CHAPTER 5

Development and Application of the Reynolds Intellectual Assessment Scales (RIAS)

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This chapter provides the reader with an extensive introduction to the RIAS (Reynolds & Kamphaus, 2003), a recently published measure of intelligence for children and adults. A brief overview of the tests 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. Clinical applications of the RIAS are discussed, followed by a brief review of the characteristics and use of the Reynolds Intellectual Screening Test (RIST). 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 3–94 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 to 25 minutes. A Composite Memory Index (CMX) is derived from the two supplementary memory subtests, which require approximately 10 to 15 minutes of additional testing time. The Composite Intelligence Index and the Composite Memory Index represent the combination of both verbal and nonverbal subtests. Table 5.1 provides an overview of the indexes and subtests of the RIAS.

For those who consider memory to be an important element in the determination of IQ, the *RIAS Professional Manual* as well as the RIAS scoring and interpretive software includes all necessary psychometric and normative information for creating intelligence indexes that combine

*Portions of this chapter are adapted with permission of PAR, Inc. from Reynolds and Kamphaus (2003). We also wish to disclose that we are the authors of the RIAS.

the VIX, NIX, and CMX subtests into Total Battery Indexes.

THEORY AND STRUCTURE

The RIAS was designed to meld practical and theoretical aspects of the assessment of intelligence. While the models of Cattell and Horn (Horn & Cattell, 1966; Kamphaus, 2001) and Carroll (1993) 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. The latter are closely related to concepts of *fluid* and *crystallized intelligence* (aka the Cattell-Horn-Carroll or CHC approach) but are clearly not entirely cognate concepts. Memory was included as a 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 (e. g., see Bigler & Clement, 1997; Goldstein & Reynolds, 1999; Reynolds & Bigler, 1994; Reynolds & Fletcher-Janzen, 1997). To understand 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

Reynolds and Kamphaus (2003) describe a set of eight primary goals for development of the RIAS, derived based on their experiences over the years in teaching, administering and interpreting, and researching intelligence tests (for more extensive review and discussion, see Reynolds & Kamphaus, 2003, especially Chapters 1 and 6).

Goal 1: Provide reliable and valid measurement of g and its two primary components, verbal and nonverbal intelligence, with close correspondence to crystallized and fluid intelligence. The general intelligence factor, g, is the most reliable component present in any multifactorial view of intelligence (Jensen, 1998). In the Cattell-Horn model (Horn & Cattell, 1966; Kamphaus, 2001) of intelligence, g is the dominant factor in the hierarchy of multiple abilities, with the next two dominant facets being crystallized and fluid intelligence. The RIAS includes subtests that match both approaches closely in order to share in the theoretical support of the Cattell-Horn model of crystallized and fluid intelligence, while taking advantage of the very practical division of intelligence into verbal and nonverbal components. Verbal and nonverbal components of intelligence also have strong support from factor-analytic work (e.g., Kaufman, 1994) and the brain sciences (e.g., Reynolds, Castillo, & Horton, 2008; Riccio & Hynd, 2000).

Goal 2: Provide a practical measurement device in terms of efficacies of time, direct costs, and information needed from a measure of intelligence. Time, cost, and efficiency have always been necessary considerations in the delivery of effective psychological and psychoeducational services, but the advent of managed care in the 1990s (for private practice and clinical settings) and the explosion of services for children with disabilities in schools has made time a crucial consideration for practitioners. A useful intelligence test needs to provide an objective, reliable, and valid assessment of the major constructs that underlie psychometric intelligence. Intellectual assessment can be done efficiently and at a significantly lower cost than is often the case with other tests. One goal for the RIAS was for it to provide an efficient measure of intelligence that, at the same time, meets regulatory guidelines for the Individuals with Disabilities Educational Improvement Act and other rules.

Goal 3: Allow continuity of measurement across all developmental levels from ages 3 through

94 years for both clinical and research purposes. Individuals frequently require reevaluation of intellectual function over a period of years. As they age, different versions of intelligence tests may be required, and these various tests have different subtests, measure different aspects of intelligence, were normed in different years, and may have sample stratifications that do not match. Thus, scores obtained over time may not be comparable due to measurement artifact and not to any real changes in the individual's cognitive level or structure (Sattler, 2001). There is clinical utility in having a common set of subtests and a common reference group for such comparisons.

Goal 4: *Substantially reduce or eliminate dependence on motor coordination and visual-motor speed in the measurement of intelligence*. The majority of current individually administered intelligence tests rely heavily on visual-motor coordination and motor speed for accurate assessment of intelligence. However, many children referred to special education services have visual-motor difficulties or frank motor impairment or they may have other neurodevelopmental disorders that produce motor-related problems (Goldstein & Reynolds, 1999). Individuals with traumatic brain injury or central nervous system disease commonly have motor problems of various forms, including fine motor, gross motor, and strength problems (Reynolds & Fletcher-Janzen, 1997). In older populations, the incidence of tremor and related motor problems is quite high. To attempt to measure the intelligence of such individuals (who form a significant portion of referrals involving intellectual assessments) with tasks that require rapid manipulation of blocks, small cardboard pieces, or even pencil markings where speed and accuracy of performance are substantial contributors to the resulting IQ or cognitive index seems inappropriate. It is our view that intelligence tests should emphasize thinking, reasoning, and problem solving.

Goal 5: *Eliminate dependence on reading in the measurement of intelligence*. Tasks where the ability to read the English language facilitates individual item performance confound the measurement of intelligence with school instruction. Certainly intelligence cannot be assessed completely independent of prior knowledge despite many failed attempts to do so (e.g., culture-free tests; see Anastasi & Urbina, 1997; Kamphaus, 2001; Reynolds, Lowe, & Saenz, 1999). However, to confound intellectual assessment with clues obtained from the ability to read a vocabulary card or to fill in blanks within printed words (which also adds a confound with the ability to spell) makes such tests inappropriate for nonreaders or those with limited English-reading skills. Reading tasks also penalize individuals with visual impairments whose intellectual functioning is assessed traditionally via verbal tasks.

Goal 6: Provide for accurate prediction of basic academic achievement at levels that are at least comparable to that of intelligence tests twice its length. Prediction of academic achievement and acquired knowledge in such areas as reading, language, and math is an important function for intelligence tests. Prediction of achievement should remain a function of any new intelligence test.

Goal 7: Apply familiar, common concepts that are clear and easy to interpret, coupled with simple administration and scoring. Formal intelligence testing via Binet-type tasks is more than a century old. During this time, innumerable tasks have been devised to measure intelligence and related abilities. Many of these tasks are quite good at the measurement of intellectual function and possess long histories in psychology and education. The use of familiar, well-researched tasks has many advantages over the use of novel, less-well-established tasks. Many of these tasks are simple and easy to administer despite the complex mental functions required for deriving a correct solution. Objective scoring can be facilitated by avoiding tasks that require lengthy verbal responses or split-second timing for awarding bonus points. Tasks that are simple to administer and objective to score nearly eliminate administration and scoring errors.

Goal 8: *Eliminate items that show differential item functioning (DIF), associated with gender or ethnicity*. The problem of cultural bias has long produced debate in psychology, in education, and in the lay press (e.g., Brown, Reynolds, & Whitaker, 1999; Reynolds, Lowe, & Saenz, 1999). Following years of debate, a host of methods for detecting test items that function differentially across nominally defined groups have been devised (Reynolds, 2000). Despite the importance of this issue, it is seldom discussed in significant detail in test manuals. However, in view of the availability of sound statistical approaches for identifying such test items, all intelligence test items should be scrutinized during development and standardization to determine whether any are in fact biased.

The RIAS provides a more reliable assessment of memory, both verbal and nonverbal, than other intelligence tests, and also treats memory function as 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, 1999; Reynolds & Fletcher-Janzen, 1997) and adulthood (Goldstein & Reynolds, 2005), particularly in later adulthood (Bigler & Clement, 1997). In fact, assessment of memory function provides a better window into the integrity of brain function than does the assessment of intelligence (e.g., see Adams & Reynolds, 2009). Memory functions are more easily disrupted than general intellectual skill in the face of central nervous system (CNS) compromise due to trauma or disease. Although intelligence will often suffer under such conditions (Joseph, 1996), memory will suffer sooner and is typically more affected. The RIAS CMX does not provide a comprehensive memory assessment, but it does cover the two areas of memory historically assessed by intelligence tests, which 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.

