CHAPTER 16

The Reynolds Intellectual Assessment Scales (RIAS) and the Reynolds Intellectual Screening Test (RIST)

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This chapter provides the reader with an extensive introduction to the Reynolds Intellectual Assessment Scales (RIAS; Reynolds & Kamphaus, 2003), an increasingly popular measure of intelligence for children and adults. A brief overview of the subtests is provided, followed by a review of the theory and structure of the RIAS, framed primarily around its goals for development. A more extensive description is then provided of the subtests and their administration and scoring. Psychometric characteristics of the RIAS are next presented, along with guidelines for interpretation and clinical applications. The chapter closes with a case study using the RIAS as the featured measure of intelligence.

The RIAS is an individually administered test of intelligence appropriate for ages 3 years through 94 years, with a co-normed, supplemental measure of memory. The RIAS includes a two-subtest Verbal Intelligence Index (VIX) and a two-subtest Nonverbal Intelligence Index (NIX). The scaled sums of *T* scores for the four subtests are combined to form the Composite Intelligence Index (CIX), which is a summary estimate of global intelligence. Administration of the four intelligence scale subtests by a trained, experienced examiner requires approximately 20–25 minutes. A Composite Memory Index (CMX) is derived from the two supplementary memory subtests, which require approximately 10–15 minutes of additional testing time. The CIX and the CMX represent combinations of verbal and nonverbal subtests. Table 16.1 provides an overview of the indexes and subtests of the RIAS.

The Reynolds Intellectual Screening Test (RIST; Kamphaus & Reynolds, 2003) is a two-subtest screening version of the RIAS that covers the same age range. The RIST is designed to allow users to make the decision regarding the need for a full RIAS evaluation in about 10 minutes or less (see Reynolds & Kamphaus, 2003, for complete RIST administration, scoring, and interpretation procedures).

THEORY AND STRUCTURE

The RIAS was designed to meld practical and theoretical aspects of the assessment of intelligence. Although the models of Carroll (1993) and Cattell and Horn (Horn & Cattell, 1966; Kamphaus, 2001) were the primary theoretical guides, the RIAS also followed closely the division of intelligence into verbal and nonverbal domains, due to the practical benefits of assessing verbal and nonverbal intelligence. Memory was included as a

TABLE 16.1. RIAS Composite Scores and Subtests

Composite Intelligence Index (CIX)

Subtests of the Verbal Intelligence Index (VIX)

Guess What. Examinees are given a set of two or three clues, and are asked to deduce the object or concept being described. This subtest measures verbal reasoning in combination with vocabulary, language development, and overall fund of available information.

Verbal Reasoning. Examinees listen to a propositional statement that essentially forms a verbal analogy, and are asked to respond with one or two words that complete the idea or proposition. This subtest measures verbal-analytical reasoning ability, but with fewer vocabulary and general knowledge demands than Guess What.

Subtests of the Nonverbal Intelligence Index (NIX)

Odd-Item Out. Examinees are presented with a picture card containing five to seven pictures or drawings, and are asked to designate which one does not belong or go with the others. This subtest measures nonverbal reasoning skills, but also requires the use of spatial ability, visual imagery, and other nonverbal skills on various items. It is a form of reverse nonverbal analogy.

What's Missing. A redesign of a classic task present on various ability measures. Examinees are shown a picture with some key element or logically consistent component missing, and are asked to identify the missing essential element. This subtest assesses nonverbal reasoning: The examinee must conceptualize the picture, analyze its Gestalt, and deduce what essential element is missing.

Composite Memory Index (CMX)

Subtests

Verbal Memory. In this verbal memory subtest, depending upon the examinee's age, a series of sentences or brief stories are read aloud by the examiner and then recalled by the examinee. This task assesses the ability to encode, store briefly, and recall verbal material in a meaningful context where associations are clear and evident.

Nonverbal Memory. This visual memory subtest contains a series of items in which a stimulus picture is presented for 5 seconds, following which an array of pictures is presented. The examinee must identify the target picture from the new array of six pictures. It assesses the ability to encode, store, and recognize pictorial stimuli that are both concrete and abstract or without meaningful referents.

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separate scale on the RIAS, due to the growing importance of working memory in models of intelligence and the practical aspects of memory to everyday diagnostic questions faced by the practitioner (see, e.g., Bigler & Clement, 1997; Goldstein & Reynolds, 2011; Reynolds & Bigler, 1994; Reynolds & Fletcher-Janzen, 1997). To clarify the theoretical underpinnings of the RIAS as well as its practical aspects and structure, a review of the goals for development of the test provides a strong heuristic.

Development Goals

We (Reynolds & Kamphaus, 2003) described a set of eight primary goals for development of the RIAS. The eight core development goals were derived from our experiences over the years in teaching intelligence testing, use of many different intelligence tests in clinical practice, and the current literature surrounding theoretical models of intelligence and research on intelligence test interpretation (for more extensive review and discussion, see Reynolds & Kamphaus, 2003, especially Chs. 1 and 6).

1. Provide a reliable and valid measurement of *g* and its two primary components, verbal and nonverbal intelligence, with close correspondence to crystallized and fluid intelligence.
2. Provide a practical measurement device in terms of efficacies of time, direct costs, and information needed from a measure of intelligence.
3. Allow continuity of measurement across all developmental levels from ages 3 years through 94 years for both clinical and research purposes.
4. Substantially reduce or eliminate dependence on motor coordination and visual–motor speed in the measurement of intelligence.
5. Eliminate dependence on reading in the measurement of intelligence.
6. Provide for accurate prediction of basic academic achievement, at levels at least comparable to those of intelligence tests twice the length of the RIAS.
7. Apply familiar, common concepts that are clear and easy to interpret, coupled with simple administration and scoring.
8. Eliminate items that show differential item functioning (DIF) associated with gender or ethnicity.

In addition to tasks targeting *g* and its two primary components, the RIAS was designed to assess basic memory functions in the verbal and nonverbal domains. Brief assessments of the integrity of memory have appeared on intelligence tests since Binet first asked children to recall a single picture and repeat a sentence of 15 words (Binet & Simon, 1905). Traditionally, scores on these tasks have been included as a component of IQ; the RIAS assesses memory function in a separate scale. The RIAS includes assessment of memory function because it is crucial to the diagnostic process for numerous disorders of childhood (Goldstein & Reynolds, 2011; Reynolds & Fletcher-Janzen, 1997) and adulthood, particularly later adulthood (Bigler & Clement, 1997). The RIAS CMX does not provide a comprehensive memory assessment, but it does cover the two areas of memory that are historically assessed by intelligence tests and are considered by many to be the two most important memory functions to assess (e.g., Bigler & Clement, 1997; Reynolds & Bigler, 1994): memory for meaningful verbal material and visual memory. Memory assessment co-norming presents the best possible scenario for contrasting test scores (Reynolds, 1984–1985), allowing the clinician to compare general intelligence directly with key memory functions.

Theory

The RIAS is a measure of intelligence that focuses on the measurement of *g*, or general intelligence (the CIX), and the two major components of general intelligence: verbal intelligence (the VIX) and nonverbal intelligence (the NIX). As with any measure of intelligence, many other basic but subsidiary cognitive processes, such as auditory and visual perception, logical reasoning, language processing, spatial skills, visual imagery, attention, and the like, play a role in performance on the RIAS. These skills are the building blocks of the primary intellectual functions assessed by the RIAS. The RIAS CMX is offered as a basic overall measure of short-term memory skills, with the Verbal Memory subtest measuring recall in the verbal associative domain, and the Nonverbal Memory subtest measuring ability to recall pictorial stimuli in both concrete (i.e., meaningful) dimensions and abstract dimensions (where concrete referents are not provided or easily derived).

The RIAS was designed to measure four important aspects of intelligence: *general intelligence* (of which the major component is *fluid* or *reasoning abilities*); *verbal intelligence* (sometimes referred to as *crystallized abilities*, a closely related though not identical concept); *nonverbal intelligence* (referred to in some theories as *visualization* or *spatial abilities*, and closely allied with fluid intelligence); and *memory* (subtests measuring this ability have been labeled variously as assessing *working memory*, *short-term memory*, or *learning*). These four constructs are measured by combinations of the six RIAS subtests (see Table 16.1).

The RIAS subtests were selected and designed to measure intelligence constructs that have a substantial history of scientific support. In addition, Carroll's (1993) seminal and often-cited three-stratum theory of intelligence informed the creation of the RIAS by demonstrating that many of the latent traits tapped by intelligence tests were test-battery-independent. He clearly demonstrated, for example, that numerous tests measured the same crystallized, visual-perceptual, and memory abilities. However, Kamphaus (2001) concluded that these same test batteries did not measure fluid abilities to a great extent.

The RIAS focuses on the assessment of stratum III and stratum II abilities from Carroll's (1993) three-stratum theory (see also Carroll, Appendix, this volume). Stratum III is composed of one construct only, *g*. Psychometric *g* accounts for the major portion of variance assessed by intelligence test batteries. More important, however, is the consistent finding that the correlations of intelligence tests with important outcomes, such as academic achievement and occupational attainment, are related to the amount of *g* measured by the test battery. In other words, so-called "*g*-saturated" tests are better predictors of important outcomes than are tests with low *g* saturation. One theory posits that *g* is actually a measure of working memory capacity (Kyllonen, 1996), whereas another theory posits that it is a measure of reasoning ability (Gustafsson, 1999). Regardless of the theory that will eventually be supported, the utility of psychometric *g* remains, much in the same way that the usefulness of certain pharmaceutical drugs will continue before their mechanisms of action are fully understood. For these reasons, the RIAS places great emphasis on the assessment of psychometric *g* and on the assessment of its theorized main components (i.e., verbal and nonverbal reasoning and working memory).

The second stratum in Carroll's (1993) hierarchy consists of traits that are assessed by combinations of subtests, or stratum I measures. There are, however, several stratum II traits to choose from.

