# Essentials

## of WJ IV<sup>°</sup> Cognitive Abilities Assessment

- Complete coverage of administration, scoring, interpretation, and reporting
- Expert advice on avoiding common pitfalls
- Conveniently formatted for rapid reference

Fredrick A. Schrank Scott L. Decker John M. Garruto

Alan S. Kaufman & Nadeen L. Kaufman, Series Editors



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Fredrick A. Schrank Scott L. Decker John M. Garruto



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#### SERIES PREFACE

n the *Essentials of Psychological Assessment* series, we have attempted to provide the reader with books that deliver key practical information in the most efficient and accessible style. The series features instruments in a variety of domains, such as cognition, personality, education, and neuropsychology. For the experienced clinician, books in the series offer a concise yet thorough way to master utilization of the continuously evolving supply of new and revised instruments as well as a convenient method for keeping up to date on the tried-and-true measures. The novice will find here a prioritized assembly of all the information and techniques that must be at one's fingertips to begin the complicated process of individual psychological diagnosis.

Wherever feasible, visual shortcuts to highlight key points are utilized alongside systematic, step-by-step guidelines. Chapters are focused and succinct. Topics are targeted for an easy understanding of the essentials of administration, scoring, interpretation, and clinical application. Theory and research are continually woven into the fabric of each book, but always to enhance clinical inference, never to sidetrack or overwhelm. We have long been advocates of "intelligent" testing—the notion that a profile of test scores is meaningless unless it is brought to life by the clinical observations and astute detective work of knowledgeable examiners. Test profiles must be used to make a difference in the child's or adult's life, or why bother to test? We want this series to help our readers become the best intelligent testers they can be.

The *Essentials of WJ IV*® *Cognitive Abilities Assessment* is designed to be a helpful reference to all examiners, whether they are experienced with the WJ III or just learning the WJ IV. The authors and contributors, all experts on the popular and widely used WJ IV, have detailed important points of administration, scoring, and interpretation that will assist in building competency with the WJ IV COG. In addition, Schrank and colleagues go beyond the interpretive guidance provided in the examiner's manual by clarifying what is measured by each test and cluster through operational definitions. Importantly, they relate the underlying cognitive processes tapped by each of the tests to internal and external neurocognitive research evidence. Their whole approach is to suggest links to evidence-based interventions for examinees who demonstrate limitations in performance on the tests and to provide models for using and interpreting results of the WJ IV COG in contemporary practice.

Alan S. Kaufman, PhD, and Nadeen L. Kaufman, EdD, Series Editors Yale Child Study Center, Yale University School of Medicine The Essentials of WJ IV Cognitive Abilities Assessment is dedicated to the memory of our colleague, teacher, and friend **Dr. Raymond S. Dean**, who championed the idea that intellectual assessment can be especially meaningful when it results in the objective identification of functional limitations in cognitive abilities.

#### ACKNOWLEDGMENTS

he Essentials of WJ IV Cognitive Abilities Assessment could not have been written without the help and support of our friends, colleagues, students, and family. Melanie Bartels Graw came to our rescue and accepted responsibility for writing the administration and scoring chapters of this book. Nancy Mather and Barbara Wendling graciously reviewed manuscript content and provided insightful feedback that both clarified and strengthened the final work you are now reading. Kevin McGrew could be consistently counted on to keep us abreast of the latest research studies that form the neurocognitive basis for interpretation that is found in Chapter 4 and the case studies in Chapters 6 and 7. In Chapter 5, Robert Walrath, John Willis, and Ron Dumont provided their independent perspective on the strengths and weaknesses of the WJ IV COG. Joseph Ferraracci helped collect case study data and Michael Eason provided support with data management. Erica LaForte provided measurement support and helped secure the necessary permissions to include relevant data and content from the WJ IV. Finally, and perhaps most important, our spouses and children provided us with the emotional support and degrees of freedom to undertake such an important and ambitious project. Thank you, sincerely.