There is also utility in having memory tests co-normed with a measure of intelligence on a fully overlapping sample. This co-norming presents the best possible scenario for contrasting test scores (Reynolds, 1984–1985), allowing the clinician directly to compare the examinee's IQ with these key memory functions.

Theory

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*, which is 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 comprising this ability have been labeled variously as *working memory*, *short-term memory*, or *learning*). These four constructs are measured by combinations of the six RIAS subtests (see Table 5.1).

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.

Table 5.1 Structure and Components of the RIAS

Composite Intelligence Index (CIX)

Subtests of the Verbal Intelligence Index (VIX)

Guess What. Examinees are given a set of 2 or 3 clues and 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 asked to designate which one does not belong or go with the others. This subtest measures nonverbal reasoning skills but will also require 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 wherein the examinee must conceptualize the picture, analyze its Gestalt, and deduce what essential element is missing.

Composite Memory Index (CMX)

Verbal Memory Index (VMX). This scale consists of a single verbal memory subtest. Depending on 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 Index (NMX). This scale consists of a single visual memory subtest. It contains a series of items in which a stimulus picture is presented for five 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.

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-three and stratum-two abilities from Carroll's (1993) three-stratum theory. Stratum three 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. Although the nature of *g* is yet to be fully understood, the scores from *g*-saturated tests have known utility, especially in terms of prediction.

The second stratum in Carroll's (1993) hierarchy consists of traits that are assessed by combinations of subtests, or stratum-one measures. A stratum-one measure is typically a single subtest that measures the trait of interest. Combinations of stratum-one subtests, such as those used to form VIX and NIX, are considered stratum-two measures and should result in enhanced measurement of complex traits such as verbal and nonverbal intelligence. Combining stratum-two index measures into an overarching composite measure, such as CIX, allows for the measurement of a complex stratum-three trait, such as general intelligence.

There are, however, several stratum-two 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 finding, from hundreds of investigations, suggesting that these abilities are ordered by their assessment of *g* (Kamphaus, 2001). Specifically, subtests that tap reasoning abilities are excellent measures of *g*, making the first few stratum-two factors the best for inclusion in an intelligence test like the RIAS, especially one that seeks to be a time-efficient test.

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) 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." (Oxford Press, 1999). 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 Chapter 6).

Kamphaus (2001) has suggested that the term *crystallized* for this second-order factor does not fully capture the centrality of language processes involved in successful performance on subtests typically associated with this ability. He proposed the term *verbal* to describe the latent construct tapped by subtests like those selected for the RIAS.

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 examinees, including those with brain injuries. In the 1963 landmark *ETS 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" (as 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 visuospatial abilities.

Digit recall, sentence recall, geometric design recall, bead recall, and similar measures loaded consistently on a "general memory and learning" stratum-two factor identified by Carroll (1993) in his numerous analyses. The RIAS Verbal Memory and Nonverbal Memory subtests are of this same variety, although 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. Carroll described memory span as "attention to a temporally ordered stimulus, registration of the stimulus in immediate memory, and output of its repetition" (p. 259). This operational definition is an accurate description of the RIAS memory subtests and composite. Memory is typically considered a complex trait with many permutations, including visual, verbal, long term, and short term. Carroll's analysis of hundreds of data sets supports the organization of the RIAS, in that he found ample evidence of a general memory trait that may be further subdivided 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 chosen also due to their complex nature—each assesses many intellectual functions and requires their integration for successful performance (also see Reynolds & Kamphaus, 2003, Chapter 6, under the heading of "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 is asked to listen to a question that contains clues presented orally by the examiner and then to give a verbal response (typically one or two words) that is consistent with the clues.

Verbal Reasoning

The second verbal subtest, Verbal Reasoning, measures analytical reasoning abilities. More difficult items of necessity 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 in the form of a reverse analogy. 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.

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 and asked to examine the picture and then 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 location of the missing component correctly.

Verbal Memory

This subtest measures the ability to encode, briefly store, and recall verbal material in a meaningful context. Young children (ages 3–4) are asked to listen to sentences of progressively greater length as each is read aloud by the examiner and then asked to repeat each sentence back to the examiner, word for word, immediately after it is read aloud. Older children and adults are asked to listen to two stories read aloud by the examiner and then to repeat each story back to the examiner, word for word, 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 five seconds and then 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, at the upper levels, primarily abstract, and at the lower age levels, common objects. The use of naming and related language strategies, however, is not helpful due to the design of the distractors. For example, one early item presents as a target stimulus a picture of a cat. On the recall page, six cats are presented, each different (save one) in some characteristic from the target stimulus.

TABLE 5.2 RIAS Subtest Composition of IQ and Index Scores

	Indexes			
	Mean = 100		SD = 15	
Subtests Mean = 50 SD = 10	***VIX***	***NIX***	***CIX***	***CMX***
GWH	%		%	
VRZ	✓	%		
OIO		%	%	
WHM		%	%	
VRM				%
NVM				%

NOTE: VRZ = Verbal Reasoning; GWH = Guess What; OIO = Odd Item Out; WHM = What's Missing; VRM = Verbal Memory; NVM = Nonverbal Memory; VIX = Verbal Composite Index; NIX = Nonverbal Composite Index; CIX = RIAS Composite Index; CMX = Composite Memory Index.

Scales and Structure

The six RIAS subtests are divided into four composite indexes as depicted in Tables 5.1 and 5.2: the Verbal Intelligence Index (VIX), the Nonverbal Intelligence Index (NIX), the Composite Intelligence Index (CIX, composed of the VIX + NIX), and the Composite memory Index (CMX). Interpretations of these indexes are discussed in a later section.

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 required 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 the intelligence and the memory subtests) averages 30 to 35 minutes once the examiner has practiced giving the RIAS and has become fluent in its administration. 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. A detailed description of the methods used for setting these administration parameters is given in Chapter 2 of Reynolds and Kamphaus (2003). Also, to facilitate ease of administration and to make it more efficient, the RIAS record form contains all of the instructions and examiner guides necessary to administer the test.

Experienced examiners as well as graduate students have consistently reported that the RIAS is surprisingly easy to administer and score.

SCORING AND INTERPRETIVE SOFTWARE

There are two separately available computerized scoring and interpretive programs related to the RIAS. One is the RIAS-IR (Reynolds & Kamphaus, 2007a), a scoring and interpretive program devoted just to the RIAS (and the RIAST), and the RIAS/WRAT-4-DIR (Reynolds & Kamphaus, 2007b), which analyzes discrepancies between the RIAS and the WRAT4 scores of examinees based on a linking sample between the two measures.

The RIAS-IR (Scoring and Interpretive Report)

The unlimited-use RIAS-IR is designed to assist clinicians with scoring, profiling, and interpreting the performance of individuals (ages 3–94) on the RIAS and the Reynolds Intellectual Screening Test (RIST; only the RIAS features are discussed here). After manual entry of an examinee's raw scores into the software, the RIAS-IR can generate up to three Score Reports, two Feedback Reports (for parents/guardians of minors, teachers, or adult examinees after a discussion of the test results), and two Interpretive Reports. Program functionality includes report editing. Report options for the RIAS and the RIST include:

RIAS Score Report

After input of all four subtest scores, the RIAS Score Report includes the examinee's demographic information, the RIAS Score Summary Table, the RIAS Profile, brief interpretive text, and an Extended Score Summary Table.

RIAS Total Battery Score Report

After input of all six subtest scores, the RIAS Total Battery Score Report includes the examinee's demographic information, the RIAS Total Battery Score Summary Table, a Total Battery Profile, and brief interpretive text.

Feedback Reports

RIAS Feedback Report

After input of all four subtest scores, the RIAS Feedback Report provides easy-to-understand information about the examinee's performance on the RIAS written in lay terms for parents/guardians, teachers, or an adult examinee.

