One

OVERVIEW

In 1905 Alfred Binet published the first edition of what would become, about 100 years later, the Stanford-Binet V (Roid, 2003). Fifteen years after the first Binet scale, Yoakum and Yerkes published the Army Mental Tests (1920), on which the Wechsler Intelligence scales (originally published in 1939) were largely based. These measures of IQ all contained test questions that have verbal, quantitative, and nonverbal (spatial) content. The view that an intelligence test should include measures that require knowledge of vocabulary and quantitative concepts has been the basis of both group as well as individually administered IQ tests for a century (Naglieri, 2015).

IQ tests took an important evoluationary step when Alan and Nadeen Kaufman published the K-ABC in 1983. Their approach was revolutionary: take verbal and quantitative measures out of the measurment of ability and use a conceptualization of intelligence to guide the inclusion of subtests. A second evolutionary step in the advancement of intelligence and its measurement was provided in 1997 when Naglieri and Das published the Cognitive Assessment System (CAS). That approach was simlar to the one taken by the Kaufmans in so far as subtests requiring knowledge of vocabulary and arithmetic were excluded. The CAS was unique in that it contained four scales following Luria's (1973) view of four brain-based abilities. The goal was to provide a new way of defining ability based on a cognitive and neuropsychological theory and develop a test to measure these basic psychological processing abilities. The K-ABC and the CAS departed from the traditional approach to IQ because of content differences and their strong conceptual basis.

There has been an evolution in thinking about what a test of ability should be. First, there are traditional IQ tests in which verbal and quantiative test questions are an intergral part of the scales. In these instruments, vocabulary, block building, and arithmetic are considered fundamental and important ways to measure ability. More recently these tests have been partitioned in more

DON'T FORGET 1.1

Psychology advanced considerably during the 20th century, especially in the knowledge of specific abilities and the essential cognitive processes that make up intelligence. Our tests of ability should reflect that evolution.

subscales based on combining subtests into new categories conceptualized from a variety of models. For example, although Wechsler originally had Verbal and Performance IQ scales, now the Wechsler Intelligence Scale for Children, Fifth Edition (Wechsler, 2014), has scales labeled Verbal Comprehension, Visual Spatial, Fluid Reasoning, Working Memory, and Processing Speed (see Naglieri, 2016a, for a review of the WISC-V). The content of the test, however, remains remarkably the same as what was in the Wechsler-Bellevue 1939 edition.

Rapid Reference 1.1

Stanford-Binet Scales

1905	First Binet scale is published by Binet and Simon, subsequently revised in 1908.
1909	Goddard translates Binet-Simon from French to English.
1916	Terman publishes the Stanford revision and extension of the Binet-Simon scale that is normed on American children and adolescents and is widely used.
1937	Terman and Merrill publish a revision of the 1916 scale called the Stanford-Binet Intelligence Scale.
1960	Stanford-Binet, Form LM (Second Edition)
1972	Stanford-Binet, Form LM (Third Edition)
1986	Stanford-Binet, Fourth Edition (by Thorndike, Hagen, & Sattler)
2003	Stanford-Binet, Fifth Edition

There is a stark contrast between traditional IQ tests and the CAS (Naglieri & Das, 1997) and CAS2 as well as the K-ABC (Kaufman & Kaufman, 1983) and K-ABC-II. The essential difference between CAS (and CAS2) and traditional IQ tests relies on two main points. First, PASS (Planning, Attention, Simultaneous, and Successive) theory (see following discussion) was used to build the test and, second, CAS2 (similar to the CAS) does not have test questions that are better described as knowledge (i.e., information, similarities, vocabulary, comprehension, arithmetic) (see Naglieri & Bornstein, 2003). For these two reasons, CAS2 is not the same as a traditional IQ tests exemplified by the Binet and Wechsler scales. This raises the question: "Why use the CAS and CAS2?"

Rapid Reference 1.2

Wechsler Scales

1939	Wechsler-Bellevue, Form I
1946	Wechsler-Bellevue, Form II
1949	Wechsler Intelligence Scale for Children (WISC)
1955	Wechsler Adult Intelligence Scale (WAIS)
1967	Wechsler Preschool and Primary Scale of Intelligence
1974	WISC-Revised
1981	WAIS-Revised
1989	WPPSI-Revised
1991	WISC-III
1997	WAIS-III
2003	WISC-IV
2008	WAIS-IV
2014	WISC-V

One of the most important services professionals in this field provide is a thorough assessment of a person's abilities to answer important questions such as, "Why is the student having trouble learning?" and "How can instruction be modified to improve the student's learning?" IQ tests have been used with varying degrees of effectiveness to determine, for example, if a learning disability exists and to explain poor performance in school. Researchers have found that traditional IQ tests have three main weaknesses. First, because the content of the verbal and quantitative questions is so similar to academic skills taught in the classroom, these tests unfairly penalize students or adults with limited educational opportunity, especially to acquire the English language (Naglieri, 2008a). Second, IQ tests have been shown to be insensitive to the cognitive problems experienced by those with, for example, specific learning disability (SLD), traumatic brain injury (TBI), and attention-deficit/hyperactivity disorder (ADHD) (Naglieri & Goldstein, 2009). Finally, attempts to use the information from IQ tests to design academic instruction have been disappointing. These limitations of traditional IQ tests provided the impetus to consider an alternative view of intelligence, which led us to the PASS theory as measured by CAS2.

DON'T FORGET 1.2

The test you select has a profound impact on what you learn about a student and what you can do to help that student.

When Naglieri and Das (1997) published the first edition of the CAS, they stated clearly that this test was based on *one* theory of ability. This was the first time a *test* of ability was built on a *specific theory*. That theory was chosen because of its relationship to neuropsychology as described by A. R. Luria (1973) (see Naglieri & Otero, 2011). The genius of Luria has been widely recognized and demonstrated by the considerable volume of his writings and the application of his ideas in numerous settings and places around the world.

In his book *The Working Brain: An Introduction to Neuropsychology* (1973), Luria described four neurocognitive processing abilities associated with three functional units of the brain. The first ability is Planning, which is a mental activity that provides cognitive control; use of processes, knowledge, and skills; intentionality; organization; and self-monitoring and self-regulation. This processing ability is closely aligned with frontal lobe functioning (third functional unit). Attention is the ability to demonstrate focused, selective, sustained, and effortful activity over time and resist distraction associated with the brain stem and other subcortical aspects (first functional unit). Simultaneous processing ability provides a person with the ability to integrate stimuli into interrelated groups or a whole usually found (but not limited to) on tasks with strong visual-spatial demands. Successive processing ability involves working with stimuli in a specific serial order, including the perception of stimuli in sequence and the linear execution of sounds and movements. It is clear from this brief explanation that PASS is *very* different from traditional IQ assessment, which is why researchers have found it to be more effective.

Since the publication of the first edition of the CAS there has been considerable research on the theory and the test. Naglieri (2012) and Naglieri and Otero (2011) suggested that the PASS theory has a very strong research foundation that continues to grow. For example, researchers have shown the following:

- Individuals with distinct disabilities such as SLD and ADHD have specific PASS profiles (Naglieri 2012; Naglieri & Goldstein, 2011).
- The CAS and CAS2 yield small differences between PASS scores across race (Naglieri, Rojahn, Matto, & Aquilino, 2005) and ethnicity (Naglieri, Rojahn, & Matto, 2007).
- Small differences between PASS scores have been found when the CAS is administered in English or Spanish (Naglieri, Otero, DeLauder, & Matto, 2007; Otero, Gonzales, & Naglieri, 2013).

- Small differences between PASS scores have been found when the Italian and English versions of the CAS were compared (Naglieri, Taddei, & Williams, 2013).
- PASS scores have shown to be strongly correlated with academic achievement scores (Naglieri & Rojahn, 2004).
- PASS scores have been successfully used for instructional planning and intervention (Naglieri & Conway, 2009).

These findings illustrate the value of the PASS theory as measured by the CAS. In this book we will provide a thorough examination of the CAS2 suite of tools, all of which are based on the PASS neurocognitive theory, and provide an update on the way in which the new versions extend the value of the orginal CAS.

Rapid Reference 1.3

Cognitive Assessment System 2

Authors: Jack A. Naglieri, PhD, J. P. Das, PhD, and Goldstein, S.
Web Location: http://www.proedinc.com/customer/ProductView.aspx?ID=6768
Publication Date: 2014
What the Test Measures: PASS theory
Age Range: 5 years through 17 years 11 months
Administration Time: Core Battery = 40 minutes, Extended Battery = 60 minutes

Qualifications of Examiners:
The CAS2 is intended for individuals with credentials as psychologists (e.g., clinical, school, developmental, counseling, neuropsychological, rehabilitation); certified specialists (educational diagnosticians, psychometrists); and other professionals who are certified to use tests of this type. Users should be knowledgeable of best practices using comprehensive measures of ability, including specific procedures for administration, scoring, and interpreting test results, as well as the PASS theory that underlies this test.

Ordering Information:
CAS2: Cognitive Assessment System, Second Edition (with case) (product #14300), price $999.00.

Cognitive Assessment System 2: Brief

Authors: Jack A. Naglieri, PhD, J. P. Das, PhD, and Goldstein, S.
Web Location: http://www.proedinc.com/customer/ProductView.aspx?ID=6777

(*continued*)

Publication Date: 2014
What the Test Measures: PASS theory
Age Range: 4 years 0 months through 17 years 11 months
Administration Time: 20 minutes

Qualifications of Examiners:
The CAS2: Brief is intended for individuals who have backgrounds or credentials as educational diagnosticians, speech and language specialists, and professionals involved in identification of students for gifted and talented programs, as well as those who are qualified to give the CAS2. Users should be knowledgeable of best practices using brief measures, including specific procedures for administration, scoring, and interpreting test results, and the PASS theory that underlies the test.

Ordering Information:
CAS2: Brief Complete Kit (product #14285), price: $266.00

Cognitive Assessment System 2: Rating Scale

Authors: Jack A. Naglieri, PhD, J. P. Das, PhD, and Goldstein, S.
Web Location: http://www.proedinc.com/customer/ProductView.aspx?ID=6765
Publication Date: 2014
What the Rating Scale Measures: PASS theory
Age Range: 4 years 0 months through 17 years 11 months
Time to Complete: 10–15 minutes

Qualifications of Examiners:
This rating scale can be used by a wide variety of professionals including those with backgrounds or credentials as teachers and those qualified to give the CAS2 and CAS2: Brief. Users should be knowledgeable of rating scales and their use, including procedures related to using, scoring, and interpreting the scores from this rating scale, and the PASS theory that underlies the instrument.

Ordering Information:
CAS2: Rating Scale Complete Kit (product #14295), price: $127.00

Publisher:

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E-mail: general@proedinc.com
Web: http://www.proedinc.com

Contact Customer Service:

Telephone: 800.897.3202

Local: 512.451.3246

Fax: 800.397.7633

Note: All prices as of December 2015.

Rapid Reference 1.4

Descriptions of the PASS Neurocognitive Abilities

Planning is a neurocognitive ability used to determine, apply, self-monitor and self-correct, and control thoughts and actions so that efficient solutions to problems can be attained.

Attention is a neurocognitive ability used to selectively focus on a particular stimulus while inhibiting responses to competing stimuli presented over time.

Simultaneous processing is a neurocognitive ability used to integrate separate stimuli into a single whole or group.

Successive processing is a neurocognitive ability used to integrate information into a specific serial order.