> Fredrick A. Schrank Scott L. Decker John M. Garruto

#### One

#### **OVERVIEW**

he Woodcock-Johnson IV Tests of Cognitive Abilities (WJ IV COG: Schrank, McGrew, & Mather, 2014b) is a battery of carefully engineered tests for measuring cognitive abilities and intellectual level. The WJ IV COG was conormed with the Woodcock-Johnson IV Tests of Oral Language (WJ IV OL; Schrank, Mather, & McGrew, 2014b), the WJ IV Tests of Achievement (WJ IV ACH; Schrank, Mather, & McGrew, 2014a) to form the complete Woodcock-Johnson IV (Schrank, McGrew, & Mather, 2014a). The three batteries can be used independently or together in any combination. When the entire system is used, comparisons can be made among an individual's cognitive abilities, oral language, and achievement scores. Normative data was obtained from a large, nationally representative sample of 7,416 individuals ranging in age from 2 to 90+ years of age. Although primarily recommended for use with school-age children, adolescents, college students, and adults, some of the WJ IV COG tests can be used selectively with preschool children. A conormed but separate battery of tests called the Woodcock-Johnson IV Tests of Early Cognitive and Academic Development (WJ IV ECAD; Schrank, McGrew, & Mather, 2015b) is recommended for use with preschool children of ages 3 through 5 or with children of ages 6 through 9 who have a cognitive developmental delay.

The WJ IV COG is based on an update to the Cattell-Horn-Carroll (CHC) theory of cognitive abilities as described by Schneider and McGrew (2012) and McGrew, LaForte, and Schrank (2014). Cognitive complexity has been infused within several new tests, and interpretive emphasis has been shifted to the most important abilities for learning, interventions, and accommodations.

This book is intended to help you understand the essentials of cognitive ability assessment using the WJ IV COG. Although interpretation of the WJ IV COG can be complex, this book is presented in an easy-to-read format. In one small guide, administration, scoring, and interpretation are addressed in simple language. The clinical and psychoeducational case report chapters are intended to help you understand the use and interpretation of the WJ IV with practical examples and illustrations. Throughout the book, important points are highlighted by "Rapid Reference," "Caution," and "Don't Forget" boxes. At the end of Chapters 1 to 5, "Test Yourself" sections will help you assess your understanding of what you have read.

This chapter begins with a discussion of how the Woodcock-Johnson cognitive tests have evolved to become the most comprehensive battery of contemporary cognitive tests available to assessment professionals. The chapter ends with a summary of the technical characteristics of the WJ IV COG and a list of suggested resources for more information on the WJ IV COG.

#### HISTORY AND DEVELOPMENT

The WJ IV COG represents the fourth generation of the cognitive tests that originally formed Part One of the *Woodcock-Johnson Psycho-Educational Battery* (WJPEB; Woodcock & Johnson, 1977). Initial work on the WJPEB begin in 1973, although some of the tests were developed prior to that date. The first revision, the *Woodcock-Johnson Psycho-Educational Battery–Revised* (Woodcock & Johnson, 1989a), was published in 1989. The *Woodcock-Johnson III Tests of Cognitive Abilities* (Woodcock, McGrew, & Mather, 2001b) was published in 2001. The WJ IV COG was published in 2014.

#### 1977: The Woodcock-Johnson Psycho-Educational Battery

The WJPEB began as one battery that consisted of three parts: Tests of Cognitive Ability, Tests of Achievement, and Tests of Interest Level. Initially, no overriding theoretical model guided development of the cognitive tests. Historically, test development began with a number of controlled experiments for measuring learning abilities. The first test constructed was Visual-Auditory Learning (Woodcock, 1958). Visual-Auditory Learning was the result of Woodcock's (1956) doctoral dissertation at the University of Oregon. Employing a set of reading rebuses, he developed the test to predict the ability to learn to read using a visual-auditory association, encoding, and retrieval experiment. Later, the Analysis-Synthesis test was developed to predict an individual's ability to learn mathematics. Additional cognitive tests were developed to create a heterogeneous mix of broad and complex cognitive abilities. In the end, 12 tests were included in the cognitive portion of the battery representing both verbal and nonverbal functions (a common interpretive construct of the era).

#### OVERVIEW 3

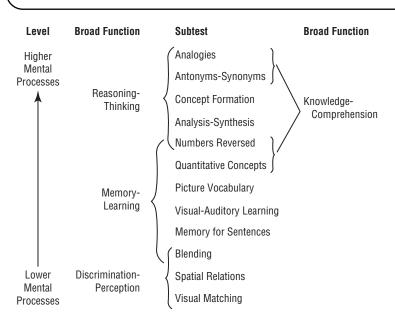


Figure 1.1 Broad functions, level-of-processing, and 12 cognitive tests from the 1977 WJPEB

Additionally, the abilities were designed to fall on a continuum from lower mental processes (simple operations) to higher mental processes (complex operations) as shown in Figure 1.1. Test-level analysis on the continuum from lower mental processes to higher mental processes has remained a useful model for interpreting test performance in all succeeding generations of the Woodcock-Johnson batteries.

