PASS Theory of Intelligence and the CAS2

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The goal of this book is to describe the context within which the PASS theory of intelligence was conceived and the reasons why this theory was used to guide construction of the Cognitive Assessment System (Naglieri & Das, 1997) and the several versions of the Cognitive Assessment System, 2nd Edition (Naglieri, Das & Goldstein, 2014). We also discuss validity issues such as equitable assessment of intelligence, using PASS scores to examine a pattern of strengths and weaknesses related to academic variability and diagnosis, and the utility of PASS scores for intervention. We suggest there is ample evidence to move beyond traditional IQ tests to embrace a second generation of intelligence tests which reflect brain function. Finally, we provide summaries of the research which supports our conclusions that intelligence testing should be theory-based, not constrained by the seminal work of test developers in the early 1900s, and measure neurocognitive processes based on brain function.

CHAPTER I. INTRODUCTION

> "ASSESSMENT OF HUMAN INTELLIGENCE DEMANDS MEASURING THINKING IN A WAY THAT IS NOT CONFOUNDED BY KNOWLEDGE; AND THINKING (INTELLIGENCE) SHOULD BE DEFINED BY BRAIN FUNCTION." — JACK A. NAGLIERI

The relationship between the PASS theory, the Cognitive Assessment System, Second Edition (CAS2; Naglieri et al., 2017) and other measures of intelligence are better understood and appreciated from a historical perspective. As Carl Sagan (1980) explained, "You have to know the past to understand the present." More recently, Sagan's mentee Neil DeGrasse Tysons cautioned, "One of the great challenges in this world is to know enough about a subject to think your right, but not enough about the subject to know your wrong" (*Neil deGrasse Tyson Teaches Scientific Thinking and Communication,* n.d.). This is especially true as we describe the present state of intelligence testing and the impact that these tests have had since they were initially developed.

During most of the 1900s and almost a quarter of 2000s, group and individually administered intelligence tests have played a key role in the practice of psychology. Since Terman built upon the work of Binet and Simon to create the 1916 Stanford-Binet, the scores these tests provided have changed the course of countless peoples' lives. The importance of tests of intelligence was recognized nearly 100 years ago by Bronner et al. (1927) who wrote, "Investigation of the mental capacities of human beings may rationally be considered a matter of prime importance for the individual and for civilization" (p. v). Today, intelligence tests are one of the most widely used tools by psychologists and the scores these tests yield are used to make important decisions about children (Benson et al., 2019).

Despite the widespread use and the enormous impact these tests' scores have had, there has been and continues to be considerable controversary over their value, test fairness, interpretation, and even how to define and measure intelligence (e.g., APA, 2021; Ackerman, 2022; Kaufman et al. 2016; Naglieri & Otero, 2017). Of all the issues surrounding intelligence tests, perhaps the two most important questions are: (a) What *theory* of intelligence was used to create the test of intelligence; and (b) do the test questions demand knowledge? To appreciate the current state of intelligence testing we need to begin with an examination of the initial efforts by Alfred Binet and Theodore Simon.

The seminal work of Binet and Simon (1916) can be considered the foundation of the intelligence testing movement. They created three initial scales to measure intelligence (1905, 1908, & 1911) and they made it clear that, "The scale … is not a theoretical work; it is the result of long investigations…in the primary schools of Paris, with both normal and sub normal children" (Binet & Simon, 1916, p. 41). Without a *theory of intelligence* to guide them, Binet and Simon, and other psychologists who created versions of the Binet-Simon scales (e.g., Goddard, 1911; Herring, 1923; Kuhlmann, 1922 & 1939; Terman, 1916; & Yerkes, 1915, 1921 & 1923) determined the content of their work *based on their personal views* of what to measure because there was no theory of intelligence to rely on. For example, Lewis Terman's 1916 version of the Stanford-Binet was developed based on his own views of what constitutes intelligence. This widely known and used adaptation of the Binet-Simon scale (Freeman, 1955) also became very controversial because of what Terman added to his version that Binet and Simon deleted in their 1911 version.

When developing the 1911 edition, Binet and Simon thoughtfully made the decision to delete certain items from the previous 1908 edition. They wrote, "There are tests which require knowledge outside the intelligence of the child…that he has learned … from his parents or friends…and there are tests too exclusively scholastic, we have thought well to suppress" (Binet & Simon, 1916, p. 275). They continued writing, "This verbal superiority must certainly come from the family life [this statement was underlined in the version of Binet and Simon's 1916 book published in 1980 with marginal notes by Lewis Terman]; the children of the rich are in a superior environment from the point of view of language; they hear a more correct language and one that is more expressive" (p. 320). The separation of verbal knowledge from intelligence is also apparent in Binet and Simon's (1916) definition of intelligence, "To judge well, to comprehend well, to reason well, these are the essential activities of intelligence" (p. 43). The difference between the 1908 to the 1911 versions of the Binet-Simon scales illustrates a fundamental distinction between intelligence and achievement (Pintner, 1923). Lewis Terman chose a differing perspective when he developed his 1916 edition.

Terman *included* items dependent upon school learning in the 1916 Stanford-Binet because he believed that "intelligence at the verbal and abstract levels is the highest form, the *sine qua non*, of mental ability" (Freeman, 1955, p. 127). This version of the Stanford-Binet would be criticized because it relied "much too heavily with verbal and abstract material, thus penalizing the individual who for whatever reason, had been handicapped … by lack of opportunity to acquire and develop the use of the English language" (Freeman, 1955, p. 127). The possible threat to validity created by test questions that demanded knowledge of English and academic skills was noted by many others. For example, Pintner (1923) wrote, "A good intelligence test must avoid as much as possible anything that is commonly learned. In a broad sense this rests upon a differentiation between knowledge and intelligence" (p. 61). Nevertheless, Terman's work on the Stanford-Binet influenced the content of the group and ultimately, individually administered intelligence tests. It also influenced the test development work of his student Arthur Otis (1918) whose dissertation impacted the development of the US Army Alpha and Beta Tests (Yoakum & Yerkes, 1920; Yerkes, 1921).

Lieutenant Colonel Yerkes (1921) provided the most complete description of the Army Alpha and Beta in the book entitled the *Memoirs of the National Academy of Sciences Volume XV Psychological Examining in the United States Army.* Yerkes began with this statement, "When, on April 6, 1917, the Nation was called to war a group of experimental psychologists promptly assembled to consider means of psychological service" (Yerkes, 1921, p. v). He described a way to "arrange a method of examining recruits in groups of 25 to 50, as an initial psychological survey" (p. 9). The aim was to "aid in the segregating and eliminating the mentally incompetent; classify men according to their mental ability; assist in selecting competent men for responsible positions" (p. 19). Yoakum and Yerkes (1920) also presented the criteria for development of the Alpha and Beta tests which made clear that "the test must be made as completely independent of schooling and educational advantages as possible" (p. 3). They also recognized the limits of the way test content was presented and regarding the US Army Alpha (the verbal tests) when they wrote, "Men who fail in alpha are sent to beta [the nonverbal test] in order that injustice by reason of unfamiliarity with English may be avoided" (p. 19). For this reason, the Alpha was intended for literates and the Beta for illiterates. Despite these cautions regarding verbal test content, the Army Alpha and Beta would be widely used in WWI for evaluating recruits and these tests would have a substantial effect on the content of intelligence tests for decades to come.

Perhaps the most important person who was ultimately influenced by Terman's Stanford-Binet and the Army Mental Tests was the 22-year-old David Wechsler who arrived at Fort Logan, Texas in May 1918 as part of the Medical Corps, trained in the School of Military Psychology (Yerkes, 1921). The intelligence test he would ultimately publish in 1939 would include subtests very similar to those found in the Army Alpha and Beta (Matarazzo, 1972). In fact, many of the subtests had the same name and very similar items. Decades later McNemar (1964) noted that despite different titles and authors, intelligence tests developed to that point were, "little more than tests of general intelligence, and thus are direct descendants of the Alpha and Beta which, in turn, were descendants of the Binet-Simon" (Matarazzo, 1972, p. 46).