INTRODUCTION TO CAS2

Since the first edition of the Cognitive Assessment System (Naglieri & Das, 1997) was published there has been a substantial increase in interest in measuring abilities within a neuropsychological perspective as well as a growing recognition of the limitations of tradition IQ tests. The publication of a new suite of tests, which includes the Cognitive Assessment System, Second Edition (CAS2; Naglieri, Das, & Goldstein, 2014a); the CAS2: Brief (Naglieri, Das, & Goldstein, 2014b); the CAS2: Rating Scale (Naglieri, Das, & Goldstein, 2014c) and the CAS2: Spanish (Naglieri, Moreno & Otero, 2017) extend the approach used when the CAS was originally published to a new level by providing measures that can be used in a wide variety of settings by professionals of different qualification levels and for different purposes. These measures provide for multiple ways to evaluate the four neurocognitive processes we call Planning, Attention, Simultaneous, and Successive (PASS), which can be used to (1) help identify a disorder in basic psychological processing reasons that is related to specific learning disabilities (and learning strengths); (2) prescribe academic instructions that best match the characteristics of the student; and (3) evaluate ability equitably across race and ethnicity.

The essential goal of the CAS and CAS2 suite of measures is to provide a way to evaluate neurocognitive abilities in a manner that is focused on basic psychological processes related to brain function. The use of a specific theory (PASS), which was used to define the abilities included in the CAS and CAS2, makes it very different than all the other test options. The most salient differences between CAS2 and traditional IQ is (1) the use of the PASS neurocognitive theory to define the constructs to be measured and their interpretation; (2) the wider range of abilities measured by PASS than traditional IQ tests; (3) and the exclusion of verbal and quantitative test questions that require the child to define words, describe similarities or differences between verbal concepts, and solve math word problems. These three key differences have considerable impact on the information the CAS2 yields.

DON'T FORGET 1.3

The purpose of the CAS2 is to measure specific PASS neurocognitive abilities in a way that will detect specific learning disabilities, will accurately evaluate a wide variety of students, and have relevance to instruction and intervention.

In this book, we will show how the PASS theory as measured by the several different CAS2 measures provides information critical to understanding learning and learning problems. We believe that a strong theoretical perspective can also provide down-to-earth practical solutions to everyday problems. Real-life case studies as well as research reports will illustrate how PASS theory can be applied to help students be more successful. The topics include administration and scoring, interpretation, intervention, and use of the instruments in several different contexts. Points that are especially important are noted in "Don't Forget," "Rapid Reference," and "Caution" boxes and included as "Test Yourself" items at the end of the chapters.

DON'T FORGET 1.4

The Goals of PASS and CAS2

- Have a test of ability based on a specific theory of ability
- Measure more abilities than traditional IQ
- Measure neurocognitive processes
- Replace IQ with cognitive processes

This book was developed to give professionals a way to quickly obtain knowledge of the CAS2 (English and Spanish), CAS2: Brief, and CAS2: Rating Scale in an easy-to-read format. Throughout the book emphasis will be given to the importance of the PASS theory and practical application of the CAS2 measures for effective evaluation of children's neurocognitive performance and consideration of this information for diagnosis and treatment. The overarching goal of this book is to provide you with all the information needed to use the three CAS2 measures with confidence. An initial description of each of the CAS2 measures is necessary in order to provide a general overview.

DESCRIPTION OF THE CAS2 MEASURES

The ultimate goal of the CAS2 (English and Spanish), CAS2: Brief, and CAS2: Rating Scale is to provide three ways to apply the PASS theory to better understand students' learning and learning problems. The CAS2 is intended to provide the most complete examination of the individual's ability to solve problems across the four PASS scales. This version will be most often used in comprehensive evaluations, typically in response to a referral, and especially for determining if a student has a disorder in basic psychological processing that is affecting academic or social performance. The CAS2: Brief is intended to be used in situations when a fast measure of PASS can be obtained for screening or reevaluation. The CAS2: Rating Scale provides a way for the user of the CAS2 or the CAS2: Brief to evaluate behaviors related to PASS theory that can be observed by the teacher in the classroom. Each of these three measures (illustrated in Figure 1.1) is described in the following sections.

CAS2

The CAS2 is an 8- or 12-subtest individually administered measure of PASS neurocognitive processing abilities for student ages 5 years 0 months through 18 years

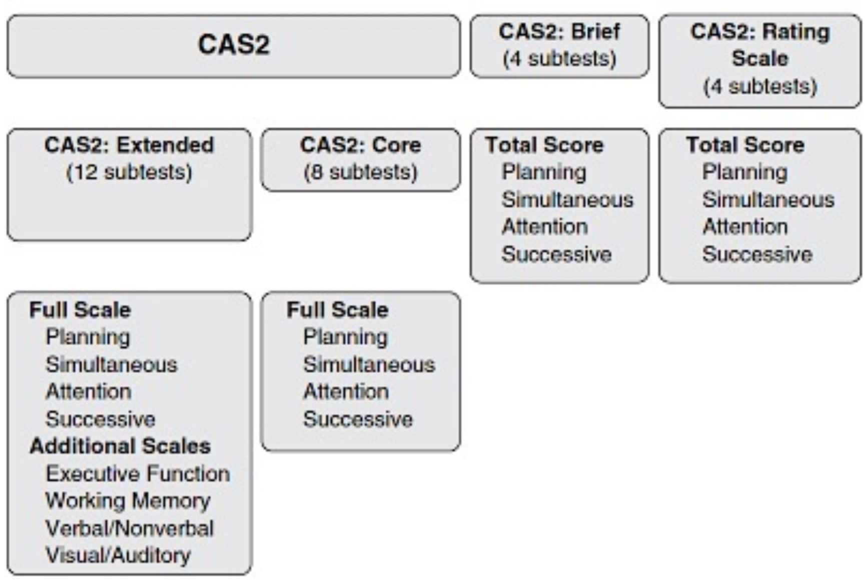

Figure 1.1 PASS Comprehensive System

11 months. It was normed on a sample of 1,342 cases representative of the US population on a number of essential demographic variables (see Naglieri, Das, & Goldstein, 2014a). *CAS2 Interpretive and Technical Manual* for more details). The CAS2 provides three levels of scores: the Full Scale score, the PASS cognitive processing scales (both set as a mean of 100 and standard deviation of 15), and the subtest scores (mean of 10 and standard deviation of 3). The test has seven components:

- The *administration and scoring manual* provides general information about testing, specific instructions for administering and scoring the subtests, norms tables, and interpretive tables.
- The *interpretive and technical manual* is a resource for information needed to use the test, including a description of the PASS theory; explanations of the test's organization and development; and information on standardization and norming, reliability, validity, and interpretation.
- There are three *stimulus books* that provide the items for the Matrices, Verbal-Spatial Relations, Figure Memory, Expressive Attention, and Visual Digit Span subtests.
- Two *student response forms* are provided, one for ages 5 through 7 years and one for ages 8 through 18 years. The forms are used for paper-and-pencil responses for the Planned Number Matching, Planned Codes, Planned Connections, Number Detection, and Receptive Attention subtests.
- A *Figure Memory response form* is used for the paper-and-pencil responses for the Figure Memory subtest.
- *Scoring templates* offer examiners a convenient aid for ease and accuracy in scoring student responses for Planned Number Matching, Number Detection, and Receptive Attention subtests.
- The *examiner record form* is used for recording responses for each subtest, as well as for a summary of the scoring and permanent documentation of test results.

Select CAS2 subtests are used to obtain the 8-subtest Core Battery which yields the Planning, Attention, Simultaneous, Successive, and Full Scale scores. The 12-subtest Extended Battery also yields these five scales as well as additional scales to measure working memory, executive function without working memory, executive function with working memory, verbal content, and nonverbal content. The subtest scores from two or more subtests are combined to form these various scales are shown in Table 1.1. Each of these scales is described more fully in Rapid Reference 1.5.

Rapid Reference 1.5

Primary CAS2 Scales

Planning This scale describes a student's ability to create a plan of action, apply the plan, verify that an action taken conforms to the original goal, and modify the plan as needed. It is based on the Planned Codes, Planned Connections, and Planned Number Matching subtests.

Attention This scale describes a student's ability to focus cognitive activity and inhibit responding to irrelevant distracting stimuli. It is based on the Expressive Attention, Number Detection, and Receptive Attention subtests.

Simultaneous This scale describes a student's ability to organize separate elements into a coherent whole. It is formed by combining the Matrices, Verbal-Spatial Relations, and Figure Memory subtests.

Successive This scale describes a student's ability to recall or comprehend information arranged in a specific serial order. The scale is composed of the Word Series, Sentence Repetition (ages 5–7 years) or Sentence Questions (ages 8–18 years), and Visual Digit Span subtests.

Full Scale The Full Scale score provides an index of the overall level of an individual's cognitive functioning. It is formed by combining the scores of the Planning, Attention, Simultaneous, and Successive subtests.

Additional CAS2 Scales

Executive Function This scale provides a measure of the child's ability to achieve a goal by planning and organizing a task while paying careful attention to the stimuli and resisting distractions in the environment. It is formed by combining the Planned Connections and Expressive Attention subtests from the Planning and Attention scales, respectively.

Executive Function With Working Memory This scale evaluates the student's ability to achieve a goal by planning and organizing a task while paying careful attention to the stimuli, resisting distractions in the environment and keeping information in memory during problem-solving. It is formed by combining the Planned Connections, Expressive Attention, Verbal-Spatial Relations, and Sentence Repetition (ages 5–7 years) or Sentence Questions (ages 8–18 years) subtests, which are included in all four PASS scales.

Working Memory This score reflects the student's ability to mentally recall and manipulate information for a short period. It is formed by combining the following subtests from the Simultaneous and Successive scales: Verbal-Spatial Relations and Sentence Repetition (ages 5–7 years) or Sentence Questions (ages 8–18 years).

(*continued*)

Verbal Content This composite measures the child's ability to process information that requires recall and/or comprehension of verbal concepts or words across the Simultaneous, Successive, and Attention scales. It is formed by combining the Verbal-Spatial Relations, Receptive Attention, and Sentence Repetition (ages 5–7 years) or Sentence Questions (ages 8–18 years) subtests.

Nonverbal Content This composite measures the child's ability to process information with images across the Simultaneous and Planning scales. It is formed by combining the Matrices, Figure Memory, and Planned Codes subtests.

Visual-Auditory Comparison Scores on the Word Series and Visual Digit Span subtests are used to investigate the role visual or aural presentation of stimuli may have in the student's ability to remember information that is arranged in a specific order.

Description of the CAS2 Subtests

Planning Subtests

Planned Codes (PCd): Planned Codes items present the child or adolescent with a legend at the top of each page that shows a correspondence of letters to specific codes (e.g., A, B, C, D to OX, XX, OO, XO, respectively). Just below the legend are four rows and eight columns of letters without the codes. The student is required to write the corresponding codes in each empty box beneath each of the letters. Students have 60 seconds per item to complete as many empty code boxes as possible.

Planned Connections (PCn): The Planned Connections subtest requires the student to connect a series of stimuli (numbers and letters) in a specified order as quickly as possible. Students have between 60 and 180 seconds to complete each item.

Planned Number Matching (PNM): Each Planned Number Matching item presents the student with a page of eight rows with six numbers on each row. The student is required to find and underline the two numbers in each row that are the same. Students have 180 seconds per item to find as many matching numbers as possible.

Simultaneous Subtests

Matrices (MAT): The Matrices are a multiple-choice subtest that uses shapes and geometric placements that are interrelated through spatial or logical organization. Students are required to analyze the relationships among the parts of the item and solve for the missing part by choosing the six best options.