WJPEB test construction followed a scientific-empirical method. Following the battery's norming (which occurred in 1976 and 1977), factor and cluster analyses were constructed to help define a small number of broad functions measured by the battery. Four functions were identified and labeled as Knowledge-Comprehension, Reasoning-Thinking, Memory-Learning, and Discrimination-Perception. In the 1970s, the term intelligence quotient and its abbreviation, IQ, were viewed somewhat negatively by many in the professional community. However, an overall cognitive score was viewed as a necessity. As a consequence, the term *Broad Cognitive Ability* (*BCA*) was introduced. In deriving the BCA, the 12 cognitive tests were differentially weighted to give a statistically better estimate of an individual's overall cognitive ability than would be obtained by weighting the tests equally.

#### 1989: The Woodcock-Johnson Psycho-Educational Battery-Revised

In 1985, John Horn made a presentation at a conference honoring Lloyd Humphreys, who was one of his mentors. Horn's presentation fostered insight into the structure of human intellectual abilities and laid the theoretical foundation for the *Woodcock-Johnson–Revised Tests of Cognitive Ability* (WJ-R COG; Woodcock & Johnson, 1989c). The WJ-R COG interpretive model was closely associated with Horn's thesis and came to be described as an operational representation of *Gf-Gc* theory (Horn, 1991).

Kevin McGrew conducted much of the statistical work for the WJ-R and served as the primary author of the *WJ-R Technical Manual* (McGrew, Werder, & Woodcock, 1991). Following Horn's 1985 presentation, McGrew synthesized all of the extant exploratory and confirmatory factor analyses of the 1977 WJPEB. He developed a table similar to that found in Figure 1.2 that served as a blueprint for planning and organizing the revision to approximate *Gf-Gc* theory more closely.

Ten new tests were developed and added to the WJ-R COG. In the 1990s, the WJ-R COG became the primary battery of tests for measuring seven broad abilities identified in *Gf-Gc* theory: Long-Term Storage and Retrieval (*Gh*), Short-Term Memory (*Gsm*), Processing Speed (*Gs*), Auditory Processing (*Ga*), Visual Processing (*Gv*), Comprehension-Knowledge (*Gc*), and Fluid Reasoning (*Gf*). An eighth factor, Quantitative Ability (*Gq*), was available when using the WJ-R *Tests of Achievement* (Woodcock & Johnson, 1989b). **Rapid Reference** 1.1 outlines these eight abilities.

Gf-Gc theory was soon applied to the analysis and interpretation of other intelligence tests. In a groundbreaking analysis, Woodcock (1990) showed that

#### Rapid Reference 1.1 Eight Gf-Gc Abilities Measured by the 1989 WJ-R

Long-Term Storage and Retrieval (Glr) Short-Term Memory (Gsm) Processing Speed (Gs) Auditory Processing (Ga) Visual Processing (Gv) Comprehension-Knowledge (Gc) Fluid Reasoning (Gf) Quantitative Ability (Gq)

	COGNITIVE FACTORS							
WJPEB Subtests	Glr	Gsm	Gs	Ga	Gv*	Gc	Gf	Gq
Visual-Auditory Learning	٠							
Memory for Sentences Numbers Reversed		0 0				0		
Spatial Relations** Visual Matching			•					
Blending				٠				
Picture Vocabulary Antonyms-Synonyms						•		
Analysis-Synthesis Concept Formation Analogies						0	• • •	
Quantitative Concepts								•
Word Attack Calculation Applied Problems Science Social Studies Humanities				0		••••		•
<i>Glr</i> —Long-Term Retrieval								
Gsm—Short-Term Memory						h Load	•	
Gs—Processing Speed					O Mo	derate	Loadin	gs
<i>Ga</i> —Auditory Processing <i>Gv</i> —Visual Processing								
<i>Gc</i> —Comprehension-Knowl	anha							
<i>Gf</i> —Fluid Reasoning	lougo							
<i>Gq</i> —Quantitative Ability								

\* There are no measures of Gv in the 1977 WJPEB.

\*\* Spatial Relations is a highly speeded test in the 1977 WJPEB.

#### Figure 1.2 Cognitive factors measured by the 1977 WJPEB

*Gf-Gc* theory describes the factor structure of other intelligence test batteries when their sets of tests are included in studies with sufficient breadth and depth of markers to ensure that the presence of all major factors could be identified. His article became widely cited in psychological and educational literature. As a consequence, *Gf-Gc* theory gained support as a major descriptor of human intellectual abilities and as a standard for evaluating tests of intelligence (McGrew & Flanagan, 1998).

