Twelve

PATTERN OF STRENGTHS AND WEAKNESSES MADE EASY

The Discrepancy/Consistency Method

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INTRODUCTION

There are many reasons why students experience academic failure (e.g., poor instruction, lack of motivation, visual problems, lack of exposure to books and reading, teaching methods that are not best for a student's particular style of learning, overall limited intellectual ability, a specific intellectual ability deficit, etc.). In this chapter, we focus on those students who have a disorder in one or more of the basic psychological processes that underlie academic success and failure, that is, a student with scores from a reliable and well-validated multidimensional test of basic psychological processes that shows strengths and weaknesses. This pattern of strengths and weaknesses (PSW) provides evidence of a disorder in basic psychological processes and supports eligibility for special education when the specific weakness in basic psychological process corresponds to a specific weakness in achievement test scores. These students can be identified only via a comprehensive assessment that uncovers the processing deficit(s) and associated academic failure, despite adequate instruction and a consideration of other exclusionary factors. This type of student would meet the criteria for a specific learning disability (SLD) as defined by the 2004 reauthorization of the

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Individuals with Disabilities Education Improvement Act (2004; referred to as IDEA 2004; see Hale, Naglieri, Kaufman, & Kavale, 2004).

This chapter is about students who have a PSW in one or more of the basic psychological processes and academic weakness(s) that are associated with that processing failure. The academic difficulties these students struggle with may have been exacerbated by poor instruction, but inadequate teaching did not cause the difficulties. These students would likely benefit from frequent progress monitoring, but ongoing progress monitoring is not enough to ensure academic success. In order to understand the reasons for academic failure, these students need to be evaluated carefully by a qualified school psychologist or other assessment expert who can identify an SLD on the basis of a disorder in one or more of the basic psychological processes and corresponding academic failure.

Students with cognitive and academic processing deficits require instruction that is tailored to their unique learning needs. In order to identify and teach these students properly, an evaluation of basic psychological processes and their relationship to academic failure must be conducted. This procedure requires that reliable, valid, and theoretically sound measures of basic psychological processes are used and that the scores, compared to measures of academic skills, are aligned with the conceptualization of processing. This method is based on finding discrepancies between good and poor measures of basic psychological processes, discrepancies between good and poor academic achievement scores, and consistency between poor processing and poor academic achievement test scores. We present a straightforward method to conduct such an evaluation, which was originally described by Naglieri (1999), and is called the discrepancy/consistency method (DCM).

In this chapter, we present the DCM to relate information about a student's basic psychological processes with academic achievement for the purpose of SLD eligibility determination. The goal is to clarify exactly how identification of students with an SLD can be accomplished with recognition of the requirements stipulated by IDEA 2004 and federal regulations (for more information see Hale, Kaufman, Naglieri, & Kavale, 2006; Kavale, Kaufman, Naglieri, & Hale, 2005). In the remainder of this chapter, we address the question of how to measure basic psychological processes and how measuring them meets federal law. We use the DCM (presented with a case study) to show clearly how the basic measurement of psychological processing and achievement test scores can be analyzed. This analysis is followed by a discussion of the extent to which the approach we recommend is consistent with validity and fairness requirements presented in IDEA 2004. See Rapid Reference 12.1.

Rapid Reference 12.1

A SLD is suggested when there is a (1) discrepancy among processing scores, (2) discrepancy among achievement scores, or (3) consistency between low processing and low achievement scores (assuming that the low scores are substantially below average).

PROCESSING AND SLD DETERMINATION

IDEA (2004) describes several important components of a comprehensive evaluation that that have relevance for SLD eligibility determination. First, a variety of assessment tools and strategies must be used to gather relevant information about the student. Second, the use of any single measure or assessment as the sole criterion for determining whether a student has a SLD is not permitted. Third, practitioners must use technically sound instruments to assess the relative contribution of cognitive and behavioral factors. Fourth, assessments must be selected and administered in a way that does not discriminate on the basis of race or culture, and these tests are administered in a form most likely to yield accurate information. Fifth, the measures used are reliable and valid for the purposes for which they were intended.

The federal regulations (2006) clarified that states are not allowed to prohibit the use of a severe discrepancy between ability and achievement for SLD determination, and use of the traditional ability-achievement discrepancy was only discouraged. The following two points were also clarified: Screening to determine appropriate instructional strategies for curriculum implementation shall not be considered an evaluation for special education eligibility. RTI may be used as a part of the SLD eligibility process, but "determining why a child has not responded to research-based interventions requires a comprehensive evaluation" (p. 46647) and "RTI does not replace the need for a comprehensive evaluation" (p. 46648). What RTI does provide is greater assurance that (1) adequate learning experiences have been provided before initiating a comprehensive evaluation and (2) the child's failure to respond is not the result of inadequate instruction. These regulations also further clarify that the assessments used in the comprehensive evaluation "include those tailored to assess specific areas of educational need and not merely those that are designed to provide a single general intelligence quotient" (p. 43785). Despite these changes in the methodology for identifying SLD, the definition of this disorder was not changed. Section 602 of IDEA 2004 defines an SLD as shown in Rapid Reference 12.2.

Rapid Reference 12.2

A. In general—The term *specific learning disability* refers to a disorder in one or more of the basic psychological processes involved in understanding or in using spoken or written language. The disorder may manifest itself in the imperfect ability to listen, think, speak, read, write, spell, or perform mathematical calculations.

B. Disorders included—Perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia.

C. Disorders not included—A learning problem that is primarily the result of visual, hearing, or motor disabilities, of mental retardation, of emotional disturbance, or of environmental, cultural, or economic disadvantage.

DON'T FORGET

A "disorder in one or more of the basic psychological processes" should meet two criteria: (1) the processing score is relatively lower than the student's average and (2) the processing score is low in relation to the national norm.

The definition of SLD and the method used to identify students with this disorder should be consistent (Hale et al., 2004, 2006; Kavale et al., 2005). Because IDEA (2004) clearly specifies that students must have a disorder in one or more of the basic psychological processes, which is the underlying cause of an SLD, cognitive processes must be measured. A comprehensive evaluation of the basic psychological processes unites the statutory and regulatory components of IDEA 2004 and ensures that the methods used for identification more closely reflect the definition. Any defensible eligibility system would demand continuity between the statutory and regulatory definitions, and for this reason alone SLD determination requires the documentation of a basic psychological processing disorder. Moreover, the tools used for this assessment must meet the technical criteria included in IDEA 2004.

Given all these guidelines, it is reasonable to ask, "Exactly how can we conduct an evaluation of a student suspected of having an SLD?" The DCM was designed to answer this question. This is a conceptual approach that could be operationalized with any well-developed measures of basic psychological processes and academic achievement. The critical element of this approach is a reliable and valid measure of basic psychological processes. Practitioners should choose wisely when selecting published tests to use for this purpose (this chapter includes a summary of research on the critical issues to guide that decision). Keep in mind that the tools we select have a profound impact on what we learn about a student, how much we can assist, and how well our decisions can withstand scrutiny in a due process hearing. We now provide a more detailed description of the DCM with examples of how it works.

DCM

Naglieri (1999) first described the DCM for the identification of SLD. The method is based on a systematic examination of cognitive and academic achievement test scores. Determining if the processing scores show a PSW is accomplished by using a modified version of the method originally proposed by Davis (1959), popularized by Kaufman (1979), and Silverstein (1993). This so-called ipsative method determines when the student's scores are reliably different from the average score.

It is important to note that the ipsative approach, which is used in the DCM, is based on an analysis of theoretically defined measures of basic psychological processes that correspond to brain function (see Naglieri & Otero, 2011, 2017). We also recommend that analysis of differences among basic psychological processing scores be based on (1) a theoretically derived test of neurocognitive processing; (2) scales that represent the theory, not subtest scores; and (3) assessment of the academic skills that correspond to the measure of neurocognitive processes. Stated more exactly, we strongly recommend using scores from scales that reflect a specific neurocognitive theory for determining if there is a disorder in one or more of the basic psychological processes and scores that measure specific aspects of academic performance. We also advocate a two-dimensional analysis of processing scores: low scores in relation to the student's average processing score and low scores in relation to the national average.

> **DON'T FORGET**
>
> SLD is defined by IDEA (2004) as a "disorder in one or more of the basic psychological processes," so these must be measured for a diagnosis to be rendered.

Naglieri (1999) first suggested that a low score in basic psychological processes could provide evidence of a specific disorder in processing only if the score is also below the average range relative to students of the same age. Additionally, the student must have deficient academic performance. The student with a weakness in basic psychological processing is very likely to have significantly lower achievement scores and may be identified as exceptional (Naglieri, 2000). This approach is illustrated in Figure 12.1, which shows that SLD can be detected when there is a significant discrepancy between the student's high cognitive processing

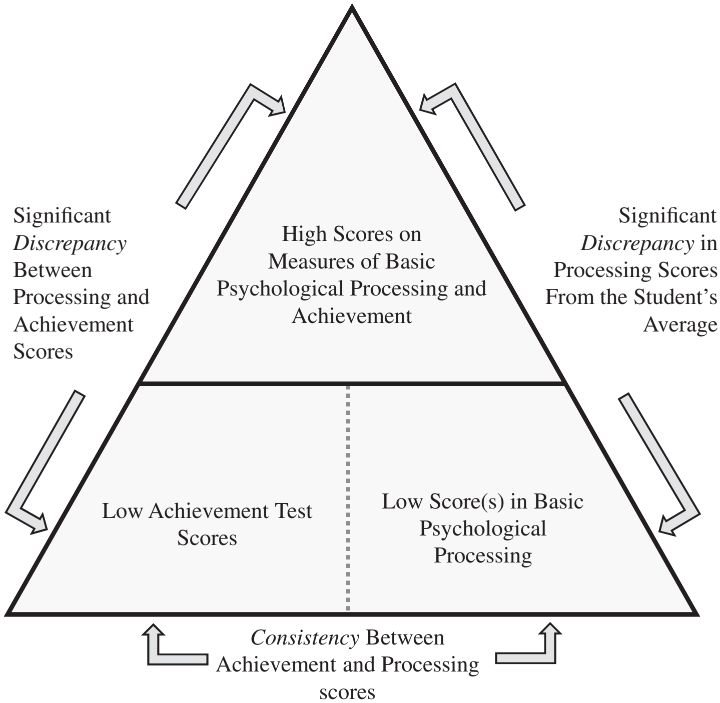

Figure 12.1. Discrepancy/Consistency Method for SLD Diagnosis

scores and some specific academic achievement, a significant discrepancy between the student's high and low cognitive processing scores (using the ipsative approach), and a consistency between the student's low processing and low achievement scores. This is a method to operationalize the PSW approach, which is discussed more fully elsewhere in ~~this book~~.