Table 1.1 CAS2 Subtests and Composite Scales

	Core and Extended Battery Scales					Supplemental Scales					
CAS2 Subtests	Planning	Simul-taneous	Attention	Successive	Full Scale	Executive Function Without Working Memory	Executive Function With Working Memory	Working Memory	Verbal Content	Nonverbal Content	Speed/Fluency
Planned Codes	C				C					X	
Planned Connect	C				C	X	X				
Planned Number Matching	E				E						
Matrices		C			C					X	
Verbal-Spatial Relations		C			C		X	X	X		
Figure Memory		E			E					X	
Expressive Attention			C		C	X	X				X
Number Detection			C		C						
Receptive Attention			E		E				X		
Word Series				C	C						
Sentence Repetition/Sentence Questions				C	C		X	X	X		
Visual Digit Span				E	E						

Note: C = Core Battery subtest; E = Extended Battery subtest. Speed/Fluency is composed only of the first two pages of the Expressive Attention subtest.

Verbal-Spatial Relations (VSR): Verbal-Spatial Relations is a multiple-choice subtest in which each item consists of six drawings and a printed question at the bottom of each page. The examiner reads the question aloud, and the child is required to select the option that matches the verbal description.

Figure Memory (FM): For each Figure Memory item, the examiner presents the student with a two- or three-dimensional geometric figure for 5 seconds. The stimulus is then removed, and the student is presented with a response page that contains the original figure embedded in a larger, more complex geometric pattern. The student is required to identify the original figure with a red pencil on the Figure Memory Response form.

Attention Subtests

Expressive Attention (EA): The Expressive Attention subtest consists of two sets of three items. Students ages 5–7 years are given three pages consisting of seven rows that each contain six pictures of common animals, with each picture depicted as either big (1 inch × 1 inch) or small (1/2 inch × 1/2 inch). In each of three pages, the student is required to identify whether the animal depicted is big or small in real life, ignoring the relative size of the picture on the page. In item set 1, the pictures are all the same size. In item set 2, big animals are depicted with big pictures, and small animals are depicted with small pictures. In item 3, the realistic size of the animal often differs from its printed size.

Students ages 8 to 18 years are presented with three Expressive Attention pages consisting of eight rows of five words each. On page 1, students are asked to read the words *blue, yellow, green,* and *red* printed in black ink. On page 2, students are asked to name the colors of four colored rectangles (printed in blue, yellow, green, and red). On page 3, the four color words from page 1 are printed in the color from page 2 and the word name and the color do not match. In this item, students are required to name the color of the ink in which the word is printed rather than read the word.

Number Detection (ND): Each Number Detection item presents the student with a page of approximately 200 numbers. Students are required to underline specific numbers (ages 5–7 years) or specific numbers in a particular font (ages 8–18 years) on a page with many distractors.

Receptive Attention (RA): The Receptive Attention subtest consists of four item sets, each containing 60 picture pairs (ages 5–7 years) or 180 letter pairs (8–18 years). Both versions require the child or adolescent to underline pairs of objects or letters that either are identical in appearance or are the same from a lexical perspective (i.e., they have the same name).

Successive Subtests

Word Series (WS): The Word Series subtest uses nine single-syllable, high-frequency words: *book, car, cow, dog, girl, key, man, shoe,* and *wall.* The examiner reads aloud a series of two to nine of these words at the rate of one word per second. The student is required to repeat the words in the same order as stated by the examiner.

Sentence Repetition (SR): The Sentence Repetition subtest (administered only to ages 5–7 years) requires the child to repeat syntactically correct sentences containing little meaning, such as "The blue is yellowing."

Sentence Questions (SQ): The Sentence Questions subtest (administered only to ages 8–18 years) requires the child or adolescent to listen to sentences that are syntactically correct but contain little meaning and answer questions about the sentences. For example, the student is read the sentence "The blue is yellowing" and then asked the following question: "Who is yellowing?"

Visual Digit Span (VDS): The Visual Digit Span subtest requires the student to recall a series of numbers in the order in which they were shown using the Stimulus Book. Each item that is two to five digits in length is exposed for the same number of seconds as there are digits. Items with six digits or more are all exposed for a maximum of 5 seconds.

Table 1.2 Structure of the CAS Scales and Subtests in Order of Administration

Scale	Subtests
Planning	
	Matching Numbers (MN)
	Planned Codes (PCd)
	Planned Connections (PCn)
Simultaneous	
	Nonverbal Matrices (NvM)
	Verbal-Spatial Relations (VSR)
	Figure Memory (FM)
Attention	
	Expressive Attention (EA)
	Number Detection (ND)
	Receptive Attention (RA)
Successive	
	Word Series (WS) and or Sentence Repetition (SR)
	Speech Rate (SpR, ages 5–7 years) or Sentence Questions (SQ, ages 8–17 years)

CAS2: Brief

The CAS2: Brief is 4 subtest individually administered measure of PASS neurocognitive processing abilities students ages 4 years 0 months through 18 years 11 months. It was normed on a sample of 1,417 students who are representative of the US population on a number of important demographic variables (see the examiner's manual for more details). The CAS2: Brief yields standard scores (mean of 100 and standard deviation of 15) for PASS and a total scale.

This test has the following five components:

1. *Examiner's manual*. This manual provides general information, general information for administering and scoring the subtests, norms tables, and interpretive tables.
2. *Examiner record form*. The administration and scoring instructions are provided on the examiner record form. In addition, the form provides space for recording responses for each subtest as well as a summary of the scoring and permanent documentation of test results.
3. *Stimulus book*. The stimulus book provides the items for the Simultaneous Matrices and Expressive Attention subtests.
4. *Student response booklet*. The student response booklet is used for the Planned Codes subtest.
5. *Scoring templates*. A spiral-bound booklet with six scoring templates provides an efficient way for scoring the Planned Codes subtest.

The CAS2: Brief yields scores (mean of 100 and standard deviation of 15) for the four PASS scores and a Total Score. The subtests used in the CAS2: Brief are similar to, but not the same as, those used in the CAS2. Each PASS scale is assessed using one subtest described in the following.

Rapid Reference 1.6

Description of the CAS2: Brief Subtests in Each PASS Scale in Order of Administration

Planning

Planned Codes The Planned Codes subtest presents the child or adolescent with a legend at the top of each page that shows a correspondence of numbers to specific codes (e.g., 1, 2, 3, 4 to OX, XX, OO, XO, respectively). Just below the legend are four rows and eight columns of numbers without the codes. The student is required to write the corresponding codes in the empty box beneath each number. Students have 60 seconds per item to complete as many empty code boxes as possible on each of the six items. Success on Planned

Codes requires that the student develop a plan of action, evaluate the value of the method, monitor its effectiveness, revise or reject an old plan as the task demands change, and control the impulse to act without careful consideration.

Simultaneous

Simultaneous Matrices The Simultaneous Matrices subtest requires that the student understand how shapes are interrelated through spatial or logical organization. Students are required to analyze the relationships among the parts of the item and solve for the missing part by choosing the best of six options. Simultaneous Matrices requires comprehension of how many geometric parts are organized into a larger, sometimes multidimensional, pattern. All of the items on this subtest are different from those used in the CAS2 as is the color pallet (blue, yellow, teal, and black).

Attention

Expressive Attention The Expressive Attention subtest presents a task that requires focus on one stimulus and resistance to responding to distractions over time. The subtest consists of two age-related sets of three items. Students ages 4 through 7 years are presented with seven rows containing six pictures of common animals that are depicted as either big (1 inch × 1 inch) or small (1/2 inch × 1/2 inch). In each of the three items, the student is required to identify whether the animal depicted is big or small in real life, ignoring the relative size of the picture on the page. In item set 1, the pictures are all the same size. In item set 2, the pictures are sized appropriately (i.e., big animals are depicted with big pictures, and small animals are depicted with small pictures). In item set 3, the realistic size of the animal often differs from its printed size.

Students ages 8–18 years are presented with three item sets, each consisting of eight rows of five randomly ordered stimuli. In item set 4, students read color words (*blue*, *yellow*, and *red*) printed in black-and-white ink. In item set 5, students name the colors of four rectangles (printed in blue, yellow, green, and red) that are presented in a quasi-random order. In item set 6, the four color words are printed in a different color ink than the color name. In this set, students name the color of the ink in which the word is printed rather than read the word.

The items on both versions of the Expressive Attention subtests are different from those used in the CAS2. The CAS2: Brief version does not include the color green used in the CAS2.

Successive

Successive Digits In the Successive Digits subtest, the examiner orally reads sets of numbers between 1 and 9 to the student. Each set of numbers ranges in length from two to nine numbers, read at the rate of one number per second. The student is required to repeat the numbers in the same order as the examiner. This Successive subtest requires reproduction of the serial order of numbers, whereas words are used in the CAS2.

CAS2: Rating Scale

The CAS2: Rating Scale is a measure of behaviors associated with the four PASS abilities for students ages 4 years 0 months through 18 years 11 months. It was normed on a representative sample of 1,383 students that represent the US population on a number of key variables (see the Examiner's Manual for more details). Similar to the CAS2 and the CAS2: Brief, the CAS2: Rating Scale yields standard scores for the four PASS scales and a Total Score (mean of 100 and standard deviation of 15), each of which is described in Rapid Reference 1.7. The rating scale has two components: an examiner's manual and a record form.

The examiner's manual provides specific instructions for administering, scoring, and interpreting the scale. In addition, it includes information needed to use the scale, a discussion of the PASS theory; explanations of the CAS2: Rating Scale's organization and development; and information on standardization and norming, reliability, validity, and interpretation. The rating form provides instructions to the rater, space for the rater to record ratings of behaviors observed by the teacher, and a section for the examiner to record the scores. The scale contains 40 items that are rated by the teacher.

Rapid Reference 1.7

Description of the CAS2: Rating Scale Items in Each PASS Scale in Order of Administration

Planning

This scale is composed of items that ask about how well the student makes decisions about how to do things. This includes items to assess if the student thinks before acting, evaluates his or her actions, controls impulses, devises new solutions, and reflects on the extent to which actions matched intentions. In general, the Planning score provides a measure of how and what a student decides to do. An example of a Planning Scale item would be "During the past month, how often did the child or adolescent have a good idea about how to complete a task?"

Simultaneous

This scale addresses how well the student understands interrelationships among ideas and objects. The questions determine if a child can understand relationships among physical objects as well as verbal concepts. An example of a Simultaneous scale item would be "During the past month, how often did the child or adolescent figure out how parts of a design go together?"

Attention

This scale evaluates how well a student can focus attention and resist distractions, sustain attention over time, and concentrate in noisy settings. An example of an Attention scale item would be "During the past month, how often did the child or adolescent work without getting distracted?"

Successive

This scale evaluates the student's ability to work with information that is in a specific order, including remembering numbers, letters, and words in order and blending sounds of words in the correct sequence. An example of a Successive scale item would be "During the past month, how often did the child or adolescent follow three to four directions given in order?"

Total Score

The PASS scale standard scores can be combined to create a composite score called the *Total Score*. The Total Score, however, should be used with the understanding that when there is considerable variability in PASS scores, the Total Score may be different from any of the four part scores used to create it. See Chapter 2 of this book for more information.

USES OF THE CAS2

The CAS2 (English and Spanish versions), CAS2: Brief, and CAS2: Rating Scale can be used to assess children and adolescents ages 4 (or 5) through 18 years. The CAS2: Rating Scale can be used whenever an evaluation of classroom behaviors related to PASS as reported by a teacher is desired. The information can be used for instructional planning as well as screening for strengths and weaknesses. The CAS2: Brief is intended to be used as a short measure of PASS to be obtained when an initial concern is raised as well as during reevaluation of a student already receiving educational services. The CAS2: Brief is also intended to be used whenever a short evaluation of a student's ability is desired as part of a larger testing program, for example, gifted screening. The CAS2: Brief is particularly useful for gifted assessment because the test measures neurocognitive abilities that go beyond a typical IQ test. These three versions of the CAS2 are appropriate when initial instructional planning (Rating Scale) or screening (CAS2: Brief) as well as comprehensive psychological, clinical, psychoeducational, or neuropsychological evaluation (CAS2) is indicated. The results from all these measures of PASS can be used at different points of the process of making clinical diagnoses, educational eligibility determination, treatment planning, and for fair and equitable assessment of diverse populations.