RIAS Total Battery Feedback Report

After input of all six subtest scores, the RIAS Total Battery Feedback Report provides easy-to-understand information about the examinee's performance on the RIAS Total Battery written in lay terms for parents/guardians, teachers, or an adult examinee.

Interpretive Reports

RIAS Interpretive Report

After input of either four or all six subtest scores, the RIAS Interpretive Report includes the examinee's demographic information, the RIAS Score Summary Table, the RIAS Profile, an Extended Score Summary Table, and extensive interpretive text with intervention and additional testing recommendations. This report also provides clinicians with the option to include the Total Battery scores (i.e., Total Test Battery, Total Verbal Battery, Total Nonverbal Battery).

The RIAS-IR provides clinicians with greater flexibility to obtain the report they desire by enabling the selection of specific report components for inclusion and by providing built-in report-editing features that also allow clinicians to cut-and-drop features into their own word processing programs. It also provides flexibility within the Interpretive Reports to generate setting-specific feedback and recommendations (i.e., school, employment, long-term care [assisted living, nursing home]) in addition to the software's default general feedback and recommendations.

Aptitude–Achievement Discrepancy Software: RIAS/WRAT4-DIR

The RIAS/WRAT4-DIR addresses the evaluation of discrepancies between intelligence test performance and achievement test performance by providing and evaluating discrepancies between scores on the Reynolds Intellectual Assessment Scales (RIAS)/Reynolds Intellectual Screening Test (RIST) and on the Wide Range Achievement Test 4 (WRAT4). By comparing general ability levels as assessed by the RIAS to achievement levels as obtained by the WRAT4, the RIAS/WRAT4-DIR provides the information necessary for assisting in the determination of special education eligibility and the presence of specific learning disabilities in individuals in cases where discrepancy analyses are useful or necessary. Although evaluation of such discrepancies is now optional in school settings, many other settings continue to adhere to a requirement of aptitude–achievement discrepancies for learning disability determination.

Two types of scoring methodologies are used to derive the discrepancy scores and to evaluate the statistical significance of the score and its prevalence within the population. The simple difference method examines the difference between an obtained RIAS score and an obtained WRAT4 score. The predicted-achievement method uses the individual's obtained RIAS score to predict his or her performance on the WRAT4. It then examines the difference between the predicted WRAT4 score and the individual's obtained WRAT4 score. Using these methods, three types of discrepancy reports that contain a total of 40 discrepancy scores are generated by the software:

1. *RIST/WRAT4 Discrepancy Interpretive Report*: provides discrepancy scores and analysis between the RIST index score and each WRAT4 subtest/composite score (i.e., Word Reading, Sentence Comprehension, Spelling, Math Computation, Reading Composite)
2. *RIAS/WRAT4 Discrepancy Interpretive Report*: provides discrepancy scores and analysis between each RIAS Index score (i.e., VIX, NIX, CIX, CMX) and each WRAT4 subtest/composite score
3. *RIAS/WRAT4 Total Battery Discrepancy Interpretive Report*: provides discrepancy scores and analysis between the RIAS Total Battery Index scores (i.e., TTB, TVB, TNB) and each WRAT4 subtest/composite score

The *RIAS/WRAT4-DIR Professional Manual Supplement* provides normative data about the separate linking sample developed specifically for derivation of this interpretive program. It consisted of 410 participants ages 5–24 and was matched to U.S. Bureau of the Census population data for gender, ethnicity, and educational attainment. The Professional Manual Supplement also provides overviews of the RIAS and the WRAT4, including original standardization information, descriptions of the two different scoring methods, and suggestions for the interpretation of the discrepancy scores. It is unlimited-use software that generates discrepancy scores and interpretive reports based on a clinician's entry of an individual's raw scores and provides an efficient file-handling system that enables the user to create examinee files where all protocols and report files for each examinee are managed.

PSYCHOMETRIC PROPERTIES

The psychometric characteristics of any measurement device and its scores are certainly crucial in determining its utility. In this section, a review of the standardization procedures and the scaling of the RIAS is presented, followed by a summary of the reliability of the scores derived from the instrument and evidence related to the validity of score interpretations. Due to the length restrictions in a single book chapter, a discussion of the developmental process of the test simply cannot be provided. However, the RIAS underwent years of development, including tryout and review of the items on multiple occasions by school, clinical, and other psychologists, including neuropsychologists. 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, as well, to ascertain the cultural saliency of the items and any potential problems of ambiguity or offensiveness in various settings. The developmental process speaks directly to the psychometric characteristics of the tests and is described in far more detail in Reynolds and Kamphaus (2003) and 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 1999 and 2002. United States Bureau of the Census projected characteristics of the U.S. population, initially to the year 2000 and then updated through 2001, were used to select a population proportionate sample. Age, gender, ethnicity, educational level (parent educational level was used for ages 3–16 and the participants' educational level was used at all other ages), and region of residence were used as stratification variables. To facilitate some of the analyses of cultural bias in the item pool, minorities were oversampled in some cells, particularly at the early ages. The resulting norms for the RIAS 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 any regard (see Reynolds & Kamphaus, 2003, especially Tables 4.2–4.5).

Norm Derivation and Scaling

Starting Points and Basal/Ceiling Rules

During standardization, starting points and basal/ceiling rules were set to ensure that participants received the maximum number of items they would be expected to receive on the final version. Once the final RIAS items were determined (after standardization), they were reordered by ascending item difficulty index. An iterative process of item selection and various basal and ceiling rules was then applied to locate the points that captured the performance of most (over 90% across all ages) of the examinees had they been administered all items on the test. The reliability of scores obtained under the basal and ceiling rules that best fit these criteria were then examined to be certain accuracy of score estimation was not adversely impacted across examinees by applying a particular set of rules. Finally (after scaling was completed using the chosen rules), the scores of all examinees were compared under the application of the chosen basal/ceiling rules and under the condition of taking all items as a final check to ascertain the impact on the scores of individual examinees. It was rare under the final rules for any examinee's subtest scaled score to be affected by more than one point and most were in fact unaffected. Once the basal and ceiling rules were established, the raw score distributions were determined and the various scaled scores derived.

Scaling Methods

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 (Zachary & Gorsuch, 1985). 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.

T-scores were chosen for the RIAS subtests over the more traditional mean = 10 scaled scores popularized by Wechsler (e.g., Wechsler, 1949) due to the higher reliability coefficients obtained for the RIAS subtest scores and expanded item pools. 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, Appendix B) provides several other common types of scores for the RIAS indexes, including percentiles, T-scores, z-scores, normal curve equivalents (NCEs), and stanines, along with a detailed explanation of each score type.

Score Reliability

Since the RIAS is a power test, the internal consistency reliability of the items on the RIAS subtests was investigated using Cronbach's coefficient alpha. Alpha reliability coefficients for the RIAS subtest scores (Cronbach, 1951) and the Nunnally reliability estimates (see Nunnally, 1978, p. 249, formula 7-15) for the index scores are presented in Reynolds and Kamphaus (2003) 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 in Chapter 5 of Reynolds and Kamphaus (2003), 100% of the alpha coefficients for the RIAS subtest scores reach .84, or higher, for every age group. 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 recommended levels. As shown in Table 5.2 of Reynolds and Kamphaus (2003, p. 78), 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. Thus, one can have strong confidence in the relative reliability and accuracy of both subtest and index scores derived from standardized administration 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. It is thus instructive to view the various reliability estimates for the RIAS (or any test) for smaller, meaningful subgroups of a population (Reynolds, 2003). When calculated separately for male and female examinees, the reliability coefficients are high and relatively uniform (see Table 5.3 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.