These second-stratum traits include fluid intelligence, crystallized intelligence, general memory and learning, broad visual perception, broad auditory perception, broad retrieval ability, broad cognitive speed, and processing speed (i.e., reaction time or decision speed). Of importance, however, is the suggestion (from the findings of hundreds of investigations) that these abilities are ordered by their assessment of *g* (Kamphaus, 2001). Specifically, subtests that tap fluid abilities are excellent measures of *g*, whereas tests of psychomotor speed are the weakest. If one accepts the aforementioned finding that *g* saturation is related to predictive validity, then the first few stratum II factors become the best candidates for inclusion in an intelligence test battery like the RIAS, especially one that seeks to be a time-efficient test. This logic informed subtest selection as well as item writing throughout the RIAS developmental process. Any test of *g* must measure so-called "higher-order" cognitive abilities—those associated with fluid abilities, such as general sequential reasoning, induction, deduction, syllogisms, series tasks, matrix reasoning, analogies, quantitative reasoning, and so on (Carroll, 1993). Kamphaus (2001) has advocated the following definition of *reasoning*: "that which follows as a reasonable inference or natural consequence; deducible or defensible on the grounds of consistency; reasonably believed or done" (*New Shorter Oxford English Dictionary*, 1993). This definition emphasizes a central cognitive requirement to draw inferences from knowledge. This characteristic of general intelligence is measured best by two RIAS subtests, Verbal Reasoning and Odd-Item Out, although all of the subtests have substantial *g* saturation (see Reynolds & Kamphaus, 2003, especially Ch. 6).

First-order factors of crystallized ability typically have one central characteristic: They involve language abilities (Vernon, 1950). These language abilities range from vocabulary knowledge to spelling to reading comprehension. On the other hand, it is not possible to dismiss this type of intelligence as a general academic achievement factor (see Reynolds & Kamphaus, 2003, for a discussion of this point). Kamphaus (2001) has proposed that the *verbal* factor be defined as "oral and written communication skills that follow the system of rules associated with a language" (p. 45), including comprehension skills.

Nonverbal tests have come to be recognized as measures of important spatial and visual-perceptual abilities—abilities that may need to be assessed for a variety of clients, including those with brain injuries. In the 1963 landmark Educational Testing Service Kit of Factor-Referenced Cognitive Tests, *spatial ability* was defined as "the ability to manipulate or transform the image of spatial patterns into other visual arrangements" (cited in Carroll, 1993, p. 316). The RIAS What's Missing and Odd-Item Out subtests follow in this long tradition of tasks designed to measure visual–spatial abilities. Digit recall, sentence recall, geometric design recall, bead recall, and similar measures loaded consistently on a *general memory and learning* stratum II factor identified by Carroll (1993) in his numerous analyses. The RIAS Verbal Memory and Nonverbal Memory subtests are of this same variety, although they are more complex than simple confrontational memory tasks such as pure digit recall. Carroll's findings suggest that the RIAS Verbal Memory and Nonverbal Memory subtests should be good measures of the memory construct that has been identified previously in so many investigations of a diverse array of tests. Memory is typically considered a complex trait with many permutations, including visual, verbal, long-term, and short-term. Carroll's analysis of hundreds of datasets supports the organization of the RIAS, in that he found ample evidence of a general memory trait that may be subdivided further for particular clinical purposes.

Description of Subtests

Subtests with a familiar look and feel, and with essentially long histories in the field of intellectual assessment, were chosen for inclusion on the RIAS. There are a total of four intelligence subtests and two memory subtests. The intelligence subtests were also chosen because of their complex nature: Each assesses many intellectual functions and requires their integration for successful performance (see also a later section of this chapter, "Evidence Based on Response Processes"). The memory subtests were chosen not only for complexity, but also due to their representation of the primary content domains of memory.

- *Guess What.* This subtest measures vocabulary knowledge in combination with reasoning skills that are predicated on language development and fund of information. For each item, the examinee listens to a question containing clues presented orally by the examiner, and then gives a verbal response (one or two words) consistent with the clues. The questions pertain to physical objects, abstract concepts, and well-known places and historical figures from a variety of cultures, geographic locations, and disciplines.

• *Verbal Reasoning.* The second verbal subtest measures analytical reasoning abilities. More difficult items also require advanced vocabulary knowledge. For each item, the examinee is asked to listen to an incomplete sentence presented orally by the examiner, and then to give a verbal response, typically one or two words, that completes the sentence (most commonly completing a complex analogy). Completion of the sentences requires the examinee to evaluate the various conceptual relationships that exist between the physical objects or abstract ideas contained in the sentences.

• *Odd-Item Out.* This subtest measures general reasoning skills emphasizing nonverbal ability. For each item, the examinee is presented with a picture card containing from five to seven figures or drawings. One of the figures or drawings on the picture card has a distinguishing characteristic, making it different from the others. For each item, the examinee is given two chances to identify the figure or drawing that is different from the others. Two points are awarded for a correct response given on the first attempt. One point is awarded for a correct response given on the second attempt (i.e., if the first response was incorrect).

• *What's Missing.* This subtest measures nonverbal reasoning skills through the presentation of pictures in which some important component of the pictured object is missing. Examinees must understand or conceptualize the pictured object, assess its Gestalt, and distinguish essential from nonessential components. For each item the examinee is shown a picture card, asked to examine the picture, and then asked to indicate (in words or by pointing) what is missing from the picture. Naming the missing part correctly is not required, so long as the examinee can indicate the missing component correctly. For each item, the examinee is given two chances to identify what is missing from the picture.

• *Verbal Memory.* This subtest measures the ability to encode, briefly store, and recall verbal material in a meaningful context. Young children (ages 3–4 years) are asked to listen to sentences of progressively greater length read aloud by the examiner, and then asked to repeat each sentence word for word immediately after it is read aloud. Older children and adults listen to two stories read aloud by the examiner, and then repeat each story back to the examiner immediately after it is read aloud. The sentences and stories were written to provide developmentally appropriate content and material of interest to the targeted age group. Specific stories are designated for various age groups.

• *Nonverbal Memory.* This subtest measures the ability to encode, briefly store, and recall visually presented material, whether the stimuli represent concrete objects or abstract concepts. For each item, the examinee is presented with a target picture for 5 seconds, and then with a picture card containing the target picture and an array of similar pictures. The examinee is asked to identify the target picture among the array of pictures presented on the picture card. For each item, the examinee is given two chances to identify the target picture. The pictures are primarily abstract at the upper age levels, and pictures of common objects at the lower age levels. The use of naming and related language strategies is not helpful, however, due to the design of the distracters.

ADMINISTRATION AND SCORING

The RIAS was specifically designed to be easy to administer and objective to score. For all subtests except Verbal Memory, there are clear, objective lists of correct responses for each test item, and seldom are any judgment calls required. Studies of the interscorer reliability of these five subtests produced interscorer reliability coefficients of 1.00 by trained examiners (Reynolds & Kamphaus, 2003). On Verbal Memory, some judgment is requited when examinees do not give verbatim responses; however, the scoring criteria provide clear examples and guidelines for such circumstances, making the Verbal Memory subtest only slightly more difficult to score. The interscorer reliability study of this subtest produced a coefficient of .95.

The time required to administer the entire RIAS (including both the intelligence and the memory subtests) averages 30–35 minutes once an examiner has practiced giving the RIAS and has become fluent in its administration. The RIST averages about 10–12 minutes. As with most tests, the first few administrations are likely to take longer. The four intelligence subtests alone (i.e., Guess What, Odd-Item Out, Verbal Reasoning, and What's Missing) can be administered to most examinees in about 20–25 minutes. The two memory subtests can typically be administered in about 10 minutes. However, significant time variations can occur as a function of special circumstances (e.g., very low-functioning individuals will probably take much less time to complete the battery, and very bright individuals may take longer). Basal and ceiling rules along with age-designated starting points were employed to control the administration time, and each was derived empirically from the responses of the standardization sample. Also, to facilitate ease and efficiency of administration, the RIAS and RIST record forms contain all of the necessary instructions and examiner guides necessary to administer the tests.

PSYCHOMETRIC PROPERTIES

Due to the length restrictions in a single book chapter, a discussion of the developmental process of the tests simply cannot be provided. However, the RIAS underwent years of development, including tryout and review of the items on multiple occasions by school psychologists, clinical psychologists, neuropsychologists, and others. Items were written to conform to clear specifications consistent with the goals for development of the test as given previously in this chapter. Items were reviewed by panels of expert psychologists for content and construct consistency, and by expert minority psychologists to ascertain the cultural saliency of the items and any potential problems of ambiguity or offensiveness. The developmental process speaks directly to the psychometric characteristics of the tests, and is described in far more detail in Reynolds and Kamphaus (2003). It should be considered carefully in any full evaluation of the instrument.

Standardization

The RIAS was normed on a sample of 2,438 participants residing in 41 states between the years of 1999 and 2002. U.S. Bureau of the Census characteristics of the U.S. population projected initially to the year 2000, and then updated through 2001, were used to select a population-proportionate sample. Age, gender, ethnicity, educational level (parental educational level was used for ages 3 years through 16 years, and the participants' actual educational level was used at all other ages), and region of residence were used as stratification variables. The resulting norms for the RIAS and the RIST were calculated on a weighted sampling that provided a virtually perfect match to the census data. The overall sample was a close match to the population statistics in every regard (see Reynolds & Kamphaus, 2003, especially Tables 4.2–4.5).

Norm Derivation and Scaling

All standard scores for the RIAS were derived via a method known as *continuous norming*. Continuous norming is a regression-based methodology used to mitigate the effects of any sampling irregularities across age groupings and to stabilize parameter estimation. An important feature of continuous norming is that it uses information from all age groups, rather than relying solely on the estimates of central tendency, dispersion, and the shape of the distributions of a single age grouping for producing the norms at each chosen age interval in the normative tables for a particular test. As such, the continuous-norming procedure maximizes the accuracy of the derived normative scores and has become widespread in its application to the derivation of test norms over the last 20 years (see, e.g., Reynolds, 2003; Roid, 2003; Zachary & Gorsuch, 1985). Calculation of normative scores via continuous norming essentially involves calculating these things, sequentially: the lines or curves of best fit for the progression of means and standard deviations across age groupings of the norming variables (using polynomial regression); the mean, standard deviation, skewness, and kurtosis of the distribution of scores for each normative age group; and percentiles and scaled scores based on the estimates obtained from the prior steps.