THEORETICAL FOUNDATION

Roots of PASS

The PASS theory is based on the neuropsychological, information-processing, and cognitive psychological research of A. R. Luria (1966, 1973, 1980a, 1980b, 1982), who is the "most frequently cited Soviet scholar in American, British, and Canadian psychology periodicals" (Solso & Hoffman, 1991, p. 251). Luria's view of the brain function was partially based on his own research and the integration of his findings with those of other researchers. He gives ample credit to those on whom he drew information about the specific functions of the brain in his 1973 book, *The Working Brain: An Introduction to Neuropsychology*. Luria described the basic building blocks of intelligence as functional systems, which means that there are basic cognitive processes that provide the ability to perform certain acts, each of which is distinctive in character and associated with different areas of the brain. Luria understood the brain as an extremely complex organ, and he viewed the PASS cognitive processes to be dynamic. Each functional system was characterized by a specific aim and carried out by several participating subprocesses. Indeed, Luria's conceptualizations of how the brain worked was revolutionary, and many of his contributions to the understanding of brain-behavior relationships were derived without the benefit of modern imaging and other methods now available in the field of neuroscience.

Luria associated each of the three functional units with specific regions of the brain. The first functional unit is associated with the brain stem, diencephalon, and medial regions of the hemispheres. The occipital, parietal, and temporal lobes posterior to the central sulcus regulate the second unit's functions. The third unit's functions are regulated by the frontal lobes, especially the prefrontal region. These functional units, illustrated in Figure 1.2, will be described in the following section.

PASS Theory

In this section each of the four PASS processes are described. Luria's three functional units include the four PASS processes as follows: Attention is in the first functional unit, Simultaneous and Successive are in the second, and Planning is in the third. To illustrate each process, one subtest from each of the four scales of the CAS2, CAS2: Brief, and CAS2: Rating Scale is discussed and examples of children's classwork that involve the process are illustrated. Rather than follow the first, second, and third functional unit sequence, this section will be organized by the PASS acronym; beginning with Planning, then covering Attention, and concluding with Simultaneous and Successive processes.

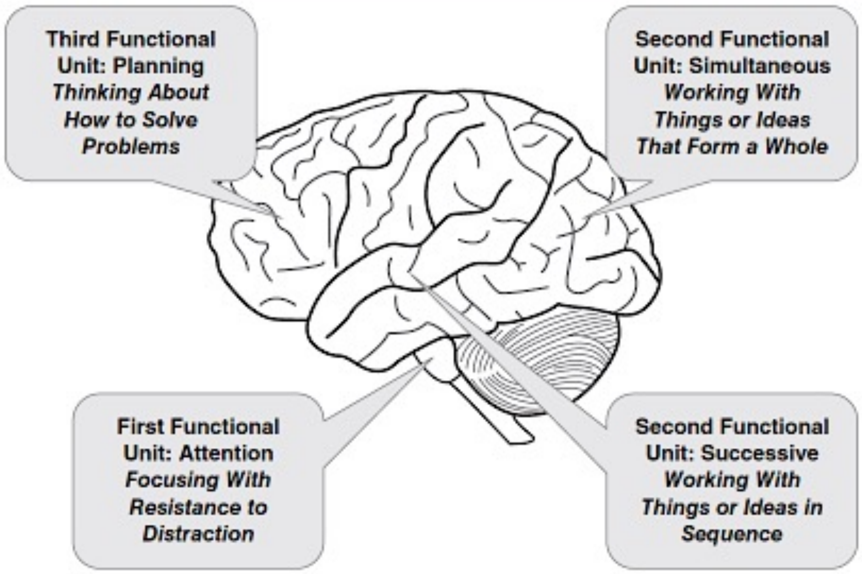

Figure 1.2 Three Functional Units and Associated Brain Structures

The PASS theory provides a conceptualization of four basic psychological processes that can be described as the basic building blocks of human functioning. The four PASS constructs are defined by Naglieri et al. (2014a) in the CAS2 interpretive manual as described in the following sections.

Planning

Planning is a neurocognitive ability used to determine, apply, self-monitor, self-correct, and control thoughts and actions so that efficient solutions to problems can be attained (Naglieri et al., 2014a). This includes control of actions and thoughts so that efficient solutions to problems can be achieved. Planning provides the means to solve problems for which no method or solution is immediately apparent and may involve retrieval of information as well as use of the other PASS abilities to process the information. Planning ability is also important when individuals reflect on events following a problem that was completed, recognizing what worked, what did not work, and considering other possible solutions in the future. The frontal lobes of the brain are directly involved in Planning processing (Naglieri & Otero, 2011).

Planning is a process essential to all activities in which there is intentionality and a need for some method to solve a problem. This includes an awareness of what is a good course of action, how well things are going, evaluation of alternative activities as they might become appropriate from moment to moment, and consideration of the relative value between continuing with a behavior or changing to a different one (Shadmehr, Smith, & Krakauer, 2010). These ongoing aspects can be either explicit or implicit and may be automatic or demand considerable cognitive control (Blais, Harris, Guerrero, & Bunge, 2010; Koziol, Budding, & Chidekel, 2010).

The essence of subtests that measure Planning is that the examinee must solve novel problems for which there is no previously acquired strategy and there should be minimal constraints placed on the way the student completes the task. All of the Planning subtests on the CAS2 and CAS2: Brief are best solved using strategies for efficient performance. In addition, the instructions were designed to fully inform the student to complete the task using whatever method seems best. This instruction provides the opportunity to apply strategies to the novel test questions that are designed to be relatively easy to complete. This enables the score to reflect efficiency, measured by how long it takes to complete the task with the most number correct. For example, the Planned Codes subtest on the CAS2 or CAS2: Brief is best completed using a strategy. Recall that Planned Codes requires the child to write a specific letter code under the corresponding letter (e.g., XO for A, OX for B, etc.) as shown in Figure 1.3. Children can use different strategies to complete the test in an efficient and timely manner. Importantly, children who use a strategy on Planned Codes obtain a significantly higher scaled score mean score than those who do not (Naglieri et al., 2014a). The CAS2: Rating Scale provides information about the student's behavior in school settings.

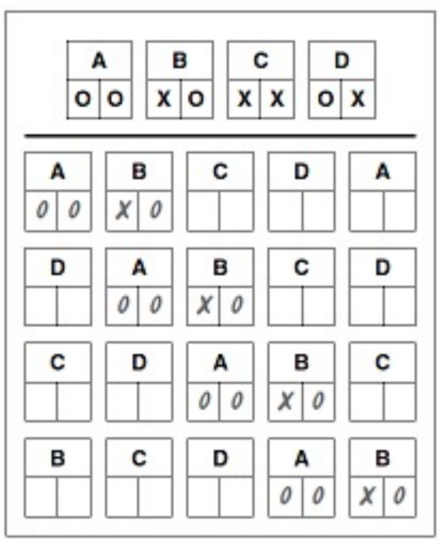

Figure 1.3 Example of a Planning Test

> **DON'T FORGET 1.5**
>
> The more novel a task is, the more Planning it requires. As a solution becomes well learned, the role of Planning decreases and the role of knowledge and skills increases.

Classroom behaviors can provide insight into a student's neurocognitive concept of planning in school. To calibrate such observations, the Planning scale items on the CAS2: Rating Scale focus on topics such as how well the student can solve new problems and especially how well a student can think of several ways to solve the same problem. This includes having a good goal in mind when various strategies are being considered, applying a strategy, and deciding if the result is consistent with the intention. These kinds of observable classroom behaviors inform us about how well the student is meeting the demands of tasks within the context of the instructional approach. That is, if instruction allows for multiple ways to solve problems, then observation of these behaviors can be helpful in gauging a student's Planning processing. Note, however, if the classroom instruction is very structured and each student is taught to use the same method of solving problems, then the behavior in the class will reflect how well the student is meeting those requirements rather than how well the student could develop a variety of solutions.

Classroom performance on *academic tasks* can also provide insights into a child or adolescent's Planning ability. Most any task can involve Planning processing regardless of the content *if* the student has to make decisions about *how* to complete the task. For example, a student may memorize the sequence of letters to spell the name *Jacqueline* or think of a way to remember the sequence by chunking the letters into groups. Chunking letters into more manageable units such as *Jac-que-line* is an excellent plan for remembering the spelling of this complicated name. If the student decides to put the letters into groups, that behavior can be deemed a reflection of his or her Planning ability. If, however, the student was taught a chunking strategy by a parent, then the student's selection of the strategy from memory represents good planning. Both behavioral outcomes are valuable, the former representing a more optimal level of Planning because it involves problem identification, generation of a possible solution, execution of the solution, and monitoring effectiveness of the strategy. The latter solution demands less Planning but still involves problem identification, selection of a strategy, execution of the solution, and monitoring the effectiveness of the plan.

Attention

Attention is a neurocognitive ability used to selectively focus on a particular stimulus while inhibiting responses to competing stimuli presented over time (Naglieri et al., 2014a), as shown in Figure 1.4. Attention is a basic component of intelligent

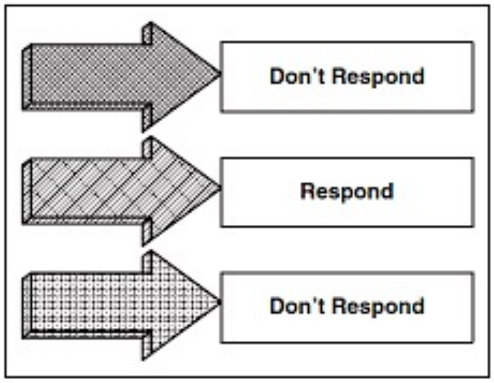

Figure 1.4 Cognitive Processing Structure of a Task That Requires Attention

behavior because it provides cortical arousal and higher forms of attention. Luria stated that optimal conditions of arousal are needed for the more complex forms of attention involving "selective recognition of a particular stimulus and inhibition of responses to irrelevant stimuli" (Luria, 1973, p. 271). Higher forms of attention are conceptualized as a mental activity that provides focused, selective cognitive activity over time and resistance to distraction. The process is involved when a person must demonstrate focused, selective, sustained, and effortful activity. The longer attention is needed, the more the activity necessitates vigilance. Intentions and goals managed by the ability to plan, control attention, and knowledge and skills also play an integral part. Brain structures such as the reticular formation enable people to focus selective attention toward a stimulus over a period of time without the loss of attention to other competing stimuli.

The *subtests* used in the CA2 and CAS2: Brief Attention scales were constructed so that each stimulus is multidimensional and the tendency is to respond to the most salient part that is incorrect. For example, the student is instructed to identify one aspect of the target (e.g., the color blue) and resist responding to distractions (e.g., the word *red* written in blue ink) as in the Stoop test (Lezak, 1995). This kind of a task requires selective focus of attention over time and resistance to distraction. Attentional processing assessed using CAS2 subtests demands focused, selective, sustained, and effortful activity. Focused attention involves directed concentration toward a particular activity, selective attention provides the inhibition of responses to distracting stimuli, and sustained attention refers to the variation of performance over time, which can be influenced by the different amount of effort required to solve the test.