TABLE 5.3 Uncorrected (and Corrected) Pearson Correlations between Reynolds Intellectual Assessment Scales (RIAS) Indexes and WJ-III Scores for a Referral Sample

RIAS Index	WISC-III VIQ	WISC-III PIQ	WISC-III FSIQ	WAIS-III VIQ	WAIS-III PIQ	WAIS-III FSIQ
VIX	.86	.44	.78	.71	.61	.70
NIX	.60	.33	.60	.67	.71	.71
CIX	.81	.42	.76	.74	.70	.75
CMX	.67	.40	.66	.76	.76	.79

Reliability estimates were also calculated separately for whites and African Americans. These values are reported in Chapter 5 of the RIAS Manual. Although the reliability estimates across ethnic groups display more variability than across gender, the values are consistently high except for several instances. Of the 320 values calculated, only five drop below .80 (i.e., range from .66 to .79). When the values are tested for the presence of statistically significant differences (again using the Feldt technique, see Reynolds, 2003) and the Bonferroni correction is applied (as recommended in the APA task force on statistical significance testing official report; Wilkinson & Task Force on Statistical Inference, 1999), no significant differences are found. Thus, the RIAS shows uniformly high internal consistency reliability estimates across age (3–94) and across gender and across ethnicity.

Test score stability (sometimes referred to as *error due to time sampling*) refers to the extent to which an individual's test performance is constant over time and is usually estimated by the test–retest method. The stability of RIAS scores over time was investigated using the test–retest method with 86 individuals ages 3–82. The intervals between the two test administrations ranged from 9 to 39 days, with a median test–retest interval of 21 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. Both the uncorrected coefficients and the corrected, or disattenuated, coefficients are reported (the corrected coefficients being corrected for the alpha for each subtest). 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 two 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. The test–retest stability coefficients for scores on the RIAS subtests and indexes are quite strong and provide evidence of more than sufficient short-term temporal stability of the scores to allow examiners to be confident in the obtained results.

Validity of RIAS Test Scores as Measures of intelligence

According to the *Standards*, *validity*, in this context, refers to "the degree to which evidence and theory *support the interpretations of test scores* entailed by proposed users of tests" (emphasis added, p. 9). Reynolds (1998) defined *validity* similarly, arguing that validity refers to the appropriateness and accuracy of the interpretation of performance on a test, with such performance usually expressed as a test score. Validation of the meaning of test scores is also a process, one that involves an ongoing, dynamic effort to accumulate evidence for a sound scientific basis for proposed test score interpretations (AERA, APA, & NCME, 1999; Reynolds, 1998). Validity as such will always be a relative concept because the validity of an interpretation will vary according to the purpose for which test scores are being used, the types of individuals or populations being examined, and the specific interpretations being made.

The *Standards* (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. What follows is a summary 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

The *Standards* states that "test content refers to the themes, wording, and format of the items, tasks, or questions . . . as well as guidelines . . . for administration and scoring" (p. 11). In discussing the types of evidence that may be appropriate in this context, the Standards concludes that evidence related to test content may be logical or empirical, and that expert judgments of the relationship between the test and the intended constructs to be assessed are appropriate.

Subtests with familiar formats were chosen for the various intelligence and memory subtests of the RIAS. Although the individual items of the RIAS are unique, each of the formats for the four intelligence and two memory tasks has a long history in the field of psychological assessment. Tasks similar in format and cognitive processing requirements to What's Missing and Verbal Reasoning, for example, can be traced to the early efforts of Alfred Binet at the turn of the twentieth century (Binet & Simon, 1905) and also to Yerkes (1917) and his team of psychologists, who built aptitude measures for the U.S. military early in the last century. Verbal analogies such as those represented on Verbal Reasoning are present on many tests of verbal ability, including early and modern versions of the SAT and GRE examinations, the Miller Analogies Test (Miller, 1926), as well as many individually administered intelligence tests (e.g., McCarthy, 1972). Item formats corresponding to those of Guess What and Odd Item Out appear shortly after these early types and are common formats on various tests of general information and matrix reasoning. Validity evidence for these item formats as measures of intellectual skill is voluminous and reviewed in a variety of sources, the most readily accessible being Eliot and Smith (1983), Kamphaus (2001), Kaufman (1990, 1994), and Sattler (2001).

Likewise, the two memory tasks chosen for inclusion in the RIAS have long, rich histories in the field of psychological testing, dating back to the 1920s and 1930s (e.g., Kamphaus, 2001; Reynolds & Bigler, 1994). Over many decades, similar tasks have been included on a variety of tests designed to measure memory function (see Benton, 1974; Reynolds & Bigler, 1994; Wechsler, 1997b).

Additionally, during the first item tryout, a panel of psychologists representing a variety of ethnic, cultural, and linguistic groups, 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. Items questioned or faulted by this panel were eliminated from the RIAS item pool or were revised. 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 by this group were either eliminated outright or modified.

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. 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 option of responding by pointing or with a one- or two-word verbal indication of the correct answer. As with any nonverbal task, some examinees might 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—rather than by left—hemisphere impairment (e.g., Joseph, 1996; Reynolds, Castillo, & Horton, 2008), a finding that supports the lack of verbal domination in strategies for solving such problems. When examiners suspect that verbal strategies are being applied, they should question the examinee regarding his or her strategies after all the subtests have been administered in order to gain relevant information for the interpretation of the examinee's test performance.

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, it is not the dominant skill involved. The RIAS memory tasks are very straightforward, with response processes that coincide with their content domain—verbal in verbal memory and nonverbal in nonverbal memory. 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

Analyses of the internal structure of a test provide information about the interrelationships of the items or subtests of a larger test and can reveal how this structure might conform to the hypothesized construct(s) being assessed (AERA, APA, & NCME, 1999). Such an examination of evidence requires both empirical and logical analyses. Here, evidence from studies of internal consistency and studies of the factor structure are reviewed in the context of proposed interpretations of RIAS scores.

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, and the evidence for coherence is certainly strong for each of the subtests as well as the composite scores. Factor analysis is another method of examining the internal structure of a scale that lends itself to assessing the validity of recommended score interpretations.

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 purposes of factor analyses of the RIAS subtest's intercorrelations, the sample was divided into five age groups (rather than one-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 3–5; childhood, ages 6–11; adolescence, ages 12–18; adulthood, ages 19–54; and senior adulthood, ages 55–94.

When the two-factor and three-factor solutions were subsequently obtained, the two-factor varimax solution made the most psychological and psychometric sense both for 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 in Reynolds and Kamphaus, 2003 for the four-subtest and six-subtest analyses. 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 is, however, indisputable and 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 this manual, we continue to believe that the separation of the Verbal Memory and Nonverbal Memory subtests into a separate memory index (i.e., CMX) is more than justified. 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 forward 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 whites and African Americans, according to recommendations and procedures outlined in detail by Reynolds (2000). Tables 6.3 through 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 (s), 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, a series of confirmatory factor analyses were conducted to examine the fit of our choice of exploratory analyses to a more purely mathematical model. 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: Model 1, The RIAS is a measure of general intellectual abilities; Model 2, The RIAS is a measure of verbal and nonverbal abilities; and Model 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-fit statistics were then compared using the LISREL-VI program (Joreskog & Sorbom, 1987) 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 = 8.17–20.57 and RMSEA ranging from .10 to .14 depending on the age range studied) than when six subtests were included. Although these models suggest, 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., 3–54 years) and .04 for ages 55 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, and in fact Model 3 with six subtests included (χ^2 = 14.14–37.48 and RMSEA ranging from .01 to .09) did not fit nearly as well as Model 2.

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.

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. A variety of external variables were chosen for investigation with the RIAS, including developmental variables (e.g., 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 with 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 3–18, for the entire sample and for a variety of ethnic groups and by gender. The correlations for all groups are uniformly large, typically exceeding .80 and demonstrating that raw scores on the RIAS increase with age and in a relatively constant manner across subtests. When the values for each subtest are compared across nominal groupings (gender and ethnicity), there are very small differences observed, none being statistically significant or clinically meaningful, indicating common developmental patterns across all groups to the extent correlational data can reveal such trends. Second, to examine the issue in more detail, lifespan developmental curves were generated for each subtest from ages 3 through 94. 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

Measures of intelligence generally should correlate well with one another if they are measuring *g* and related constructs. Thus, to understand a new measure and its appropriate interpretations, it is instructive to assess the relationship of the new measure to other measures of intelligence. For children (ages 6–16), the best known and most widely researched scale over the years and one that has maintained a reasonably consistent structure is the Wechsler Intelligence Scale for

Children, in its third edition (WISC-III; Wechsler, 1991) when the RIAS was published, and now in its fourth.