For the RIAS and the RIST, census-weighted means and standard deviations of the subtest raw scores for the 52 age groups in the normative sample were analyzed separately to determine the best-fitting polynomial regression equations. Mean subgroup age and its powers up to the sixth power were used as predictors. Visual inspection of the polynomial curves derived from the group standard deviations, and those previously derived from the individuals' raw scores, showed considerable congruence. Means and standard deviations were then calculated for each normative age group, using the polynomial regression equations derived above. The method of continuous norming assumes that the best estimate of distribution shape is derived from the composite skewness and kurtosis aggregated across groupings of the normative variables (Angoff & Robertson, 1987). Composite estimates of skewness and kurtosis were thus calculated from the averages of these respective values in the 52 age groups. Percentiles and normalized standardized scores corresponding to raw scores were calculated for every normative age group, using the respective mean and standard deviation values obtained in step 2. *T* scores were derived to have a mean of 50 and a standard deviation of 10 for each of the RIAS subtests. These scores were then combined into the various composite and index scores described previously (see Table 16.1) and scaled via a similar procedure to a mean of 100 and standard deviation of 15.

T scores were chosen for the RIAS subtests over the more traditional scaled scores (mean = 10) popularized by Wechsler (e.g., Wechsler, 1949), due to the higher reliability coefficients obtained for the RIAS subtest scores. With high degrees of reliability of test scores, the use of scales that make finer discriminations among individuals is possible, producing a more desirable range of possible scores. For the convenience of researchers and examiners who wish to use other types of scores for comparative, research, or other purposes, the RIAS manual (Reynolds & Kamphaus, 2003, App. B) provides several other common types of scores for the RIAS and RIST indexes, including percentiles, *T* scores, *z* scores, normal curve equivalents, and stanines, along with a detailed explanation of each score type.

Score Reliability

Since the RIAS is a power test (i.e., items are presented in order of difficulty, from least to most difficult, and individuals' scores depend entirely on how many items they respond to correctly), the internal-consistency reliability of the items on the RIAS subtests was investigated by using Cronbach's coefficient alpha. Alpha reliability coefficients for the RIAS subtest scores and the Nunnally reliability estimates for the index scores are presented in Tables 16.2 and 16.3, respectively, for 16 age groups from the total standardization sample. The reliability estimates are rounded to two decimal places and represent the lower limits of the internal-consistency reliability of the RIAS scores.

According to the tables, 100% of the alpha coefficients for the RIAS subtest scores reach .84 or higher for every age group. As the data in Table 16.2 show, the median alpha reliability estimate for each RIAS subtest across age equals or exceeds .90. This point is important because many measurement experts recommend that reliability estimates above .80 are necessary and those above .90 are highly desirable for tests used to make decisions about individuals. All RIAS subtests meet these

TABLE 16.2. Reliability Coefficients of the RIAS Subtests by Age Group

	Subtest					
Age (years)	Guess What (GWH)	Verbal Reasoning (VRZ)	Odd-Item Out (OIO)	What's Missing (WHM)	Verbal Memory (VRM)	Nonverbal Memory (NVM)
3	.89	.84	.93	.84	.93	.93
4	.92	.87	.91	.89	.94	.93
5	.95	.86	.90	.85	.95	.94
6	.93	.86	.94	.92	.89	.96
7	.93	.89	.95	.94	.93	.96
8	.92	.88	.94	.92	.90	.95
9	.92	.90	.95	.93	.92	.96
10	.91	.88	.94	.93	.92	.96
11–12	.89	.90	.94	.93	.90	.95
13–14	.90	.92	.94	.93	.91	.96
15–16	.91	.92	.95	.92	.93	.95
17–19	.92	.92	.94	.90	.94	.90
20–34	.92	.94	.95	.93	.94	.95
35–54	.95	.94	.95	.93	.94	.96
55–74	.91	.93	.95	.91	.93	.95
75–94	.94	.93	.95	.92	.94	.96
Median	.92	.90	.94	.92	.93	.95

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TABLE 16.3. Reliability Estimates of the RIAS Indexes by Age Group

Age (years)	Index VIX	NIX	CIX	CMX
3	.91	.92	.94	.94
4	.94	.93	.95	.95
5	.94	.92	.96	.95
6	.94	.94	.96	.94
7	.94	.95	.97	.95
8	.94	.94	.96	.93
9	.94	.95	.97	.95
10	.93	.95	.95	.95
11–12	.94	.95	.96	.93
13–14	.95	.95	.97	.95
15–16	.95	.95	.97	.95
17–19	.95	.94	.96	.93
20–34	.96	.96	.97	.96
35–54	.97	.96	.98	.97
55–74	.95	.95	.97	.95
75–94	.96	.96	.98	.97
Median	.94	.95	.96	.95

Note. VIX, Verbal Intelligence Index; NIX, Nonverbal Intelligence Index; CIX, Composite Intelligence Index; CMX, Composite Memory Index. From Reynolds and Kamphaus (2003). Copyright 2003 by Psychological Assessment Resources, Inc. Reprinted by permission.

recommended levels. As shown in Table 16.3, the reliability estimates for all RIAS indexes have median values across age that equal or exceed .94. These reliability estimates are viewed as excellent and often exceed the reliability values presented for the composite indexes or IQs of tests two or three times the length of the RIAS.

One cannot always assume that because a test is reliable for a general population, it will be equally reliable for every subgroup within that population. Therefore, test developers should demonstrate whenever possible that their test scores are indeed reliable for subgroups, especially those subgroups that because of gender, ethnic, or linguistic differences, might experience test bias (Reynolds, 2000). As noted 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) these values may also provide information relevant to the consequences of test use. When calculated separately for male and female examinees, the reliability coefficients are high and relatively uniform (see Table 5.4 of Reynolds & Kamphaus, 2003, for the full table of values), with no significant differences in test score reliability at any age level as a function of gender. For male and female examinees, the RIAS subtests and the indexes are highly comparable across groups. Reliability estimates were also calculated separately for European American and African American ethnic/racial group members (see Reynolds & Kamphaus, 2003).

The stability of RIAS scores over time was investigated via the test–retest method with 86 individuals ages 3 years through 82 years. The intervals between the two test administrations ranged from 9 to 39 days, with a median test–retest interval of 16 days. The correlations for the two testings, along with mean scores and standard deviations, are reported in detail in the RIAS manual (Reynolds & Kamphaus, 2003) in Tables 5.7–5.11 for the total test–retest sample and for four age groups: 3–4 years, 5–8 years, 9–12 years, and 13–82 years. The obtained coefficients are of sufficient magnitude to allow confidence in the stability of RIAS test scores over time. In fact, the values are quite good for all of the subtests, but especially for the index scores. The uncorrected coefficients are all higher than .70, and 6 of the 10 values are in the .80s. The corrected values are even more impressive, with all but 2 values ranging from .83 to .91. When viewed across age groups, the values are generally consistent with the values obtained for the total test–retest sample.

Validity of RIAS Test Scores as Measures of Intelligence

The *Standards* volume (AERA et al., 1999, pp. 11–17) suggests a five-category scheme for organizing sources of evidence to evaluate proposed interpretations of test scores, although clearly recognizing that other organizational systems may be appropriate. The RIAS manual (Reynolds & Kamphaus, 2003) provides a thorough analysis of the currently available validity evidence associated with the RIAS/RIST scores as measures of intelligence organized according to the recommendations just noted.

Evidence Based on Test Content

Evidence with respect to the content validity of the RIAS subtests may be gleaned from the item review and item selection processes. As the *Standards* volume (AERA et al., 1999) notes, expert judgments may be used to assess agreement with test specifications and constructs in evaluating validity based on test content. During the first item tryout, a panel of minority psychologists, all with experience in assessment, reviewed all RIAS items for appropriateness as measures of their respective constructs and for applicability across various U.S. cultures. Another panel of five psychologists with doctoral degrees in school psychology, clinical psychology, clinical neuropsychology, and measurement also reviewed all items in the item pool for appropriateness. Items questioned or found faulty were either eliminated outright or modified. The RIAS items in the published version thus passed a series of judgments by expert reviewers. Final items were then chosen on the basis of traditional item statistics derived from true-score theory. Analyses of item characteristics across age, gender, and ethnicity were also undertaken to ensure appropriateness of content across various nominal groupings.

Evidence Based on Response Processes

Evidence based on the response processes of the tasks is concerned with the fit between the nature of the performance or actions in which the examinee is actually engaged and the constructs being assessed. For heavily *g*-loaded and memory tasks on the RIAS, the best evidence related to the response process is gleaned from an examination of these tasks themselves, as well as from their correlates (see the later section on relations to external variables).

The four RIAS intelligence subtests are designed to measure general intelligence in the verbal and nonverbal domains. As such, the tasks are complex and require the integration of multiple cognitive skills, thereby avoiding contamination by irrelevant, noncognitive response processes.

Because of their relationship to crystallized intelligence, the two verbal subtests invoke vocabulary and language comprehension. However, clearly academic or purely acquired skills such as reading are avoided. The response process requires integration of language and some general knowledge to deduce relationships; only minimal expressive language is required. One- or two-word responses are acceptable for virtually all items. The response process also is not contaminated by nonintellectual processes, such as motor acuity, speed, and coordination. Rather, problem solving through the processes of deductive and inductive reasoning is emphasized.

Likewise, the two nonverbal tasks avoid contamination by extraneous variables such as motor acuity, speed, and coordination. Examinees have the response options of pointing or giving a one- or two-word verbal indication of the correct answer. As with any nonverbal task, some examinees may attempt to use verbal encoding to solve these tasks, and some will do so successfully. However, the tasks themselves are largely spatial and are known to be more affected by right- than by left-hemisphere impairment (e.g., Joseph, 1996; Reynolds & French, 2003)—a finding that supports the lack of verbal domination in strategies for solving such problems.

Response processes of the two RIAS memory subtests also avoid contamination from reading and various aspects of motor skills. Although good language skills undoubtedly facilitate verbal memory, they are not the dominant skills involved. The RIAS memory tasks are very straightforward, with response processes that coincide with their content domain—verbal in the Verbal Memory subtest and nonverbal in the Nonverbal Memory subtest. Even so, in the latter case, examinees who have severe motor problems may give a verbal indication of the answer they have selected.