Naglieri (1999) and Flanagan and Kaufman (2004) cautioned that, because the absolute value of a relative weakness could still be within the average range, a weakness that is low relative to the student's average and below the average category should be used to ensure that a student has "a disorder in the basic psychological processes" necessary for SLD identification (IDEA 2004, p. 11). To restate, the PSW should include significant variability in the cognitive processing scores and the lowest processing score is far enough below normal to be reasonably considered as a disorder (Naglieri, 1999). When there is a similar PSW in academic scores, a diagnosis of a SLD is supported, assuming that all exclusionary conditions are also met. All this is based on ensuring that the measures of basic psychological processes meet the technical requirements included in IDEA, that is, valid, reliable, nondiscriminatory, and more than general ability. The two important issues are (1) exactly how the DCM would work and (2) whether or not the tests recommended are sufficiently reliable and valid.

Using the DCM

In this chapter, we illustrate the use of the DCM with three instruments. First, the Cognitive Assessment System, Second Edition (CAS-2; Naglieri, Das, & Goldstein, 2014a) is used to measure basic psychological processes as defined by the planning attention simultaneous successive (PASS) theory. Second we use the Feifer Assessment of Reading (FAR; Feifer, 2015) and third the Feifer Assessment of Math (FAM; Feifer, 2016) as measures of academic performance that also involves PASS processes. Our goal is to show how SLD can be operationalized and such information used for diagnostic and instructional decision making. We are not suggesting that these are the only ways to use the DCM, but we do show that this approach has several advantages. First, it is parsimonious; there are four basic psychological processes to consider. Second, the integration of CAS-2 with FAR and FAM is theoretically sound and an elegant neurocognitive solution to the alignment of a disorder in basic psychological processes with academic difficulty. Third, this solution is consistent with requirements in IDEA 2004.

Specifics of the DCM

Using the DCM to determine if one or more of the four PASS scores could reflect a PSW is accomplished by comparing the difference between any individual PASS scale score with the average of the student's four PASS scores. This method has been used often in intelligence testing (see Kaufman, 1994; Naglieri, 1999, 2011) because it has the advantage of providing statistical guidelines for examining individual profiles relative to the student's level of functioning. Once strengths and weakness in PASS are detected, the scores from the CAS-2 can be compared to academic achievement scores on the FAR or FAM using values for significance found in Naglieri and Otero (2017). The steps for analyzing the CAS-2 are fully described by Naglieri and Otero (2017) and summarized here.

> **DON'T FORGET**
>
> According to IDEA 2004, measurement of the basic psychological processes must be made using tests that are reliable and validated for that specific use.

Assume that we have the following PASS scores for the CAS-2 12-subtest Extended Battery: Planning = 84, Simultaneous = 111, Attention = 96, and Successive = 93 for a student 8 years of age. The differences between each PASS score

Table 12.1 Differences Between PASS Standard Scores and the Student's Average PASS Score Required for Significance for the CAS-2 Extended and Core Batteries.

			CAS-2 PASS Scales			
	Age	*p*	Planning	Simultaneous	Attention	Successive
CAS-2 Extended	5–7	.05	9.5	9.3	8	9.4
		.10	8.5	8.3	7.2	8.4
	8–18	.05	9.3	8.3	9.5	9.1
		.10	8.4	7.4	8.6	8.2
CAS-2 Core	5–7	.05	11.2	10.1	9	10.7
		.10	10.1	9	8.1	9.6
	8–18	.05	10.2	9.1	10.9	10.4
		.10	9.2	8.1	9.8	9.3

Note: CAS-2 Extended has 12 subtests; CAS-2 Core has 8.

and the average are obtained by subtracting the mean score (96.0) from each PASS score. Negative values mean the score is below the average and positive scores indicate the value is above the average. Compare those difference scores to the values in Table 12.1. Differences between the individual score and average PASS score that are equal to or greater than the value in the table are significant. In this illustration, the Planning score of 84 is 12 points below the students' PASS average (a value of 8.4 is needed at $p = .10$). This indicates that the Planning is significantly different from the average PASS score and the score is below the average range (90–109) and therefore designated as a weakness. By contrast, the Simultaneous score of 111 is above the student's average PASS score by 15 points (a value of 7.4 is needed) and is statistically significant. Because this score is in the above average range (110–119) it is designated as a strength. The Attention score of 96 is very similar to the student's average as is the Successive scale score of 93.

Once it has been established that there is a weakness (i.e., disorder) in one or more of the basic psychological processes (i.e., the weakness in PASS) then the PASS scores can be compared to achievement test scores. Any achievement test can be used; however, the use of an achievement measure that is aligned with PASS makes the connection between processing and academic failure more explicit.

Practitioners should look for discrepancies (significant differences) between high PASS scores and low scores on the FAR and FAM as well as consistencies (no significant differences) between low achievement and low PASS scores. The consistency between PASS and achievement scores indicates that the two measures are highly related; that is, they require the same kind of cognitive process despite a difference in test content.

What Is a Basic Psychological Process?

We use the terms *basic psychological process* and *cognitive process* to refer to a foundational neurocognitive ability that provides the means by which an individual functions in all settings and where each specific cognitive process provides a unique ability to perform. Our focus is on the PASS theory as described by Naglieri and Otero (2011, 2017) and as measured by the CAS-2. From this theory, successive processing is used to work with information that is arranged in a specific sequence and simultaneous processing is vital to seeing relationships among ideas. Attention is vital for focus of cognitive activity as well as resistance to distraction, and planning is the key to effective use of these processes and the entire base of knowledge and skills. Having several neurocognitive processing abilities affords us with the capability of completing the same task using different types or various combinations of processes. For example, a student may struggle to remember the sequence of letters needed to spell a long name (low in successive processing) but by organizing the string of letters into groups (using planning and simultaneous processes) the task can be achieved. Thus, changing the PASS processes a student uses can be an effective approach to intervention. See Rapid Reference 12.3.

PASS processes underlie all mental and physical activity. Through the application of these processes humans acquire all types of knowledge and skills to achieve fluency. However, it is very important to recognize that skills, such as reading decoding or math facts, also involve cognitive processes to varying degrees depending on the developmental level of the learner and the PASS

Rapid Reference 12.3

Planning. Thinking about how you do what you decide to do

Attention. Being alert and resisting distractions

Simultaneous. Understanding how things go together to form a whole

Successive. Understanding how things go together in a specific order

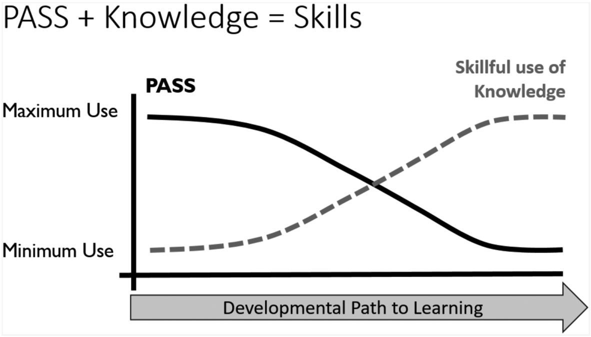

Figure 12.2. The Role of PASS on the Development Path to Learning

demands of the task. Naglieri and Otero (2007) describe this developmental learning process within the context of PASS as shown in Figure 12.2. The figure illustrates the role of PASS processing during learning. Initially, when there is little knowledge the learner has to rely on the ability to think (i.e., PASS). As knowledge is acquired, the role of PASS goes down and skillful or fluent application of knowledge results. For example, when a student sees and hears the word *book* for the first time there is an initial accumulation of knowledge. The student may look at the word and notice it starts with a *b,* then two letter *o*s, and ends with a letter *k.* Noticing these separate letters demands *attention,* the serial relationship of the letters involves *successive,* seeing the two *o*s as a group is *simultaneous,* and any analysis of how to manage the learning is *planning.* With good instruction and repetition, the word will be learned and the student will be able to read the word *book* fluently and with very little effort. At that point, the knowledge, which initially relied on PASS (and instruction, motivation, etc.), will become a skill and the word will be read fluently.

Assessment of basic psychological processes must be conducted using tests that are relatively free of academic content. Having measures of cognitive processes and achievement that do not have the same content maximizes the extent to which the two measures provide information that reflects the processing or academic construct efficiently rather than the combination of processing and academic skill. It is also critical to recognize that although achievement domains can be defined effectively by the content of the questions, processing tests are defined by the neurocognitive processing demands of the test questions and not by the content or modality. For example, the CAS-2 Successive processing scale is composed of three subtests that look very different. In one subtest (Word Series) high-imagery single-syllable words must be repeated in order as stated by the examiner; a second (Visual Digit Span) requires that numbers, which were viewed, are recalled in order; and a third requires comprehension of the syntax of complex sentences. Despite the differences in these tasks, they all demand appreciation of the sequencing of the information—successive processing. The variety in modality and content strengthens the interpretation of the Successive scale on the CAS-2 because alternative interpretations are less plausible. For example, the description of word series as an auditory sequencing test is not supported because the visual sequencing test is included in the Successive processing scale. This is important because it helps understand how a student with poor successive processing can have an SLD in reading decoding and also have problems in math.