Wechsler's Verbal and Performance Scales would become the most widely used measure of intelligence perhaps because it was based on the Army Alpha and Beta even though these tests were not conceived on a theory of intelligence which would guide item development. As Pintner (1923) stated, "We did not start with a clear definition of general intelligence… psychologists borrowed from every-day life a vague term implying all-round ability… and has been and still is attempting to define it more sharply and endow it with a stricter scientific connotation" (p. 53).

We suggest that the first question that should confront any intelligence test developer should be, "What theory of intelligence will the test be built upon?" The question of test content would then be guided by the theory of intelligence. We further suggest that the theory of intelligence should be based on an understanding of neurocognitive brain functions. This is precisely the way the Planning, Attention, Simultaneous and Successive (PASS) theory and the Cognitive Assessment System (CAS) (Naglieri & Das, 1997) were conceived and developed. The primary advantage of using the PASS theory is that it provided a definition of intelligence associated with brain functions, a clear vision of what the subtests should measure, and test content was not constrained by previous tests.

J. P. Das reported two events that led to the PASS theory in an interview posted by Naglieri (2023). First was his reaction to a lecture Luria gave at the 1969 World Psychology Conference in London entitled, "The Origin and Cerebral Organization of Man's Conscious Action". Second was the publication of Luria's 1970 paper in *Scientific American* entitled, "The Functional Organization of the Brain." Das said, "at that time Luria's paper in *Scientific American* was catching on and when Luria talked about cortical function [the three functional units] that made me think intelligence must be based somewhere in the brain. In my paper on mental retardation (Das & Jarman, 1975), we found two factors that could be interpreted from Luria: Simultaneous and Successive processes. We published the initial book Simultaneous *and Successive Cognitive Processes* (Das et al., 1979) which described these two components of Luria. I was full of these big ideas and then you (Jack Naglieri) magically appeared." That was the origin of the PASS Theory and the CAS.

Luria's description of brain function provided a conceptualization of intelligence that could be considered the impetus for a second generation of intelligence tests. The description of Simultaneous and Successive processing was one of the theories that influenced the work of Alan and Nadeen Kaufman. They emphasized the importance of having a theoretical basis and a focus on cognitive processes when they created the K-ABC in the late 1970s. I (JN) had the privilege of being involved with that seminal effort. That was revolutionary; and that test remains a viable alternative to traditional IQ tests. The research of J. P. Das and his colleagues on Simultaneous and Successive Cognitive Processing was referenced by the Kaufmans during the development of their test. Today, it behooves all those who use tests to be fully informed about the validity and utility of any innovative approach to conceptualizing and measuring human intelligence.

In the remainder of this book, we will provide a description of each of the PASS neurocognitive abilities, their measurement and relevance to learning. Details of the neuropsychological foundation of the PASS Theory and recent research on neuro networks will be provided. The research on the relationship between intelligence test item content and test fairness will be summarized followed by related validity issues such as factorial support for PASS, correlations to achievement, profiles of strengths and weaknesses and a method for eligibility determination and intervention. We will conclude with a discussion of the ethical obligations of psychologist vis-à-vis equity and the practice of intellectual assessment.

CHAPTER 2. THE PASS NEUROCOGNITIVE THEORY

The PASS theory (Naglieri & Das, 1997a) is rooted in the conceptualization of brain function as described by Alexander Luria (1966, 1973a, 1980). Das and Naglieri utilized Luria's description of the basic neurocognitive processes to define intelligence (Das et al., 1994; Naglieri & Das, 1997a; Naglieri & Otero, 2017). Luria hypothesized that human cognitive functions can be conceptualized within a framework of three separate but interrelated brain systems that provide four basic psychological processes. These brain systems are referred to as functional units because the neurocognitive mechanisms work in separate but interrelated components, namely, Planning, Attention, Simultaneous, and Successive basic psychological processes. Each of these neurocognitive abilities will be described in the sections that follow.

PLANNING

Planning is a neurocognitive ability used when a person decides how to complete a task which involves using a strategy, self-monitoring, and self-correction especially in novel situations (Goldberg, 2009). This includes control of actions and thoughts so that solutions to problems can be achieved. Planning provides for the generation of ways to solve problems, especially in situations where no method or solution is immediately apparent. In those situations, this may involve acquisition or retrieval of others' solutions as well as use of the other PASS strengths. Planning ability is also important when individuals reflect on events following a problem that was completed, recognizing what worked, what did not work, and anticipating other viable options to consider in the future. The frontal lobes of the brain are directly involved in Planning processing (Naglieri & Otero, 2011) and are like concepts such as metacognition and executive function (Goldberg, 2009).

CAS2 and CAS2: Brief subtests on the Planning scale vary in their content, but they all present the examinee with novel problems to solve. The examinee who creates a strategy completes the task more efficiently and therefore obtains a higher score. All the Planning subtests on the CAS2 and CAS2: Brief are best solved using strategies for efficient performance. The questions on the CAS2: Rating scale ask how well the student decides *how* to do things, thinks before acting and avoids being impulsive. The Planning subtests were created to detect spontaneous development and use of strategy was made possible because minimal constraints are placed on the way the student completes the tasks. That is, the instructions were explicitly designed to inform the student to complete the task using whatever method seems best. The instruction, "You can do it any way you want" provides the flexibility to use strategies to complete the relatively easy tasks. This enables the score to reflect efficiency, measured by how long it takes to complete the task and the number of correct responses.

For example, the Planned Codes subtest on the CAS2 is best completed using a strategy. Planned Codes require the child to write a specific letter code under the corresponding letter (e.g., XO for A, OX for B, etc.). 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 significantly higher scores than those who do not (Naglieri et al., 2014a). The Planning scale score can be compared to the information about the student's use of strategies from the CAS2: Rating Scale.

Classroom behaviors and the questions on the CAS2: Rating Scale can provide insight into a student's ability to use planning. For example, the teacher's observations about how well the student solves novel tasks and how well a student can think of several ways to solve a problem can illustrate if and how a student is using Planning. Examples of this include having a goal in mind when a student considers various strategies, applies a strategy, and then decides if the result is consistent with the intention. It is important to know, 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 following directions rather than how well the student *could* develop a variety of solutions.

ATTENTION

Attention is a neurocognitive ability used to selectively focus on a specific stimulus while inhibiting responses to other stimuli (Naglieri et al., 2014a). Attention is an essential component of intelligent behavior because it provides cortical arousal, higher forms of attention, and is required for recruitment of other neurocognitive processes. 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, 1973b, p. 271). Higher forms of attention include focused and selective cognitive activity, shifting attention based on salience, and resistance to distraction. The longer attention is needed, the more the activity requires effort.

ATTENTION SCALE SUBTESTS

The subtests used in the CA2 and CAS2: Brief Attention scales vary in their content, but all are multidimensional and created so that the tendency to respond to the most salient part is distracting. 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 red word written in blue ink) as in the Stroop test (Stroop, 1935). This task requires resistance to distraction, focused, selective, sustained, and effortful activity (Lezak, 1995). Focused attention allows for identification of a specific stimulus, selective attention provides the inhibition of responses to distracting stimuli and sustained attention provides continued effort over time.

Classroom behaviors observed by the teacher and questions in the CAS2: Rating Scale can reflect a student’s ability to attend and resist distractions over time. For example, behavioral evidence of good attention can be noted when the teacher observes how well a student can stay focused on their work despite distractions in the class and maintain effort. There are many classroom activities that are particularly dependent on the neurocognitive concept of Attention. For example, tasks which require focused attention and resistance to distractions from the environment as well as distracting thoughts. Some tasks demand more attention than others, especially as the complexity increases. For example, reading a single word requires much less attention than reading and understanding a paragraph. Solving a math problem such as 2 + 6 – 1 =? involves attending to the numbers and the signs in addition to knowing the math facts. Answering multiple-choice tests 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 multiple-choice options are similar. This ability is associated with the base of the brain.