Evidence Based on Internal Structure

The RIAS provides an index score (CIX) that purports to be a measure of *g*. The RIAS additionally provides indexes that focus on verbal ability (VIX), a construct closely related to crystallized intelligence, and nonverbal ability (NIX), a construct closely related to fluid intelligence. A separate memory index (CMX) is also provided. The CIX, which is derived from the four intelligence subtests of the RIAS, presupposes a common underlying construct that reflects overall intelligence. The other index scores likewise presuppose some meaningful, identifiable dimension underlying their construction. The extent to which a composite score can be evaluated internally is directly related to the dimensionality of the scores that make up the composite. Therefore, evidence based on the internal structure of the RIAS is provided from two sources: item coherence (or internal consistency), and factor analyses of the intercorrelations of the subtests. The internal-consistency evidence has been reviewed in the section on the reliability of test scores derived from the RIAS. Factor analysis is another method of examining the internal structure of a scale that lends itself to assessing the validity of recommended score interpretations.

Factor analysis is a common method of examining the patterns of relationships among a set of variables. It is a commonly recommended analytical approach to evaluating the presence and structure of any latent constructs among a set of variables, such as subtest scores on a test battery (see Cronbach, 1990; Kamphaus, 2001). Two methods of factor analysis have been applied to the intercorrelation matrix of the RIAS subtests—first with only the four intelligence subtests examined, and then with all six subtests examined under both techniques of analysis. Exploratory analyses were undertaken first and were followed by a set of confirmatory analyses to assess the relative goodness of fit of the chosen exploratory results to mathematically optimal models. For the exploratory factor analyses, the method of *principal factors* was chosen. In such analyses, the first unrotated factor to be extracted is commonly interpreted as *g*. The correlations of each subtest with this factor (i.e., the factor loadings) are indicators of the degree to which each subtest measures general intelligence as opposed to more specific components of ability.

For purposes of factor analyses of the RIAS subtests' intercorrelations, the sample was divided into five age groups (rather than 1-year interval groups) to enhance the stability and the generalizability of the factor analyses of the RIAS scores. These age groupings reflect common developmental stages. The five age groupings were early childhood, ages 3 years through 5 years; childhood, ages 6 years through 11 years; adolescence, ages 12 years through 18 years; adulthood, ages 19 years through 54 years; and senior adulthood, ages 55 years through 94 years. A Pearson correlation between each possible pair of RIAS subtest scores within each age level was determined, and factor analyses were performed.

When the two-factor and three-factor solutions were subsequently obtained, the two-factor varimax solution made the most psychological and psychometric sense for both the set of four intelligence subtests and for all six RIAS subtests. In the four-subtest three-factor solution, no variables consistently defined the third factor across the four age groupings. In the six-subtest three-factor solutions, singlet factors (i.e., factors with a single salient loading) appeared, commonly representing a memory subtest; What's Missing tended to behave in an unstable manner as well. Summaries of the two-factor varimax solutions are presented for the four-subtest and six-subtest analyses in Table 16.4. In each case, the first, unrotated factor is a representation of *g* as measured by the RIAS.

The *g* factor of the RIAS is quite strong. Only the intelligence subtests have loadings that reach into the .70s and .80s. All four intelligence subtests are good measures of *g*; however, of the four, the verbal subtests are the strongest. Odd-Item Out and What's Missing follow, the latter being the weakest measure of *g* among the four intelligence subtests. The strength of the first unrotated factor

TABLE 16.4. Two-Factor Solutions for the Four-Subtest and Six-Subtest Analyses of the RIAS

	g[a]					Factor 1					Factor 2				
Subtest	3–5 years	6–11 years	12–18 years	19–54 years	55–94 years	3–5 years	6–11 years	12–18 years	19–54 years	55–94 years	3–5 years	6–11 years	12–18 years	19–54 years	55–94 years
RIAS intelligence subtest loadings from a principal-factors solution by age group															
Guess What	.71	.77	.88	.87	.82	.66	.73	.78	.74	.65	.34	.32	.44	.48	.50
Verbal Reasoning	.78	.81	.85	.84	.85	.69	.74	.78	.73	.80	.40	.37	.39	.45	.38
Odd-Item Out	.70	.60	.60	.73	.74	.36	.32	.30	.42	.50	.63	.57	.58	.62	.55
What's Missing	.60	.49	.63	.66	.69	.30	.21	.32	.36	.33	.58	.53	.60	.60	.67
RIAS intelligence and memory subtest loadings from a principal-factors solution by age group															
Guess What	.70	.77	.84	.82	.82	.66	.74	.77	.77	.68	.29	.33	.38	.35	.47
Verbal Reasoning	.79	.79	.86	.83	.83	.78	.70	.83	.78	.76	.29	.39	.34	.36	.40
Odd-Item Out	.67	.63	.58	.71	.74	.41	.26	.23	.44	.48	.57	.67	.64	.58	.57
What's Missing	.59	.44	.57	.64	.68	.37	.21	.38	.46	.32	.47	.44	.43	.45	.66
Verbal Memory	.54	.48	.41	.58	.60	.51	.48	.40	.49	.56	.22	.18	.15	.31	.28
Nonverbal Memory	.49	.48	.57	.66	.61	.16	.23	.26	.28	.31	.59	.47	.59	.71	.56

Note. From Reynolds and Kamphaus (2003). Copyright 2003 by Psychological Assessment Resources, Inc. Adapted by permission.

[a] g, or general intelligence factor, reported as the subtests' loadings on the first unrotated principal factor. Loadings for both factor 1 and factor 2 are those following varimax rotation.

is, however, indisputable; it indicates that first and foremost, the RIAS intelligence subtests are measures of *g*, and that the strongest interpretive support is given in these analyses to the CIX. At the same time, the varimax rotation of the two-factor solution clearly delineates two components of the construct of *g* among the RIAS intelligence subtests. For every age group, the verbal and nonverbal subtests clearly break into two distinct factors that coincide with their respective indexes, VIX and NIX. The six-subtest solution also breaks along content dimensions, with Verbal Memory joining the two verbal intelligence subtests on the first rotated factor, and Nonverbal Memory joining the two nonverbal intelligence subtests on the second rotated factor. However, in view of the analysis of the content and response processes as well as other evidence presented throughout the RIAS manual (Reynolds & Kamphaus, 2003), it remains sensible to separate the Verbal Memory and Nonverbal Memory subtests into a separate memory index (i.e., CMX). This decision is further supported by the outcomes of a recent analysis of the RIAS factor structure demonstrating the alignment of the subtests with their factors and the separation of the CMX from the others (Dombrowski, Watkins, & Brogan, 2009). Memory is clearly a component of intelligence. The two memory tasks that were chosen for the RIAS are relatively complex, and both are strong predictors of broader composites of verbal and nonverbal memory (Reynolds & Bigler, 1994)—characteristics that are at once an asset and a liability. Although these two memory tasks are good measures of overall or general memory skill, they tend to correlate more highly with intelligence test scores than do very simple, confrontational measures of working memory, such as digit repetition. Given the purpose of providing a highly reliable assessment of overall memory skill, such a compromise is warranted.

The stability of the two-factor solution across other relevant nominal groupings and the potential for cultural bias in the internal structure of the RIAS were also assessed. For this purpose, the factor analyses were also calculated separately for males and females and for European Americans and African Americans, according to recommendations and procedures outlined in detail by Reynolds (2000). Tables 6.3–6.6 in Reynolds and Kamphaus (2003) present these results for each comparison. The similarity of the factor-analytic results across gender and across ethnicity was also assessed. Two indexes of factorial similarity were calculated for the visually matched rotated factors and for the first unrotated factor—the coefficient of congruence (r_c) and Cattell's (1978) salient variable similarity index—as recommended in several sources (e.g., Reynolds, 2000). In all cases, the factor structure of the RIAS was found to be highly consistent across gender and ethnicity.

Subsequent to the exploratory factor analyses, several confirmatory factor analyses were conducted to examine the fit of exploratory analyses to a more purely mathematical model (see Reynolds & Kamphaus, 2003, for table values and a thorough discussion). Based on the theoretical views of the structure of the RIAS discussed earlier in this chapter, three theoretical models were tested. The models were defined as follows: (1) The RIAS is a measure of general intellectual abilities; (2) the RIAS is a measure of verbal and nonverbal abilities; and (3) the RIAS is a measure of verbal, nonverbal, and memory abilities.

The resulting chi-square (χ^2), residuals, root mean square error of approximation (RMSEA), and other model-fitting statistics were then compared; the LISREL-VI program (Joreskog & Sorbom, 1987) was used to test the relative fit of the three models. Model 1, general intelligence, clearly fit better when only the four intelligence subtests were included (χ^2 = 8.17 to 20.57 and RMSEA ranging from .10 to .14, depending on the age range studied) than when six subtests were included. Although these models suggested, much in the same way as the exploratory factor analyses showed, that the RIAS is dominated by a large first factor, the RMSEAs were still high enough to suggest that models 2 and 3 should be explored.

Model 2 was a very good fit to the data, particularly when four subtests were included in the model versus six subtests. For the model that included four subtests, the chi-square values were between .22 and 1.49. Similarly, the RMSEAs were less than .01 for the first four age groups (i.e., 3 years to 54 years) and .04 for ages 55 years and older—values suggesting that two factors explained virtually all of the variance between the four subtests. These findings indicated that the fit of a three-factor model was not likely to be as good.

In fact, model 3 with six subtests included (χ^2 = 14.14 to 37.48, and RMSEA ranging from .01 to .09) did not fit nearly as well as model 2. There were some indications that the six-subtest two-factor model was also plausible for the population 19 years and older. Although the four-subtest two-factor model is recommended, these results suggest that use of all six subtests for assessing verbal and nonverbal intelligence may be defensible for adults as well. In cases where memory problems are part of the referral question for adults, the use of six subtests may be beneficial; however, integrating the memory subtests into the VIX and NIX is not recommended. With clinical populations, we continue to prefer the division of the RIAS subtests into the VIX, NIX, and CMX, even though placing the memory subtests into the VIX and NIX may have a reasonable mathematical foundation in the confirmatory factor analyses.