#### 2001: The Woodcock-Johnson III

In 1993, John Carroll published *Human Cognitive Abilities: A Survey of Factor Analytic Studies.* The thesis of this book is often described as Carroll's threestratum theory (Carroll, 1993, 1998). Carroll said that human cognitive abilities could be conceptualized in a three-stratum hierarchy. Through his analysis of 461 data sets, Carroll identified 69 specific, or narrow, cognitive abilities (stratum I), similar to the Well Replicated Common Factor (WERCOF) abilities identified by Horn (1968, 1991) and associates (Ekstrom, French, & Harmon, 1979). In addition, Carroll grouped the narrow abilities into broad categories of cognitive abilities (stratum II) that are similar, in most respects, to the broad *Gf-Gc* factors described by Horn and his associates. Stratum III represents the construct of general intellectual ability (g) (Carroll, 1993, 1998). Figure 1.3 is a visual representation of Carroll's three-stratum theory.

The integration of these two independently and empirically derived theories has come to be called CHC theory. CHC theory provided the blueprint for the WJ III and subsequent support for interpretation of the WJ III COG. The primary difference between Carroll's three-stratum model and Horn's *Gf-Gc* model is the meaning of the general intellectual ability (g) factor at stratum III. Horn was emphatic that he did not believe g was an entity. The presence of a psychometric g was never the subject of debate; Horn suggested that g was merely a statistical artifact rather than a quality of cognitive functioning. However, because many assessment professionals expressed a need for a general intellectual ability score in the WJ III COG, the first-principal component (g) score was made available via computer scoring. The score was called General Intellectual Ability (GIA). Inclusion of this score on the WJ III can be traced to the influence of Carroll.

The primary emphasis in interpretation of the WJ III COG was the broad factors from stratum II. Kevin McGrew and Nancy Mather joined Richard Wood-cock on the WJ III author team (Woodcock, McGrew, & Mather, 2001a, 2001b). The authors developed the model of two qualitatively different tests for each of the broad CHC factors so that interpretation of the ability would be as broad-based as possible. During the decade that followed publication, the WJ III COG became one of the most widely used tests for measurement of intellectual ability and differential cognitive abilities.

#### 2014: The Woodcock-Johnson IV

When the time came to complete work on a fourth edition of the *Woodcock-Johnson*, Richard Woodcock had retired from active participation and a team of scientist-practitioner authors consisting of Fredrick Schrank,

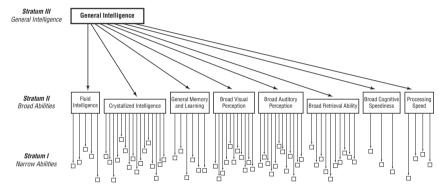


Figure 1.3 Carroll's three-stratum theory

Kevin McGrew, and Nancy Mather ushered in the new era of Woodcock-Johnson cognitive abilities assessment. Several new tests and interpretive procedures were created. One of the authors' goals was to move beyond the initial specification of CHC theory and base the WJ IV COG on the current status of contemporary research into human cognitive abilities. Impetus for this goal can be traced to a suggestion by John Carroll at the University of Virginia in 1994 when he offered a self-critique of his three-stratum theory. Among other considerations, he cautioned that the specifications in his theory were based on considerable subjectivity in sorting and classification of factors from independently derived data sets. He noted that his specification of abilities was based primarily on scores from psychometric tests and that cross-validation of the proposed constructs was needed from other data sets and other forms of scientific research. In the WJ IV, CHC theory has evolved beyond the initial specifications through both simplification and elaboration (McGrew et al., 2014; Schneider & McGrew, 2012). In Chapter 4 of this book, other sources of research are reviewed to cross-validate, modify, add to, or clarify some of the theoretical constructs posited by Cattell, Horn, Carroll, Woodcock, and others.

The interpretive model for the WJ IV reflects the most contemporary reflection of CHC theory at the time of publication. Analysis of the WJ-R, WJ III, and WJ IV standardization samples (which were not analyzed by Carroll) provided three large, multi-ability data sets to either confirm or revise initial construct specifications. Support for changes to the interpretive constructs was gleaned from other sources of neuroscience research. Perhaps the most significant changes to the WJ IV COG broad abilities were derived from contemporary research in the domains of working memory and phonological processing. See **Rapid Reference** 1.2.