Classroom behaviors can reflect a student's ability to attend and resist distractions over time. For example, behavioral evidence of good attention would be suggested when the teacher sees a student stay focused on his or her work despite distractions in the class and maintain effort over time despite continued noises. By contrast, poor attention can be inferred when a student can work only for a short period of time, has problems listening and following directions, and cannot concentrate except when distractions are minimal.

There are many *academic tasks* that are particularly dependent on the neurocognitive concept of Attention. Clearly, all academic tasks (as well as everything a person does in and outside of school) require attention and resistance to distractions (in the environment as well as distracting thoughts). Some tasks require more attention than others, particularly because as the complexity of a task increases, so too will the attentional demands. For example, reading a single word requires much less attention than reading and understanding a paragraph. Solving a math problem such as $2 + 4 - 1 = ?$ involves attending to the numbers and the signs in addition to knowing the math facts. Answering a multiple-choice test can be particularly demanding on attention when the problem requires deciding what part of the information given is important and what is not and when the options are very similar. For example, Figure 1.5 illustrates a math word problem that requires attention to the details to determine the exact question (what is 6×5.25).

Each of these buckets of apples weighs 5.25 pounds.

What is the total weight of all 6 buckets of apples?

F 31.50 lb **H** 30.50 lb **K** 5.31 lb
G 31.20 lb **J** 31.20 lb

Figure 1.5 Example of a Task That Requires Attention and Resistance to Distraction

The reader has to decide what is important (the number of buckets and the amount each weighs) and what is not (e.g., what is being weighed). Then the options need to be carefully examined to determine which one is correct. In this example, two of the options are the same to the left of the decimal and two are the same to the right of the decimal. There is a lot of information to examine for this relatively simple math word problem, making it challenging from an attentional perspective.

Simultaneous

Simultaneous is a neurocognitive ability used to integrate separate stimuli into a single whole or interrelated group (Naglieri et al., 2014a). The essence of Simultaneous processing is that separate elements must be combined into a conceptual whole. This ability is involved in visual-spatial tasks as well as those language activities that require comprehensive grammatical structures. The spatial aspect of Simultaneous ability involves the perception of stimuli as a group or whole and the formation of visual images. The grammatical dimension of Simultaneous processing allows for the integration of words into ideas through the comprehension of word relationships, prepositions, and inflections so the person can obtain meaning. Thus, Simultaneous processes involve nonverbal-spatial as well as verbal content. This ability is associated with the parietal-occipital-temporal brain regions.

The distinguishing characteristic of CAS2 *subtests* designed to measure Simultaneous processing is the requirement that information must be organized into a coherent whole. One example is the Matrices subtest on the CAS2 and the Simultaneous Matrices subtest on the CAS2: Brief. The Verbal-Spatial Relations subtest also measures Simultaneous processing, but it requires verbal comprehension of the grammatical components of language such as word relationships and understanding of prepositions and inflections (Naglieri, 1999). Although the Matrices and Verbal-Spatial Relations subtests differ in their content (nonverbal and verbal, respectively) they demand the same Simultaneous neurocognitive ability because both subtests require an understanding of the interrelationships of information. The information in the Matrices subtest is represented by the graphic representation of shapes on the page, and the information in Verbal-Spatial Relations subtest is presented in the written statement at the bottom of the page, in the oral reading of the statement by the examiner, and in the way images are arranged on the page. In both subtests the student has to understand these relationships to arrive at the correct response.

Classroom behaviors can provide insight into a student's Simultaneous processing ability. To measure this ability, the CAS2: Rating Scale items focus on topics such as if the student likes hands-on materials and visual-spatial tasks. Children who like to draw designs, especially three-dimensional ones, and those who are good at patterns and complex shapes are usually good in Simultaneous processing. But Simultaneous neurocognitive ability is also the foundation of understanding the reading of a whole word; understanding grammar, patterns in language, verbal concepts, reading comprehension; following a discussion; and getting the big-picture. Figure 1.6 provides an example of an item similar to those found in the CAS Verbal Spatial Relations subtest. In this item the child must decide which of the six options shows "the arrow pointing to the square in the circle." In order to solve this problem, the child must understand the relationships among each of the objects (in this case an arrow, circle, and square) to determine which option matches the written statement. This test demands simultaneous processing because the child must organize the three objects into a whole to solve the problem. The important thing to remember is that any task that demands that someone pull many parts of information together into an organized whole requires a lot of Simultaneous neurocognitive ability.

Successive

Successive is a neurocognitive ability used to work with information that is arranged in a specific serial order in which each part follows the other in a strictly defined order (Naglieri et al., 2014a). Successive processing is involved

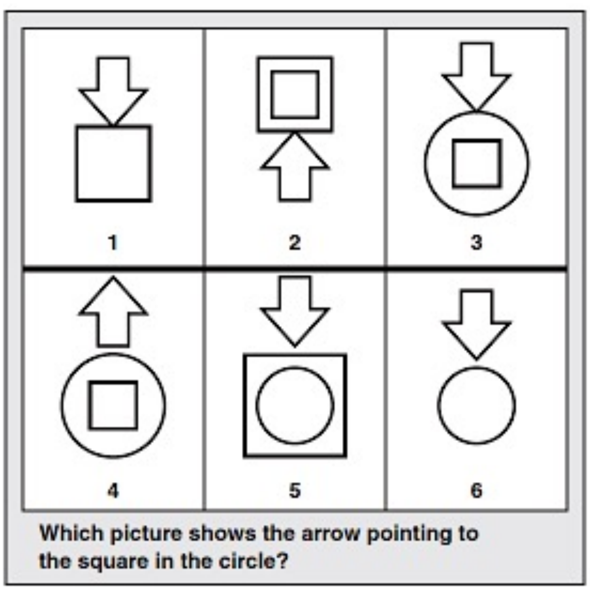

Figure 1.6 Example of a Simultaneous Processing Test

in the perception of stimuli in sequence as well as the formation of sounds and movements into a specific order. This type of ability is necessary for the recall of information in order as well as phonological analysis and the syntax of language (Das, Naglieri, & Kirby, 1994). Deficits with successive processing are also associated with early reading problems in young children, because it requires a child to learn sounds in a sequential order. This ability is associated with the temporal brain regions.

Successive processing is also involved in subtests like Digit Span Forward (as well as the recall of numbers, words, or movements), which is found on many tests of ability. These tests are sometimes described as measures of working memory or sequential processing (a concept very close to Successive processing in PASS theory). Sometimes a backward version is included that involves Successive as well as Planning processing abilities. The Successive tasks included in the CAS and CAS2 provide a way to measure this ability using tests that demand repeating a sentence using the correct series of words (Sentence Repetition) as well as comprehension of sentences that are understood only by appreciating the sequence of words (Sentence Questions; see Figure 1.7). Additionally, CAS2 has a Visual Digit Span test, allowing for measurement of successive processing across auditory and visual modalities. It is important to note that Successive neurocognitive tests all demand working with information in order, and they do involve remembering information, but it is the sequencing of information that is most critical to success on these subtests.

Classroom behaviors can inform us about a student's ability to work with information in order. For example, the examination of a successive series of events is also involved in reading, especially initial reading to decode unfamiliar words and spelling. Successive processing is critical when a student is presented with very confusable words and must focus carefully on the pronunciation of sounds in order. In addition, the child must learn the association of the sounds, in order, with the letters of the words, and this demands Successive processing.

Based on Sequence of Information

1. The blue is yellow. Who is yellow?
2. The red greened the blue with a yellow. Who used the yellow?

   The red blues a yellow green of pinks that are brown in the purple, and then grays the tan. What does the red do first?

Figure 1.7 Example of a Successive Processing Subtest That Demands Comprehension

STANDARDIZATION, RELIABILITY, AND VALIDITY

In this section we provide an overview of standardization of the CAS2 suite of tests, and their reliability, and brief summary of validity. For more information about these psychometric issues see each of the three manuals as well as sources such as Naglieri (2015) and Naglieri and Otero (2012, 2014).

Standardization

The CAS2 scales were standardized, and norming was based on a total sample of 4,142 children and adolescents ages 4 to 18 years. The CAS2 ($N = 1{,}342$), CAS2: Brief ($N = 1{,}417$), and CAS2: Rating Scale ($N = 1{,}383$) samples were chosen carefully to match closely the 2013 US Census data on the variables of age, gender, geographic region, and ethnicity. Procedures used for data collection and norming as well as a description with regard to geographic region, gender, race, ethnicity, family income, educational level of parents, and educational classification of the three samples are fully described in the respective manuals. Some important psychometric qualities are summarized in the sections that follow.

Reliability

The average reliability coefficients by age for the three CAS2 measures are summarized in Rapid Reference 1.8. The CAS2 subtest reliabilities range from .80 (Planned Connections) to .91 (Verbal-Spatial Relations) and overall illustrate that these subtests have good reliability. Importantly, when these subtests were combined into PASS scales, the reliability coefficients were very high, ranging from .84 (Attention) to .93 (Simultaneous) for the 8-subtest Core Battery and ranging from .90 (Attention) to .94 (Simultaneous) for the 12-subtest Extended Battery. The Full Scale reliabilities were .95 and .97 for the CAS2 Core and Extended Batteries, respectively. The PASS scale and Total Score reliability coefficients for the CAS2: Brief were high, ranging from .88 (Simultaneous Matrices) to .93 (Planning) with a .94 on the Total Score. The CAS2: Rating Scale reliability coefficients were also high, ranging from .93 (Simultaneous Matrices) to .96 (Attention) with a .98 on the Total Score. These reliability results were also similar across gender, race, ethnicity, and special education categories (see respective manuals and Rapid Reference 1.9).

Rapid Reference 1.8

Coefficient Alpha Reliabilities for the CAS2

Subtests/Scales	CAS2
Planned Codes	.88
Planned Connections	.80
Planned Number Matching	.82
Matrices	.88
Verbal-Spatial Relations	.91
Figure Memory	.85
Expressive Attention	.82
Number Detection	.80
Receptive Attention	.83
Word Series	.83
Sentence Repetition	.83
Sentence Questions	.85
Visual Digit Span	.86
Core Battery (8 Subtests)	
Planning	.90
Simultaneous	.93
Attention	.86
Successive	.89
Full Scale	.95
Extended Battery (12 Subtests)	
Planning	.92
Simultaneous	.94
Attention	.90
Successive	.92
Full Scale	.97
Supplemental Composites	
Executive Function Without Working Memory	.86
Executive Function With Working Memory	.91
Working Memory	.92
Verbal Content	.91
Nonverbal Content	.92

Rapid Reference 1.9

Coefficient Alpha Reliabilities for the CAS2: Brief and CAS2: Rating Scale

Scales	CAS2: Brief	CAS2: Rating Scale
Extended Battery (12 Subtests)		
Planning	.93	.95
Simultaneous	.88	.93
Attention	.89	.96
Successive	.86	.94
Total Score	.94	.98

Stability of scores is an important statistic, especially to determine if there are practice effects on the CAS2, CAS2: Brief, and CAS2: Rating Scale. Each of the manuals for these measures contains information about the similarities or differences between first and second test administrations. Table 1.3 shows CAS2 mean scores for the first and second administrations and the difference in standard score units (mean of 100 and standard deviation of 15). The differences between the mean scores are very small, illustrating that the CAS2 scores show little practice effects over time. The Extended Battery PASS score differences ranged from less than 1 (Planning) to 2.8 (Successive), and similar differences for the Core Battery. Practice effects for the CAS2: Brief and the CAS2: Rating Scale were also small, as shown in Table 1.4.