In summary, the results of the confirmatory factor analyses suggest that the CIX, VIX, and NIX possess evidence of factorial validity. The CMX, in particular, requires further research with a variety of clinical and nonclinical samples. Although factor-analytic results are often open to alternate interpretations, it is our opinion, based on the findings just described as well as the conceptual distinctions we have drawn previously, that it is best not to use all six subtests to measure general intelligence.

Evidence Based on Relations with Other (External) Variables

Another important area in the validation process is the evaluation of the relationship of scores on the instrument of interest to variables that are external to the test itself. This evaluation may include, for example, relationships with other tests that measure similar or dissimilar constructs, diagnostic categorizations, and relationships with developmental constructs such as age. The *Standards* volume (AERA et al., 1999) emphasizes that a wide range of variables are of potential interest, and that different relationships will have different degrees of importance to examiners who work in different settings or are using the test for different purposes. As with other areas of evidence, test users ultimately have the responsibility of evaluating the evidence and determining its saliency and adequacy for their own intended use of the instrument. Several different external variables were chosen for investigation with the RIAS, including developmental variables (i.e., age), demographic variables, relations with other tests, and clinical status.

Developmental Trends

As a developmental construct, intellectual ability grows rapidly in the early years, begins to plateau in the teens but shows some continued growth (particularly in verbal domains), and eventually declines in the older years. This decline generally begins sooner and is more dramatic for nonverbal, or fluid, intelligence (Kaufman, McLean, Kaufman-Packer, & Reynolds, 1991; Kaufman, Reynolds, & McLean, 1989; Reynolds, Chastain, Kaufman, & McLean, 1987). If raw scores on the tasks of the RIAS reflect such a developmental process or attribute, then relationships with age should be evident. The relationship between age (a variable external to the RIAS) and performance on the RIAS was investigated in two ways.

First, the correlation between age and raw score for each subtest was calculated for the primary developmental stage, ages 3 years through 18 years. The correlations for all groups were uniformly large, typically exceeding .80 and demonstrating that raw scores on the RIAS increase with age and in a relatively constant manner across subtests (see Reynolds & Kamphaus, 2003). To examine the issue in more detail, lifespan developmental curves were generated for each subtest from ages 3 years through 94 years. These curves are presented in the RIAS manual (Reynolds & Kamphaus, 2003) and show a consistent pattern of score increases and declines (with aging) across all groups.

Correlations with the Wechsler Scales

Edwards and Paulin (2007) found that the RIAS indexes all correlated highly with the Wechsler Intelligence Scale for Children—Fourth Edition (WISC-IV; Wechsler, 2003) Full Scale IQ (FSIQ), with correlations ranging from a low of .60 (NIX–FSIQ) to a high of .78 (VIX–FSIQ). The pattern of correlations was much as predicted; namely, the highest correlations were between those aspects of the tests most closely associated with *g* (from their respective factor analyses).

In another study, a group of 31 adults were administered the RIAS and the Wechsler Adult Intelligence Scale—Third Edition (WAIS-III; Wechsler, 1997) in a counterbalanced design. All but two of the correlations exceeded .70; the VIX–PIQ correlation was the lowest at .61. All of the RIAS indexes correlated at or above .70 with the WAIS-III FSIQ. Furthermore, there were no significant differences among any of the correlations. This finding is most likely a function of the *g* saturation of both the RIAS and WAIS-III. These findings were corroborated by a recent comparison of the RIAS and the WAIS-III, where the scales on the two measures were found to have the following correlations: CIX–FSIQ, .94; VIX–VIQ, .89; NIX–PIQ, .88 (Umphress & Taylor, 2008). Functionally, both the RIAS and WAIS-III appear to measure the same intelligence constructs.

Correlations with the Woodcock–Johnson III Tests of Cognitive Abilities

Krach, Loe, Jones, and Farrally (2009) found that the RIAS indexes also correlated highly with the Woodcock–Johnson III Tests of Cognitive Abilities (WJ III COG; Woodcock, McGrew, & Mather, 2001). Correlations ranged from a low of .54 (Gf–NIX) to a high of .88 (Gc–CIX). The WJ III COG relies on the use of abstract geometric structures and colors for the Gf scale, in contrast to the use of many concrete items as seen on the subtests used to derive the NIX.

Correlations with Measures of Academic Achievement

One of the major reasons for the development of the early, individually administered intelligence tests was to predict academic achievement levels. Intelligence tests have done well as predictors of school learning, with typical correlations in the mid-.50s and .60s (for summaries, see Kamphaus, 2001; Sattler, 2001). To evaluate the relationship between the RIAS and academic achievement, 78 children and adolescents were administered the RIAS and the Wechsler Individual Achievement Test (WIAT; Wechsler, 1992).

School learning is fundamentally a language-related task, and this fact is clearly evident in these data. Although all of the RIAS indexes correlated well with all of the WIAT composite scores, the highest correlations were consistently between the VIX and CIX and the WIAT composites. These correlations were predominantly in the .60s and .70s, indicating that the RIAS has strong predictive value for educational achievement.

Evidence Based on the Consequences of Testing

The final area of the validation process is the most controversial of all the aspects of this process, as presented in the *Standards* volume (AERA et al., 1999). It is most applicable to tests designed for selection and may deal with issues of bias or loss of opportunity. How these applications should be evaluated for clinical diagnostic tests is largely unclear. However, accurate diagnosis might be one anticipated consequence of testing and should be the key to evaluating the "consequential" validity of a clinical instrument. The evidence reviewed in the preceding sections demonstrates the ability of the RIAS to provide an accurate estimate of intellectual ability and certain memory skills, and to do so accurately across such nominal groupings as gender and ethnicity. Cultural biases in the format and content of tests, when apparent, have also been found to produce undue consequences of testing. Evidence pointing toward a lack of cultural bias in the RIAS is extensive for male and female examinees, as well as for European Americans, African Americans, and Hispanic Americans. This evidence has been provided previously in this chapter and in Chapter 4 of the RIAS manual (Reynolds & Kamphaus, 2003), where results of item bias studies are reported. The studies of potential cultural bias in the RIAS items were extensive in both objective and subjective formats and resulted in the removal of many items and modification of others, as described in detail in the manual. Evidence based on consequences is thus supportive, but work remains to be done in this arena, particularly with as yet unstudied ethnic groups.

In evaluating evidence for test score interpretations, examiners must always consider their purposes for using objective tests. Evidence clearly supports the use of the constructs represented on the RIAS. The potential consequences of knowing how an individual's performance compares to that of others are many and complex, and are not always anticipated. The RIAS was designed to eliminate or minimize any cultural biases in the assessment of intelligence and memory for individuals reared and educated in the United States (who are fluent in the English language). The data available to date indicate that the RIAS precludes undue consequences toward diverse individuals who fit the target population. Examiners must nevertheless act wisely, consider the need for objective testing of intelligence and memory, and work to minimize or eliminate unsupported interpretations of scores on such tests.

CRITIQUES OF THE RIAS

Much as other standardized instruments have been, the RIAS has been the focus of some criticisms (Beaujean, McGlaughlin, & Margulies, 2009; Nelson, Canivez, Lindstrom, & Hatt, 2007). Most of these have centered on the methods utilized to determine the validity of the VIX, NIX, CIX, and CMX scales. Limitations of the research conducted that has challenged the validity of the RIAS include the use of both small sample sizes and specific populations. Thus it is difficult to determine whether the findings of these critiques are generalizable. Researchers, however, have urged continuing investigation of the validity of RIAS score inferences because of the test's promising features (Beaujean et al., 2009; Edwards & Paulin, 2007; Nelson et al., 2007).

APPLICATIONS OF THE RIAS

As a measure of intelligence, the RIAS is appropriate for a wide array of purposes and should be useful when assessment of an examinee's intellectual level is needed. The RIAS will be useful with preschool and school-age children for purposes of educational placement, as well as for diagnosis of various forms of childhood psychopathology (especially developmental disorders) where intellectual functioning is an issue. Diagnosis of specific disorders—such as intellectual disabilities, learning disabilities, the various dementias, and the effects of central nervous system (CNS) injury or compromise—most often calls for the use of an intelligence test as a component of patient evaluation, and the RIAS is appropriate for such applications. Clinicians who perform general clinical and neuropsychological evaluations will find the RIAS very useful when a measure of intelligence is needed. Practitioners will also find the RIAS useful in disability determinations under various state and federal programs, such as the Social Security Administration's disability program and Section 504 regulations. The RIAS was already being used consistently in such disability exams almost immediately following its publication (M. Shapiro, personal communication, April 2003).

Although the RIAS is rapid to administer, relative to the majority of other comprehensive measures of intelligence, it is not an abbreviated measure or a short form of intellectual assessment. The RIAS is regarded as an instrument that "substantially lessens the time to assess intelligence without compromising statistical integrity" (Elliot, 2004, p. 328). The RIAS is a comprehensive measure of verbal and nonverbal intelligence and of general intelligence, providing the same level of useful information often gleaned from much longer intelligence tests. When the memory subtests are also administered, the RIAS can provide even more useful information than typical intelligence tests currently used.

The major clinical uses of intelligence tests are generally classification (most commonly, diagnostic) and selection. The RIAS has broad applicability in each of these areas. Some of the more common uses in these areas are discussed here.

Learning Disabilities

For the evaluation of a learning disability, assessment of intelligence is a common activity. However, when a child or adult is evaluated for the possible presence of a learning disability, both verbal and nonverbal intelligence should be assessed. Individuals with learning disabilities may have spuriously deflated IQ estimates in one or the other domain, due to the learning disabilities themselves. Lower verbal ability is the more common type of learning disability in the school population and among adjudicated delinquents (Kaufman, 1994). However, the concept of nonverbal learning disabilities is gaining momentum. For individuals with such disabilities, verbal ability will often exceed nonverbal ability. The assessment of functioning in both areas is important, and the RIAS provides a reliable assessment of these domains, as well as a composite intelligence index.