WISC-IV Edwards (2006) reported on correlations between the RIAS and the WISC-IV factor indexes for two referral samples. In the first group of 83 children ages 7–9, the correlations reported were: RIAS VIX-WISC-IV VCI r = .83, NIX-PRI r = .42, CIX-WMI r = .58, CIX-PSI r = .36, and CIX-FSIQ r = .75. In a sample of 121 children and adolescents ages 6–16, Edwards reported the same set of correlations as: RIAS VIX-WISC-IV VCI r = .83, NIX-PRI r = .54, CIX-WMI r = .62, CIX-PSI r = .45, and CIX-FSIQ r= .79.

In another study, Edwards and Paulin (2007) reported on another referral sample, of 26 boys and 24 girls ranging in age from 6–12 years, administered both the RIAS and the WISC-IV. In this study, some additional correlations were reported and the correlations were generally larger as well. Edwards and Paulin reported correlations between related constructs of: RIAS VIX-WISC-IV VCI r = .90, NIX-PRI r = .72, and CIX-FSIQ r = .90. They also reported a correlation between the RIAS CIX and the WISC-IV GAI of .90. The RIAS composite scores are thus seen to be very highly correlated with the cognate composite scores on the WISC-III and WISC-IV, except for the PRI, which on the Wechsler Scales is confounded by motor and speed of performance—factors eliminated as confounds on the RIAS and factors less confounding in the assessment of adults.

WISC-III Table 5.4 summarizes RIAS correlations with the WISC-III and WAIS-III. The RIAS indexes all correlate highly with the WISC-III Full Scale IQ (FSIQ), with correlations ranging from a low of .60 (NIX to FSIQ) to a high of .78 (VIX to FSIQ). The relatively lower correlations between the RIAS NIX and the WISC-III IQs are most likely attributable to the increased emphasis on motor and language skills on the WISC-III Performance IQ (PIQ) relative to that in the RIAS. The WISC-III PIQ subtests also rely on sequencing (e.g., Picture Arrangement and Coding), whereas the RIAS has no subtest in which sequencing is crucial to the task. Speed of performance and motor skills are also less important on the RIAS, taking away confounds in the measurement of nonverbal intelligence present on the Wechsler Scales at the child level. For adults, these are far less salient issues. With this one exception, the pattern of correlations is much as was predicted, namely, the highest correlations were between those aspects of the tests most closely associated with *g* (from their respective factor analyses).

WAIS-III A group of 31 adults were administered the RIAS and the Wechsler Adult Intelligence Scale—Third Edition (WAIS-III; Wechsler, 1997a) in a counterbalanced design. All but two of the correlations exceed .70; the VIX-PIQ correlation was the lowest at .61. All of the RIAS indexes correlate at or above .70 with the WAIS-III FSIQ (see Table 5.3).

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 (see Kamphaus, 2001, and Sattler, 2001, for summaries). 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 the data presented in Reynolds and Kamphaus (2003). Although all of the RIAS indexes correlate well with all of the WIAT composite scores, the highest correlations are consistently between the VIX and CIX and the WIAT composites. These correlations are

TABLE 5.4 Correlations between RIAS Indexes and WISC-III and WAIS-III IQs

	RIAS Index		
WJ-III Score	**VIX**	**NIX**	**CIX**
Reading Composite	.88 (.85)	.74 (.75)	.88 (.86)
Basic Reading Composite	.79 (.74)	.59 (.60)	.76 (.73)
Comprehension	.88 (.86)	.74 (.75)	.87 (.85)
Low Identification	.85 (.81)	.62 (.64)	.81 (.78)
Reading Fluency	.37 (.33)	.06 (.06)	.26 (.24)
Passage Comprehension	.85 (.81)	.71 (.72)	.85 (.82)
Math Composite	.80 (.75)	.70 (.71)	.82 (.79)
Calculation Composite	.72 (.67)	.57 (.58)	.72 (.68)
Math Reasoning	.86 (.83)	.85 (.86)	.90 (.88)
Calculation	.76 (.72)	.63 (.64)	.76 (.72)
Math Fluency	.68 (.63)	.55 (.56)	.66 (.63)
Applied Problems	.79 (.75)	.76 (.77)	.84 (.81)
Written Language Composite	.56 (.51)	.33 (.34)	.54 (.50)
Written Expression Composite	.58 (.53)	.55 (.57)	.64 (.60)
Writing Fluency	.50 (.45)	.34 (.35)	.49 (.45)
RIAS Mean	94	99	96
RIAS *SD*	17	14	16

NOTE: *N* varies by subtests. Not all were administered to all children. Total $N = 121$, but most correlations in this table are based on *N*s from 50 to 81. Corrections are for the population estimated of the *SD*s of the scores.
SOURCE: Data courtesy of Charles Szasz of West Virginia.

predominantly in the .60s and .70s, indicating that the RIAS has strong predictive value for educational achievement as measured by the WIAT.

Reynolds and Kamphaus (2007b) report on a correlational study between the RIAS and the WRAT4, based on a sample of 410 nonreferred individuals ranging in age from 5 to 24 years. The majority of the 16 correlations reported were in the .50s and .60s, with the VIX correlating highest overall with the WRAT4 achievement variables of Sentence Comprehension, Word Reading, and the Reading Composite. Correlations with the Math Computation scores were mostly in the .40s. The RIAS CMX correlated in the .40s and .50s with all of the WRAT4 variables. When the RIAS Total Battery scores are used, the correlations increase, some reaching into the .70s. In another study, Reynolds and Kamphaus (2007c), including over 2,000 children and adults, reported the RIAS to correlate in the .40s and .50s with a simple measure of rapid word calling.

Beaujean et al. (2006) reported the RIAS to be a significant predictor of SAT scores as well. Correlations of .58 were determined in a very-high-achieving sample (mean SAT > 1.5 *SD*s above the population mean) between the CIX and the SAT using two methods of centering SAT scores as described therein.

In an unpublished study conducted for a school district, Szasz (2006, personal communication) reported correlations between the RIAS and the Woodcock-Johnson-III for a sample of 121 students referred for potential special education placement. Table 5.4 provides the correlation table from this study. In general, the correlations for the RIAS and the WJ-III scores trend higher than with other achievement tests, some reaching into the high .80s. Indeed, most of the correlations with reading achievement, especially complex reading tasks such as comprehension, are quite high. These correlations indicate the RIAS has strong predictive value for educational achievement as measured by the WJ-III as well as a wide range of other academic achievement tests and across all age levels, predicting achievement well for children, adolescents, and adults.

Performance of Clinical Groups

Examination of performance on the RIAS by groups of clinically identified individuals (wherein the RIAS was not a component of the process of clinical diagnosis) can also be instructive. For example, individuals with mental retardation (MR), dementia, and related cognitive problems associated with intellectual impairment should earn lower scores on the RIAS than the normally functioning examinees in the RIAS standardization sample. In interpreting such scores of preselected samples, however, especially when those samples are selected on the basis of extreme scores on a cognitive measure, one must always consider the problem of regression to the mean on a second testing. Thus, scores obtained from a sample with MR will typically be higher on such a testing, but the scores should still be well below the population mean.

