learning	Long-Term Retrieval (*Glr*) *Associative memory*	Visual (rebuses)—Auditory (words) in the learning condition; Visual (rebuses) in the recognition condition	Learning and recalling pictographic representations of words	Oral (sentences)
Test 3: Spatial Relations	Visual-Spatial Thinking (*Gv*) *Visualization* *Spatial relations*	Visual (drawings)	Identifying the subset of pieces needed to form a complete shape	Oral (letters) or Motoric (pointing)

Table 7. *(cont.)*
WJ III COG Construct and Content Coverage

Test	Primary Broad CHC Factor *Narrow CHC Ability*	Stimuli	Test Requirement	Response
Test 4: Sound Blending	Auditory Processing (*Ga*) *Phonetic coding: Synthesis*	Auditory (phonemes)	Synthesizing language sounds (phonemes)	Oral (word)
Test 5: Concept Formation	Fluid Reasoning (*Gf*) *Induction*	Visual (drawings)	Identifying, categorizing, and determining rules	Oral (words)
Test 6: Visual Matching	Processing Speed (*Gs*) *Perceptual speed*	Visual (numbers)	Rapidly locating and circling identical numbers from a defined set of numbers	Motoric (circling)
Test 7: Numbers Reversed	Short-Term Memory (*Gsm*) *Working memory*	Auditory (numbers)	Holding a span of numbers in immediate awareness while reversing the sequence	Oral (numbers)
Test 8: Incomplete Words	Auditory Processing (*Ga*) *Phonetic coding: Analysis*	Auditory (words)	Identifying words with missing phonemes	Oral (word)
Test 9: Auditory Working Memory	Short-Term Memory (*Gsm*) *Working memory*	Auditory (words, numbers)	Holding a mixed set of numbers and words in immediate awareness while reordering into two sequences	Oral (words, numbers)
Test 10: Visual-Auditory Learning–Delayed	Long-Term Retrieval (*Glr*) *Associative memory*	Visual (rebuses) in the recognition condition; Visual-auditory in the relearning condition	Recalling and relearning pictographic representations of words from 30 minutes to 8 days later	Oral (sentences)
Test 11: General Information	Comprehension-Knowledge (*Gc*) *General (verbal) information*	Auditory (questions)	Identifying where objects are found and what people typically do with an object	Oral (sentences)
Test 12: Retrieval Fluency	Long-Term Retrieval (*Glr*) *Ideational fluency*	Auditory (directions only)	Naming as many examples as possible from a given category	Oral (words)
Test 13: Picture Recognition	Visual-Spatial Thinking (*Gv*) *Visual memory*	Visual (pictures)	Identifying a subset of previously presented pictures within a field of distracting pictures	Oral (words) or Motoric (pointing)
Test 14: Auditory Attention	Auditory Processing (*Ga*) *Speech-sound discrimination* *Resistance to auditory stimulus distortion*	Auditory (words)	Identifying auditorily-presented words amid increasingly intense background noise	Motor (pointing)
Test 15: Analysis-Synthesis	Fluid Reasoning (*Gf*) *General sequential (deductive) reasoning*	Visual (drawings)	Analyzing puzzles (using symbolic formulations) to determine missing components	Oral (words)
Test 16: Decision Speed	Processing Speed (*Gs*) *Semantic processing speed*	Visual (pictures)	Locating and circling two pictures most similar conceptually in a row	Motoric (circling)
Test 17: Memory for Words	Short-Term Memory (*Gsm*) *Memory span*	Auditory (words)	Repeating a list of unrelated words in correct sequence	Oral (words)
Test 18: Rapid Picture Naming	Processing Speed (*Gs*) *Naming facility*	Visual (pictures)	Recognizing objects, then retrieving and articulating their names rapidly	Oral (words)
Test 19: Planning	Visual-Spatial Thinking (*Gv*) & Fluid Reasoning (*Gf*) *Spatial scanning* *General sequential reasoning*	Visual (drawings)	Tracing a pattern without removing the pencil from the paper or retracing any lines	Motoric (tracing)
Test 20: Pair Cancellation	Processing Speed (*Gs*) *Attention and concentration*	Visual (pictures)	Identifying and circling instances of a repeated pattern rapidly	Motoric (circling)