DON'T FORGET

Always ask the question, "What empirical evidence is there that supports a particular approach to measuring basic psychological processes?"

PASS Theory and Measurement

A. R Luria's theoretical description of how the human brain functions is considered one of the most complete (Lewandowski & Scott, 2008). In his seminal works—*Human Brain and Psychological Processes* (1966), *Higher Cortical Functions in Man* (1980), and *The Working Brain* (1973)—Luria described the brain as a functional mosaic with parts that make specific contributions to a larger interacting network (Luria, 1973). That is, Luria stressed that no area of the brain functions without input from other areas so that cognition and behavior result from an interaction of complex brain activity across various areas. Luria's (1966, 1973, 1980) research on the functional aspects of the brain provided the basis for the PASS neurocognitive approach as an alternative to traditional notions of intelligence, which were initially described by Das, Naglieri, and Kirby (1994), operationalized by the CAS (Naglieri & Das, 1997), and more recently updated by Naglieri and Otero (2007, Naglieri and Otero 2017). The four PASS processes represent a fusion of cognitive and neuropsychological constructs such as executive functioning (planning and attention); selective, sustain and shifting, attention (attention); visual-spatial processing of information into a coherent whole (simultaneous); and serial processing of information (successive; Naglieri & Das, 2005). The four PASS neurocognitive processes can be measured by the CAS-2, the CAS-2: Brief, and the CAS-2: Rating scale (Naglieri, Das, & Goldstein, 2014a, 2014b, 2014c). These individually administered measures are fully described in their respective test manuals and in the *Essentials of CAS-2 Assessment* (Naglieri & Otero, 2017). These four PASS neurocognitive processes are more fully described in the sections that follow.

Planning

Planning is a neurocognitive ability used to determine, select, and use strategies to solve problems when self-monitoring and self-correction are especially important (Naglieri & Otero, 2017). Planning is essential to all activities when there is the need for problem-solving. This includes an awareness of the need for a solution, monitoring how well things are going, consideration of alternative solutions that might be appropriate, and consideration of the relative value between continuing with a behavior or changing to a different one (Shadmehr, Smith, & Krakauer, 2010). Planning processing is also important when we reflect on the results of a completed task, recognizing what worked and what did not work, and considering other possible solutions in the future. These uniquely human activities are the responsibility of the frontal lobes of the brain (Goldberg, 2009).

To measure planning a test must allow a student to solve a novel problem for which there is no previously acquired strategy and minimal constraints should be placed on the way the student chooses to complete the task. For example, all of the Planning subtests on the CAS-2 and CAS-2: Brief (Naglieri et al., 2014a, 2014b) are best solved using strategies that the examinee decides to use after giving instructions that inform the student to complete the task using whatever method seems best. For this reason, the test scores reflect efficiency, measured by how long it takes to complete the task with the most correct responses.

Performance on academic tasks can also provide insights into a student's use of planning as well as the other PASS neurocognitive processes. Most any task can involve planning if the student has to make decisions about how to complete the task. For example, math computation demands evaluation of the task, consideration of the possible solutions, selection and use of the solution, checking to ensure that the solution was effective, and recognizing when the task is completed successfully. The same is true for writing, reading comprehension, evaluation of social situations, time management, and many other tasks that are best completed using a strategic (planning processing) approach. All PASS processes are involved in academic tasks (Naglieri & Rojahn, 2004) and these processes contribute to success on all reading and mathematics tests. The FAR (Feifer, 2015) and FAM (Feifer, 2016) tests offer a way to see how a student completes the task, for example, when a student spontaneously organizes verbal information that has to be recalled in a logical manner (planning) on the Word Recall subtest of the FAR. Similarly, a student may use a strategy (planning) to examine possible answers carefully (attention). This strategy can then be used to select an equation that best represents a mathematical word problem on the FAM.

We suggest that the CAS-2 and FAR and FAM together within a PSW model and DCM can provide an efficient and accurate assessment of SLDs in students.

This approach not only highlights cognitive and academic strengths and weaknesses but also provides a reliable and valid approach for SLD identification consistent with federal regulations. It also serves as a powerful framework to better inform intervention decision making. We begin our discussion with how planning and attention are expressed in mathematics.

The term *developmental dyscalculia* (*DD*) describes students with specific math-related deficits, including difficulty learning and retrieving mathematical facts, difficulty executing math calculation procedures when engaged in problem-solving, or lack of basic number sense and concept development skills to use a particular strategy when problem-solving (Rosselli, Matute, Pinto, & Ardila, 2006). Therefore, dyscalculia entails numerous cognitive and quantitative processes that underscore the development of mathematical achievement. One way to connect scores on a measure of cognitive processes with those obtained from an examination of academic knowledge is to use the FAM with the CAS-2. The FAM is specifically designed to examine the underlying neurodevelopmental processes that support the acquisition of proficient math skills. The test is composed of 19 individual subtests measuring various aspects of math fact retrieval, numeric and spatial memory, perceptual estimation skills, linguistic math concepts, and core number sense development. The FAM yields scores that reflect how a student solved the academic skills problems, which is consistent with the PASS theory as operationalized by the CAS-2 (see Rapid Reference 12.4). We demonstrate how this could work with a case example.

Case Study of William

William is a fourth-grade student whose rambunctious and playful personality has often lead to academic and behavioral pitfalls in class. Though quite popular with peers, he tends to have a rather impulsive response style when problem-solving and often dives into an assignment with no particular strategy or plan. Unfortunately, poor planning is not a very prudent strategy when engaged in more-complex mental operations such as solving mathematical word problems. For example, take a math word problem involving rate, time, and distance, when there is often too much information embedded within the problem. William often chooses the first numeral or data point presented in a hurried fashion and usually selects the wrong algorithm (strategy) to solve the problem. Planning, which is the essence of good executive functioning, is a necessary prerequisite for deciding "what to do when" and is very important when solving mathematical problems. Results of the CAS-2 provide important insight into William's ability to learn.

William's CAS-2 Full Scale score was in the below-average range and in the 19th percentile. Because this score reflects a combination of PASS processing

Rapid Reference 12.4

Math Subtypes as Measured by the FAM and PASS Processes

Math Subtype	Description	PASS Process
Procedural	A deficit in the ability to count, order, or sequence numbers, as well as difficulty remembering the sequence of mathematical procedures (e.g., algorithm) when problem-solving; consequently, when there is a breakdown in the procedural error system, the syntactical arrangement and execution of arithmetical procedures becomes compromised	Successive and Attention
Verbal	Difficulties encoding and retrieving overlearned math facts such as single-digit addition, single-digit subtraction, single-digit multiplication, and single-digit division; an inability to automatically retrieve stored math facts	Attention, Simultaneous, and Planning
Semantic	Consists of visual-spatial deficits hindering a variety of mathematically related skills including estimation skills, aligning numbers in columns when problem-solving, magnitude representations, and pattern recognition skills among objects; math difficulties stem from an inability to develop core number sense and magnitude representation	Simultaneous and Planning

strengths and weaknesses, emphasis should be placed on the separate PASS scores, which vary considerably. For instance, his simultaneous and successive processing scores were in the average range; however, William has cognitive weaknesses on the Planning and the Attention scales, which lead to poor control of thinking and acting and little use of strategies to focus attention and resist distractions. In fact, lower scores in Planning and Attention are typical for students with attention-deficit hyperactivity disorder (ADHD; Naglieri & Otero, 2011) and can be described as a problem with executive functioning (Naglieri et al., 2014c). Importantly, academic scores on the FAM mirror cognitive limitations on the

Table 12.2 William's PASS and Full Scale Scores From the CAS-2

	CAS-2		Difference From PASS Mean		
PASS Scales	Standard Score	Percentile Rank	91.2	Significantly Different (.05) From PASS Mean?	Strength (S) or Weakness (W)
Planning	77	6	−14.2	yes	W
Attention	82	12	−9.2	yes	W
Simultaneous	105	63	13.8	yes	
Successive	100	50	8.8	no	
CAS-2 Full Scale	92	30			

CAS-2, as shown in Table 12.2. The FAM yields three composite scales described in Rapid Reference 12.5.

The results of the FAM revealed significant deficits with the Semantic Index and, in particular, the Equation Building subtest due to poor planning and a tendency to select the first equation that best represented the word problem rather than a careful consideration of all choices. The Equation Building subtest requires students to select, though not solve, the proper equation that best represents a mathematical word problem and is part of the Semantic Index. William also performed very inconstantly on the Spatial Memory subtest, due primarily to his

Rapid Reference 12.5

Scales on the FAM

Procedural Index. Measures the ability to count, order, and sequence numbers, as well as the ability to follow an algorithm or set of procedures used in calculating equations

Verbal Index. Measures the ability to automatically identify numbers, recall stored mathematical facts, and understand basic math terminology

Semantic Index. Measures the ability to determine magnitude representation, estimation skills, pattern-recognition skills, and quantitative reasoning when applying mathematical skills to solve real-world problems

Table 12.3 FAM Results for William

FAM Index	Standard Score (95% CI)	Percentile Rank	Qualitative Descriptor
Procedural Index	96 (+/−8)	39	Average
Verbal Index	101 (+/−8)	53	Average
Semantic Index	79 (+/−5)	8	Moderately below average
FAM Total Index	92 (+/−8)	30	Average

inconsistent attention span. He also became distracted by answer options that were similar to but not the correct answer. Table 12.3 depicts William's FAM profile of scores.