During the standardization of the RIAS, 15 different clinical groups were identified, and their scores on the RIAS analyzed to supplement the validation of the interpretation of RIAS scores as reflecting intelligence and memory processes. In each instance, the primary diagnosis given by the agency serving the examinee was accepted, and no independent review or diagnosis was undertaken. The samples included those with traumatic brain injury (TBI), dementia, and stroke/CVA, mental retardation, deaf and hearing impaired, learning disabilities, and a variety of others. The various impairments represented a variety of organic deficits within each category, along with diffuse brain lesions. There were samples of children with learning disabilities (LD) and attention-deficit/hyperactivity disorder (ADHD) as well as the cognate adult samples, which came from more than one source. In reviewing the outcomes of testing with the RIAS with these 15 clinical samples, Reynolds and Kamphaus concluded that all of the various clinical groups in these studies demonstrated some levels of deviation from the population mean on the RIAS. Although most deviations are small decrements, as is commonly found in the literature, the samples with more severe disorders showed greater decrements in performance. Again, however, the purpose for presenting these data is not to make definitive statements about these clinical groups but to describe how the RIAS scores function for each group. Moreover, these data are preliminary and not definitive as to any score patterns on the RIAS that may emerge for clinical groups. Replication with larger and more carefully defined samples will be necessary before firm conclusions can be drawn. The evidence thus far is quite supportive because the score patterns do conform well to known patterns in the related literature and can be reviewed in detail in Reynolds and Kamphaus (2003), Chapter 6.

Evidence Based on the Consequences of Testing

This area of the validation process is the most controversial of all the aspects of the process as presented in the standards. 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, whites, African Americans, and Hispanic Americans. This evidence has been reviewed previously in this chapter and is discussed in detail in Chapters 4–6 of the RIAS Manual. 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. Evaluation of the mean scores of different ethnic groups from the RIAS standardization sample indicated that mean score differences across groups for whites, African Americans, and Hispanic Americans were about half the size typically reported in the research literature for traditional intelligence tests such as the Wechsler and the Binet series.

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 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 the RIAS precludes undue consequences toward minority groups and women 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.

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-aged children for purposes of diagnosis and educational placement and for diagnosis of various forms of childhood psychopathology (especially developmental disorders) where intellectual functioning is an issue. Diagnosis of specific disorders, such as mental retardation, learning disabilities, the various dementias, and the effects of central nervous system 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.

Intelligence tests, including the RIAS, have many additional uses and perform certain functions particularly well. Performance on an intelligence test predicts a host of outcomes. For example, the relationship between intelligence and persistence and success in school and related academic environments is one of the most widely, soundly documented relationships in all of psychology (Jensen, 1998). Intellectual level predicts a plethora of other quite varied outcomes as well, such as job performance in numerous occupations and professions and recovery following traumatic brain injury (Golden, Zillmer, & Spiers, 1992).

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 a comprehensive measure of verbal and nonverbal intelligence and of general intelligence, providing the same level of useful information often gleaned from other intelligence tests much greater in length. 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 Disability

For the evaluation of a learning disability, assessment of intelligence is a common activity. However, when children and adults are evaluated for the possible presence of a learning disability, both verbal and nonverbal intelligence should be assessed. Individuals with a learning disability may have spuriously deflated IQ estimates in one or the other domain due to the learning disability itself. Lower verbal ability is the most common in the school population and among adjudicated delinquents (Kaufman, 1994). However, the concept of the nonverbal learning disability is gaining momentum. For individuals with nonverbal learning disability, 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. The three RIAS intelligence index scores (i.e., VIX, NIX, and CIX) allow for an accurate estimation of intelligence simultaneously with the diagnosis of learning disability.

Mental Retardation

Most definitions, including those of the American Association on Mental Retardation (2002) 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 mental retardation. The RIAS is applicable to the diagnosis of mental retardation for which the evaluation of verbal and nonverbal intelligence as well as adaptive functioning is necessary. Mental retardation is a pervasive intellectual problem 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 mental retardation. Lower levels of functioning such as profound mental retardation are difficult to assess accurately on nearly all tests of intelligence, and 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 mental retardation 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 RIAS also has eliminated issues of motor skill and timing to enhance the assessment of intelligence free of irrelevant confounds, which makes it especially useful for identifying high-IQ children (see Bruegeman, Reynolds, & Kamphaus, 2006, for a detailed discussion of these issues). The range of index scores available on the RIAS (up to index scores of 160, four *SD*s above the mean) is adequate at all ages for identifying persons with significantly above-average levels of overall intellectual function as well as in the verbal and nonverbal domain.

Visual Impairment

Individuals with significant visual impairments that are uncorrected should not be administered the RIAS nonverbal subtests. The verbal subtests, however, should be useful with such individuals.

Hearing Deficiency

Individuals with significant hearing impairment may require examination by specially trained examiners. In such instances, the examiner must judge whether the particular individual's impairment makes any portion of the RIAS more or less useful. Because of the extreme variability in the levels and types of hearing impairments and the communication skills (both form and level) of individuals with significant hearing impairments, no general rule for applicability is offered. Judgments of applicability should be made on a case-by-case basis by examiners with special training and experience with these populations.

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 examiners 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., Standards for Educational and Psychological Testing; American Educational Research Association [AERA], American Psychological Association [APA], & National Council on Measurement in Education [NCME], 1999).

Neuropsychological Impairment

The RIAS can form one central component of the neuropsychological evaluation of children and adults. Assessment of general intelligence levels is important in establishing comparison levels for the interpretation of the highly specific tasks that are commonly used by neuropsychologists. The RIAS has been shown to be sensitive to intellectual decline in the various dementias and in cerebrovascular accident and traumatic brain injury (Reynolds & Kamphaus, 2003). The brevity of the RIAS also makes it attractive in the context of neuropsychological assessment, in view of the extensive length of such evaluations. The RIAS can provide strong and efficient measurement of general intelligence and create more time for the neuropsychologist to assess the many specific cognitive and psychomotor functions that are desirable components of the comprehensive neuropsychological examination. The RIAS memory subtests also can provide a preliminary indication of the need for a more extensive memory evaluation.

Memory Impairment

The information gleaned from evaluating memory functions can provide valuable clinical information above and beyond what is traditionally assessed using IQ measures. Memory is generally recognized as a focal or discrete subset of cognitive functions and as such is often quite vulnerable to central nervous system (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.

For both children and adults, memory deficits can occur in a broad range of cognitive and psychiatric disorders. For example, memory dysfunction is often seen in individuals diagnosed with learning disability (LD), attention deficit/hyperactivity disorder (ADHD), traumatic brain injury, and stroke/cerebrovascular accident (CVA). Many of the common neurodevelopmental and genetic disorders of children have memory and/or attention problems as an element of the symptom complex (Goldstein & Reynolds, 1999; Reynolds & Fletcher-Janzen, 1997). One significant value of including memory measures in an assessment is that it allows the examiner to expand the scope of available information to include clinically meaningful measures that pertain to the examinee's current functioning in daily activities such as learning and memory.

The RIAS memory measures add important information in terms of the ecological validity of the evaluation. For example, the ability to focus attention and learn new information is critical for academic success. The verbal and nonverbal memory measures can give the examiner a very good preliminary indication of a student's ability to learn and remember material. This can lead to more meaningful and better informed evaluation recommendations and remediation strategies.

It is important to note that the RIAS does not provide memory measures to assess delayed memory. Delayed memory functioning (e.g., recall and retrieval) can be affected adversely even though an examinee performs at expected levels on immediate or short-term memory measures. As such, the RIAS does not provide a comprehensive measure of all memory domains.

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 due to the time required. The RIAS offers the clinician a more efficient means of gathering information on the psychometric intelligence of individuals with emotional problems. Often, especially in the case of children, other cognitive disorders, such as LD, may contribute to the emotional problems observed. An intellectual assessment can be helpful in identifying cognitive and intellectual difficulties in such cases. Level of intellectual function may also influence the choice of appropriate treatments. For example, cognitive behavioral therapies and analytic/insight-oriented approaches to treatment would not be appropriate for individuals with borderline levels of intellectual function and, in some cases, even low average intelligence. Knowledge of the intellectual level of a referred child or adult with emotional problems as the primary complaint can provide a broader context for treatment, and the RIAS seems especially well suited for use in such referrals.

Job Performance

In personnel settings, IQ tests are sometimes used to predict success in job training programs and, 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.

SUMMARY OF A CASE STUDY

This case summary is an illustration of the use of RIAS results. While a much more extensive evaluation was conducted, this section highlights only the findings most relevant to the use of the RIAS and does not present the entire case due to space limitations.