SIMULTANEOUS

Simultaneous processing is a neurocognitive ability used to integrate separate stimuli into a single whole or interrelated group (Naglieri et al., 2014a). This ability is used when separate elements must be combined into a conceptual whole. This may involve visual-spatial as well as linguistic stimuli that require comprehensive grammatical structures. The spatial aspect of Simultaneous ability involves the perception of stimuli and their interrelationships as a whole and the use of visual images. The grammatical dimension of Simultaneous processing provides a way to integrate words into ideas through the comprehension of word relationships, prepositions, and inflections so the person can obtain meaning. It is important to recognize that Simultaneous processes (like all PASS abilities) can involve nonverbal as well as verbal content. This ability is associated with the parietal-occipital-temporal brain regions.

SIMULTANEOUS SCALE SUBTESTS

The CAS2 and CAS2: Brief subtests used to measure Simultaneous processing vary in their content, but all require that the examinee gain an understanding of the interrelationships among the information provided in the item which might be visual spatial or linguistic. For example, the Matrices and Verbal Spatial Relations subtests on the CAS2, respectively. Although the Matrices and Verbal-Spatial Relations subtests differ in their content (nonverbal and verbal) they demand the same Simultaneous neurocognitive ability because both subtests require an understanding of the interrelationships of information. The third subtest on this scale is Figure Memory which is a visual spatial task that requires identifying the details of a shape that we exposed for five seconds when that shape was embedded in a more complex design. The diversity of the demands across these subtests, and all subtests on the CAS2, illustrates how the fundamental factor which influences the score is one of the PASS processes.

Classroom behaviors and items included in the CAS2: Rating Scale can reflect the use of Simultaneous processing. Students who prefer hands-on materials and visual-spatial tasks, like to draw designs, especially three-dimensional ones, and those who are good at patterns and complex shapes are usually good in Simultaneous processing. Simultaneous neurocognitive ability is also essential for identifying words as a whole (e.g., sight words), understanding grammar and patterns in the spelling of words, verbal concepts, and reading comprehension dependent on getting the big picture. Following directions such as, "put your coat on the back of the chair behind you" demands Simultaneous processing because the examinee must understand the relationships among each of the objects. Any task that demands that a person combines many parts of information or things together into an organized whole may be particularly dependent upon Simultaneous neurocognitive ability.

SUCCESSIVE

Successive processing is a neurocognitive ability used when information is arranged in a specific sequence in which each part follows the other in a strictly defined order (Naglieri et al., 2014a). Successive processing is used to manage any activity that is arranged in a sequence, for example, formation of sounds and movements into a specific order. This ability is necessary for recall of information in order, understanding a statement based on the syntax of the language, as well as phonological analysis (Lezak, 1995). Successive processing is important for initial acquisition of reading, decoding, remembering the sequence of motor movements, speech articulation, and any task that requires sequential order. This ability is associated with the temporal brain regions.

SUCCESSIVE SCALE SUBTESTS

The CAS2 and CAS2: Brief subtests used to measure Successive processing vary in their content, but all assess how well a student can manage a sequence of stimuli. 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 as well as comprehension of sentences that are understood only by appreciating the sequence of words. The CAS2 also measures successive processing across auditory and visual modalities using the Word Recall and Visual Digit Span tests, respectively. It is important to note that all Successive neurocognitive tests require working with information in a specific order.

Classroom behaviors and those included in the CAS2: Rating Scale can reflect a student's facility working with information in order. For example, following a series of directions given by the teacher demands Successive processing. Similarly, the examination of the sequence of a 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 confusing words and must focus carefully on the pronunciation of sounds in order. Finally, Successive processing is involved in speech articulation, and the initial acquisition of complex movements.

CHAPTER 3. MEASUREMENT OF PASS THEORY USING CAS2

CAS2, CAS2: BRIEF & CAS2: RATING SCALE

There are several ways to measure PASS neurocognitive abilities using the Cognitive Assessment System, Second Edition (CAS2; Naglieri et al., 2014a). Practitioners have the option to use the CAS2 12-subtest Extended version which yields standard scores for all subtests, the Full Scale, Planning, Attention, Simultaneous, Successive scales and six Supplemental scores (see Figure 1). The CAS2 8-subtest version yields all subtests and five scores for the PASS and Full Scale. Both versions as well as the English, Spanish (Naglieri et al., 2017), and Digital (Naglieri & Otero, n.d.) formats are scored using *CAS2: Online Scoring and Report System* (Naglieri et al., 2014d) which generates all scores and an interpretive report. The CAS2: Brief is comprised of four subtests, which yields five standard scores (PASS and a Total Score). A list of the subtests included in the CAS2 12 and 8-subtest versions and the CAS2: Brief is provided in Table 1. The 8 subtests on the CAS2 Core are the same as those on the CAS2 Extended but the subtests on the CAS2 Brief are similar but not the same as those on the CAS2. Finally, the CAS2: Rating Scale is comprised of 10 items per PASS scale completed by a teacher also yields PASS and Total scores. Standard scores set at a mean of 100 and standard deviation of 15 are provided.

FIGURE 1. COGNITIVE ASSESSMENT SYSTEM- 2ND EDITION.

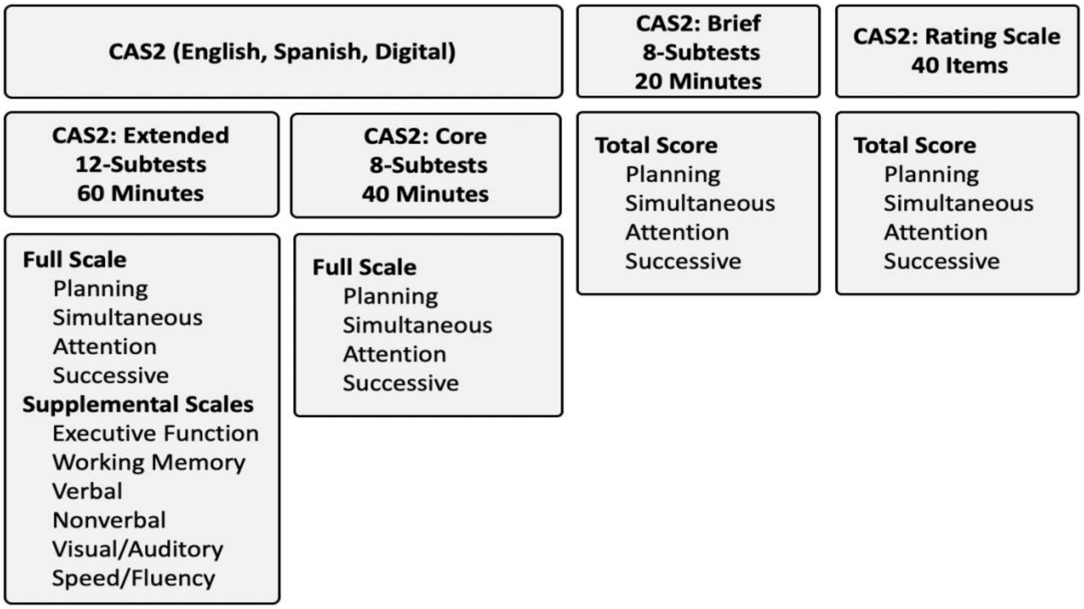


TABLE 1. SUBTESTS INCLUDED IN THE THREE VERSIONS OF THE CAS2.

CAS2 Extended	CAS2 Core	CAS2 Brief
Planned Codes	Planned Codes	Planned Codes
Planned Connections	Planned Connections	
Planned Number Matching		
Matrices	Matrices	Simultaneous Matrices
Verbal-Spatial Relations	Verbal-Spatial Relations	
Figure Memory		
Expressive Attention	Expressive Attention	Expressive Attention
Number Detection	Number Detection	
Receptive Attention		
Word Series	Word Series	Successive Digits
Sentence Repetition or Sentence Questions	Sentence Repetition or Sentence Questions	
Visual Digit Span		

Note. The 8 subtests on the CAS2 Core are the same as those on the CAS2 Extended but the subtests on the CAS2 Brief are similar but not the same as those on the CAS2.