The 22 WJ III ACH measures were developed to sample the major aspects of oral language and academic achievement. To meet this objective, the tests sample achievement in reading, mathematics, and written language as well as in oral language and curricular knowledge. The specification of item content in these tests was based primarily on the principle of providing a broad sampling of achievement rather than an in-depth assessment in a relatively narrow area. For example, Test 19: Academic Knowledge includes questions in science, social studies, and humanities that cover several levels of difficulty and a wide range of content in each subarea. Table 8 outlines the curricular areas covered by the WJ III ACH and the CHC narrow abilities measured by each of the tests. An analysis of the tests' task requirements is also included in Table 8.

Table 8.
WJ III ACH Construct and Content Coverage

Test	Curricular Area *Narrow CHC Ability*	Stimuli	Test Requirement	Response
Test 1: Letter-Word Identification	Reading *Reading decoding*	Visual (text)	Identifying printed letters and words	Oral (letter name, word)
Test 2: Reading Fluency	Reading *Reading speed*	Visual (text)	Reading printed statements rapidly and responding true or false (Yes or No)	Motoric (circling)
Test 3: Story Recall	Oral Expression *Language development* *Listening ability* *Meaningful memory*	Auditory (text)	Listening to and recalling details of stories	Oral (passage)
Test 4: Understanding Directions	Listening Comprehension *Listening ability* *Language development*	Auditory (text)	Listening to a sequence of instructions and then following the directions	Motoric (pointing)
Test 5: Calculation	Mathematics *Math achievement* *Number fluency*	Visual (numeric)	Performing various mathematical calculations	Motoric (writing)
Test 6: Math Fluency	Mathematics *Math achievement*	Visual (numeric)	Adding, subtracting, and multiplying rapidly	Motoric (writing)
Test 7: Spelling	Spelling *Spelling ability*	Auditory (words)	Spelling orally presented words	Motoric (writing)
Test 8: Writing Fluency	Writing *Writing speed*	Visual (words with picture)	Formulating and writing simple sentences rapidly	Motoric (writing)
Test 9: Passage Comprehension	Reading *Reading comprehension* *Verbal (printed) language comprehension*	Visual (text)	Identify a missing key word that makes sense in the context of a written passage	Oral (word)
Test 10: Applied Problems	Mathematics *Quantitative reasoning* *Math achievement* *Math knowledge*	Auditory (questions); Visual (numeric, text)	Performing math calculations in response to orally presented problems	Oral
Test 11: Writing Samples	Writing *Writing ability*	Auditory; Visual (text)	Writing meaningful sentences for a given purpose	Motoric (writing)
Test 12: Story Recall–Delayed	Long-Term Retrieval (*Glr*) *Meaningful memory*	Auditory (sentence)	Recalling previously-presented story elements	Oral (passage)
Test 13: Word Attack	Reading *Reading decoding* *Phonetic coding: Analysis & synthesis*	Visual (word)	Reading phonically regular non-words	Oral (word)