Brad is a 9-year-old boy referred for difficulties in learning to read. Brad was born following a full-term, uneventful pregnancy. Currently, Brad is in good physical health. Overall, Brad 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 Brad's intellectual abilities, academic achievement, and social-emotional adjustment. Achievement testing as well as consultation with the school confirmed grade-level performance in math but very poor reading skills.

On testing with the RIAS, Brad earned a Composite Intelligence Index (CIX) of 88. On the RIAS, this level of performance falls within the range of scores designated as below average and exceeds the performance of 21% of individuals at Brad's age. Brad earned a Verbal Intelligence Index (VIX) of 78, which falls within the moderately below-average range of verbal intelligence skills and exceeds the performance of 7% of individuals Brad's age. Brad earned a Nonverbal Intelligence Index (NIX) of 103, which falls within the average range of nonverbal intelligence skills and exceeds the performance of 58% of individuals Brad's age. Brad earned a Composite Memory Index (CMX) of 75, which falls within the moderately below-average range of working memory skills. This exceeds the performance of 5% of individuals Brad's age. On testing with the RIAS, Brad earned a Total Test Battery (TTB) score of 80. This level of performance on the RIAS falls within the range of scores designated as below average and exceeds the performance of 9% of individuals at Brad's age. Brad's Total Verbal Battery (TVB) score of 75 falls within the range of scores designated as moderately below average and exceeds the performance of 5% of individuals his age. The chances are 90 out of 100 that Brad's true TVB falls within the range of scores from 71 to 81.

Brad's Total Nonverbal Battery (TNB) score of 91 falls within the range of scores designated as average and exceeds the performance of 27% of individuals his age.

RIAS Discrepancy Score Summary Table

Discrepancy Score	Score Difference	Statistically Significant?	Prevalence in Standardization Sample
VIX < NIX	25	yes	9.20%
CIX > CMX	13	yes	40.00%
VRM > NVM	1	no	94.60%
TVB < TNB	16	yes	28.30%

VIX is the Verbal Intelligence Index, NIX is the Nonverbal Intelligence Index, CIX is the Composite Intelligence Index, CMX is the Composite Memory Index, VRM is the Verbal Memory Subtest, NVM is the Nonverbal Memory Subtest, TVB is the Total Verbal Battery Index, and TNB is the Total Nonverbal Battery Index.

Discrepancy Norm-Referenced Interpretations

Although the CIX is a good estimate of Brad's general intelligence, a statistically significant discrepancy exists between his NIX of 103 and his VIX of 78, demonstrating better-developed nonverbal intelligence or spatial abilities. The magnitude of the difference observed between these two scores is potentially important and should be considered when drawing conclusions about Brad's current status. A difference of this size is relatively uncommon, occurring in only 9% of cases in the general population. In such cases, interpretation of the CIX or general intelligence score may be of less value than viewing Brad's verbal and nonverbal abilities separately.

When compared to Brad's measured level of general intelligence as reflected in Brad's CIX, it can be seen that his CMX falls significantly below his CIX. This result indicates that Brad is able to engage in intellectual problem solving and general reasoning tasks at a level that significantly exceeds his ability to use immediate recall and working memory functions. Although the size of the observed difference is reliable and indicates a real difference in these two cognitive domains, the magnitude of the difference observed is relatively common, occurring in 40% of the population. Within the subtests making up the CMX, Brad's performance was substantially equivalent on verbal and nonverbal memory tasks. This result indicates that Brad functions about equally well when called on to engage in recall or use working memory functions in either the verbal or nonverbal domain.

School Feedback and Recommendations

Brad's CIX score of 88 and TTB score of 80 indicate mild deficits in overall development of general intelligence relative to others at Brad's age. Individuals earning general intelligence scores in this range frequently experience at least some difficulty acquiring information through traditional educational methods provided in the classroom setting.

The TTB measures the same general construct as the CIX with the exception that six tests are included rather than four. Evidence in the RIAS/RIST Professional Manual (Reynolds & Kamphaus, 2003) documents the equivalence of these two scores based on evidence that a first-factor solution is defensible at all age levels of the RIAS whether four or six subtests are used. There also is evidence from a variety of intelligence tests to suggest the "indifference of the indicator." In other words, general intelligence may be assessed using a variety of cognitive tests, providing further evidence that for most individuals the TTB and CIX will be interchangeable. There will be exceptions to this well-documented scientific finding, in the case of severe brain injury, for example, where significant memory impairment may be present, but these cases will be exceptions rather than the rule.

Since most instructional programs presume at least average intellectual ability and involve lecture, note taking, and other typical instructional approaches, with the exception of demonstrative and repetitive methods commonly used with young children, difficulties in acquiring information when these methods are used is anticipated. Given Brad's deficits, special teaching methods might be considered, including special class placement for severe deficits in general intellectual development. Teachers should prepare an individualized curriculum designed for students who learn at a slower rate than others of the same age and grade level. Alternative methods of instruction should be considered that involve the use of repeated practice, spaced practice, concrete examples, guided practice, and demonstrative techniques. Individuals with general intelligence scores in this range often benefit from repeated practice approaches to training because of problems with acquisition and long-term retrieval, as well as an individualized instructional method that differs significantly from that of their age-mates. It also will be important to assist Brad in developing strategies for learning and studying. Although it is important for all students to know *how* to learn and not just what to learn, low scores on general intelligence indices make the development of learning and study strategies through direct instruction even more important. If confirmed through further testing, co-occurring deficits in adaptive behavior and behavioral problems should be added to the school intervention program.

Brad's VIX score of 78 and TVB score of 75 indicate moderate deficits in the development of verbal intellect relative to others at Brad's age. Verbal memory problems of varying severity levels are commonly evident in this group of individuals, and special attention to Brad's VRM score is necessary.

Verbal ability is important for virtually every aspect of activity because language is key to nearly all areas of human endeavor. A multitude of research investigations have documented the importance of verbal ability for predicting important life outcomes. *Verbal ability* should be considered equivalent to the term *crystallized intelligence*. As assessed by the RIAS, verbal ability (like crystallized intelligence) is highly related to general intelligence, and as such its relationship to important life outcomes is easily correlated. Verbal ability also is the foundation for linguistic knowledge, which is necessary for many types of learning.

With the exception of the early grades, along with Kindergarten and pre-K settings, school is principally a language-oriented task. Given Brad's relative verbal deficits, special teaching methods might be considered, including special class placement in the case of severe deficits in verbal intellectual development. The examiner should also consider either conducting, or making a referral for, an evaluation for the presence of a language disorder. Alternative methods of instruction that emphasize "show me" rather than "tell me" techniques, or as a minimum pair these two general approaches, are preferred.

Although linguistic stimulation likely cannot counteract the effects of verbal ability deficits that began in infancy or preschool years, verbal stimulation is still warranted to improve adaptation or at least prevent an individual from falling further behind peers. Verbal concept and knowledge acquisition should continue to be emphasized. A simple word-for-the-day program may be beneficial for some students. Verbal knowledge builders of all varieties may be helpful, including defining words, writing book reports, a book reading program, and social studies and science courses that include writing and oral expression components. Alternatively, assistive technology (e.g., personal digital assistance devices, tape recorders, MP3 players, or iPods) may be used to enhance functioning in the face of the extensive verbal demands required for making adequate academic progress.

In addition, teachers should rely more heavily on placing learning into the student's experiential context, giving it meaning and enabling Brad to visualize incorporating each newly learned task or skill into his life experience. The use of visual aids should be encouraged and made available to Brad whenever possible. Academic difficulties are most likely to occur in language-related areas (e.g., the acquisition of reading), especially early phonics training. The acquisition of comprehension skills also is aided when the verbal ability falls into this level by the use of language experience approaches to reading, in particular. Frequent formal and informal assessment of Brad's reading skills, as well as learning and study strategies (the latter with an instrument, e.g., the School Motivation and Learning Strategies Inventory—SMALSI; Stroud & Reynolds, 2006) is recommended. This should be followed by careful direct instruction in areas of specific skill weaknesses and the use of high-interest, relevant materials. It also will be important to assist Brad in developing strategies for learning and studying. Although it is important for all students to know how to learn and not just what to learn, low scores within the verbal intelligence domains make the development of learning and study strategies through direct instruction even more important.