Validity

The validity of PASS constructs measured by the CAS2, CAS2: Brief, and CAS2: Rating Scale rests as much on the considerable amount of research already published (see Naglieri, 2012; Naglieri & Otero, 2011) as it does with the evidence for the second edition. In this section, previous research on CAS will be merged with the research conducted as part of the development of the three CAS2 tools for measuring PASS theory. More details about these topics will be summarized in the sections that follow. Interested readers may find other evidence of validity more fully presented in the respective CAS2 manuals. This discussion of validity will begin with the correspondence of the PASS theory to the subtests and behavioral items included across the three CAS2 measures designed to evaluate this neurocognitive conceptualization of ability.

Table 1.3 Practice Effects for the CAS2 PASS, Full Scale, and Supplemental Scale Standard Scores ($N = 144$)

	First	Second	Difference
Core Battery (8 Subtests)			
Planning	99.0	100.2	1.2
Simultaneous	98.5	99.7	1.2
Attention	100.6	100.8	0.2
Successive	97.8	102.5	4.7
Full Scale	98.5	100.8	2.3
Extended Battery (12 Subtests)			
Planning	99.2	100.1	0.9
Simultaneous	98.6	100.9	2.3
Attention	100.2	101.7	1.5
Successive	98.6	101.4	2.8
Full Scale/Total	99.0	101.2	2.2
Supplemental Scales			
Executive Function Without Working Memory	99.5	102.7	3.2
Executive Function With Working Memory	98.2	101.7	3.5
Working Memory	97.9	100.7	2.8
Verbal Content	98.1	101.7	3.6
Nonverbal Content	98.9	102.1	3.2

Note: CAS2 was administered to students ages 5 through 18 years over an average interval of 19 days. See CAS2 manual for more details.

Table 1.4 Practice Effects for the CAS2: Brief and CAS2: Rating Scale

Subtests/Scales	CAS2 Pre	Post	Difference
CAS2: Brief			
Planning	98.8	104.2	5.4
Simultaneous	102.4	102.7	0.3
Attention	101.9	108.1	6.2
Successive	98.9	100.9	2.0
Total Scale	100.2	105.5	5.3
CAS2: Rating Scale			
Planning	98.8	98.3	−0.5
Simultaneous	98.2	98.2	0.0
Attention	99.9	100.1	0.2
Successive	98.9	99.4	0.5
Total Scale	99.1	99.1	0.0

Note: CAS2: Brief $N = 168$ (interval was approximately 3 to 4 weeks). CAS2: Rating Scale $N = 136$ (mean interval was 21 days).

OPERATIONALIZATION OF PASS THEORY IN THE THREE CAS2 MEASURES

The construct validity of the CAS2, CAS2: Brief, and CAS2: Rating Scale is supported by the factor-analytic studies described in the respective manuals. Results of the confirmatory factor analyses across the three measures supported the operationalization of the PASS scales. Confirmatory factor analysis is appropriate because (1) previous research has been published showing that PASS scales were successfully operationalized with the first edition of the CAS, (2) PASS is a well-supported theory and the second edition provides an opportunity to further confirm if test and the theory are consistent, and (3) the three CAS2 measures can be examined as a group to test the construct validity of PASS across direct testing and teacher observations. The results of the confirmatory factor analyses of the three CAS2 measures yield a remarkably consistent picture. Three confirmatory factor analytic studies were conducted, one each for the CAS2, CAS2: Brief, and CAS2: Rating Scale. This gives the opportunity to determine if the four PASS scales are supported using analysis of subtest scores (CAS2), groups of items within each subtest (CAS2: Brief), and behavioral item–level analysis (CAS2: Rating Scale). For each measure a one-factor (no PASS scales); two-factor (Planning and Attention as one factor and Simultaneous and Successive as a second); three-factor (Planning and Attention as one factor, Simultaneous as a second, and Successive as the third); and four-factor PASS structure was tested. In every instance the best fit to the three different standardization samples was PASS (see respective manuals for more details).

These three independent factor analyses confirmed that the best fit to the data was the arrangement of subtests to PASS scales for the CAS2 as well as items to PASS scales (CAS2: Rating Scale and CAS2: Brief) was the four dimensional PASS theory. These findings support the interpretation of the four PASS scales and provide confidence in the use of the CAS2 suite of measures. What follows are important findings about the PASS constructs as measured by the CAS and the CAS2, CAS2: Brief, and the CAS2: Rating Scale. These research findings illustrate that PASS (1) is strongly related to academic achievement, (2) is the most appropriate measure of ability for diverse populations, and (3) effectively identifies disorders in basic psychological processes that underlie specific learning disabilities, ADHD, and autism.

PASS RELATIONSHIP TO ACHIEVEMENT

Intelligence tests can play critically important roles in explaining academic performance and predicting future achievement. Studying the relationship between IQ and achievement is complicated by the fact that IQ test questions measure very similar content to achievement tests (e.g., vocabulary, arithmetic word problems, etc.). The similarity in content gives IQ tests an advantage over those measures that do not include verbal and quantitative test items (see Naglieri & Bornstein, 2003). Despite that advantage, Naglieri (1999) reported that the correlations between achievement test scores with the CAS and K-ABC were as high or higher than those found for the WISC-III and WJ-R. The results for the CAS were later reported by Naglieri and Rojahn (2004), who examined the relationships between the Planning, Attention, Simultaneous, and Successive scores as operationalized by the CAS, and achievement as measured by the Woodcock-Johnson Tests of Achievement–Revised (WJ-R; Woodcock & Johnson, 1989), using a nationally representative sample of 1,559 students. The correlation between the CAS Full Scale with the WJ-R was .71 and Naglieri et al. (2014a) reported an average correlation between the CAS2 and achievement of .70.

Naglieri (2016a) summarized the strength of the correlation between the WISC-V and WIAT-III using data from the WISC-V manual (Wechsler, 2015, Table 5.13). In order to look at the relationship with and without the influence of those portions of the WISC-V that clearly require verbal knowledge two procedures were used. First, the average correlation among all five WISC-V scales with the WIAT-III total was computed. Second, the average of the WISC-V scales when the Verbal Comprehension Index was excluded was obtained. This enables understanding how correlated the Wechsler is when the most achievement-like scale (Verbal Comprehension, which includes questions that require knowledge—Similarities and Vocabulary) is excluded. The same approach was taken with data from the WJ-IV test of cognitive abilities (McGrew, LaForte & Shrank, 2014, Table 5.7) and the K-ABC-II (Kaufman & Kaufman, 2004). The findings are provided in Table 1.5.

What is most revealing about the results in Table 1.5 is the clear pattern across the WISC-V, WJ-IV, and the KABC-II. The correlation between each of these tests and achievement was higher when the scales that demand verbal knowledge were included. The best explanation for why, for example, the Verbal Comprehension scale and the WIAT-III were so highly correlated is the similarity in content across the two tests. Some (e.g., Lohman & Hagen, 2001) argue that this is evidence of validity; we suggest, however, that correlations of achievement test scores with ability tests that demand knowledge of words and arithmetic are artificially inflated because of the shared content. The correlations between the scales that do not require knowledge are a more accurate estimate of the relationship between ability and achievement. In this summary, what is found is that the correlations of ability tests with achievement when controlling for overlap in content ranged

Table 1.5 Average Correlations Between Ability Tests and Achievement Including and Excluding Scales That Require Knowledge

	Correlations		Average Correlations	
			All Scales	Scales Without Achievement
WISC-V	Verbal Comprehension	.74		
WIAT-III	Visual Spatial	.46		
$N = 201$	Fluid Reasoning	.40		
	Working Memory	.63		
	Processing Speed	.34	.53	.47
WJ-IV COG	Comprehension Knowledge	.50		
WJ-IV ACH	Fluid Reasoning	.71		
$N = 825$	Auditory Processing	.52		
	Short-Term Working Memory	.55		
	Cognitive Processing Speed	.55		
	Long-Term Retrieval	.43		
	Visual Processing	.45	.54	.50
KABC-II	Sequential/Gsm	.43		
WJ-III ACH	Simultaneous/Gv	.41		
$N = 167$	Learning/Glr	.50		
	Planning/Gf	.59		.48
	Knowledge/GC	.70	.53	
CAS	Planning	.57		
WJ-III ACH	Simultaneous	.67		
$N = 1{,}600$	Attention	.50		
	Successive	.60	.59	.59

Note: WJ-IV Scales Comprehension-Knowledge = Vocabulary and General Information; Fluid Reasoning = Number Series and Concept Formation; Auditory Processing = Phonological processing.

from .47 to .50. When including the knowledge-based scales the correlations were higher, ranging from .53 to .54. Most important, the correlation for the CAS, which does not include these achievement-laden subtests, was .59, higher than all the others.

These findings, as well as others (Naglieri & Bornstein, 2003; Naglieri & Rojahn, 2004; Naglieri, Goldstein, DeLauder, & Schwebach, 2006), of the PASS theory as measured by the CAS and CAS2 illustrate that this neurocognitive approach to understanding intelligence is strongly correlated with achievement test scores. Interestingly, these studies show that cognitive processes are as effective for prediction of academic performance as traditional IQ tests even though the CAS and CAS2 do not include academically laden measures such as vocabulary and arithmetic. This provides an advantage for understanding achievement strengths and weaknesses for children who come from disadvantaged environments as well as those who have had a history of academic failure.

RACE AND ETHNIC DIFFERENCES

The need for tests of ability to be appropriate for diverse populations has become progressively more important as the characteristics of the US population have changed. Recent federal law (e.g., IDEA 2004) stipulates that assessments must be selected and administered so as to be nondiscriminatory on a racial or cultural basis. It is, therefore, critical that any measures used for evaluation of ability be evaluated for test bias. The psychometric analysis should include internal evidence such as reliability, item difficulty, factor structure, as well as mean score differences; but the theoretical perspective taken by the test authors plays a critical role in making a test more or less appropriate for diverse populations.

Some researchers have suggested that conceptualizing intelligence on the basis of neuropsychological abilities would make tests more appropriate for diverse populations (Fagan, 2000; Naglieri, 2005). Fagan (2000) and Suzuki and Valencia (1997) argued that measures of cognitive processes that do not rely on tests with language and quantitative content are more appropriate for assessment of culturally and linguistically diverse populations. Although there is considerable evidence for the validity of general intelligence as measured by traditional IQ tests (see Jensen, 1980), researchers have traditionally found a mean difference of about 12 to 15 points between African Americans and Whites on measures of IQ that include verbal, quantitative, and nonverbal tests (Kaufman & Lichtenberger, 2006). Results for newer intelligence tests have been different.

The first evidence of smaller race differences for a different kind of ability test was reported in the original K-ABC manual. For children ages 2.5 to 12.5, without controlling for background variables, Whites ($N = 1{,}569$) scored 7 points higher than African Americans ($N = 807$) and 3 points higher than Hispanics ($N = 160$) on the global measure of mental processing (i.e., the total test score). These differences are considerably smaller than the differences of 16 points and 11 points, respectively, reported for the WISC-R Full Scale IQ (Kaufman & Kaufman, 1983, Tables 4.36 and 4.37; Kaufman, Lichtenberger, Fletcher-Janzen, & Kaufman, 2005, Table 6.7). Similar findings were reported by Naglieri (1986) in a study of 172 fifth-grade students (86 Whites and 86 African Americans matched on basic demographic variables) who were administered the K-ABC and the WISC-R. The difference between the groups on WISC-R Full Scale was 9.1, but the difference for the K-ABC was 6.0. Results for the KABC-II

(Kaufman & Kaufman, 2004) showed a similar reduction in race or ethnic differences. When controlling for gender and mother's education, African American children ages 3 to 18 years earned mean MPIs that were only 5 points lower than the means for White children (Kaufman & Kaufman, 2004, Tables 8.7 and 8.8; Kaufman et al., 2005, Table 6.7). Similar findings have been reported for the CAS.