Table 8. *(cont.)*
WJ III ACH Construct and Content Coverage

Test	Curricular Area *Narrow CHC Ability*	Stimuli	Test Requirement	Response
Test 14: Picture Vocabulary	Oral Expression *Language development* *Lexical knowledge*	Visual (picture)	Identifying objects	Oral (word)
Test 15: Oral Comprehension	Listening Comprehension *Listening ability*	Auditory (text)	Identifying a missing key word that makes sense in an oral passage	Oral (word)
Test 16: Editing	Writing Skills *Language development* *English usage*	Visual (text)	Identifying and correcting errors in written passages	Oral
Test 17: Reading Vocabulary	Reading *Verbal (printed) language comprehension* *Lexical knowledge*	Visual (word)	Reading words and supplying appropriate meanings	Oral (word)
Test 18: Quantitative Concepts	Mathematics *Math knowledge* *Quantitative reasoning*	Auditory (question); Visual (numeric, text)	Identifying math terms and formulae; Identifying number patterns	Oral (word)
Test 19: Academic Knowledge	General *General information* *Science information* *Cultural information* *Geography achievement*	Auditory (question); Visual (text; picture)	Responding to questions about science, social studies, and humanities	Oral (word, sentences)
Test 20: Spelling of Sounds	Spelling *Spelling ability* *Phonetic coding: Analysis & synthesis*	Auditory (letter, word)	Spelling letter combinations that are regular patterns in written English	Motoric (writing)
Test 21: Sound Awareness	Reading *Phonetic coding*	Auditory (question, word)	Providing rhyming words; Removing, substituting , and reversing parts of words to make new words	Oral (word)
Test 22: Punctuation & Capitalization	Writing *English usage*	Auditory (question); Visual (letters, words)	Applying punctuation and capitalization rules	Motoric (writing)

Developmental Evidence

The existence of divergent growth curves is one type of evidence for the existence of unique abilities (Carroll, 1983, 1993). Figures 3a and 3b present examples of growth curves from age 5 to 90 for the principle cognitive and achievement measures in the WJ III. The growth curves illustrate that the unique abilities measured by the WJ III follow different developmental courses or trajectories over the age span from childhood to geriatric levels. The examples were constructed using age 5 years, 0 months (5-0) as a starting point.

Figures 3a and 3b are cross-sectional graphs that display average score changes consistent with the developmental growth and decline of cognitive and achievement abilities across the life span. These pictographic patterns of growth and decline are based on cross-sectional data, not longitudinal data. They portray the rise and decline of median performance across age for the general population at the time the WJ III was normed.

Construct Validity

Internal structure evidence, or construct validity, is best summarized by confirmatory factor-analytic (CFA) models. The breadth of abilities measured by the WJ III is best