William's case illustrates how overall scores can be misleading because his overall FAM index score was consistent with his CAS-2 Full Scale score even though he clearly has specific weaknesses in the basic psychological processes of planning and attention with deficits in academic achievement. William makes careless mistakes due to impulsive problem-solving, which is most likely reflective of ADHD and is related to poor planning and attention. The DCM provides educators a way to conceptualize the relationships between the specific PASS processing and academic strengths to arrive at an accurate diagnosis. Clearly, William would meet IDEA 2004 criteria as a student with an SLD using the DCM and a PSW model. Once the disorder in basic psychological processing is established, then specific interventions can be considered (Naglieri & Feifer, 2017). For example, instructional modification may include color-coding math operational signs as well as color-coding important vocabulary terms embedded within word problems in order to trigger more consistent decision making. Cognitive interventions could include methods described by Naglieri and Pickering (2010), such as the handouts labeled Planning Facilitation and Overcoming Problems with Inattention. Additionally, specific strategies to stop, think, and create and plan when working, as well as targeted self-monitoring strategies to double-check work, would be beneficial as well. See Naglieri and Feifer (2017) for more information about interventions. Figure 12.3 illustrates William's profile of CAS2 and FAM scores using the DCM approach.

Attention

The case of William also illustrates the role of attention in academic tasks. We use the term *attention* to designate a neurocognitive ability used to focus on a particular stimulus and inhibit responses. An-optimal level of arousal is needed

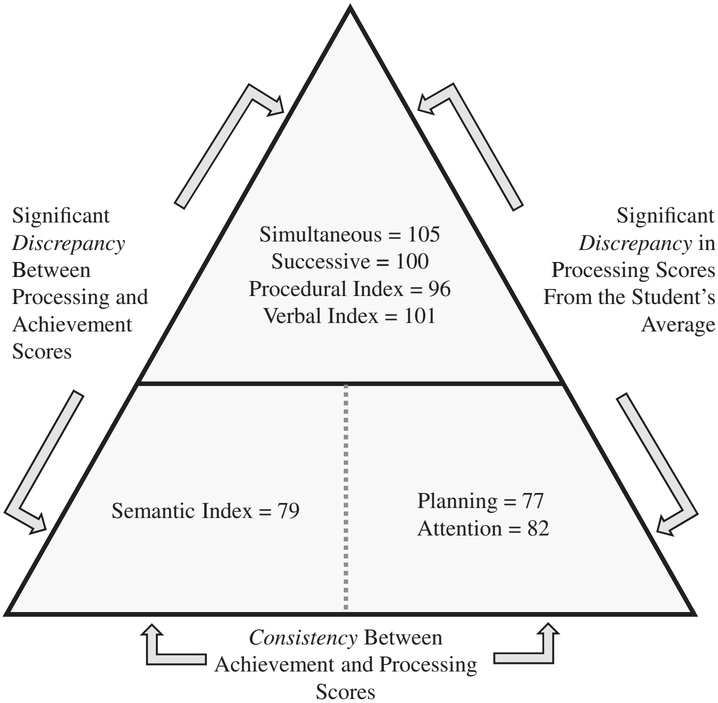

Figure 12.3. CAS-2 and FAM Results for Discrepancy/Consistency Method for the Case of William

for the more-complex forms of attention that involve "selective recognition of a particular stimulus and inhibition of responses to irrelevant stimuli" (Luria, 1973, p. 271). Higher forms of attention are shown when a student demonstrates focused, selective, sustained, and effortful activity. The longer attention is needed for it, the more the activity requires vigilance. Brain structures such as the reticular formation enable an individual to focus selective attention toward a stimulus over a period of time without the loss of attention to other competing stimuli. Attentional processing assessed using CAS-2 subtests demand 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.

There are many academic tasks that are particularly dependent on attention. Clearly, everything a person does in and outside of school requires attention and resistance to distractions in the environment as well as distracting thoughts. Some tasks require more attention than others, particularly when the complexity of a task increases and a student has to select an answer from several options that look similar, as illustrated in the case of William. The key to detecting the role of attention in any specific activity is to notice the complexity of the stimuli. Whenever there are many things a student could attend to and what he or she has to focus on is less salient, attention will be required. Listening to the teacher when a fellow student is talking and being distracted by a text message or a sound outside of the room all illustrate what we measure on the Attention scale of the CAS-2 and the CAS-2 Rating scale.

Simultaneous

Simultaneous processing is used to integrate separate stimuli into a single whole where separate elements must be combined into a conceptual whole (Naglieri & Otero, 2017). 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 CAS-2 subtests designed to measure simultaneous processing is the requirement that information must be organized into a coherent whole.

There are many academic tasks that are particularly dependent on simultaneous processing. These include, for example, recognizing sight words, whole-language instruction, comprehension of the meaning of a statement, paragraph or story, math word problems, and more advanced content such as geometry, chemistry, and so on. In this section, we examine how simultaneous processing can disrupt multiple aspects of the reading process as well as a how simultaneous processing can affect the ability to visualize mathematics. This can include poor reading comprehension because the student cannot see how to combine all the information into a cohesive whole or poor reading fluency due to an inability to take in the entire visual-spatial word form, thereby leading students to read at a slow pace and focusing on each sound of a word rather than the word as a whole. This tends to be a primary issue in surface dyslexia, which refers to poor reading fluency due to limitations with visual perceptual and orthographic processing (Feifer, 2015).

The FAR uses 15 individual subtests to measure various aspects of reading, including phonological development, orthographical processing, decoding skills, morphological awareness, reading fluency, and comprehension skills. The

Rapid Reference 12.6

Reading Subtypes as Measured by the FAR and PASS Processes

Reading Subtype	Description	PASS Process
Dysphonetic	A deficit in the ability to use a phonological route to bridge letters and sounds; specific measures of phonemic awareness, decoding words and nonwords as well as decoding words in context comprise this domain	Successive, attention
Surface	A deficit in the ability to automatically recognize words by taking in the visual perceptual and orthographic properties of the visual word form; specific measures of text perception, rapid naming, orthographic processing, and reading phonologically irregular words comprise this domain	Simultaneous, attention
Mixed	The most severe type of reading disorder because these students lack the phonological processing skills to accurately identify words as well as the orthographic processing skills to automatically recognize the printed word form	Successive, simultaneous, and attention
Reading comprehension	A deficit in the ability to successfully derive meaning from print, despite adequate reading mechanics; specific measures of language development, working memory, executive functioning, and morphological processing comprise this domain	Planning, attention

instrument measures four specific subtypes of reading disorders, all of which are derived from deficits in one or more PASS attributes (see Rapid Reference 12.6).

Case of Nick

Nick has been attending Bailey Elementary School since kindergarten and began receiving targeted academic interventions in first grade. According to school reports, Nick had difficulty acquiring basic sound-symbol associations, and his reading fluency was measured at just 27 words per minute correct on the

Table 12.4 Nick's PASS and Full Scale Scores From the CAS-2

	CAS-2		Difference From PASS Mean		
PASS Scales	Standard Score	Percentile Rank	92.0	Significantly Different (.05) From PASS Mean?	Strength (S) or Weakness (W)
Planning	100	50	8.0	no	
Attention	104	61	12.0	yes	
Simultaneous	74	4	−18.0	yes	W
Successive	90	25	−2.0	no	
CAS-2 Full Scale	92	30			

completion of first grade. Nick began receiving Tier 2 reading support services in second grade and worked with the school's reading specialist for approximately 30 minutes each day. He responded well to his reading intervention services and completed second grade reading approximately 57 words per minute accurately. Nevertheless, there were additional academic concerns on entering third grade. For instance, Nick was described as having difficulty with spelling and written language skills and was inconsistent with reading comprehension skills. He struggled to keep pace with his peers and often failed to complete his work in a timely manner. Table 12.4 depicts Nick's CAS2 profile of scores.

Nick's overall CAS-2 Full Scale score was in the average range and at the 30th percentile compared to peers, but this score does not fully explain his PASS neurocognitive abilities. There were specific strengths noted in his Planning (100) and Attention (104) scales. He used a very efficient strategy when problem-solving and had little difficulty changing his plan based on the cognitive demands of the task. Furthermore, Nick worked very diligently and conscientiously throughout the test, refrained from making careless miscues, and focused his attention to the task at hand. However, there was a cognitive weakness noted on the Simultaneous processing scale (74), which can directly hinder a variety of academic skills such as spelling (difficulty conjuring up a visual spatial image of the printed word form), reading fluency, speed (difficulty automatically recognizing words as a conceptual whole), and mathematics (seeing patterns in numbers). Rapid Reference 12.7 describes each of the reading indices on the FAR.

Rapid Reference 12.7

FAR Scales

Phonological Index. Measures the ability to use phonemic awareness and decoding skills to recognize words, nonwords, and words embedded within context

Fluency Index. Measures the ability to use visual perceptual and orthographical skills to rapidly retrieve and recognize words

Mixed Index. A combined measure of decoding skills and orthographic skills to accurately and automatically identify words in print

Comprehension Index. Measures the ability to derive meaning from print as well as underlying language skills, morphological processing skills, and executive functioning skills.

Nick's achievement test scores correspond to the Cognitive processing scales as shown by his pattern of scores on the FAR. He obtained a FAR total index score of 84, which, similar to the CAS-2 Full Scale score, was in the below-average range and at the 14th percentile compared to peers, but does not uniformly represent all of the scores the test yields. He performed adequately when decoding words in isolation as well as using decoding skills to accurately identify words embedded within the context of a story (successive processing). A relative strength was noted in his ability to answer targeted questions from story passages, because Nick had little difficulty deriving meaning from print.