One unique feature of the CAS2 and CAS2 Brief is that once the standard administration directions are provided to the examinee, the examiner is allowed to use alternative means to ensure the examinee clearly understands what is required to complete the task. If the child does not seem ready or appears in any way confused or uncertain, the examiner is allowed to provide a brief explanation if necessary. This is intended to give the examiner the freedom to explain what the child must do in whatever way necessary to ensure that the child understands the task. This can be in any form including gestures, verbal statements, or communication in any language. The intent of this instruction is to give the examiner full decision making to make clear the demands of the subtest and to enable the examiner to be certain that the child was well-informed about what to do. To date we are not aware of any other measure of cognitive ability allowing this additional method. For more information about the different versions of the CAS2 including for example, PASS scale variability, psychometric analysis of differential item functioning, and score interpretations, see the respective Manuals.

The development of the CAS2 Español began with an initial translation of the CAS into Spanish undertaken in 2000 by a group at the University of Puerto Rico led by Wanda Rodriquez. These researchers used a method called "back translation" in which the test is translated from English to Spanish, and then it is translated back from Spanish to English. The administration and scoring manual, the test's written materials, and the test scoring sheet were translated using this method. The twelve CAS subtests were divided into two equal groups, and each group was assigned to a pair of translators. Each translator of the team worked independently on six subtests, and once the subtests were translated, the two translators on the same team compared their translations. Any disagreements were discussed and when necessary, teams consulted a translator on the other team. When agreement was reached in the translation of their six subtests, one translator from each team joined to determine the consistency of the vocabulary used in the whole test. Once these processes were completed, the product was presented to two psychologists with broad experience in instrument translation and they in turn checked for the coherence between the English and Spanish versions. A similar approach was used for the CAS2—Spanish, but with a larger group of experts which included psychologists and educators from different geographical locations with knowledge of different Spanish dialects.

Within the normative sample of the CAS2, Hispanic males and females were proportionally well represented consistent with the 2011 US census. According to the US census, Hispanics ages 5 to 21 years constituted 21% of the population, and the CAS2 matched this within its normative sample. The validity of using PASS and CAS with Hispanics has been achieved through several means. Several studies have examined the CAS scores for racial and ethnic group differences. Naglieri, Rojahn, and Matto (2007) found that CAS Full Scale scores for Hispanic and White children differed 4.8 points when demographic differences were statistically controlled. They also reported that the correlations between CAS scores with achievement did not differ significantly for the Hispanic and White samples. Naglieri et al. (2007) compared PASS scores 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 (mean of 84.6) and Spanish (mean of 87.6) versions of the CAS, and the scores from the two versions were highly correlated (r = .96). Additionally, Otero, Gonzales, and Naglieri (2013) studied the performance of referred Hispanic ELLs on the English and Spanish versions of the CAS and reported that the Full-Scale scores on the English (mean of 86.4) and Spanish (mean of 87.1) versions were very similar and highly correlated (r = .99, corrected for range restriction). These findings for the CAS suggest that ability may be more fairly assessed across race and ethnic groups with the PASS neurocognitive approach.

CAS2 VERSIONS AND USERS

The rationale behind the development of the various versions of the CAS2 was driven by the ways different practitioners could obtain and use PASS scores. For example, the CAS2 8 and 12-subtest versions offer a comprehensive examination of a person's neurocognitive abilities which can be used for diagnostic decision-making and instructional planning. The CAS2: Brief can be used as a screening tool for possible learning problems, decisions related to instructional planning, as well as for re-evaluations and gifted identification. The CAS2: Rating Scale can be used with the CAS2 and CAS2: Brief to determine the similarity of the scores across these measures. For a full discussion of these versions of the CAS2 see *Essentials of CAS2 Assessment* (Naglieri & Otero, 2017) and the respective test Manuals.

Test publishers in the Unites States have instituted standards for the purchase of assessment instruments such as the CAS2 in a manner consistent with the *Standards for Educational and Psychological Testing*, published by the American Educational Research Association (AERA), and the American Psychological Association (APA). A central principle of professional test use is that individuals should administer only those tests for which they have the appropriate training and expertise.

The three versions of the CAS2 have different qualification levels. C level qualification requires a high level of expertise in test interpretation and by individuals with either a doctoral degree in psychology or related field or state licensure or certification to practice or active full membership in a professional organization (such as APA, NASP, or NAN) that requires training and experience in assessment. That is individuals with credentials as psychologists (e.g., clinical, school, developmental, counseling, neuropsychological, rehabilitation), certified specialists (educational diagnosticians, psychometrists), and other trained professionals who are certified to use tests of intelligence. The CAS2 Brief requires level A qualification. Those who use this test should be knowledgeable about measurement issues, procedures related to using, scoring, and interpreting test results, and the theory underlying the instrument. This would include, for example, individuals with backgrounds and/or credentials as educational diagnosticians, school psychologists, and speech and language specialists. The CAS2 Rating Scale also requires level A qualification. Users should be knowledgeable of rating scales and their use, including procedures related to using, scoring, and interpreting test results, and the theory underlying the scale. This includes, for example, those with backgrounds and/or credentials as teachers, educational diagnosticians, school psychologists, and speech and language specialists.

NEUROPSYCHOLOGICAL UNDERPINNINGS

The CAS and the CAS2 were created using the PASS Theory as a guide; the theory itself was based on Luria's understanding of how the brain operates. Although sophisticated neuroscientific resources that exist today did not exist in the times of Luria, his understanding of how the brain works still stands as valid (e.g., Zelazo & Carlson, 2020). The functional units of the brain he described can today be understood as functional networks. These networks involve several cortical and subcortical structures that are in constant flux of neural activity based on environmental demands. For example, studies using functional imaging technology (Avram et al., 2013; Yeo et al., 2011; Zaytseva et al., 2014) have shown that each area of the brain participates in numerous large and small-scale functional systems within and across cortical and subcortical brain structures. Supportive research in neuroscience literature has shown that functional systems combine and dissolve at different times and on fast timescales across tasks (Sporns et al., 2021; Koziol et al., 2014; Koziol et al., 2016). These networks have a profound impact on constructs such as attention, executive function, learning and memory, and information processing. Luria (1973a) clearly stated that cognitive activity is the result of an interplay of complex functional systems, yet each system makes unique contributions. His assertion remains true today.

Neuropsychology has traditionally interpreted tests within a serial-order processing paradigm (Koziol et al., 2014): First we perceive, then we think, and then we react. However, our brains are continuously responding to an ever-changing, dynamic environment. This makes a static paradigm insufficient for understanding and measuring neurocognitive processes, as well as for interpreting test performance. Our brain is endlessly bombarded by external and internal stimuli and yet, most of us manage to funnel and direct information by activating and inhibiting different brain regions dynamically. Once the saliency of information is selected for further processing, different brain regions *must* communicate to integrate the required information. Additionally, as we move from one task to another, there must also be a mechanism for allowing the brain to shift from the demands of one task to the demands of another. In other words, there must be a process allowing different parts of the brain to communicate and interact as we continuously adapt to ever-changing demands of different tasks.

No part of the brain functions in isolation, and any given cortical region has a degree of information-processing specificity for a cognitive ability or part of cognitive operations (Friston, 2002; Johnson, 2005; Passingham & Rowe, 2015; Passingham, 2021). This specificity is referred to as functional specialization. As originally put forth by the work of Luria, effective performance on any given task is characterized by the functional integration of distal brain regions. This amalgamation represents the transitory, dynamic, context-specific communications that convey information via subsets of anatomical connections among a limited number of brain regions engaged by a cognitive process (Koziol & Stevens, 2012).