Intellectual Disabilities

Most definitions—including those of the American Association on Intellectual and Developmental Disabilities (2009) and the *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition, text revision (DSM-IV-TR; American Psychiatric Association, 2000)—require the administration of an individually administered test of intelligence for diagnosis of an intellectual disability. The RIAS is applicable to this diagnosis, for which the evaluation of verbal and nonverbal intelligence as well as adaptive functioning is necessary. Intellectual disabilities are pervasive problems and not limited to serious problems in only the verbal or nonverbal domain. The range of scores available on the RIAS will also make it useful in distinguishing levels of severity of intellectual disabilities. Lower levels of functioning, such as profound intellectual disability, are difficult to assess accurately on nearly all tests of intelligence; this is likewise true of the RIAS. Although normed on children as young as 3 years of age, the RIAS also has limited discriminative ability below mild levels of intellectual disability in the 3-year-old age group.

Intellectual Giftedness

Many definitions of giftedness include reference to superior levels of performance on measures of intelligence. Here again, measures of both the verbal and nonverbal domains are useful, due to the influences of schooling and educational opportunity on verbal intelligence. The range of index scores available on the RIAS is adequate at all ages for identifying persons with significantly above-average levels of overall intellectual functioning, as well as in the verbal and nonverbal domains.

Physical/Orthopedic Impairment

The RIAS will be particularly useful in the evaluation of intellectual functioning among individuals with any significant degree of physical or motor impairment. The RIAS has no real demands for speed or accuracy of fine motor movements. If necessary, the pointing responses by the examinee on the RIAS nonverbal tasks can all be replaced with simple verbal responses, designating the location of the chosen response. It is, however, very important for an examiner to have knowledge of the physical impairments of any examinee and to make any necessary modifications in the testing environment, doing so in a manner consistent with appropriate professional standards (e.g., the *Standards for Educational and Psychological Testing*; AERA et al., 1999).

Neuropsychological and Memory Impairment

The information gleaned from evaluating memory functions can provide valuable clinical information above and beyond what is traditionally obtained with IQ measures. Memory is generally recognized as a focal or discreet subset of cognitive functions, and as such is often quite vulnerable to CNS trauma and various other CNS events. Disturbances of memory and attention are the two most frequent complaints of children and adults following traumatic brain injury at all levels of severity, as well as other forms of CNS compromise (e.g., viral meningitis, AIDS dementia complex, and other systemic insults). Therefore, it is not unusual for memory functioning to be affected, even when there is little or no impact on general intellectual ability. The memory measures on the RIAS offer clinicians valuable assessment tools with which to evaluate recent or more immediate memory functioning in both the auditory (i.e., verbal memory) and visual (i.e., nonverbal memory) modalities.

Emotional Disturbance

Individuals with various forms of emotional and/or psychotic disturbance (e.g., depression, schizophrenia) may exhibit cognitive impairments to varying degrees. Often clinicians do not assess the intelligence of such individuals because of the time required to do so. The RIAS offers clinicians a more efficient means of gathering information on the psychometric intelligence of individuals with emotional problems.

Job Performance

In personnel settings, IQ tests are sometimes used to predict success in job training programs; in other instances, lower limits are set on IQ levels for specific jobs. The RIAS and the RIST are strong predictors of academic performance, and the tasks involved and constructs assessed on these instruments match up well with known predictors of job performance in the form of other IQ tests. When intelligence level is a question in such situations, the RIAS and the RIST are appropriate choices.

CASE STUDY (ABBREVIATED)

Carl Last, age 6, was referred to the clinic by his parents, Jamie and Harold Last, for a psychoeducational evaluation. Carl's parents are concerned about his behavioral, emotional, and academic functioning. Six months prior to the current evaluation, Carl was diagnosed with attention and anxiety disorders. The Lasts are interested in verifying these diagnoses and hope to find out whether Carl is experiencing learning problems. Mr. and Mrs. Last are interested in receiving a better understanding of his difficulties, so that they can help him be successful in school and at home.

Parent Interview

Carl's past medical history includes colic, occasional constipation, and complaints of itchy skin. Currently, Carl is in good physical health and wears glasses for corrective vision while reading. Mr. Last reported that results of Carl's previous hearing screenings have been within normal limits, but that his hearing has not been checked recently. Family history is significant for a variety of health problems.

According to Mr. Last, Carl has always been a hyperactive child. He reported that Carl "learned to hop before he could walk" and frequently bounces when he is excited. Furthermore, he noted that Carl has not taken naps since the age of 2 and is overly active, such as rocking back and forth and fidgeting with things in his hands. Mr. Last also noted that Carl often waves his fingers back and forth, especially when he is frustrated or doing an undesirable activity. Mr. Last indicated that Carl's rocking and finger waving could be due to anxiety related to school, as he often engages in these behaviors when doing school activities. Mrs. Last indicated that in addition to hyperactivity, Carl is easily distracted and pays too much attention to minute details. She described Carl as making many careless mistakes and answering questions impulsively.

In addition, Mr. Last reported that Carl displays atypical and compulsive behaviors. Carl has specific places for all of his belongings; he is disturbed when things are misplaced and must immediately return them to their desired place. Moreover, Mrs. Last indicated that Carl is "anal" at times about organization and neatness, and insists on placing his belongings (such as his trophies) in a perfect line. She noted that Carl engages in cleaning rituals one or two times a month. Mrs. Last described the cleaning as repetitive, with Carl frequently moving objects as if they are "just not quite right." Mr. Last also indicated that Carl says phrases repetitively, such as muttering a phrase he has heard to himself over and over.

In addition to difficulties with hand washing, cleaning, and repetitive speech patterns, Mr. Last noted that Carl has unusual feelings and spells where he stares blankly. Specifically, Carl often claims, "Here comes that feeling. I don't like that feeling." At this point, Carl closes his eyes and is still for a couple of seconds until the feeling passes. He describes the experience as feeling "all shivery in my body and my brain." These experiences have occurred since Carl was 2 or 3 years old; they currently fluctuate from happening a couple of times a week to a couple of times a day. Mr. Last also reported that a couple of times a month, Carl appears to lose touch with reality and stares blankly for a few minutes. When he comes out of the stares, he does not rejoin the conversation in a normal matter; instead, he frequently asks about details from the past.

The Lasts reported that during kindergarten and first grade, Carl has experienced difficulties with inattention and concentration—specifically, problems with following directions and staying focused. The Lasts indicated that due to these problems, Carl has had difficulty with reading comprehension and formerly received tutoring services after school. They are currently not concerned about his reading performance. Carl is currently receiving B's and C's.

Behavioral Observations

Carl appeared for the evaluation well groomed and appropriately dressed on both days of testing. Consistent with the reports from his parents, Carl was hyperactive. He frequently rocked back and forth repetitively in his seat and moved about the testing room on occasion. He fidgeted with his hands during most of the 2-day evaluation, often rolling a pencil back and forth on his legs. At times, Carl seemed focused on the breaks that he was allowed during testing; he frequently asked to take a break. He engaged in age-appropriate social interaction and was generally well behaved throughout the sessions. He seemed comfortable with the examiners, and rapport was easily established. Carl required frequent redirection to the task at hand, but upon redirection he could maintain focus. He answered questions impulsively and was talkative throughout the evaluation.

Overall, Carl presented himself as well behaved and cooperative during testing. He seemed engaged in most testing procedures and appeared to put forth his best effort. Results of the evaluation are viewed as valid estimates of Carl's intellectual abilities, academic achievement, and social-emotional adjustment.

Teacher Interview

Carl's teacher, Mrs. Taylor, provided information regarding his overall functioning in the school setting. She noted that Carl is having learning problems, specifically with reading and reading comprehension. During the teacher interview, Mrs. Taylor noted that Carl has made adequate progress throughout the school year, but still seems to be having difficulties with reading. She indicated that Carl was hyperactive in the beginning of the year, but appears to have calmed down somewhat. However, she noted that he often does not seem relaxed and appears to feel "uncomfortable in his own body." Mrs. Taylor indicated that Carl's attention is variable, depending on the nature of the task; however, she noted that he often fails to give close attention to his assignments, such as failing to go back and check his work. Mrs. Taylor noted that Carl is well liked by his peers and does not have any behavior problems.

Intelligence Testing

The RIAS and the Wechsler Abbreviated Scale of Intelligence (WASI) were given to evaluate Carl's intelligence. As Table 16.5 indicates, Carl earned a low average to average RIAS VIX score of 89 (23rd percentile) and an average NIX score of 105 (63rd percentile). Taken together, the VIX and NIX scores yielded a CIX score of 95 (37th percentile), which falls in the average range. There was significant scatter within RIAS subtests, with scores ranging from high average to below average (see Table 16.6). For example, Carl had difficulty on a verbal subtest requiring him to complete verbal analogies, earning a below-average score. There is a significant discrepancy between Carl's verbal and performance intellectual ability scores, suggesting that his nonverbal reasoning skills as measured by the RIAS are more highly developed. Carl earned an average CMX score of 107, indicating that he has an average ability to learn and remember material.

Due to the considerable scatter on the subtests of the RIAS, Carl was administered the WASI as a second measure of cognitive ability. This instrument is an abbreviated version of the WISC-III. Carl earned a Verbal composite score of 98 (45th percentile), which falls in the average range. His score of 78 (7th percentile, significantly below-average range) on the Performance component was significantly different from his Verbal IQ. Again, Carl's performance was variable and produced significant subtest scatter. Carl's Performance IQ was negatively affected by the timed nature of the Block Design task. Qualitatively, it was noticed that Carl was not interested by the blocks and was inattentive and off task during this subtest. He earned a significantly below-average score on this subtest, which affected his overall Performance IQ. Verbal and Performance IQ scores combined to yield an overall Full Scale IQ of 86, which is considered to be low average when compared to that of his same-age peers.

TABLE 16.5. Carl's Composite Scores on the RIAS

Composites	Standard score	Confidence interval	Percentile
VIX	89	84–95	23rd
NIX	105	99–110	63rd
CIX	95	90–109	37th
CMX	107	101–112	68th

Note. The RIAS yields standard scores with a mean of 100 and a standard deviation of 15. Standard scores between 85 and 115, which include 68% of the general population, are considered to be within the average range.