A significant weakness was observed in the Fluency Index, which was in the moderately below-average range and at the 3rd percentile compared to peers. He worked slowly when rapidly identifying objects and letters, demonstrated poor text orthography skills, and had difficultly reading an isolated list of phonologically irregular words (i.e., *yacht, onion, debt,* etc.). Lower scores on rapid naming and text orthography tasks often stem from poor simultaneous processing and an inability to visualize the entire printed word form as a unique whole. This can lead to inconsistent spelling as well as slower print identification skills when reading. Nick would benefit from would benefit from a targeted reading fluency intervention in order to increase text automatic recognition and fluency (i.e., Read Naturally, Great Leaps, RAVE-O, etc.). See Naglieri and Pickering (2010) and Naglieri and Feifer (2017) for more intervention options. Figure 12.4 illustrates Nick's profile of CAS2 and FAR scores using the DCM method.

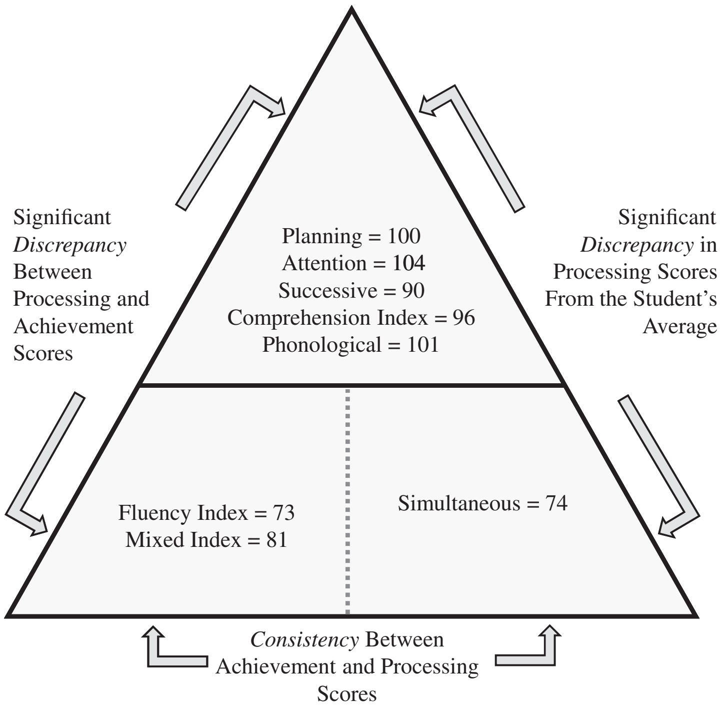

Figure 12.4. CAS-2 and FAR Results for Discrepancy/Consistency Method for the Case of Nick

Simultaneous and Math

Case of Cheryl

Cheryl is an eighth-grade student who has consistently earned straight As throughout her educational career and has been a model student in class. She is a conscientious and attentive student and takes pride in her academic efforts. Cheryl has outstanding language development skills and is quite verbose and articulate in her manner. She has no history of math-related difficulties and has easily memorized most math facts. However, her advanced language and memory skills appear to be no match for the spatial types of skills needed to pass her geometry class, and this marked the first time in her academic career that Cheryl was failing a course. She especially struggled on problems involving spatial relationships and estimation skills, because Cheryl appeared out of her element when thinking in pictures and not in words. A review of her CAS-2 PASS scores provided an explanation for her learning difficulty, as seen in Table 12.5.

Table 12.5 Cheryl's PASS and Full Scale Scores From the CAS-2

	CAS-2		Difference From PASS Mean		
PASS Scales	Standard Score	Percentile Rank	102.6	Significantly Different (.05) From PASS Mean?	Strengths (S) or Weaknesses?
Planning	107	68	4.4	no	
Attention	124	95	21.4	yes	S
Simultaneous	82	12	−20.6	yes	W
Successive	108	70	5.4	no	
CAS-2 Full Scale	92	30			

Cheryl has a strength in the Attention scale (124) and a cognitive weakness on the Simultaneous scale (82) with average scores on Planning (107) and Successive processing (108). It is likely that she has compensated for simultaneous weakness by developing and using strategies (planning), having excellent ability to focus and resist distractions (attention), and good ability to work with and remember information in sequence (successive processing). However, geometry relies primarily on simultaneous processing to draw on a visual-spatial image, or gestalt, when dealing with questions of shape, size, relative position of figures, and the properties of space. Cheryl's cognitive weakness in simultaneous processing is hindering the acquisition of specific kinds of math skills.

Further testing with the FAM noted significant deficits with her semantic index, which involves a collection of subtests measuring skills such as spatial memory, perceptual estimation, and magnitude representation. In other words, the FAM provides evidence of how a particular cognitive processing deficit, as measured and defined by the CAS-2, specifically hinders mathematics. Her overall FAM index scores are shown in Table 12.6.

Cheryl's overall FAM Semantic Index score was in the below-average range and at the 12th percentile compared to peers. This represented an absolute weakness with mathematical skills. Nevertheless, Cheryl still had a strength in the verbal domain of math, because she was very quick to memorize single-digit addition, subtraction, multiplication, and division facts (this is dependent on using good strategies [planning] and remembering sequences of information [successive processing]). However, she had a poor understanding of the conceptual

Table 12.6 FAM Scores for Cheryl

FAM Index	Standard Score (95% CI)	Percentile Rank	Qualitative Descriptor
Procedural Index	84 (+/−8)	14	Moderately below average
Verbal Index	94 (+/−8)	34	Average
Semantic Index	70 (+/−5)	14	Moderately below average
FAM Total Index	82 (+/−8)	12	Below average

underpinnings of mathematics and struggled with an array of skills in the Semantic Index including poor estimation skills, poor magnitude representational skills, and limitations with spatial memory (simultaneous processing). In fact, Cheryl has the profile of a student with a cognitive weakness (simultaneous processing) and a mathematical weakness (Semantic Index), which was consistent with semantic dyscalculia.

It is important to note that Cheryl also has cognitive and academic strengths, which have been revealed using the DCM. This method shows the presence of a discrepancy within her PASS cognitive profile of strong cognitive processing and weak simultaneous processing. In addition, there is a consistency between her simultaneous score and her academic processing skills as represented by the Semantic Index score on the FAM. Targeted interventions should include teaching methods that allow Cheryl to touch, see, and feel spatial properties due to an inability to visualize them when problem-solving. This may include working with dice, dominoes, unifix cubes, vertical number lines, puzzles, tangible shapes, and more experiential learning to facilitate her spatial awareness skills. For more on intervention see Naglieri and Pickering (2010) and Naglieri and Feifer (2017). Figure 12.5 illustrates Cheryl's profile of CAS2 and FAR scores using the DCM approach.

Successive

Successive processing is a neurocognitive ability that is used to work with information that is arranged in a specific serial order (Naglieri et al., 2014a). Successive processing is required to recognize, recall, and reason when success on any task demands the perception of stimuli in sequence, for example, the formation of sounds, letters, words. and movements into a specific order. This ability is necessary for the recall of information in order as well as phonological analysis and the syntax of language (Das et al., 1994). Deficits with successive processing are also associated with early reading problems in young students,

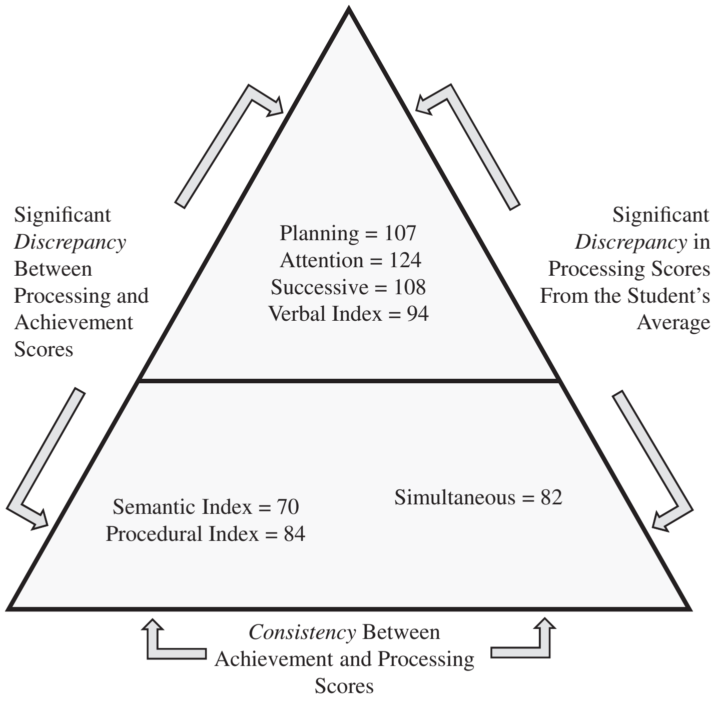

Figure 12.5. CAS-2 and FAR Results for Discrepancy/Consistency Method for the Case of Cheryl

because suck skill requires a student to learn sounds in a sequential order. This ability is associated with the temporal brain regions.

Many academic tasks demand successive processing, for example, counting, memorizing math facts, initial reading decoding of unfamiliar words, spelling, and sequencing of words to make a sentence. It is important to note that the overall meaning of a sentence demands simultaneous processing, but the ordering of the words to reflect the meaning requires successive processing. Successive processing is critical when a student is presented with very confusable words and must focus carefully on the pronunciation of sounds in order. Tests of phonological skills, reading decoding, and spelling all demand considerable successive processing. When serial information is grouped into a pattern (such as the number 55,366 organized into 55–3–66), then planning (i.e., using the strategy of chunking; see Naglieri & Pickering, 2010) and simultaneous processing (organizing the numbers into related groups) are also involved.