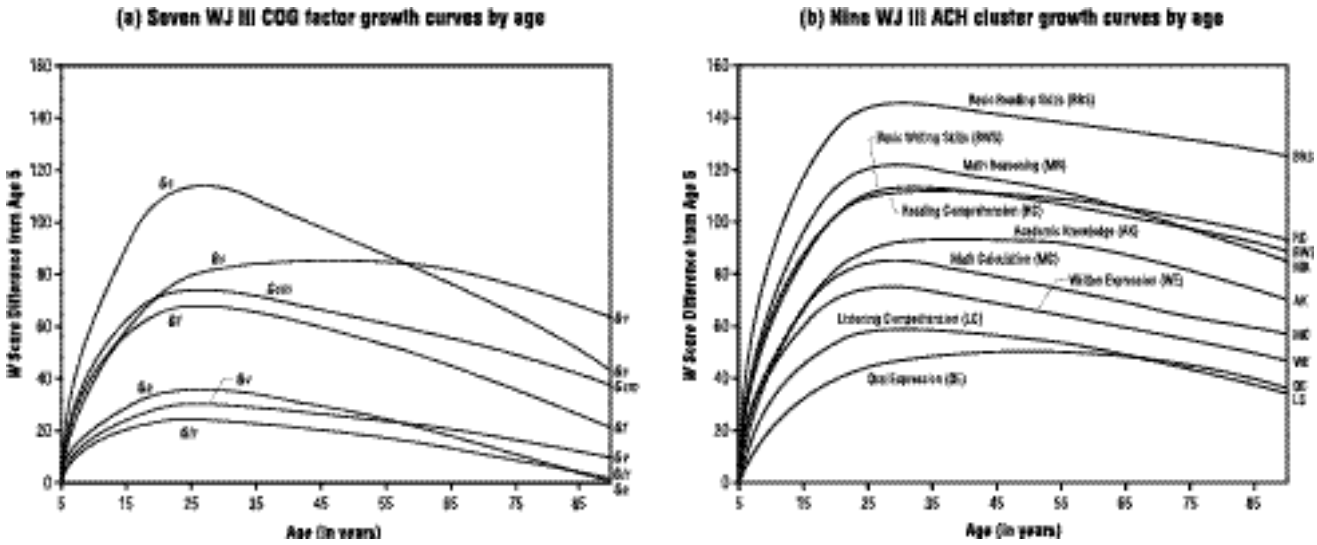

Figure 3.
Plot of WJ III COG and WJ III ACH growth curves by age.

described by a *g* + nine broad-factor model (*Gc*, *Gf*, *Ga*, *Glr*, *Gv*, *Gs*, *Gsm*, *Grw*, *Gq*) plus the specification of several narrow abilities. This model is presented in Figure 4. This model demonstrates how the WJ III tests conform to the narrow ability, broad ability, and general intellectual ability strata derived from CHC theory.

Figure 4 demonstrates an important pattern: Almost all tests from the WJ III COG each load solely on a single factor. This pattern is an indication that the cognitive tests have minimized the influence of construct-irrelevant variance. In contrast, the WJ III ACH is factorially complex, as demonstrated in Figure 4. The pattern of achievement test and cluster intercorrelations reported in the Technical Manual support this interpretation. The cognitive cluster intercorrelations are low to moderate (typically .20 to. 60), providing evidence that the broad cognitive abilities are related to, but distinct from, one another. The typical range of correlations for achievement clusters that do not share common tests is .50 to .70.

Concurrent Validity

A number of special studies reported in the Technical Manual show that the WJ III tests and clusters correlate well with other tests measuring similar constructs. As shown in Table 9, the General Intellectual Ability (GIA–Std and GIA–Ext) scores had correlations ranging from .67 to .76, across several samples, with the full scale or composite scores from the *Wechsler Preschool and Primary Scale of Intelligence–Revised* (WPPSI-R) (Wechsler, 1989), the *Wechsler Intelligence Scale for Children–Third Edition* (WISC-III) (Wechsler, 1991), the *Differential Ability Scales* (DAS) (Elliott, 1990), the *Kaufman Adolescent and Adult Intelligence Test* (KAIT) (Kaufman & Kaufman 1993), and the *Stanford-Binet Intelligence Scale–Fourth Edition* (SB-IV) (Thorndike, Hagen, & Sattler, 1986). Correlations in this range are similar to those reported in other publications and test manuals between full scale or composite scores of other major intelligence batteries. These correlations support the interpretation of the WJ III GIA first-principal component (*g*) scores as valid measures of general intellectual ability. Supporting its use as a screening measure of intellectual ability, the Brief Intellectual Ability score had correlations ranging from .60 to .70 with the WPPSI-R, the WISC-III, the *Wechsler Adult*