TABLE 16.6. Carl's Subtest Scores on the RIAS

Subtest	Age-adjusted *T* score
Guess What	49
Odd-Item Out	57
Verbal Reasoning	33
What's Missing	47
Verbal Memory	48
Nonverbal Memory	59

Overall, Carl appears to be functioning in the average to low average range of intelligence and conceptual reasoning skills. His performance seems to be adversely affected by difficulties with attention and off-task behaviors. During administration of both the RIAS and the WASI, Carl answered questions impulsively, failing to listen to detailed directions for the tasks. His scores on both verbal and performance tasks were variable, depending on the nature of each task. In general, however, Carl should be able to make age-appropriate progress in learning and remembering new information, given his cognitive abilities.

Parent and Teacher Rating Scales

Carl's mother and father both completed the Behavior Assessment System for Children—Parent Rating Scales (BASC-PRS), and Mr. Last completed the Conners Parent Rating Scale—Revised: Long Version (CPRS-R:L). On the BASC-PRS, they rated Carl as having attention problems in the at-risk range. Specifically, they indicated that Carl is easily distracted and sometimes has difficulties with listening to directions, completing work on time, listening attentively, and forgetfulness. In order to help clarify the results of the BASC-PRS, Carl's father also completed the CPRS-R:L. Although ratings were within the average range, Mr. Last endorsed items indicative of inattention and cognitive problems, such as failing to give close attention to details and making careless mistakes. This is consistent with information obtained during the parent interview.

Mrs. Taylor, Carl's first-grade teacher, completed the Behavior Assessment System for Children—Teacher Rating Scales (BASC-TRS) to evaluate his attentional skills. Mrs. Taylor did not rate him as having any clinically significant problems with attention on the BASC-TRS. However, she noted that Carl is easily distracted from classwork and often has trouble concentrating. Furthermore, during her interview, she noted (as indicated earlier) that Carl often does not pay close attention to his assignments, failing to check over his work for any potential errors. It should be noted that both the parents and the teacher completed their rating scales after Carl had been on medication for a substantial amount of time. Therefore, it is possible that ratings of attention, which were below the clinically significant level, were influenced by the positive effects noticed since Carl has been taking atomoxetine hydrochloride (Strattera). Carl's parents and teacher indicated that they have noticed an increased ability to sustain attention and concentrate since he began taking Strattera. From the conversations with the teacher and parents, as well as the rating scales, however, it seems that Carl is still having difficulty with inattention. These difficulties are interfering with his ability to perform in the classroom and at home.

Achievement Testing

Broad reading, basic reading skills, and reading comprehension were assessed by the Woodcock–Johnson III Tests of Achievement (WJ III ACH). Carl's overall reading achievement was commensurate with his overall intellectual functioning as measured by the RIAS and the WASI. Carl demonstrated average letter–word identification skills, average passage comprehension skills, and low average skills on a subtest measuring reading fluency or speed. These scores combined to form a WJ III Broad Reading Composite of 89 (24th percentile), which is in the average to low average range. Carl's decoding skills were assessed through a portion of the WJ III ACH. He was asked to pronounce nonwords to further measure phonic and structural analysis skills in the Word Attack subtest. This subtest assessed Carl's ability to match sound blends to letter combinations. Carl was asked to read such nonwords as *zoop* and *rox*. He earned a standard score of 102 (55th percentile), a score in the average range of functioning. These scores suggest that Carl's overall reading achievement falls within age-appropriate limits.

Carl's basic writing skills, such as spelling, sentence construction, and writing fluency, were also assessed by the WJ III ACH. The Spelling subtest measured Carl's ability to write orally presented words correctly. Carl earned an average to low average standard score of 88. The Writing Fluency subtest measured his skill in formulating and writing short, simple sentences quickly. He earned a standard score of 91, which is in the average range. Carl was also asked to produce writing samples consisting of a sentence describing a given picture or using specific words. On this Writing Samples subtest, Carl earned an 84, in the low average range. He did not appear to be paying attention to the task or directions. When asked to write sentences, he frequently wrote fragments or single words. Overall, Carl demonstrated average to low average writing abilities. His lack of attention to the directions of the task had an adverse impact on his writing scores.

Carl's mathematical skills, such as calculation, applied problems, and math fluency, were likewise assessed with the WJ III ACH. Carl earned a significantly below-average score on the Calculation subtest (72, 3rd percentile); a below-average score on the Math Fluency subtest (77, 6th percentile); and a low-average score on the Applied Problems subtest (84, 15th percentile). When these subtests were examined, it was noticed that Carl failed to give close attention to detail, specifically regarding the addition or subtraction signs. For example, on the Math Fluency portion, which required him to do simple addition and subtraction quickly, Carl added all of the numbers. He was given oral instructions to pay attention to the signs, but Carl did not take notice of the changing signs.

Overall, achievement testing indicates that Carl's academic achievement is in the average to low average range and is consistent with his general cognitive ability. Carl demonstrated age-appropriate reading, writing, and mathematics skills. However, he failed to pay close attention to details and listen attentively to directions. Again, Carl's inattention seems to be having a negative impact on his academic performance.

Behavioral, Social, and Emotional Functioning

In order to better understand Carl's functioning across behavioral, social, and emotional domains, several measures of social and emotional functioning were given. As noted earlier, Mr. and Mrs. Last completed the BASC-PRS, and Mr. Last completed the CPRS-R:L. Also as noted earlier, Carl's teacher, Mrs. Taylor, was interviewed and completed the BASC-TRS to provide information regarding Carl's social, emotional, and behavioral functioning at school. Finally, Carl himself was interviewed and completed two self-report measures—the Revised Children's Manifest Anxiety Scale (RCMAS) and the Children's Depression Inventory (CDI)—to discern his thoughts and feelings regarding numerous issues. The results of these latter two measures suggested that Carl generally perceives himself as a well-adjusted child. He reported that he is happy with himself, his family, and his friends. He further indicated that he enjoys school and likes his teacher. He does not indicate any significant problems with depression or anxiety. However, during the child interview, Carl noted that he is sometimes afraid of nightmares, blood, and skulls.

Mr. and Mrs. Last indicated that Carl demonstrates problems with hyperactivity, attention, perfectionism, and atypicality. Mrs. Taylor, Carl's first-grade teacher, also endorsed items indicative of difficulties with hyperactivity, attention, and atypicality. In the area of hyperactivity, Mr. Last indicated that Carl often talks excessively, is overly active, fidgets with his hands, and has difficulty playing in leisure activities quietly. Furthermore, the Lasts noted that Carl often interrupts others when they are speaking and occasionally blurts out answers to questions before the questions have been completed. Mrs. Taylor rated Carl as being overly active and often tapping his foot or pencil. She further indicated that at times he hurries through assignments, is unable to wait his turn, and acts without thinking. These symptoms of hyperactivity and impulsivity are consistent with information obtained during the parent interview and with observations of Carl during testing.

Carl's parents and teacher all also noted that Carl is displaying atypical behaviors. For example, they indicated that Carl will repeat one activity or thought over and over, and that he stares blankly at times. Furthermore, they noted that Carl often rocks back and forth and waves his fingers repeatedly when he seems excited. During time spent at the clinic, Carl indeed frequently rocked back and forth in his seat during testing. The Lasts also indicated that Carl complains about being unable to block out unwanted thoughts and feelings. For example, Carl often claims that he gets "shivery" feelings that he does not like and that he cannot block out. Moreover, the Lasts described Carl as having an acute sense of hearing and as often hearing sounds that they do not hear. They also described Carl as "particular" and endorsed items suggesting that he displays perfectionistic behaviors. Specifically, Mr. Last noted that everything has to be just right, that he gets upset if someone rearranges his things, and that things must be done the same way every time. This information is consistent with that obtained during the parent interview, when Mr. Last described obsessive–compulsive behaviors. In addition, the Lasts described Carl as repetitively cleaning and lining up his belongings, and they indicated past difficulties with hand washing. During time spent at the clinic, Carl was observed going to the bathroom to wash his hands after playing with bubbles that made his hands "smell like throw-up." Furthermore, Mrs. Taylor indicated that Carl went to the bathroom more frequently than his classmates, approximately six times a day. The teacher also noted that Carl's desk is very organized, but that she did not see this neatness or his trips to the bathroom as interfering with his schoolwork. Similarly, the Lasts noted that Carl's compulsive behaviors are not having a significant impact on his functioning at home. Overall, Carl appears to be experiencing problems with hyperactivity and inattention, and is displaying some atypical behaviors.

Summary

The results of this evaluation reveal that Carl's developed intelligence is in the average to low average range. This suggests that Carl will be able to benefit from instruction, although difficulties with attention, impulsivity, and off-task behaviors are affecting his daily school performance. Carl is demonstrating average perceptual and visual–motor skills commensurate with cognitive functioning. Carl is functioning in the average to significantly below-average range on tests of attention and executive functioning measuring his ability to plan, organize, and regulate his mental activity. Specifically, Carl appears to have difficulty paying attention to speech sounds and using attention to hold and process information. Carl's difficulties with attention and executive functioning are likely to impede his academic progress.

Overall, Carl is achieving academically at a level that is expected for his cognitive abilities. Specifically, his reading, writing, and mathematics achievement skills are in the average to low average range. Consistent with his cognitive profile, his test performance was adversely affected by his difficulties with attention. He often failed to pay close attention to details, such as mathematical signs, and did not attend to the specific directions of the task. In all, Carl is achieving in the average to low average range, which is commensurate with his cognitive abilities. Therefore, Carl does not meet diagnostic criteria for a specific learning disability in any area.

Behaviorally, Carl appears to be experiencing significant problems with inattention, hyperactivity, and impulsivity. Parent and teacher reports indicate that Carl fails to give close attention to details in schoolwork and is easily distracted. Furthermore, they noted that he fails to finish schoolwork and chores, dislikes tasks that require sustained mental effort, and is often forgetful. This pattern of inattention was likewise observed during testing in the clinic.