Luria's work on developing cognitive constructs and corresponding behaviors as manifestations of the operations of brain systems became known as functional units of the brain. In more recent terminology, this is equivalent to the well-recognized concept of brain networks. Table 2 represents a conceptualization of how PASS processes relate to functional units and how these relate to large scale neural networks.

TABLE 2. PASS, FUNCTIONAL UNITS, AND NEURO-NETWORKS.

PASS Processes	Functional Units	Neuro-network
Planning	3rd Functional Unit	This neurocognitive process provides for the programming, regulation, and verification of behavior, and is responsible for behaviors such as asking questions, solving problems, self-monitoring, regulation of voluntary activity, conscious impulse control, various linguistic skills such as spontaneous conversation, and the complex expression of personality. Planning is associated with the prefrontal lobes of the brain and interacts with the first and second units and their associated networks.
Attention	1st Functional Unit	This neurocognitive process provides the brain with the appropriate level of arousal or cortical tone, as well as directive and selective attention. The first functional unit, along with its related networks, allows for orientating, sustaining, and reorienting attention to what has relevance at any moment in time. Attention (i.e., cortical arousal) is associated with the brain stem and reticular activating system which interacts with default mode network and activation of the ventral and dorsal attention networks. It is also associated with the fronto-parietal system which facilitates Simultaneous and Successive processes.

Simultaneous and Successive	2nd Functional Unit	Simultaneous neurocognitive process provides for the understanding and use of inter-related nature of information. Successive neurocognitive processing provides for the understanding and use of sequential information. Activation of the frontal, parietal and temporal regions is key to both Simultaneous and Successive processing. This region is considered the association cortex which has many interrelated functions (such as attention, spatial representation, working memory, eye movements, an assortment of other sensory information, and the guidance of actions)

The functional architecture of the brain is typified by joint connections across several brain profiles of the cerebro-cortical, cortical–basal ganglia, cerebro-cerebellar, and basal ganglia–cerebellar circuitry systems (Bostan et al., 2010, 2013; Bostan & Strick, 2010; Koziol et al., 2013; Li et al., 2021). As an example, Yeo and colleagues (2011) have reliably observed seven patterns of cortical networks in adults, adolescents, children, and infants, as assessed through resting-state neuroimaging technologies (Uddin et al., 2013, Yeo et al., 2015). These networks are fundamental for adapting to the briskly changing demands of our surroundings, including undergoing assessment of neurocognitive functions. These networks include the fronto-parietal network, ventral attention network, dorsal attention network, visual network, limbic network, sensory–motor network, and default mode network. Examples of some of these networks and how they add to our understanding of PASS processes are provided below.

We have mentioned that Planning provides for the generation of possible ways to solve problems, particularly when no method or solution is immediately apparent, or no solution exists within a person's repertoire of mental tools to solve a problem. Planning is related to Luria's 3rd functional unit of neurocognitive activity. When we are confronted with a task or circumstances that require rapid problem solving the frontal lobe and associated structures are recruited to do the job. It is the frontal lobe together with other brain cortical and subcortical structures that come into play to direct and control behavior as we move to create solutions. The frontal parietal network is critical for our ability to coordinate behavior in a rapid, accurate, and flexible goal-driven manner. It is a distinct control network, in part functioning to flexibly interact with and alter other functional brain networks. The network consists of the dorsolateral prefrontal cortex, the anterior cingulate cortex, the anterior prefrontal cortex, the lateral cerebellum, the anterior insula, the caudate nucleus, and the inferior parietal lobule.

Attention is a multivariate construct that fundamentally drives our concentration of awareness on some phenomenon to the exclusion of other stimuli. To focus attention on relevant and ignore irrelevant stimuli or details attention must be recruited, focused, sustained and flexible. Starting with the brain stem, the reticular activating system energizes the brain and regulates cortical tone for different mental states. The ascending reticular activating system projects to the intralaminar nuclei of the thalami, which projects diffusely to the cerebral cortex (Wijdicks, 2019).

The ventral attention network ("VAN" provides salience information and allows for identification of objects and of what these objects are used for. It includes the temporo-parietal junction, the supra-marginal gyrus, the frontal operculum, and the anterior insula (Onofri et al., 2022). The dorsal attention network (DAN) participates in goal-directed executive control processes by managing spatial attention and shifting of attention, in conjunction with identifying where objects are and knowing how to use them. This network is located within the intraparietal sulcus and frontal eye fields. The interaction of the ventral and dorsal networks guides purposeful behavior as we constantly interact with our dynamically changing environmental events. After we become aware of something we need to orient to, dorsal fronto-parietal regions become activated, and the dorsal network is central to selective attention (Corbetta et al., 2008; Zhao et al., 2022). When we attend to a constantly changing environment, however, both ventral and dorsal networks become activated. The visual network is made up of the occipital lobe and lateral temporal and superior parietal regions; it connects with the superior parietal lobe and intraparietal sulcus, both of which are linked to the dorsal attention network (Zeise, 2021). The visual network is involved in sustaining attention, suppressing attention to irrelevant stimuli, and interacting with these control systems to help direct attention.

Other neural networks include the limbic, sensory–motor, and default mode networks. The limbic network acts together with other systems to provide motivational and reward influences (Koziol et al., 2014). It consists of the dorsal anterior cingulate and the bilateral insulae, and it provides a cortical signal of salient events, including errors. The motor network is composed of the primary, supplementary, and premotor cortex, along with the sensory cortex, putamen, thalamus, and cerebellum (Kolb & Whishaw, 2021). The default mode network includes the anterior medial prefrontal cortex, the posterior cingulate, and the dorsomedial prefrontal and medial temporal systems (Uddin et al., 2019). This network is active when external stimuli are at a minimum.

The basic neurocognitive processes (PASS) responsible for the cognitive activity underlying intelligence and behavior represent a "working constellation" (Luria, 1966, p. 70) of networks. Just as a variety of neural networks operate in a dynamic manner for a particular task, a person may execute the same task using any combination of the PASS processes, along with the application of the person's knowledge and skills. Although completing most any task is accomplished through the integration of all processes, not every process is involved equally in every task. In addition, a task may be approached using varying combinations of processes, depending on how the task was initially taught or learned. For example, tasks like math calculation may be dominated by a single process (e.g., planning), while tasks such as reading decoding may be strongly related to another process (e.g., successive), while also recruiting other neurocognitive processes. Reading comprehension of familiar text may, for example, recruit both Simultaneous and Successive processes, while reading something composed of unfamiliar content may require an additional process to be recruited. The dynamic way PASS abilities intersect provides a way of using the neurocognitive processing strengths to address the PASS weaknesses involved in the learning process.

TEST CONTENT AND EQUITABLE ASSESSMENT

Now that the PASS theory and its operationalization in the CAS2 has been presented we can begin to cover the practical implications of having a theoretical basis for a test of intelligence. Recall that two interrelated issues raised at the start of this paper are closely related to equitable assessment of intelligence: (a) the need for a theory of intelligence and (b) the development of subtests which do not require academic knowledge to represent the theory. We suggest that a theory of intelligence should provide the vision for the cognitive structure of the tasks used to measure intelligence from that theoretical perspective. For example, the PASS theory provided the description of what kind of thinking the subtests should evoke. From our theory this means the following: Planning subtests should measure how well a person creates and uses strategies to complete a task. Attention subtests should measure how well a person can focus and resist distractions. Simultaneous subtests should measure how well a person can understand relationships among things. Successive subtests should measure how well a person can manage the sequence of a task.

When the Cognitive Assessment System was initially built, the measurement of the PASS basic psychological processes could have been achieved using tasks that demand knowledge. For example, written composition was used as a measure of Planning by Das, Kirby, and Jarman (1979), but a subtest like that would have reflected knowledge as well as Planning and therefore it was not deemed appropriate. This issue is particularly important because the content of subtests included in an intelligence test are related to the concept of fairness described in the Standards for Educational and Psychological Testing (AERA, APA, NCME, 2014).