Math is a highly complex skill and often requires an underlying appreciation of ordering numbers, comprehending numeric quantities, and manipulating symbols in a sequential fashion (Feifer, 2016). Similar to reading and all other academic areas, planning, attention, simultaneous and successive processes are involved in various aspects of math. What is important to note is that although successive processing is a psychological process that underlies specific aspects of mathematics, it also underlies reading and written language skills as well. For instance, stitching together the sequence of sounds needed to spell requires successive processing, as does the ability to blend targeted phonemes when actively decoding a word. Perhaps this is why nearly two-thirds of children with a math learning disability also have a reading disability due, in part, to the successive processing demands of both tasks (Ashkenazi, Black, Abrams, Hoeft, & Menon, 2013).

According to Dehaene (2011), the sequential coding of numbers formulates the basis of the brain's internal number line and therefore relies on successive processing. Consequently, when there is a breakdown in this system, the syntactical arrangement and execution of arithmetical procedures becomes compromised. As a result, students often struggle to count forward and backward from various points on a number line, and routinely must "begin at 1" when counting or risk losing their place. In addition, successive processing deficits may impair the all-important algorithm or the internal set of procedures involved in calculating equations not committed to rote memory. This can involve recalling the sequences of steps necessary to perform multiple-step tasks such as long division, multiplying or dividing multiple-digit numbers, reducing fractions, and working with decimals. Last, there is often a breakdown in remembering the sequence of steps necessary to execute procedural operations due in part to limitations with successive processing (Feifer, 2016). Using the CAS-2 and FAR and FAM provides clinicians with a framework for a targeted, brain-based assessment of specific processing strengths and weaknesses that subserve reading and math skills as shown in the next case study.

Case of Peter

Peter struggled to remember the sequence of steps when doing math equations, basic math facts, and long passages when reading, when decoding words, and spelling hard words. What remained puzzling is that Peter had an outstanding memory for details and excelled when remembering specific aspects of a field trip or any type of experiential learning experience. Peter was initially referred for a school psychological evaluation while in third grade. The test results indicated no significant discrepancy between his ability and his achievement, both of which

Table 12.7 Peter's PASS and Full Scale Scores From the CAS-2

	CAS-2		Difference From PASS Mean		
PASS Scales	Standard Score	Percentile Rank	92.2	Significantly Different (.05) From PASS Mean?	Strength (S) or Weakness (W)
Planning	94	34	1.8	no	
Attention	94	34	1.8	no	
Simultaneous	102	55	9.8	yes	
Successive	79	8	−13.2	yes	W
CAS-2 Full Scale	92	30			

were in the average range. Furthermore, there were no attention or behavioral concerns reported as well. In fact, Peter was described as very polite and respectful in manner and put forth an excellent effort in school. He did not qualify for special education services, and the evaluation offered little with respect to targeted interventions or classroom accommodations to assist with learning.

Peter is currently in fifth grade and remains below grade level in reading and mathematics. He was referred for an updated assessment using a processing strengths and weaknesses approach to determine how Peter learns in order to identify more-specific and effective intervention strategies. Table 12.7 depicts Peter's CAS2 profile of scores.

Consistent with previous intelligence testing, Peter's overall CAS-2 Full Scale score of 92 was in the average range and at the 27th percentile (see Table 12.8).

Table 12.8 Peter's Scores on the FAM

FAM Index	Standard Score (95% CI)	Percentile Rank	Qualitative Descriptor
Procedural Index	76 (+/−8)	5	Moderately below average
Verbal Index	81 (+/−8)	10	Below average
Semantic Index	98 (+/−5)	45	Average
FAM Total Index	86 (+/−8)	18	Below average

Most of his PASS scores are in the average range, with the exception of his successive (79) processing, which was a weakness. Lower scores on this scale reflect his difficulty working with information in a sequential order. It is important to note that difficulties with successive processing can hinder verbal information (i.e., remembering multiple-step directions) or nonverbal information (i.e., remembering longer algorithms or steps when engaged in more complex mathematics). Therefore, the next question that arises is how does poor successive processing directly affect Peter's reading and mathematical skills?

Further testing with the FAM noted significant deficits with Peter's Procedural Index, which involves a collection of sequence-based skills such as skip counting forward and backward from various points on a number line as well as recognizing patterns and sequences among number relationships. His overall FAM Total Index score was 86, which was in the below-average range and in the 18th percentile. Peter's core deficit with successive processing influences mathematics in a symbolic fashion (i.e., difficulty identifying number patterns) as well as a conceptual fashion (i.e., difficulty remembering the sequences of steps needed to solve more-complex equations). In addition, Peter also struggled on the Verbal Index, which is a measure of automatic or reflexive problem-solving of single-digit math facts. He had difficulty retrieving basic math facts when timed, though his conceptual understanding of mathematics was sound (Semantic Index). Peter was also administered the FAM to determine the impact of his low successive processing with reading skills (see Table 12.9).

Table 12.9 Peter's Scores on the FAR

FAR Index	Standard Score (95% CI)	Percentile Rank	Qualitative Descriptor
Phonological Index	79 (+/−3)	8	Moderately below average
Fluency Index	92 (+/−8)	30	Average
Mixed Index	85 (+/−4)	16	Below average
Comprehension Index	90 (+/−10)	25	Average
FAR Total Index	84 (+/−4)	14	Below average

Peter obtained a FAR total index score of 84 +/−4, which is in the below-average range of functioning and in the 14th percentile (see Table 12.9). He especially had difficulty within the Phonological Index, which required Peter to use successive processing to chunk together individual sounds or phonemes in order to identify words. Instead, he tended to overly rely on his stronger simultaneous processing, as evidence by his good performance on the Fluency Index. For instance, Peter performed well on a task that required him to identify phonologically irregular words (i.e., *yacht, debt, onion,* etc.), though he had considerably more difficulty identifying words that were more readily decodable. In essence, Peter struggled on more decodable words because of his weakness in successive processing and resulting difficulty combining sounds in a sequential manner to identify targeted words. Instead, he was simply memorizing his way through books by using his strong simultaneous processing to take in the entire printed word form, a strategy much better suited for phonologically irregular words that cannot readily be decoded. Peter would benefit from an explicit phonological approach to reading (i.e., Fundations, Wilson, Orton-Gillingham, etc.) that allowed him to develop more automaticity with respect to blending sounds to recognize words.

Once again, the DCM provides a way to examine the specific processing strengths and weaknesses within Peter's neurocognitive abilities, as well as his academic skills, for eligibility determination and to develop targeted interventions. As can be seen from Figure 12.5, there was a significant discrepancy between Peter's successive processing and the rest of his psychological processing scores as measured by the CAS-2. In addition, the FAM indicated that his Procedural Index was a relative weakness, and FAR indicated that his Phonological Index was a weakness. Finally, there was a consistency between Peter's difficulties in the sequential aspect of mathematics (Procedural Index) and sequential aspects of reading (Phonological Index) and lower successive processing scores. Therefore, it is important to note that PASS basic psychological processes as measured by the ~~xxx~~CAS-2 help us understand variation in the development of numerous skills. Specific strategies to assist Peter in math may include learning how to chunk information, using mnemonic strategies to remember longer mathematical algorithms, practice number line fluency skills, and playing math games to develop greater procedural knowledge when problem-solving. See Naglieri and Pickering (2010) and Naglieri and Feifer (2017) for more information about interventions. Figure 12.6 illustrates Peter's profile of CAS2 and FAR-FAM scores using the DCM approach.

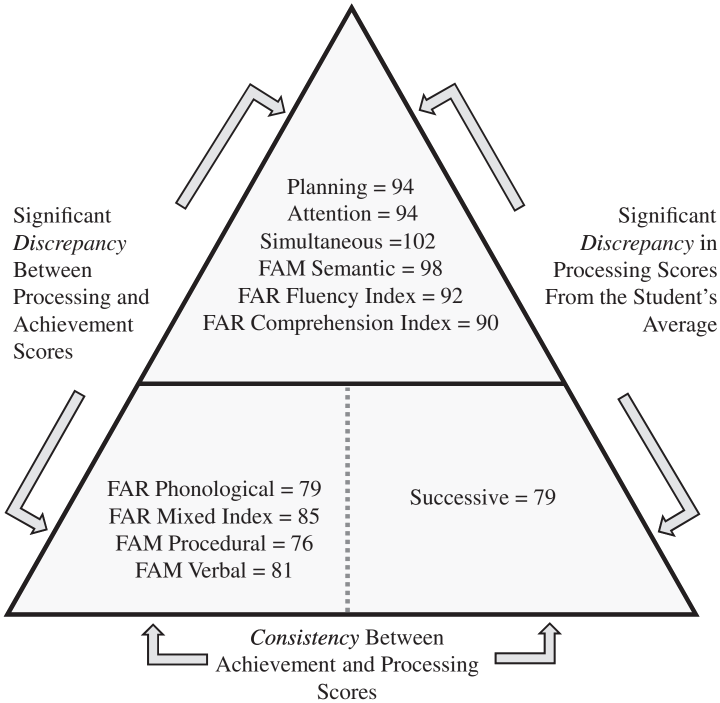

Figure 12.6. CAS-2, FAR, and FAM Results for Discrepancy/Consistency Method for the Case of Peter

VALIDITY OF THE PASS THEORY

IDEA 2004 and the DCM

The long-standing approach of using an ability-achievement discrepancy to determine if a child has an SLD is no longer required but is not disallowed in IDEA 2004, which also states that "the local educational agency may use a process that determines if the child responds to scientific, research-based intervention as a part of the evaluation procedures". Importantly, the Response to Intervention (RTI) method is allowed but not mandated (see §614(b) 6B of IDEA 2004). Instead of an ability achievement discrepancy or RTI, the analysis of the PSW in basic psychological processes (and achievement) originally proposed by Naglieri (1999) and suggested by others (Flanagan, Alfonso & Mascolo, 2011; Hale & Fiorello, 2004) has emerged as a viable method of SLD eligibility determination. The DCM described in the chapter provides a specific procedure for identifying SLD that is based on a PSW in basic psychological processes (PASS) and academic skills. Perhaps most important, using this method unifies the definition of SLD and the method used to identify children as suggested by Kavale et al. (2005) and Hale et al. (2004, 2006). These authors argued that because IDEA 2004 clearly states that children must have a disorder in "one or more of the basic psychological processes," a comprehensive evaluation of the basic psychological processes unites the statutory and regulatory components of the law (p. 11).