## *Example 1.2* Reference 1.2 Broad and Narrow CHC Abilities Measured by the WJ IV COG

WJ IV COG Test	Primary Broad CHC Ability Narrow Ability
I Oral Vocabulary A: Synonyms B: Antonyms 2 Number Series	Comprehension-Knowledge (Gc) Lexical knowledge (VL) Language development (LD) Fluid Reasoning (Gf) Quantitative reasoning (RQ) Inductive reasoning (I)

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WJ	IV COG Test	Primary Broad CHC Ability Narrow Ability
3	Verbal Attention	Short-Term Working Memory (Gwm) Working memory capacity (WM) Attentional control (AC)
4	Letter-Pattern Matching	Cognitive Processing Speed (Gs) Perceptual speed (P)
5	Phonological Processing A: Word Access B: Word Fluency C: Substitution	Auditory Processing (Ga) Phonetic coding (PC) Speed of lexical access (LA) Word Fluency (FW)
6	Story Recall	Long-Term Storage and Retrieval (GIr) Meaningful memory (MM) Listening ability (LS)
7	Visualization A: Spatial Relations B: Block Rotation	Visual Processing (Gv) Visualization (Vz)
8	General Information A: Where B: What	Comprehension-Knowledge (Gc) General (verbal) information (K0)
9	Concept Formation	Fluid Reasoning ( <i>Gf</i> ) Inductive reasoning (I)
10	Numbers Reversed	Short-Term Working Memory (Gwm) Working memory capacity (WM)
	Number-Pattern Matching	Cognitive Processing Speed (Gs) Perceptual speed (P)
12	Nonword Repetition	Auditory Processing (Ga) Phonetic coding (PC) Memory for sound patterns (UM) Auditory memory span (MS)
13	Visual Auditory Learning	Long-Term Storage and Retrieval (Glr) Associative memory (MA)
14	Picture Recognition	Visual Processing (Gv) Visual memory (MV)
15	Analysis-Synthesis	Fluid Reasoning (Gf) General sequential (deductive) reasoning (RG)
16	Object-Number Sequencing	Short-Term Working Memory (Gwm)
17	Pair Cancellation	Cognitive Processing Speed (Gs) Perceptual speed (P) Spatial scanning (SS) Attentional control (AC)
18	Memory for Words	Short-Term Working Memory (Gwm) Auditory memory span (MS)

Another primary goal for the WJ IV COG was to incorporate cognitive complexity into several of the tests and clusters. One interpretive model that has remained constant throughout all editions of the Woodcock-Johnson is the analysis of test requirements via level of cognitive complexity (see Figure 1.1). By deliberate design, the WJPEB, WJ-R, and WJ III all included tasks that fall on a continuum from simple cognitive operations to complex cognitive processes. In the WJ IV, a concerted effort was directed to increase the number of tests with cognitive complexity requirements to provide greater ecological validity and interpretive relevance for the test or cluster scores. In the WJ IV COG, increased cognitive complexity is most clearly evidenced in the composition of the tests that compose the auditory processing cluster. The tests that comprise the WJ IV COG Auditory Processing cluster are designed to measure cognitively complex, ecologically relevant processes that involve auditory processing abilities. Each test is based on a combination of narrow abilities that spans one or more other broad abilities. The two new tests are COG Test 5: Phonological Processing and COG Test 12: Nonword Repetition. More information on the interpretation of the auditory processing tests can be found in Chapter 4.

The new author team had many other goals in mind as well. To select the tests that compose the GIA score (the core tests), those that are included in the standard battery, and the tests that compose each cognitive cluster, the authors drew heavily on their experiences as psychologists and educators. Their aim was to select tests that would provide the most important information for professional practice needs. As a result, the composition of the GIA score and most of the broad CHC factor scores changed dramatically from the WJ III. New tests, such as Test 3: Verbal Attention, were developed to assess working memory in an ecologically valid format so that test results would more effectively mirror the typical working memory requirements often required in classroom and occupational performance. Another example is Test 4: Letter-Pattern Matching, which was developed to assess visual perceptual speed for orthographic pattern recognition, a foundational function that underlies reading and spelling performance.

Perhaps one of the most innovative features of the WJ IV COG is the *Gf-Gc* Composite, a measure of intellectual level that is derived solely from four academically predictive tests representing the two highest-order (*g*-loaded or *g*-saturated) factors included in the CHC theory of cognitive abilities (McGrew, 2005, 2009; McGrew et al., 2014; Schneider & McGrew, 2012). The *Gf-Gc* Composite is