The Standards for Educational and Psychological Testing state that "opportunity to learn…can influence the fair and valid interpretations of test scores (p. 56). "Opportunity to learn is a fairness issue when [there is] differential access to opportunity to learn for some individuals and then holds those individuals who have not been provided that opportunity accountable for their test performance… [even if the test] may not be biased" (p. 57). Equitable assessment can be maximized when all examinees have an equal opportunity to display their ability to answer the questions on a test and fairness can be thwarted by the inclusion of questions that demand knowledge some may not have had the opportunity to acquire. The standards also state that "Test users should be alert to potential misinterpretations of test scores…[and] take steps to minimize or avoid foreseeable misinterpretations and inappropriate uses of test scores" (p. 143). However, there is a history of using tests which demand knowledge (e.g., vocabulary, word analogies, arithmetic word problems) to measure intelligence and in some instances very similar test questions appear on intelligence and achievement tests (Naglieri, 2008; Schneider, 2013).

The similarity in content across intelligence and achievement tests was noted by Schneider (2013) when he wrote "inspection of the contents of most IQ tests reveals that many test items could be repurposed as items in an achievement test (e.g., vocabulary, general knowledge, and mental arithmetic items) (p. 287)". Fagan and Holland (2006) suggested that differences in knowledge between African Americans and Whites was related to differences in intelligence test scores which could be eliminated when there is equal opportunity for exposure to the information to be tested. Other researchers (e.g., Goldstein et al., 2023; Thaler, et al, 2015) have also suggested that intelligence tests which do not rely on knowledge would be more equitable. Despite these recent efforts to reexamine the content of intelligence tests, similar questions can be found on intelligence and achievement tests. For example, the Woodcock-Johnson IV cognitive ability test includes an oral vocabulary subtest with a sample item like, “Tell me another word for immense.” Correct answers are large, enormous, and big. This kind of a question requires vocabulary knowledge, but a similar item is on the Woodcock-Johnson IV achievement test. That scale includes a reading vocabulary-synonyms subtest with a sample item like: “Tell me another word for enormous.” Correct answers are big, immense, large, and huge. The use of questions that demand verbal knowledge are used to measure cognitive ability and to measure achievement. This kind of a question makes sense on an achievement test because the score represents the amount of vocabulary knowledge the person has vis-à-vis the normative group. Even though it is typical for intelligence tests to include measures of verbal knowledge, verbal analogies, general information, verbal reasoning, and arithmetic word problems (Brulles et al., 2022), the use of questions that demand knowledge in a cognitive test has historical precedence but warrants justification.

Terman included verbal tests in the 1916 Stanford-Binet because he believed responses to verbal questions represented the highest form of mental ability. More recently, Lohman, et al, (2008) defended the inclusion of verbal and quantitative test items that demand knowledge by arguing that “verbal and quantitative abilities . . . add importantly to the prediction of academic success” (p. 276). Some might suggest the logic behind this position to be considered circular. That is, verbal and arithmetic questions are good measures of intelligence because they correlate with verbal and math achievement test scores. Using test questions that demand knowledge to measure intelligence is also illustrated by Lubiniski and Benbow (2021) who wrote, “the SAT-Mathematics and SAT-Verbal composite is an excellent measure of IQ or general intelligence” (p. 4). A similar approach was used by Lynn (2010) who asserted that, “Scores on [reading comprehension and mathematics can be] used as a proxy for IQ [because a] reading test is a measure of verbal comprehension and [a] mathematics test is a measure of “quantitative reasoning”, and both of these are major components of general intelligence (e.g. Carroll, 1993, p. 597; McGrew & Flanagan, 1998, p. 14–15) (p. 95).”

Lynn (2010) used the 2007 PISA reading and math scores as a measure of intelligence (IQ) to compare children across regions in Italy. He concluded, “The lower IQ in southern Italy may be attributable to genetic admixture with populations from the Near East and North Africa” (p. 9). Lynn’s conclusion was challenged by D’Amico, et al., (2012) who found little differences between southern and northern Italian children on Raven’s Progressive Matrices (Raven, 1954) and PASS scores from the Italian version of the Cognitive Assessment System (Naglieri & Das, 2006). D’Amico et al. argued that the differences on the PISA verbal and math scores reflected differences in children’s educational opportunity, not intelligence, and their results suggested that measuring intelligence with tests that are not dependent upon knowledge were more valid and equitable. Regardless of the rationale for the use of intelligence tests that demand knowledge, test content has considerable implications for fair assessment.

The correspondence between test questions that demand knowledge and test fairness across intelligence tests can be understood by examination of average test score differences across racial and ethnic groups. Brulles et al., (2022) explored this question for group and individually administered intelligence tests and found larger race and ethnic differences on tests that include knowledge than tests with minimal knowledge. Table 3 provides a larger summary of the available research. The results suggest that those tests that require knowledge yield large score differences in total standard scores by race (average difference by race of 9.4 standard score points) and ethnicity (Mn = 6.6). In contrast, tests that require minimal knowledge yield smaller average score differences by race (Mn = 4.3) and ethnicity (Mn = 2.9). These findings suggest a relationship between intelligence test content and test equity.

TABLE 3. STANDARD SCORE DIFFERENCES BY RACE AND ETHNICITY ACROSS INTELLIGENCE TESTS.

	Race	Ethnicity
Tests that require knowledge	Mn = 9.4	Mn =6.6
Otis-Lennon School Ability Test	13.6	-
Stanford-Binet IV	12.6	-
WISC-V	11.6	-
WJ- III (normative sample)	10.9	10.7
CogAT 7 Nonverbal	11.8	7.6
CogAT 7 - Verbal	6.6	5.3
CogAT 7-Quantitative	5.6	3.6
CogAT- Nonverbal	6.4	2.9
CogAT-Total (V, Q & NV)	7.0	4.5
K-ABC II Fluid-Crystallized Index	9.4	9.8
K-ABC II Mental Processing Index	8.1	8.2
WISC-V (statistical controls)	8.7	-
Tests that require minimal knowledge	Mn = 4.3	Mn = 2.9
K-ABC (normative sample)	7.0	-
K-ABC (matched samples)	6.1	-
KABC-II (adjusted for gender & SES)	6.7	5.4
CAS-2 (normative sample)	6.3	4.5
CAS (statistical control normative data)	4.8	4.8
CAS-2 (statistical control normative data)	4.3	1.8
CAS-2 Brief (normative samples)	2.0	2.8
NNAT (matched samples)	4.2	2.8
Naglieri General Ability Test-Verbal	2.2	1.6
Naglieri General Ability Test-Nonverbal	1.0	1.1
Naglieri General Ability Test-Quantitative	3.2	1.3

Note. These results were reported for the Otis-Lennon School Ability Test by Avant and O'Neal (1986); Stanford-Binet IV by Wasserman & Becker, (2000); Woodcock-Johnson III race differences by Edwards and Oakland (2006) and ethnic differences by Sotelo-Dynega, Ortiz, Flanagan, and Chaplin (2013); CogAT7 by Carman, Walther and Bartsch (2018) and Lohman (2012), WISC-V by Kaufman, Raiford, and Coalson (2016); K-ABC by Naglieri (1986); KABC:2 by Lichtenberger, Volker, Kaufman and Kaufman, (2006); Scheiber, C., Kaufman, A.S. (2015); CAS by Naglieri, Rojahn, Matto, and Aquilino (2005); CAS-2 and CAS2:Brief by Naglieri, Das, and Goldstein, 2014a and 2014b; Naglieri Nonverbal Ability Test by Naglieri and Ronning (2000), and Naglieri General Ability Tests: Verbal, Nonverbal and Quantitative by Naglieri, Brulles, and Lansdowne (2022).