DOES THE DCM MEET IDEA 2004 REQUIREMENTS?

There had been an increasing emphasis on empirically supported methods of SLD eligibility determination in IDEA 2004. In order to demonstrate the science behind the DCM we are presenting, several of those requirements are discussed. Interested readers could read more on the validity of the PASS theory for SLD diagnosis and intervention in several other sources (Naglieri, 1999, 2005, 2008; Naglieri & Conway, 2009; Naglieri & Das, 1997, 2005; Naglieri & Otero, 2011, 2017) and, therefore, only a few points relevant to the DCM is summarized here.

> **DON'T FORGET**
>
> Always ask the question, "What empirical evidence is there that supports a particular approach to measuring basic psychological processes?"

IS COGNITIVE PROCESSING ASSESSMENT NONDISCRIMINATORY?

The need for fair assessment of diverse populations of students has become progressively more important as the US population continues to become more diverse. Recognizing this change, IDEA (2004) stresses that assessments must not discriminate on the basis of race, culture, or language background. Appropriate assessment of students who may have SLD from all race and ethnic groups must be accomplished using tools that are nondiscriminatory. At the heart of this issue is selection of the tools that can be most effectively used within a diverse context. Fagan (2000), Naglieri (2015), and Suzuki and Valencia (1997) argued that because processing tests do not rely on questions with language and quantitative content, they are more appropriate for assessment of culturally and linguistically diverse populations. Ceci (2000) suggested that a processing approach could (1) allow for early detection of disabilities before academic failure is experienced, (2) have better diagnostic utility, and (3) provide a way to better understand students' disabilities.

There is evidence that PASS cognitive processing scores differ minimally between race and ethnic groups and when the test is given in different languages.

DON'T FORGET

There is considerable evidence that the PASS theory as measured by the CAS can be appropriately used for culturally and linguistically diverse populations.

For example, PASS cognitive processing scores of 298 African American children and 1,691 Caucasian children were compared (Naglieri, Rojahn, Matto & Aquilino, 2005). Controlling for key demographic variables, regression analyses showed a CAS Full Scale mean standard score difference of 4.8 points in favor of Caucasian children. Similarly, Naglieri, Rojahn, and Matto (2007) examined the utility of the PASS theory with Hispanic children by comparing performance on the CAS of Hispanic and Caucasian children from the standardization sample ($N = 2{,}200$). The study showed that the two groups differed by 4.8 standard score points when demographics differences were statistically controlled. They also found that the correlations between achievement and the CAS scores did not differ significantly for the Hispanic and Caucasian samples (Naglieri et al., 2007). These initial findings suggested that measuring neurocognitive abilities rather than traditional intelligence quotients (IQs) resulted in smaller differences between Hispanic and Caucasian groups. The next study of Hispanics provided additional insights into the value of PASS theory as measured by the CAS.

Comparisons of PASS scores obtained for the English and Spanish versions of the CAS have been conducted. Naglieri, Otero, DeLauder, and Matto (2007) compared PASS standard obtained on the CAS when administered in English and Spanish to bilingual children referred for reading problems. The children earned similar Full Scale scores on the English and Spanish versions of the CAS, using the regular norms conversion tables, which were highly correlated ($r = .96$). Deficits in successive processing were found on both versions of the test (consistent with the view that children with reading disabilities are poor in this process), and 90% of children who had a cognitive weakness on the English version of the CAS also had the same cognitive weakness on the Spanish version of the CAS. 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 one point and a high correlation between the scores (.94). Similar results were reported for the CAS-2 Full Scale scores in the test manual (Naglieri et al., 2014a). Without controlling for demographic differences, Hispanics and non-Hispanics differed on the CAS-2 Full Scale scores by 4.5 points, and with controls for demographic characteristics, the difference was 1.8. Very similar results are reported in the CAS-2: Brief manual.

Natur (2009) compared Arabic-speaking Palestinian students using the Arabic version of the CAS to a matched sample of children from the United States. He found a very small difference between the Arab (Full Scale standard score mean of 101.0) and US (Full Scale standard score mean of 102.7) scores using the US norms. Naglieri, Taddei, and Williams (2013) found that Italian children's ($N = 809$) Full Scale standard score of 100.9 on the Italian version of the CAS (Naglieri & Das, 2006) was very similar to the Full Scale of 100.5 for a matched sample of US children ($N = 1{,}174$) from the original standardization sample. The samples' CAS standard scores were based on the US norms. Importantly, multigroup confirmatory factor analysis results supported the configural invariance of the CAS factor structure between Italians and Americans for the 5- to 7-year-old and 8- to 18-year-old age groups.

Race differences in PASS scores have also been studied. The CAS scores of 298 African American and 1,691 Caucasian children were compared by Naglieri, Rojahn, Matto, and Aquilino (2005). Controlling for key demographic variables, regression analyses showed a CAS Full Scale mean score difference of 4.8. They also found that correlations between the CAS scores and Woodcock-Johnson–Revised Tests of Achievement (WJ-R ACH; Woodcock, McGrew, & Mather, 2001) were very similar for African Americans (.70) and Caucasians (.64), illustrating the lack of predictive bias in the scores. This research was replicated by results for the CAS-2 and the CAS-2: Brief. The approach used to compare race groups was the same method described by Naglieri et al. (2005). After the effects of gender, region, parental education, and educational setting were statistically controlled a CAS-2 Full Scale standard difference of 4.5 score points was found. Similar findings are reported in that manual for the CAS-2: Brief.

The small differences by race and ethnicity, as well as the similarity in scores across different versions of the CAS (English versus Spanish, US versus Arabic, and US versus Italian samples), as well as the factorial similarity for the Italian and US samples strongly suggest that the neuropsychologically based PASS theory as measured by the CAS appears to be robust across cultures and language. These findings are best understood within the context of differences found on other ability tests, which is summarized next.

Table 12.10 provides a summary of standard score differences by race for the CAS (Naglieri & Das, 1997) and CAS-2 (Naglieri et al., 2014a), K-ABC and KABC-II (Kaufman & Kaufman, 1983, 2004), the Stanford-Binet-IV (SB-IV; Roid, 2003), the WISC-IV (Wechsler, 2003), and the Woodcock-Johnson Tests of Cognitive Abilities, Third Edition (WJ-III; Woodcock et al., 2001). The results for the WISC-IV are reported by O'Donnell (2009), the SB-IV by Wasserman and Becker (2000), and the WJ-III results are from Edwards and Oakland (2006). The race differences for the K-ABC normative sample were reported in that test's manual (Kaufman & Kaufman, 1983) and the findings for the KABC-II were

Table 12.10 Mean Standard Score Differences by Race on Several Ability Tests

Ability Test	Standard Score Difference	
Traditional IQ Tests		
	SB-IV**	12.6
	WISC-IV*	11.5
	WJ-III*	10.9
	WISC-IV**	10.0
Nontraditional Tests		
	K-ABC**	7.0
	K-ABC**	6.1
	KABC-II**	5.0
	CAS-2*	6.3
	CAS***	4.8
	CAS-2***	4.3

Note: Comparisons made using unmatched samples from the standardization samples are designated with*; samples matched on demographic characteristics are designated with **, and sample differences controlled using regression procedures are designated with ***.

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 CAS-2 by Naglieri et al. (2014a). The results clearly show that measuring ability as a cognitive process as operationalized by the CAS, CAS-2, KABC, and KABC-II is associated with smaller race differences (see Naglieri & Otero, 2017, for more details).

There is an important difference between traditional IQ tests and those tests that take a cognitive processing approach to conceptualizing ability. That is, the content of the subtests is less academically laden, especially the CAS and CAS-2. We suggest that the exclusion of tests that demand knowledge of words (e.g., vocabulary, similarities) and math (e.g., arithmetic) and the inclusion of tests that represent a theoretical conceptualization of basic psychological processes play a critical role in reducing the differences between groups. It is important, however, to ask the question, "Does elimination of academic content reduce the validity of the processing test?" This question is perhaps most clearly addressed by studying the correlation between the scores from a test of processing with a test of achievement.

PASS Relationship to Achievement

Understanding the relationship between a test of ability or basic psychological processes with a test of achievement is complicated by the fact that IQ test questions measure very similar content to achievement tests (e.g., vocabulary, arithmetic word problems, phonological skills, etc.). For this reason, traditional IQ tests have an advantage over those measures that do not include verbal and quantitative test items (Naglieri & Bornstein, 2003). Despite that advantage, Naglieri (1999) initially reported that the correlations between achievement test scores with the CAS and K-ABC were as high as or higher than those found for the WISC-III and WJ-R. More recently, Naglieri (2015, 2016) examined the strength of the correlation between the WISC-V and WIAT-III using data from the test's manual (Table 5.12; Wechsler, 2014). In order to look at the relationship with and without the influence of those portions of the WISC-V, we require verbal knowledge used in the two procedures. 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 allows for a way to understand how correlated the Wechsler is when the most achievement-like scale (Verbal Comprehension, which includes questions that require knowledge, similarities, and vocabulary) is excluded. When combined with other test data, this method proves very revealing. The same approach was taken with data from the Woodcock-Johnson IV Test of Cognitive Abilities and Achievement (2014, Table 5.6) and the K-ABC-II (Kaufman & Kaufman, 2004). The findings are provided in Table 12.11.