Mr. and Mrs. Last and Mrs. Taylor also reported that Carl is hyperactive and impulsive. Specifically, he often talks excessively, is overly active, fidgets with his hands, and has difficulty playing in leisure activities quietly. In addition, he often interrupts others when they are speaking and occasionally blurts out answers to questions before the questions have been completed. During his evaluation at the clinic, Carl was overactive, frequently rocking back and forth in his seat, and answered questions impulsively. The Lasts and Mrs. Taylor indicated that Carl's ability to concentrate and attend has improved since he began taking Strattera. However, this pattern of behavior is still consistent with a DSM-IV-TR diagnosis of attention-deficit/hyperactivity disorder, combined type (314.01).

According to the Lasts and Mrs. Taylor, Carl displays a pattern of atypical behaviors. Mr. Last described Carl as often staring blankly and not making sense when he comes out of his stares. The Lasts noted that Carl often complains of unwanted "shivery" feelings and is extremely sensitive to sounds, hearing things that others do not hear. Furthermore, he often does not seem to listen when he is spoken to and has occasional days where he does not act like his usual self. On one occasion, Mr. Last noted that Carl seemed completely sedated and lethargic all day, and at times talked in nonsensical, incomplete thoughts. Moreover, Carl has a history of engaging in obsessive–compulsive, repetitive behaviors. Carl engaged in repetitive hand-washing and lining-up behaviors as a toddler. He currently has occasional days, a couple of times a month, where he engages in repetitive cleaning rituals. Specifically, he must line up his toys and trophies in his room over and over as if they are not exactly right. Carl also engages in repetitive body rocking and often waves his fingers back and forth. Mr. Last indicated that these behaviors are worse when Carl is frustrated or when he is doing undesirable activities. He further indicated that these behaviors could be related to anxiety about school. In addition, Carl uses repetitive speech patterns, such as muttering a specific phrase over and over. Hand washing was noticed during the clinic evaluation, and the Lasts indicated that there are occasions when he feels that he must wash his hands due to smells. These behaviors are indicative of compulsions; however, it is unclear at this time whether Carl feels driven to perform these actions to reduce anxiety or distress. In addition, Carl's parents and teachers do not report that these behaviors significantly interfere in his daily life, and it is unclear at this time whether these behaviors cause Carl marked distress. Furthermore, Carl's compulsions are not time-consuming, lasting less than 1 hour a day.

DSM-IV-TR Diagnosis

314.01 Attention-deficit/hyperactivity disorder, combined type

300.3 Obsessive–compulsive disorder (rule out)

REFERENCES

American Association on Intellectual and Developmental Disabilities. (2009). *Intellectual disability: Definition, classification, and systems of supports* (11th ed.). Washington, DC: Author.

American Educational Research Association (AERA), American Psychological Association (APA), and National Council on Measurement in Education (NCME). (1999). *Standards for educational and psychological testing.* Washington, DC: AERA.

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed., text rev.). Washington, DC: Author.

Angoff, W. H., & Robertson, G. R. (1987). A procedure for standardizing individually administered tests, normed by age or grade level. *Applied Psychological Measurement, 11*, 33–46.

Beaujean, A., McGlaughlin, S. M., & Margulies, A. S. (2009). Factorial validity of the Reynolds Intellectual Assessment Scales for referred students. *Psychology in the Schools, 46*(10), 932–950.

Bigler, E. D., & Clement, P. F. (1997). *Diagnostic clinical neuropsychology* (3rd ed.). Austin: University of Texas Press.

Binet, A., & Simon, T. (1905). New methods for the diagnosis of the intellectual level of subnormals. *L'Année Psychologique, 11*, 191–244.

Carroll, J. B. (1993). *Human cognitive abilities: A survey of factor-analytic studies*. New York: Cambridge University Press.

Cattell, R. B. (1978). Matched determiners vs. factor invariance: A reply to Korth. *Multivariate Behavioral Research, 13*(4), 431–448.

Cronbach, L. J. (1990). *Essentials of psychological testing* (5th ed.). New York: Harper & Row.

Dombrowski, S. C., Watkins, M. W., & Brogan, M. J. (2009). An exploratory investigation of the factor structure of the Reynolds Intellectual Assessment Scales (RIAS). *Journal of Psychoeducational Assessment, 27*(6), 494–507.

Edwards, O. W., & Paulin, R. V. (2007). Referred students' performance on the Reynolds Intellectual Assessment Scales and the Wechsler Intelligence Scale for Children Fourth Edition. *Journal of Psychoeducational Assessment, 25*, 334–340.

Elliot, R. W. (2004). Test review: Reynolds Intellectual Assessment Scales. *Archives of Clinical Neuropsychology, 19*, 325–328.

Goldstein, S., & Reynolds, C. R. (Eds.). (2011). *Handbook of neurodevelopmental and genetic disorders in children* (2nd ed.). New York: Guilford Press.

Gustafsson, J. E. (1999). Measuring and understanding g: Experimental and correlational approaches. In P. L. Ackerman, P. C. Kyllonen, & R. D. Roberts (Eds.), *Learning and individual differences: Process, trait, and content determinants* (pp. 275–291). Washington, DC: American Psychological Association.

Horn, J. L., & Cattell, R. B. (1966). Refinement and test of the theory of fluid and crystallized general intelligences. *Journal of Educational Psychology, 57*(5), 253–270.

Joreskog, K. G., & Sorbom, D. (1987). *LISREL 6.13: User's reference guide*. Chicago: Scientific Software.

Joseph, R. (1996). *Neuropsychiatry, neuropsychology, and clinical neuroscience: Emotion, evolution, cognition, language, memory, brain damage, and abnormal behavior* (2nd ed.). Baltimore: Williams & Wilkins.

Kamphaus, R. W. (2001). *Clinical assessment of child and adolescent intelligence* (2nd ed.). Boston: Allyn & Bacon.

Kamphaus, R. W., & Reynolds, C. R. (2003). *Reynolds Intellectual Screening Test*. Lutz, FL: Psychological Assessment Resources.

Kaufman, A. S. (1994). *Intelligent testing with the WISC-III*. New York: Wiley.

Kaufman, A. S., McLean, J. E., Kaufman-Packer, J., & Reynolds, C. R. (1991). Is the pattern of intellectual growth and decline across the adult lifespan different for men or women? *Journal of Clinical Psychology, 47*(6), 801–812.

Kaufman, A. S., Reynolds, C. R., & McLean, J. E. (1989). Age and WAIS-R intelligence in a national sample of adults in the 20 to 74 year range: A cross-sectional analysis with education level controlled. *Intelligence, 13*(3), 235–253.

Krach, S., Loe, S. A., Jones, W., & Farrally, A. (2009). Convergent validity of the Reynolds Intellectual Assessment Scales (RIAS) using the Woodcock–Johnson Tests of Cognitive Ability, Third Edition (WJ-III) with university students. *Journal of Psychoeducational Assessment, 27*(5), 355–365.

Kyllonen, P. C. (1996). Is working memory capacity Spearman's *g*? In Dennis & P. Tapsfield (Eds.), *Human abilities: Their nature and measurement* (pp. 49–75). Mahwah, NJ: Erlbaum.

New shorter Oxford English dictionary. (1993). Portsmouth, NH: Oxford University Press.

Nelson, J. M., Canivez, G. L., Lindstrom, W., & Hatt, C. V. (2007). Higher-order exploratory factor analysis of the Reynolds Intellectual Assessment Scales with a referred sample. *Journal of School Psychology, 45*, 439–456.

Reynolds, C. R. (1984–1985). Critical measurement issues in learning disabilities. *Journal of Special Education, 18*, 451–476.

Reynolds, C. R. (2000). Methods for detecting and evaluating cultural bias in neuropsychological tests. In E. Fletcher-Janzen, T. Strickland, & C. R. Reynolds (Eds.), *Handbook of cross-cultural neuropsychology* (pp. 249–286). New York: Plenum Press.

Reynolds, C. R. (2003, August). *Twenty years of continuous norming: An author's perspective*. Paper presented at the annual meeting of the American Psychological Association, Toronto.

Reynolds, C. R., & Bigler, E. D. (1994). *Test of Memory and Learning*. Austin, TX: PRO-ED.

Reynolds, C. R., Chastain, R. L., Kaufman, A. S., & McLean, J. E. (1987). Demographic influences on adult intelligence at ages 16 to 74 years. *Journal of School Psychology, 25*(4), 323–342.

Reynolds, C. R., & Fletcher-Janzen, E. (Eds.). (1997). *Handbook of clinical child neuropsychology* (2nd ed.). New York: Plenum Press.

Reynolds, C. R., & French, C. L. (2003). The neuropsychological basis of intelligence. In A. M. Horton & L. C. Hartlage (Eds.), *Handbook of forensic psychology* (pp. 35–92). New York: Springer.

Reynolds, C. R., & Kamphaus, R. W. (2003). *Reynolds Intellectual Assessment Scales*. Lutz, FL: Psychological Assessment Resources.

Roid, G. H. (2003). *Stanford–Binet Intelligence Scales, Fifth Edition*. Itasca, IL: Riverside.

Sattler, J. M. (2001). *Assessment of children: Cognitive applications* (4th ed.). San Diego, CA: Jerome M. Sattler.

Umphress, T., & Taylor, S. (2008). A comparison of low IQ scores from the Reynolds Intellectual Assessment Scales and the Wechsler Adult Intelligence Scale—Third Edition. *Intellectual and Developmental Disabilities, 46*(3), 229–233.

Vernon, P. E. (1950). *The structure of human abilities*. New York: Wiley.

Wechsler, D. (1949). *Wechsler Intelligence Scale for Children*. New York: Psychological Corporation.

Wechsler, D. (1992). *Wechsler Individual Achievement Test*. San Antonio, TX: Psychological Corporation.

Wechsler, D. (1997). *Wechsler Adult Intelligence Scale—Third Edition*. San Antonio, TX: Psychological Corporation.

Wechsler, D. (2003). *Wechsler Intelligence Scale for Children—Fourth Edition*. San Antonio, TX: Psychological Corporation.

Woodcock, R. W., McGrew, K. S., & Mather, N. (2001). *Woodcock–Johnson III*. Itasca, IL: Riverside.

Zachary, R., & Gorsuch, R. (1985). Continuous norming: Implications for the WAIS-R. *Journal of Clinical Psychology, 41*, 86–94.