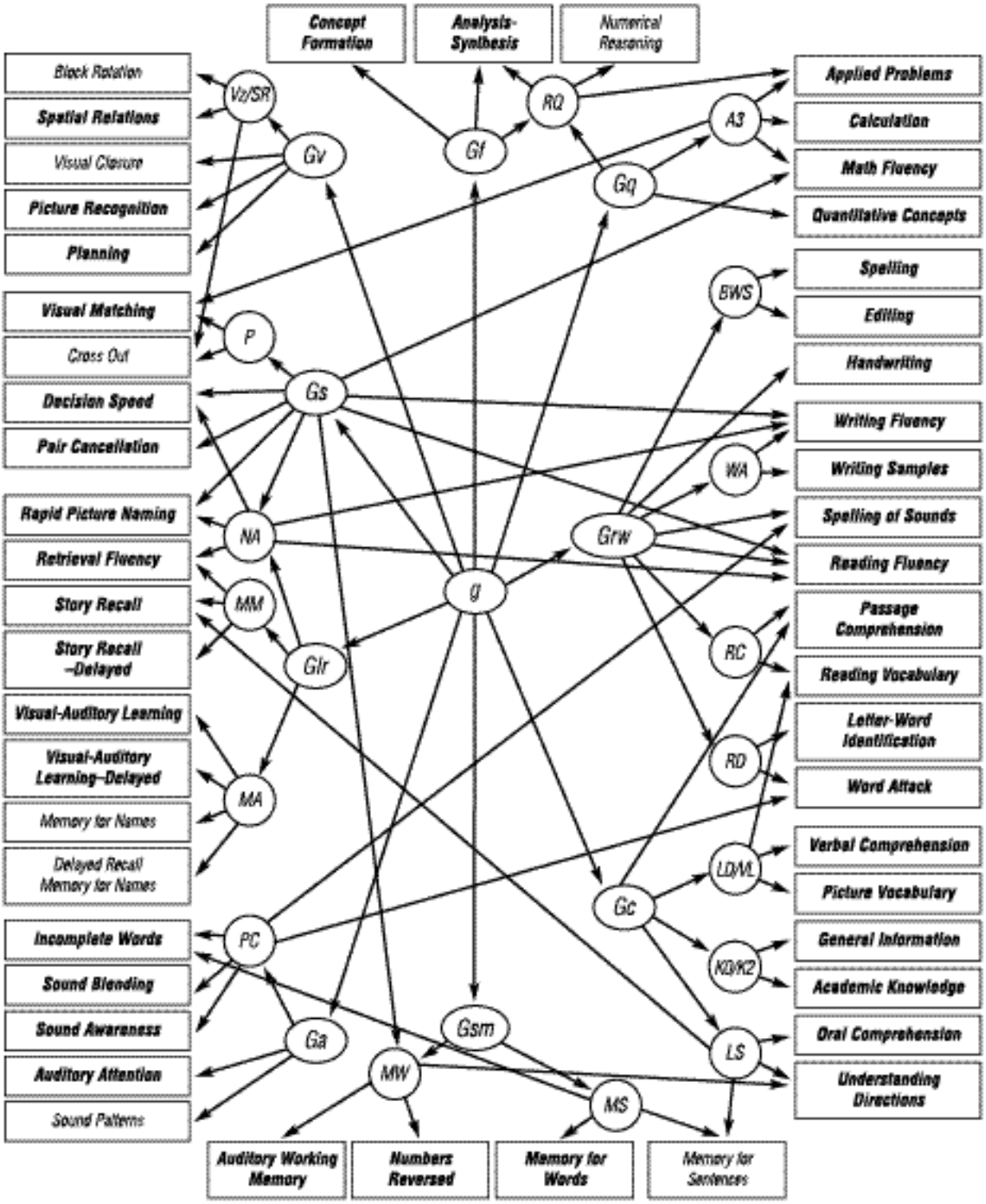

Figure 4.
Hypothesized model of the WJ III based on three levels of factors: g*, the broad CHC factors, and the narrow CHC abilities.*

Note: Bold font indicates WJ III tests. Regular font indicates WJ III Research tests. Ovals = Broad CHC factors and *g*. Circles = Narrow CHC factors. Residuals omitted from figure.

Broad Abilities Specified: *g* = General Intellectual Ability, *Gf* = Fluid Reasoning, *Gc* = Comprehension-Knowledge, *Gq* = Quantitative Ability, *Grw* = Reading/Writing Ability, *Gsm* = Short Term Memory, *Glr* = Long Term Retrieval, *Gs* = Processing Speed, *Gv* = Visual-Spatial Thinking, *Ga* = Auditory Processing

Narrow Abilities Specified: RQ = Quantitative reasoning, A3 = Math achievement, BWS = Basic writing skills, WA = Writing ability, RC = Reading comprehension, RD = Reading decoding, LD/VL = Language development/Lexical knowledge, K0/K2 = General information/Cultural information, LS = Listening skills, MS = Memory span, MW = Working memory, PC = Phonetic coding, MA = Associative memory, MM = Meaningful memory, NA = Naming facility, P = Perceptual speed, Vz/SR = Visualization/Spatial Relations