Naglieri et al. (2005) compared PASS scores on the CAS for 298 African American children and 1,691 White children. Controlling for key demographic variables using regression analyses, they found a CAS Full Scale mean score difference of 4.8 points in favor of White children. Similarly, Naglieri, Rojahn, et al. (2007) studied the use of the PASS scores as measured by the CAS with Hispanic children by comparing Hispanic and White children. The study showed that the two groups differed by 6.1 points using unmatched samples, 5.1 with samples matched on basic demographic variables, and 4.8 points when demographics differences were statistically controlled. Researchers have also examined children with limited English language skills.

Naglieri, Otero, et al. (2007) compared scores obtained on the CAS when administered in English and Spanish to bilingual children ($N = 40$) referred for reading difficulties. They found a 3.0 point difference between the CAS Full Scale scores, and these scores were highly correlated (.96). Otero, Gonzalez, and Naglieri (2012) replicated that study with another group of students referred for reading problems and found CAS Full Scale scores that differed by less than 1 point and had a high correlation between the scores (.94). Results for the CAS2 Full Scale scores were reported in the test manual (Naglieri et al., 2014a). For children and adolescents ages 5 to 18 years without controlling for demographic variables, African Americans and non–African Americans differed by 6.3 standard scores, and with controls for demographic characteristics, the difference was 4.5. Similarly, without controlling for demographic differences, Hispanics and non-Hispanics differed on the CAS Full Scale scores by 4.5 points, and with controls for demographic characteristics, the difference was 1.8. Similar findings are reported for the CAS2: Brief (Naglieri, et al., 2014b).

These findings for race differences are best understood within the context of differences found on traditional intelligence tests. Table 1.6 provides a summary of standard score differences by race for the Stanford-Binet-IV (SB-IV; Roid, 2003); Woodcock-Johnson Tests of Cognitive Abilities, Third Edition (WJ-III; Woodcock, McGrew, & Mather, 2001); the WISC-IV (Wechsler, 2003); K-ABC and KABC-II (Kaufman & Kaufman, 1983, 2004); and the CAS (Naglieri & Das, 1997) and CAS2 (Naglieri et al., 2014a). The results for the WISC-IV are reported by O'Donnell (2009), for the SB-IV by Wasserman and Becker (2000),

Table 1.6 Standard Score Mean Differences by Race on Traditional and Nontraditional Intelligence Tests

Test	Difference
Traditional IQ Tests	
SB-IV (matched samples)	12.6
WISC-IV (normative sample)	11.5
WJ-III (normative sample)	10.9
WISC-IV (matched samples)	10.0
Nontraditional Tests	
K-ABC (normative sample)	7.0
K-ABC (matched samples)	6.1
KABC-II (matched samples)	5.0
CAS2 (normative sample)	6.3
CAS (demographic controls of normative sample)	4.8
CAS2 (demographic controls of normative sample)	4.3

Note: The data for these results are reported for the Stanford-Binet IV from Wasserman (2000); Woodcock-Johnson III from Edwards and Oakland (2006); Kaufman Assessment Battery for Children from Naglieri (1986); Kaufman Assessment Battery for Children II from Lichenberger, Sotelo-Dynega, and Kaufman (2009); CAS from Naglieri, Rojahn, Matto, and Aquilino (2005); CAS2 from Naglieri, Das, and Goldstein (2014a); and Wechsler Intelligence Scale for Children IV (WISC-IV) from O'Donnell (2009).

and the WJ-III results are from Edwards and Oakland (2006). The race differences for the K-ABC normative sample was reported in that test's manual (Kaufman & Kaufman, 1983) and the findings for the KABC-II were summarized by Lichtenberger, Sotelo-Dynega, and Kaufman (2009). Differences for the CAS were reported by Naglieri et al. (2005) and in the test manual for the CAS2 by Naglieri et al. (2014a).The results of this analysis of race differences illustrate that measuring ability as a cognitive process, in contrast to traditional concepts of IQ, provides a more equitable way to assess diverse populations of children. The findings suggest that as a group, traditional IQ tests showed differences in ability scores between the races that are about twice as large as that found for cognitive processing tests such as the CAS, CAS2, and K-ABC. All of the traditional tests included in Table 1.6 have verbal, quantitative, and nonverbal content, and two of these three types of questions demand knowledge that is very similar to that required by standardized achievement tests (see Naglieri & Bornstein, 2003). It is clear that conceptualizing and measuring ability using a cognitive processing approach results in smaller race differences without a loss of prediction to achievement or in the case of the CAS sensitivity to learning problems, both of which are critical components of validity.

DETECTING LEARNING PROBLEMS

All intelligence tests give a Full Scale score that is composed of scales that in turn are composed of subtests. The analysis of subtest and scale variation on ability tests is a method called *profile analysis,* which has been advocated by Kaufman (1994) and others (e.g., Sattler, 1988) to identify strengths and weaknesses that may underlie a learning disability. Information about strengths and weaknesses has been used to generate hypotheses that are integrated with other information so that decisions can be made regarding eligibility, diagnosis, and treatment. Despite the widespread use of this method, some have argued that subtest profile analysis does not provide useful information beyond that which is obtained from the IQ scores (e.g., Dombrowski & Watkins, 2013; McDermott, Fantuzzo, & Glutting, 1990). Naglieri (1999) proposed that subtest analysis is problematic because of limitations in subtest reliability and validity and suggested that profile analysis of scales could be more effective. Theoretically derived scales could be helpful if the ability test shows a specific pattern for a specific group of exceptional students, which in turn could have implications for understanding the cognitive characteristics of the group, allow for guidance during the eligibility process (see Naglieri, 2011a, 2012) and guide interventions (Naglieri & Pickering, 2010).

Naglieri (2011a) summarized research about students with reading decoding failure and ADHD reported in the technical manual for the Wechsler Intelligence Scale for Children, Fourth Edition (WISC-IV; Wechsler, 2003) technical manual; for the Woodcock-Johnson III Tests of Cognitive Abilities (WJ-III; Woodcock et al., 2001) from Wendling, Mather, and Shrank (2009), and CAS data from the technical manual and Naglieri, Otero, et al. (2007). For students with autism spectrum disorders (ASD) data were obtained for the WISC-IV (Wechsler, 2003), CAS (from Goldstein & Naglieri, 2011), WJ-III (from Wendling et al., 2009), and the K-ABC II (technical manual). The findings should be considered with recognition that the samples were not matched on demographic variables across the various studies, the accuracy of the diagnosis may not have been verified, and some of the sample sizes were small. Notwithstanding these limitations, the findings provide important insights into the extent to which these various tests are likely to yield scale-level profiles that are distinctive, theoretically logical, and ultimately relevant to instruction.

The results of the summary of scale profiles for the measures provided in Figure 1.8 suggest that some of these tests yield profiles that are more distinct than others across the three groups of exceptional children. The scores across all scales on the WJ-III for students with specific reading decoding difficulties were all within the average range, and all of the KABC-II scores were in the 80s. The

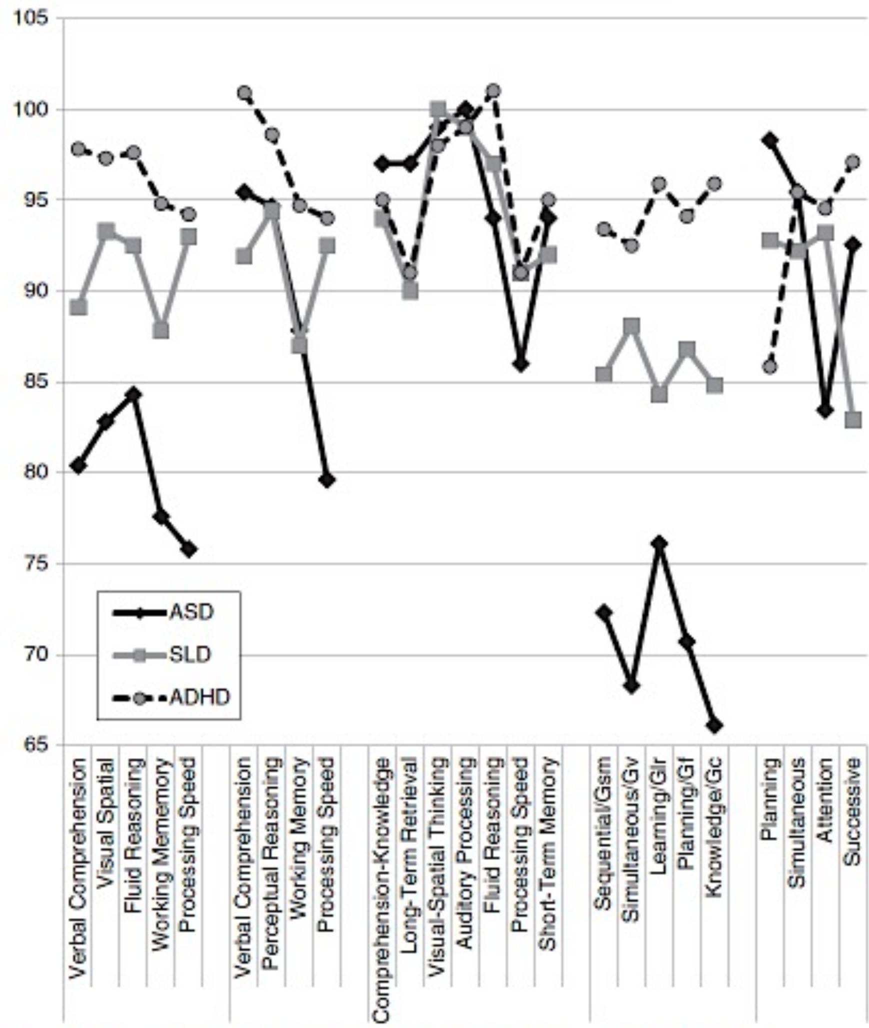

Figure 1.8 Scale Profiles Across Ability Tests for Special Populations

Note: Gc = Comprehension-Knowledge; Glr = Long-Term Retrieval; Gv = Visual-Spatial Thinking; Ga = Auditory Processing; Gf = Fluid Reasoning; Gs = Processing Speed; Gsm = Short-Term Memory; GIA = General Intellectual Ability.

WISC-IV profile was lowest for the Working Memory scale. The CAS profile showed variability across the four PASS scales with a very low score of 82.9 on the Successive scale. These findings are consistent with the view that students with specific reading decoding failure also have considerable difficulty with tasks that involve sequencing of information (Das, Janzen, & Georgiou, 2007).

The test profiles for students with ADHD showed that all scores for the scales on the WISC-IV, WJ-III, and KABC-II were within the average range. None of these tests provided evidence of a cognitive problem related to ADHD, except for a low score on the Planning scale of the CAS. Difficulty with Planning (e.g., executive function) for children with ADHD is consistent with Barkley's view that ADHD is a failure of self-control (Barkley, 1997), which has been described as frontal lobe functioning (Goldberg, 2009). Finally, the results for individuals with ASD show that processing speed on scores for the WISC-IV and the WJ-III were very low. This is similar to the findings for these two tests for individuals with ADHD. The low processing speed scores provide little insight into the cognitive characteristics of students with ASD and ADHD. Importantly, the low Attention score on the CAS is consistent with the conceptualization that individuals with ASD have "difficulties in disengaging and shifting attention" (Klinger, O'Kelley, & Mussey, 2009, p. 214). The findings for those with ASD, similar to the results for those with SLD and ADHD, show that the PASS scores indicated distinctive profiles for students with different diagnoses.