Perhaps the best test of the hypothesis that knowledge leads to equity problems for group administered IQ tests such as the CogAT and OLSAT which provide verbal, nonverbal, and quantitative scores is addressed with the results presented for the Naglieri General Ability Tests: Verbal, Nonverbal and Quantitative (Naglieri et al., 2022; Selvamenan et al., 2022). Race, ethnic, gender, and parental education level differences on the Verbal, Nonverbal, and Quantitative tests of the Naglieri General Ability Tests were examined. These tests were explicitly designed to measure general ability without the knowledge demands found in traditional IQ tests. That is, they have features which the authors suggested make them appropriate for diverse populations of students which include the following: (a) each test's directions were delivered using an animated scene like that experienced by the student being tested so no verbal instructions are used; (b) no verbal response is required of the student; (c) the verbal test requires the student to identify a verbal concept represented in pictures and determine which image does not represent the concept; (d) the quantitative test uses questions that require close examination of the relationships among numbers and/or symbols, numerical sequences, equivalency, and patterns involving only basic math; (d) the nonverbal test uses questions that require examination of shapes presented in a pattern, sequence, spatial orientation, and other distinguishing characteristics to arrive at the correct answer in a manner similar to the Naglieri Nonverbal Ability Test, 3rd Edition (Naglieri, 2016). These three tests have different content, but factor analytic results provide support for the validity of them as measures of a broad general ability factor (Naglieri et al., 2021). The results for these three tests presented in Table 3 support the view that the academic knowledge required in traditional IQ tests likely contributes to differences across race and ethnicity.

It is important to recall that, as shown above, many psychologists have cautioned against including questions that demand knowledge in intelligence tests. These voices were largely ignored, and the early development of intelligence tests has had a lasting impact on the content of intelligence tests used today. There were other, equally troubling impacts intelligence test scores had on the understanding of race and ethnic differences which punctuate the history of intelligence testing. That is, the attribution of genetic reasons for low IQ test scores as illustrated by Terman's prediction that the Stanford-Binet would reveal, "significant racial differences in general intelligence … which cannot be wiped out by any scheme of mental culture" (Brookwood, 2021, p. 68). Subsequently, he and others supported the use of IQ tests to identify low intelligence children and adults who would be involuntarily institutionalized and sterilized for the improvement of society. Robert Yerkes, co-author of the Army Mental Tests and Harvard University professor, was president of the American Psychological Association and leader of the Eugenics Section of the American Breeders' Association's Committee on the Inheritance of Mental Traits. He advocated for institutional segregation and sterilization of persons with a low IQ score. Researchers such as Terman's student Florence Goodenough (1926) reported average Stanford-Binet scores by racial and ethnic groups. In her Table II entitled, "Distribution of Intelligence Quotients by Racial Stock" she reported that Mexicans, Negroes, Indians, and Italians had the lowest Stanford-Binet IQ scores.

The history of psychologists' embrace of the eugenics movement was recognized by the American Psychological Association's 2021 "Apology to People of Color for APA's Role in Promoting, Perpetuating, and Failing to Challenge Racism, Racial Discrimination, and Human Hierarchy in the U.S." This apology articulated "the role psychologists played in creating and promoting the use of psychological tests that have been used to disadvantage many communities of color, contributing to the overdiagnosis, misdiagnosis, and lack of culturally appropriate diagnostic criteria." The apology also noted the "roles of psychology and [the] APA in promoting, perpetuating, and failing to challenge racism, and the harms that have been inflicted on communities of color," and the role intelligence tests have played to systemically "create the ideology of White supremacy and harm communities of color."

We suggest that fair assessment of intelligence must be achieved, and this is more likely to occur if a different approach to test development and test content is followed. In our opinion an intelligence test should be conceived and developed on a theory of intelligence and the test's questions should measure the kind of thinking and problem solving that is defined by the theory. To ensure that all students have an equal opportunity to do as well as they can on a measure of intelligence, *test questions should* *measure how well students can think in a way that is not confounded by how much they know*. This is the approach Das and Naglieri used when the Cognitive Assessment System was initially created in 1984.

CHAPTER 4. PASS THEORY AND CAS2

The initial effort which led to the PASS theory was initiated by Das and colleagues (Das et al., 1975, 1979; Das et al., 1994) and included an extensive analysis of the methods used by Luria, related measures used in neuropsychology, as well as cognitive and educational psychology. The possible methods that could be used to measure Luria's conceptualization of basic psychological processes and ultimate operationalization using the CAS was summarized in several books (e.g., Das et al., 1994; Kirby, 1984; Kirby & Williams, 1991; Naglieri, 1999; Naglieri & Das, 1997b; Naglieri et al., 2014a; Naglieri & Otero, 2011, 2017). The publication of the CAS2 (Naglieri et al.,2014), and the CAS2: Brief (Naglieri et al., 2014) test Manuals provided additional evidence for PASS theory and was further described in *Essentials of CAS2 Assessment* (Naglieri & Otero, 2017). We summarize additional validity research in the sections that follow.

PASS CORRELATIONS WITH ACHIEVEMENT

Psychologists often rely on the examination of intelligence test scores to understand academic strengths and weaknesses and to anticipate future academic achievement. This makes understanding the correlation between intelligence and achievement an important validity issue. Some (e.g., Ackerman, 2022) argue that school grades should be used to examine the relationship between intelligence and achievement. Others (e.g., Jensen, 1998) noted that grades are "more influenced by the teacher's idiosyncratic perceptions of the child's apparent effort" (p. 278). We will present evidence of the relationship between intelligence and standardized achievement tests because these tests have demonstrated reliability. There is, however, a methodological limitation to this kind of research.

Studying the relationship between intelligence test score and achievement is complicated by the similarity in the items on traditional intelligence tests and achievement tests (e.g., vocabulary, arithmetic word problems) (Ackerman, 2022). The similarity in content gives some intelligence tests an advantage over those such as the CAS2, which does not include verbal and quantitative test items (Naglieri & Bornstein, 2003). The first large scale study of the relationship between PASS scores and achievement was reported by Naglieri and Rojahn (2004). They examined the relationships between the PASS scores from the CAS and achievement scores from the Woodcock-Johnson Tests of Achievement–Revised (WJ-R;

Woodcock & Johnson, 1989) for a nationally representative sample of 1,559 students and found an average correlation of .70.

Naglieri and Otero (2017) reported the correlations between several intelligence tests and achievement tests using two methods. First, the average correlation among all the scales on each intelligence test with an achievement test was computed. Second, the average of the scales on the intelligence tests that clearly did not demand knowledge were obtained. This enabled an understanding of how each intelligence test was correlated with achievement when the most achievement-like scale on the intelligence test was excluded. This procedure was conducted for the WISC-V and WIAT-III using data from the WISC-V manual (Wechsler, 2014), Woodcock Johnson IV (McGrew et al., 2014) and the K-ABC-II (Kaufman & Kaufman, 2004). The findings clearly showed that the correlation between each of these tests and achievement was higher when the scales that demand verbal knowledge were included. For example, the best explanation for why 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. However, we suggest 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. What was most important was the correlation between the CAS and achievement; it was the highest of any of the correlations obtained with tests that demanded knowledge. A recent meta-analysis of the relationship between PASS scores on the CAS and achievement revealed the same findings.

Georgiou et al. (2020) examined the relationships between PASS scores from the CAS with reading and math with 93 independent samples. They found that (a) PASS "cognitive processes (operationalized with CAS) can produce correlations that are stronger than those derived from popular IQ batteries (e.g., WISC) that include tasks (e.g., Arithmetic, Vocabulary) whose content is often confounded by school learning;" (b) PASS "processes have direct implications for instruction and intervention programming. For example, cognitive strategy instruction based on PASS processes has been found to improve children's math calculation (Iseman & Naglieri, 2011) and PASS Reading Enhancement Program (PREP) has been found to improve children's decoding (Papadopoulos et al., 2004) and reading comprehension" (Mahapatra et al., 2010)and (c) "the present meta-analysis adds to a growing body of research examining the role of intelligence in academic achievement (e.g., Peng et al., 2019; Roth et al., 2015) suggesting that there are significant benefits if we conceptualize intelligence as a constellation of cognitive processes that are linked to the functional organization of the brain" (p. 10).