What is most revealing about these results is the clear pattern across the WISC-V, WJ-III, and the KABC-II. The correlations between each of these tests and achievement was higher when the scales that demand verbal knowledge were included. The Verbal Comprehension scale and the WIAT-III give the best explanation why. The results were so highly correlated because of the similarity in content across the two tests. Some researchers (e.g., Lohman & Hagan, 2001) argue that this is evidence of validity; we suggest that correlations between achievement test scores and ability tests are artificially inflated because of the shared content. The correlations between the scales that do not require knowledge

Table 12.11 Average Correlations Between Ability and Achievement Including and Excluding the Most Academically Laden Scales on the Tests of Ability

Average Ability and Achievement Correlations			All Scales	Selected Scale Correlations
WISC-V	Verbal Comprehension	.74	.53	
WIAT-III	Visual Spatial	.46		.47
N = 201	Fluid Reasoning	.40		
	Working Memory	.63		
	Processing Speed	.34		
WJ-IV COG	Comprehension Knowledge	.50	.54	
WJ-IV ACH	Fluid Reasoning	.71		
N = 825	Auditory Processing	.52		
	Short-Term Working Memory	.55		.50
	Cognitive Processing Speed	.55		
	Long-Term Retrieval	.43		
	Visual Processing	.45		
KABC-II	Knowledge/GC	.70	.53	
WJ-III ACH	Sequential/Gsm	.43		.48
N = 167	Simultaneous/Gv	.41		
	Learning/Glr	.50		
	Planning/Gf	.59		
CAS	Planning	.57	.59	
WJ-III ACH	Simultaneous	.67		
N = 1,600	Attention	.50		
	Successive	.60		

are a more accurate estimate of the relationship between ability as measured by a specific test and achievement. In this summary, what is found is that the correlation for the CAS, which does not include these achievement-laden subtests was .59, higher than all the others.

Do Exceptional Children Have Specific PASS Profiles?

Recently, Naglieri (2015) summarized reports found in the Wechsler Intelligence Scale for Children, Fourth Edition (WISC-IV; Wechsler, 2003) technical manual, 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 et al. (2007). We have added the WISC-V (Wechsler, 2014) data from that test's manual to this comparison as shown in Figure 12.7. The findings must be considered with recognition that the samples were not matched on demographic variables across the various studies, the

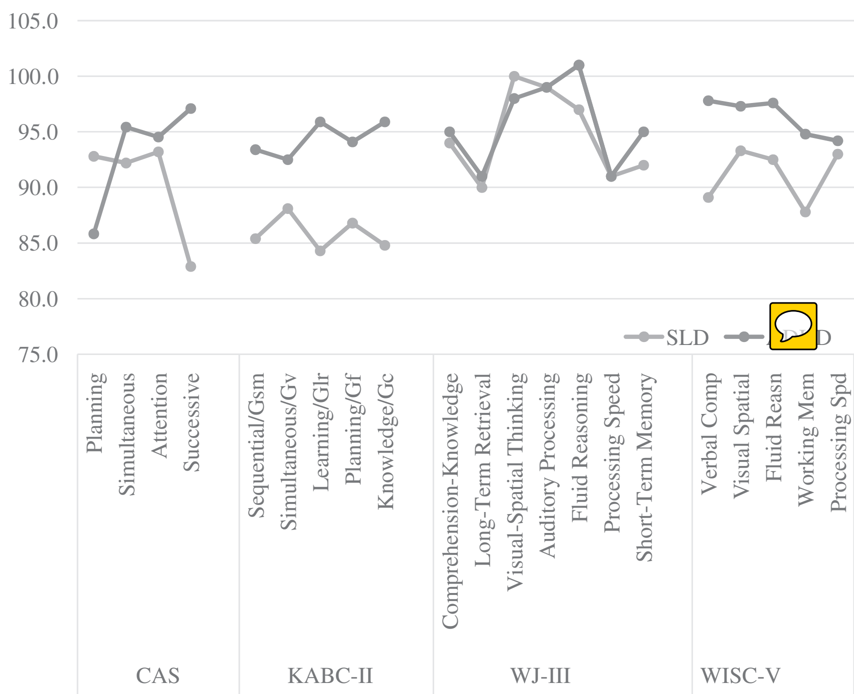

Figure 12.7. Ability Test Profiles for Students With Specific Learning Disabilities and Attention-Deficit Hyperactivity Disorder

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, thereby providing validity evidence for application of the DCM for SLD diagnosis. As is apparent from these data, the students with a specific reading decoding disability showed a specific PASS cognitive weakness that is different from those with ADHD. These findings provide support for use of the PASS theory and the DCM.

The profiles of the PASS processing standard scores obtained from children with reading decoding disability and ADHD are consistent with theoretical expectations and previous research (see Figure 12.7). For example, reading decoding is a common problem for many children that has been related to a cognitive weakness in successive processing. Das, Naglieri, and Kirby (1994) suggested that a successive processing deficit underlies a phonological skills deficit and is an associated reading decoding failure. Successive processing's involvement increases if the word is not easily recognized, and this process is even more important if the words are to be read aloud because articulation also requires a considerable amount of successive processing. For this reason, a test of phonemic skills, such as phonemic separation, is sensitive to reading failure (Das, Mishra, & Kirby, 1994). Several studies on the relationship between PASS and reading disability have shown that successive processing is an important ability that underlies phonological skills (Das, Parrila, & Papadopoulos, 2000). Finally, Huang, Bardos, and D'Amato (2010) studied PASS profiles on the CAS for large samples of students in regular education ($N = 1{,}692$) and students with learning disabilities ($N = 367$). They found 10 core PASS profiles for those in regular educational and eight unique profiles from students with SLD. Haung et al. (2010) concluded that "a student with a true LD has a relatively high chance of being accurately identified when using profiles analysis on [PASS] scores" (p. 28). They added that their "analysis has provided evidence for the use of the PASS theory and that it appears that it has sufficient applications for diagnosis for students suspected of having a LD" (p. 28). Individuals with ADHD have a different disorder in basic psychological processing. Is there a theoretical reason why individuals with ADHD have a weakness in planning? Yes, and the theory is borne out by the research.

According to Barkley (1997) "ADHD represents a profound disturbance in self-regulation and organization behavior across time" (p. vii). Children with ADHD (combined and hyperactive-impulsive types) exhibit problems with inhibition, poor planning, reduced self-monitoring, poor organization, impaired problem-solving, poor self-regulation, and problems developing, using, and monitoring strategies (Barkley, 2003; Hale, Fiorello, & Brown, 2005). These children are described as having difficulty with the basic psychological process of planning (Naglieri & Otero, 2011) and executive function, which are associated with the prefrontal lobes (Goldberg, 2009). Associating these symptoms to the frontal lobes as suggested by Goldberg provides a clear connection between the disorder and the PASS neurocognitive theory we have presented in this chapter and as described by Naglieri and Otero (2011, 2017). The data presented in this chapter for individuals with ADHD are also consistent with cross-cultural studies and findings by Van Luit, Kroesbergen, and Naglieri (2005) and Taddei and Venditti (2010), who found that Dutch and Italian children with ADHD, respectively, also earned their lowest score on the Planning scale of the CAS. Finally, Canivez and Gaboury (2010) also found support for the diagnostic utility of the PASS theory for those with ADHD.

CONCLUSION

The purpose of this chapter was to describe a procedure that can be used to identify children with SLD using the PSW model and the DCM. Our approach to defining and measuring basic psychological processes that form the foundation of the PSW is based on the PASS neurocognitive theory that has been extensively studied. We have shown how the DCM can be used within the PASS theory, which unites a test of basic psychological processes (CAS-2) with tests of reading (FAR) and math (FAM). We have also presented case studies and research evidence that illustrate the extent to which our approach meets requirements of IDEA 2004, that the assessment of SLDs is not discriminatory, and that the tools used are valid for this purpose. Our goal is to use new approaches to measuring cognition and achievement that, as the evidence presented in this chapter and elsewhere, are theoretically sound, empirically supported, and straightforward to use. Our hope is that we can help practitioners more accurately identify and instruct students with SLDs.

TEST YOURSELF

1. The definition of an SLD used in IDEA 2004:

(a) Requires an ability achievement discrepancy
(b) Is based on a disorder in one or more of the basic psychological processes
(c) Requires having deficits in more than one academic area
(d) Requires measuring words per minute

2. **The DCM requires that a "disorder" in basic psychological processing be:**
   (a) Low relative the norm
   (b) Low relative to the student's average
   (c) Neither a nor b
   (d) Both a and b
3. **IDEA 2004 requires that assessment of SLDs be determined using:**
   (a) A comprehensive evaluation
   (b) RTI only
   (c) Measures that are valid for the purposes for which they were intended
   (d) A and c only
4. **When using a PSW approach there should be:**
   (a) A "disorder" in basic psychological processes
   (b) Achievement test scores that align with the variation of processing scores
   (c) Both a and b
5. **According to IDEA 2004 an appropriate test of basic psychological processes should be:**
   (a) Nondiscriminatory
   (b) Reliable
   (c) Valid for the purpose for which it is used
   (d) All of the above

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

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