This summary of research on PASS as measured by the CAS, CAS2, CAS2: Brief, and CAS2: Rating Scale provides a brief examination of the information about the utility of this approach. Such a summary is, by definition, limited in details, and therefore interested readers should consult the CAS2 manuals as well as ongoing research on PASS theory. Additional information may also be obtained from one of the authors' website: www.jacknaglieri.com.

PASS AND ACADEMIC INTERVENTIONS

One of the most important goals for the assessment of PASS neurocognitive abilities is to help decide how a student learns best, what obstacles to learning exist, and how this information informs instruction. Knowing the PASS profile of an individual student can help determine instruction. Once we know how the student thinks and learns, then coordinating the information about the PASS profile from the CAS2 with the cognitive processing demands of the instruction (see the Chapter 5, "Intervention") will provide ways to maximize learning. The relationship between PASS neurocognitive processes and academic instruction has been examined in a series of research studies that will be briefly described.

There are several resources for applying the PASS theory to academic instruction and remediation. The PASS Remedial Program (PREP; Das, 1999) and COGENT (Das, 2004) are instructional methods that have been studied by Das and his colleagues. Naglieri and colleagues have studied a method known as the *planning facilitation* (see Naglieri & Pickering, 2010). This method draws heavily on cognitively based instructional methods described, for example, in Kirby and Williams (1991), *Learning Problems: A Cognitive Approach*; Pressley and Woloshyn (1995), *Cognitive Strategy Instruction That Really Improves Children's Academic Performance* (2nd ed.); Scheid (1993), *Helping Students Become Strategic Learners*; and Naglieri and Pickering (2010), *Helping Children Learn: Intervention Handouts for Use in School and Home* (2nd ed.). These two areas of research will be summarized in the next section.

PLANNING FACILITATION

The connection between planning and intervention has been examined in several studies involving math and reading. These intervention studies focused on the concept that children can be encouraged to be more strategic (use good Planning) when they complete academic tasks and that the facilitation of plans positively affects academic performance. The initial concept for planning facilitation was based on the work of Cormier, Carlson, and Das (1990) and Kar, Dash, Das, and Carlson (1992). These authors taught children to discover the value of strategy use without being specifically instructed to do so. The children were encouraged to examine the demands of the task in a strategic and organized manner. They demonstrated that students differentially benefited from the technique that encouraged the use of strategies. That is, students who performed poorly on Planning as measured by the CAS2 demonstrated significantly greater gains than those with higher planning scores or those with low scores on the Attention, Simultaneous, or Successive scales. These results indicated that a relationship between PASS and instruction was found.

Naglieri and Gottling (1995, 1997) demonstrated that planning facilitation could improve children's performance in math calculation. All children in these studies attended a special school for those with learning disabilities. In the investigations students completed mathematics work sheets in sessions over about a 2-month period. The method designed to indirectly teach planning was applied in individual one-on-one tutoring sessions (Naglieri & Gottling, 1995) or in the classroom by the teacher (Naglieri & Gottling, 1997) about two to three times per week in half-hour blocks of time. In the intervention phase, the students were given a 10-minute period for completing a mathematics page, a 10-minute period was used for facilitating planning, and another 10-minute period was devoted to mathematics. All students were exposed to the intervention sessions that involved the three 10-minute segments of mathematics-discussion-mathematics in 30-minute instructional periods. Students were encouraged to recognize the need to plan to use strategies when completing mathematic problems during the intervention periods. The teachers provided probes that facilitated discussion and encouraged the children to consider various ways to be more successful. A student's response often became the beginning point for discussion and further development of the strategy. More details about the method are provided by Naglieri and Gottling (1995, 1997) and by Naglieri and Pickering (2010).

Naglieri and Johnson (2000) further studied the relationship between planning facilitation and PASS profiles for a class of children with learning disabilities and mild mental impairments. The purpose of their study was to determine if children with cognitive weaknesses in each of the four PASS processes showed different rates of improvement when given the same group planning facilitation instruction. Students with a cognitive weakness (an individual PASS score significantly lower than the child's mean and below 85) in Planning, Attention, Simultaneous, and Successive scales were used to form contrast groups after all the classroom work was completed. A no-cognitive-weakness group was also identified. Naglieri and Johnson (2000) found that children with a cognitive weakness in Planning improved considerably over baseline rates, and those with no cognitive weakness improved only marginally. Similarly, children with cognitive weaknesses in Simultaneous, Successive, and Attention showed substantially lower rates of improvement. The importance of this study was that the five groups of children responded very differently to the same intervention. Thus, PASS processing scores were predictive of the children's response to this math intervention.

The effects facilitating planning had on reading comprehension were reported by Haddad, Garcia, Naglieri, Grimditch, McAndrews, and Eubanks (2003). Their study examined whether an instruction designed to facilitate Planning would have differential benefits on reading comprehension, and if improvement was related to the PASS processing scores of each child. The researchers used a sample of general education children sorted into groups based their PASS scale profiles. Even though the groups did not differ by CAS Full Scale scores or pretest reading comprehension scores, children with a Planning weakness benefited substantially (effect size of 1.4) from the instruction designed to encourage the use of strategies and plans. By contrast, children with no PASS weakness or a Successive weakness did not benefit as much (effect sizes of .52 and .06, respectively). These results further support previous research suggesting that the PASS profiles are relevant to instruction.

Iseman and Naglieri (2011) examined the effectiveness of the strategy instruction for 10- to 15-year-old students with LD and ADHD randomly assigned to an experimental group or a control group that received standard math instruction. They found large pre-post effect sizes for students in the experimental group (0.85) but not the control group (0.26) on classroom math worksheets as well as standardized test score differences in math fluency (1.17 and .09, respectively) and numerical operations (.40 and −.14, respectively). One year later, the experimental group continued to outperform the control group. These findings strongly suggested that students with LD and ADHD in the experimental group evidenced greater improvement in math work sheets, transfer to standardized tests of math, and at follow-up 1 year later than the control group. The findings also illustrate the effectiveness of strategy instruction, especially for those with low Planning scores on the CAS.

The results of these Planning strategy instruction studies using academic tasks suggest that changing the way aptitude is conceptualized (e.g., as the PASS rather than traditional IQ) and measured (using the CAS2) increases the probability that an aptitude-by-treatment interaction (ATI) is detected. Past ATI research suffered from conceptualizations of aptitudes based on the general intelligence model, which did not adequately assess basic psychological processes that are related to instruction. The traditional IQ approach is very different from the PASS theory as measured by the CAS2. The summaries of studies provided here are especially different from previous ATI research that found students with low general ability improve little, whereas those with high general ability respond more to instruction. By contrast, children with a weakness in one of the PASS processes (Planning) benefited more from instruction compared to children who had no weakness or a weakness in a different PASS process. The results of these studies also suggest that the PASS profiles can help identify which academic instruction will most likely be successful. The application of these results is further elaborated in Chapter 5 in this book and by Naglieri and Pickering (2010).

PREP AND COGENT

PASS Reading Enhancement Program (PREP), and Cognition Enhancement Training (COGENT) (Das, 2009) was developed as a cognitively grounded remedial program based on the PASS theory of cognitive functioning (Das et al., 1994). It aims at improving the processing strategies—specifically, Simultaneous and Successive processing—that underlie reading, while at the same time avoiding the direct teaching of word-reading skills such as phoneme segmentation or blending. PREP is also founded on the premise that the transfer of principles is best facilitated through inductive, rather than deductive, inference (see Das, 2009, for details). The program is, therefore, structured so that indirectly acquired strategies are likely to be used in appropriate ways.

PREP is appropriate for poor readers in grades 2 through 5 who are experiencing reading problems. Each of the 10 tasks in PREP involves a cognitive processing–focused emphasis component and a curriculum-related component. The cognitive-processing components, which require the application of Simultaneous or Successive strategies, include structured nonreading tasks. These tasks also facilitate transfer by providing the opportunity for children to develop and internalize strategies in their own way (Das, Mishra, & Pool, 1995). The curriculum-related components involve the same cognitive demands as their matched cognitive-processing components (e.g., Simultaneous and Successive processing). These cognitive processes have been closely linked to reading and spelling (Das et al., 1994). Several studies attest to the efficacy of PREP for enhancement of reading and comprehension (Boden & Kirby, 1995; Carlson & Das, 1997; Das et al., 1995; Parrila, Das, Kendrick, Papadopoulos, & Kirby 1999).

The utility of PASS Reading Enhancement Program (PREP) was examined (Das, Hayward, Georgiou, Janzen, & Boora, 2008) on Canadian First Nations children. Effectiveness of two reading intervention programs (phonics-based and PREP) was investigated in Study 1 with 63 First Nations children identified as poor readers in grades 3 and 4. In Study 2, the efficacy of additional sessions for inductive learning was compared to PREP. Results of Study 1 showed a significant improvement for word reading and pseudo-word decoding reading tasks following PREP. The phonics-based program resulted in similar improvement in only one of the reading tasks, word decoding. In Study 2, the important dependent variables were word reading and word decoding as well as passage comprehension. Results showed that PREP participants evidenced continued improvements in their reading decoding and comprehension. The next study on PREP (Mahapatra, Das, Stack-Cutler, & Parrila, 2010) involved two groups of children selected from two English schools in India. One group consisted of 15 poor readers in grade 4 who experienced difficulty in comprehension and a comparison group of 15 normal readers in grade 4 who did not receive PREP. Performance on word reading and reading comprehension scores (Woodcock's Reading Mastery Test) and performance on tests of PASS cognitive processes were recorded pre- and posttest. Results showed a significant improvement in comprehension as well as in Simultaneous processing scores in the PREP group, suggesting that this approach is effective even in children whose first language is not English. This has obvious application possibilities for all children who learn English as a second language.

COGENT is a program designed to improve the cognitive development of children ages 4 to 7 or those who are beginning readers. The COGENT program is designed for the enhancement of cognition especially linked to literacy and school learning. The main objective is to supplement children's literacy skills, and the program should benefit cognitive development of normal children as well as children with special needs. COGENT consists of five distinct modules, each designed to activate different aspects of cognitive processes, language, and literacy. The tasks are also designed to enhance phonological awareness and working memory and spatial relationships expressed in statements provided by the facilitator. Further elaboration of the COGENT program is provided by Das (2009) and in a study by Hayward, Das, and Janzen (2007). This study is important because they studied the effects of PREP and COGENT on Canadian First Nations children who often have reading problems. Forty-five grade 3 students from a reservation school in Western Canada were divided into remedial groups and no-risk control groups. One remedial group was given the cognitive enhancement program (COGENT) throughout the school year. The second group received COGENT for the first half of the year followed by a pull-out cognitive-based reading enhancement program (PREP). Results showed significant improvements word reading and comprehension for those exposed to COGENT.

TEST YOURSELF

1. What is the key difference between the CAS2 and traditional IQ?

a. The CAS2 is based on Army mental testing methods.
b. The CAS2 is designed to be used for intervention planning.
c. The CAS2 is based on a specific neurocognitive theory.
d. The CAS2 does not include verbal and quantitative tests.
e. All choices are true except (a).

2. Which ability test yields the smallest group differences and is the best to use for nondiscriminatory assessment?

a. WISC-V
b. WJ-IV
c. KABC-II
d. CAS2

3. The CAS2 includes all of the following scales except which choice?

a. PASS
b. Full Scale
c. Executive Function
d. Fluid Reasoning
e. Working Memory

4. Which ability test yields distinct scale profiles for students with specific learning disabilities?

a. WISC-V
b. WJ-IV

   c. CAS2
   d. KABC-II

5. **Which ability test correlates the highest with academic achievement test scores?**
   a. WISC-V
   b. CAS2
   c. WJ-IV
   d. KABC-II

Answers: 1. e; 2. d; 3. d; 4. c; 5. b