Brad's CMX of 75 falls within the moderately below-average range and indicates moderate difficulties with recall of verbal and visual/spatial information relative to others Brad's age. Individuals who score in this range frequently experience consternation in the acquisition of new information and may need some assistance in developing strategies for the day-to-day recall of verbal and visual/spatial information.

Students with deficits in memory ability relative to others their age can benefit from special accommodations in the classroom and from instruction on developing better memory techniques. The use of multiple modalities is typically recommended to increase retention, such as routinely pairing visual/spatial stimuli with verbal stimuli in order to enhance recall. The use of lists, visual, oral language, and written language directions, and verbal and visual reminders may be especially helpful. Repetition of information during learning is often helpful along with review of important material at regular intervals after initial instruction to improve retention.

Memory is a complex function that heavily involves attention. Brad's low performance on the CMX most likely reflects complex difficulties with memory as well as difficulties with attention to at least some degree. Although specific instructional strategies must await a comprehensive assessment of memory functions as noted in subsequent sections, some general recommendations for classroom management of Brad's memory problems can be provided. For example, students referred for learning problems who score 75 on the CMX should be seated near the front of the classroom to ensure that the teacher can obtain the maximum degree of attention to classroom instruction and directions for completing work. The instructions, particularly for younger students, should be specific, simple, and given one at a time. The teacher may wish to stand close to Brad when giving instruction and directions in the classroom. Brad's teacher should ensure that homework assignments are provided in writing or are written down by Brad prior to leaving the classroom for the day. It would be helpful to have the teacher check to ensure that any homework instructions or instructions for any other projects to be completed are written accurately and completely. Maintenance of a daily calendar and instruction in the use of general types of memory strategies also will be helpful to most students with this level of performance on the CMX. Instruction in the use of such memory strategies as rehearsal, chunking, visualization, and related mnemonic aides also can be useful in improving memory function.

Brad's VRM score of 35 suggests that he will experience moderate difficulties in learning and recall of verbal material, even when presented in a meaningful or experiential context, which should be performed because it aids recall. When presenting verbal information to Brad, cues for future recall should be provided and a discussion of strategies for the recall of verbal information would be helpful. Moderate attentional difficulties also are common with VRM scores at this level.

Students with verbal memory deficits relative to others their age may benefit from instruction on developing better memory techniques as related to verbal material. Students such as Brad should be seated near the classroom instructor, who should be sure to ascertain that he or she has Brad's attention during any form of lecture or verbal presentation. Direct instruction in reading and study strategies also may be quite helpful. Memory strategies can be taught, including strategies such as rehearsal, chunking, and skill in making verbal associations. Calling Brad's name prior to giving instructions or other verbal information that will need to be recalled may be helpful along with the use of other techniques to assure his specific attention to the material being presented. Pairing verbal information with visual presentations including pictures or demonstrations of what is expected or what is to be recalled also may be quite useful. A determination of existing strategies employed for learning verbal material can be obtained from administration of the School Motivation and Learning Strategies Inventory for students beginning at age 8 years (Stroud & Reynolds, 2006).

Brad's NVM score of 34 suggests that he will experience moderate difficulties in the learning and recall of visual/spatial material, including maps, figures, graphs, drawings, locations, the arrangement of items in a written work, signs, faces, and directions that require visualization. These difficulties will likely occur even when Brad is presented material in a meaningful or experiential context, which should be performed because the use of concrete objects often aids recall.

Discrepancy Feedback and Recommendations

The magnitude of discrepancy between Brad's VIX score of 78 and NIX score of 103 is relatively unusual within the normal population. Although this is the most common pattern within referral populations, the magnitude of the discrepancy occurring for Brad makes the difference noteworthy. In general, this pattern represents substantially disparate skills in the general domains of verbal and nonverbal reasoning with clear superiority evident in the nonverbal domain. Relative to their verbal reasoning and general language skills, individuals who display this pattern will experience greater success in tasks involving spatial reasoning, visualization skills, the use of mental rotation, reading of nonverbal cues, and related aspects of nonverbal reasoning and communication that usually includes nonverbal and visual memory skills. Nonverbal ability is less influential in others' appraisal of general intellectual functioning. Because NIX is greater than VIX, Brad's general intellectual functioning may appear lower than is reflected by his CIX score. Whenever possible, one should take advantage of Brad's relatively higher levels of performance in the nonverbal domain by always providing visual cues and an explanation of tasks, expectations, or a demonstration of what is expected to be learned (where possible). Experiential learning is typically superior to traditional lecture and related pedagogical methods for individuals with this score pattern. The synthesis of information as opposed to the analysis of information is often a relative strength.

Teaching should emphasize the use of visual images, spatial representations of relationships, experiential learning, and the synthesis of information as opposed to methods of deduction in learning. Difficulties are likely to occur with traditional pedagogical styles such as lecturing and the completion of reading and written assignments. An emphasis on the spatial relationships of numbers and the construction of problems is likely to be the most effective means for teaching math versus the memorization and the learning of step-by-step rules for calculation. A heavy emphasis on learning by example and by demonstration is likely to be most effective with students with this intellectual pattern. Also common are problems with sequencing, including sequential memory and, in the early grades, mastery of phonics when synthesizing word sounds into correct words. Emphases on holistic methods of learning are likely to be more successful in addition to experiential approaches. The practical side of learning and the application of knowledge can be emphasized to enhance motivation in these students.

Often, these students do not have good study, learning, and test-taking strategies. It is often useful to assess the presence of strategies with a scale such as the School Motivation and Learning Strategies Inventory and then to target deficient areas of learning strategies for direct instruction (Stroud & Reynolds, 2006).

Recommendations for Additional Testing

In cases where the CMX falls below 90, additional follow-up assessment with a more comprehensive memory battery often provides additional clues and insights into appropriate instructional practices as well as rehabilitative exercises that may be most useful. Follow-up evaluation with a comprehensive memory battery should be given even stronger consideration when the CMX is below 90 and also falls at a level that is significantly below the CIX. Evaluation with a comprehensive memory battery such as the Test of Memory and Learning—Second Edition (TOMAL-2; Reynolds & Voress, 2007) is recommended for such assessments because of the high degree of variability in performance produced by even small changes in memory tasks.

Brad's NIX score of 103 is significantly higher than his VIX score of 78. As such, follow-up evaluation may be warranted. Although this is the most common pattern in referral populations, additional information is almost always helpful in making a diagnosis, in treatment planning, and/or in making vocational recommendations. Evaluations that consider disturbances in language and verbal functions in general (including receptive and expressive language) and other left-hemisphere-related tasks may prove helpful. Although empirical research at this point is lacking, clinical experience with the RIAS indicates that when the VIX score is significantly below the NIX score and the absolute value of the VIX is less than 90, there is a high probability of the presence of a language disorder that may have an adverse impact on academic attainment or success in any academically related vocational training program. When this pattern occurs, as in the case of Brad, screening for a language disorder is recommended at a minimum and a more comprehensive language assessment should be considered.

SUMMARY

The RIAS was devised from theories of intelligence that have practical value and empirical support. Therefore, the RIAS indexes are firmly rooted in modern intelligence test theory of the 1990s, thus making the results interpretable. In addition, usage of modern test theories means that the most important and predictive intellectual abilities are assessed. More than this, however, the RIAS is designed to promote empirically supported practice in intellectual assessment. The practices of the past that lack empirical support, most prominently subtest level profile analysis of IQ-tests, have been the principal reason for giving lengthy subtest batteries of intelligence. The RIAS is steeped in empirical research that not only fails to support such practices, but also refutes their utility. The RIAS takes advantage of well-known and well-researched tasks to provide the examiner with measurement of the constructs of primary utility when questions of intelligence need to be answered.

The RIAS was developed with special attention to well-reasoned modern standards for psychological and educational assessment (AERA, APA, NCME, 1999). Consistent with these standards, the RIAS provides many opportunities for validation research to uncover new or unforeseen and contraindicated inferences based on test scores.

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Queries in Chapter 5

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