Table 9.
Correlations From Several Criterion Validity Studies for the WJ III COG General Intellectual Ability (GIA) Score

Criterion	MEDIAN CORRELATIONS		
	GIA–Std	GIA–Ext	BIA
Differential Ability Scales	0.72	0.74	0.68
Wechsler Preschool and Primary Scale of Intelligence–Revised	0.73	0.74	0.67
Stanford-Binet Intelligence Scale–Fourth Edition	0.76	0.71	0.60
Wechsler Intelligence Scale for Children–Third Edition	0.71	0.76	0.69
Wechsler Adult Intelligence Scale	0.67	—	0.62
Kaufman Adolescent and Adult Intelligence Test	0.75	—	0.68
Das•Naglieri Cognitive Assessment System	—	—	0.70

Intelligence Scale (WAIS-III) (Wechsler, 1997), the DAS, the *Das•Naglieri Cognitive Assessment System* (CAS) (Naglieri & Das, 1997), and the SB-IV.

As shown in Table 10, the pattern and magnitude of the correlations suggests that the WJ III ACH is measuring academic skills and abilities similar to those measured by other achievement tests. Criterion measures included the *Wechsler Individual Achievement Test* (WIAT) (Wechsler, 1992) and the *Kaufman Test of Educational Achievement* (KTEA) (Kaufman & Kaufman, 1985).

Table 10.
Reading, Math, and Writing Criterion Validity Correlations for the WJ III ACH

Criterion	WJ III ACH MEDIAN CORRELATIONS*								
	BR	BRS	RC	BMS	MC	MR	BWL	BWS	WE
Kaufman Test of Educational Achievement									
Reading Composite	0.76	0.66	0.81	—	—	—	—	—	—
Reading Decoding	0.67	0.66	0.74	—	—	—	—	—	—
Reading Comp	0.65	0.44	0.62	—	—	—	—	—	—
Wechsler Individual Achievement Test									
Reading Composite	0.67	0.82	0.78	—	—	—	—	—	—
Basic Reading	0.63	0.82	0.70	—	—	—	—	—	—
Reading Comp	0.68	0.68	0.79	—	—	—	—	—	—
Kaufman Test of Educational Achievement									
Math Composite	—	—	—	0.66	0.60	0.41	—	—	—
Math Calculation	—	—	—	0.65	0.67	0.49	—	—	—
Math Applications	—	—	—	0.52	0.40	0.29	—	—	—
Wechsler Individual Achievement Test									
Math Composite	—	—	—	0.70	0.69	0.56	—	—	—
Numerical Operations	—	—	—	0.57	0.59	0.38	—	—	—
Math Reasoning	—	—	—	0.66	0.60	0.60	—	—	—
Kaufman Test of Educational Achievement									
Spelling	—	—	—	—	—	—	0.67	0.77	0.57
Wechsler Individual Achievement Test									
Writing Composite	—	—	—	—	—	—	0.47	0.69	0.31
Written Expression	—	—	—	—	—	—	0.47	0.57	0.31
Spelling	—	—	—	—	—	—	0.52	0.77	0.42

* BR = Broad Reading; BRS = Basic Reading Skills; RC = Reading Comprehension; BMS = Broad Math Skills; MC = Math Calculation Skills; MR = Math Reasoning; BWL = Broad Written Language; BWS = Basic Writing Skills; WE = Written Expression

The procedures followed in developing and validating the WJ III have produced a diagnostic system that can be used with confidence in a variety of settings. Throughout the development and the design of associated research studies, test standards as outlined in the *Standards for Educational and Psychological Testing* (AERA, APA, & NCME, 1999) were followed carefully. Special efforts were made to provide all of the major types of validity evidence and to provide fair, unbiased measures of an individual's abilities and achievement.

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