INTELLIGENCE TEST PROFILES

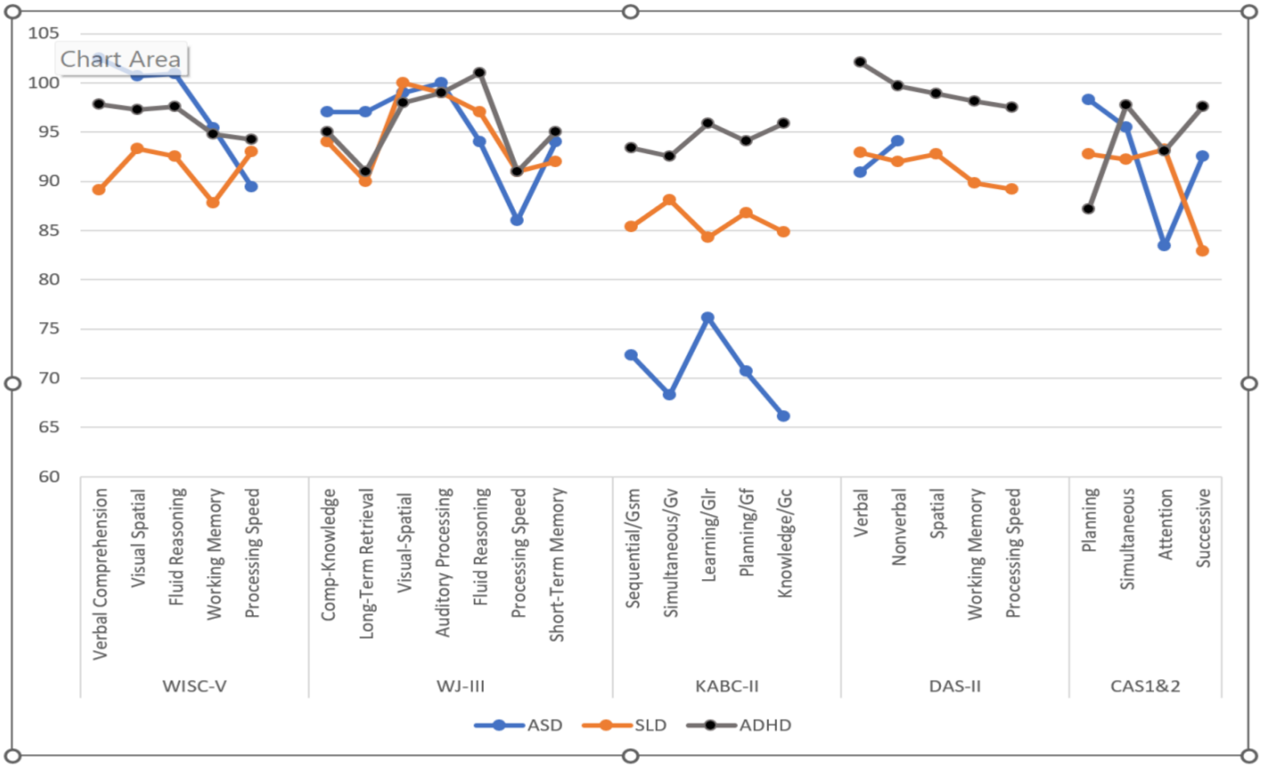
There has been and continues to be considerable controversy about which scores on the various intelligence tests should and should not be interpreted when practitioners examine a profile of scores. The issue is centered around the amount of support that has been found for subtest, scale or full-scale level interpretation. For example, Kaufman advocated for interpretation at many levels (Kaufman et al., 2016). Other researchers argue that valid interpretation of the many scores typically provided, "is dependent on how precisely each score reflects its intended construct and whether it provides unique information independent of other constructs" (Watkins & Canivez, 2022, p. 619). These researchers have found that the most valid score on, for example, the Wechsler Intelligence Scale for Children Fifth Edition (Canivez et al., 2017; Watkins & Canivez, 2022), Stanford-Binet Fifth Edition (Canivez, 2008), Differential Abilities Scales (Canivez & McGill, 2016), and the Woodcock-Johnson Fourth Edition (Dombrowski et al., 2017) is the total score that estimates general ability, or *g.* Moreover, the reanalysis of John Carroll's (1993) survey of factor-analytic studies conducted by Benson et al. (2018) came to the same conclusion. They wrote that nearly all the specified abilities presented by Carroll "have little-to-no interpretive relevance above and beyond that of general intelligence" (p. 1028). These researchers have published many studies and have consistently found that practitioners should only report the total score which represents general ability and not the subtests or scales that are provided. There has been only one exception, the PASS scales of the CAS.

Canivez (2011) concluded that sufficient variance was attributed to the PASS scales on Cognitive Assessment System (Naglieri & Das, 1997) supporting their interpretation. The factorial structure of the CAS2 has also been examined. Papadopoulos et al. (2023) conducted a series of analyses using the standardization sample of the CAS2. Their study included analysis of four cognitive factors (i.e., correlated model), a general g factor (i.e., one- and second-order factor models), or a combination of the two (i.e., bi-factors models). The results revealed that the correlated PASS model accounted for the inter-subtest covariation of the PASS neurocognitive abilities better than the unitary *g* factor or the bifactor models.

Furthermore, factorial invariance analysis provided evidence that the PASS model, as a measure of cognitive processing or intelligence, was the same between genders. The factor analytic research provides important information about the structure of intelligence tests and direction to practitioners about which scores to interpret, but it is equally important to examine intelligence test profiles across disabilities.

Naglieri and Otero (2017), and Otero and Naglieri (2023) addressed the utility of scale variability by examining profiles for individuals with ADHD, SLD, and ASD. Rather than an examination of subtest scores, they reported the scores on the scales provided in each test. They chose this approach because scales have higher reliability than subtests and scales typically correspond to some intellectual construct identified by the authors. This level may also provide information that could be used to identify a specific pattern of strengths and weaknesses relevant to a student's learning difficulty and may have diagnostic value. The data provided in Figure 2, largely obtained from the respective tests' technical manuals, must be considered with recognition that the samples were not matched on demographic variables across the various studies, the accuracy of the diagnoses may not have been verified, and some of the sample sizes were small (see Naglieri & Otero, 2023). Notwithstanding these limitations, the findings provide insights into the extent to which these tests are likely to yield profiles that could offer insight into the groups' cognitive variability.

FIGURE 2. SCALE PROFILES ON VARIOUS INTELLIGENCE TESTS FOR SAMPLES WITH ASD, SLD, AND ADHD.



Note. DAS-II Scores for individuals with Autism were only available for the Verbal and Nonverbal Scales.

The profiles for students with SLD in reading decoding (dyslexia) across the WISC-V, KABC-II and DAS-II scales show little variability (4-6 points). The WJ-III scores were all within the average range (90+) with a range of 10 points between the Visual-Spatial and Long-Term Retrieval scales. (More recent data for the WJ-IV is not provided in their Manual). The PASS scores also varied by 10 points, but the lowest score of 83 was on the Successive processing scale and the other three scales were in the average range. The patterns for students with ADHD were also provided.

There was small variability of scores for the ADHD samples on the WISC-V, KABC-II and the DAS-II (3-5 points). Although the WJ-III scores varied by 10 points all the scales' scores were within the average range. The PASS scores varied by 11 points; the highest score was on the Successive and Simultaneous scales (98) and the lowest score was on the Planning Scale (87). The results for the CAS included the CAS2 as well as values reported by Naglieri et al. (2003 & 2004) and Van Luit et al., (2005).

The results for students with ASD showed a small difference between the Verbal and Nonverbal scales' scores on the DAS-II. The KABC-II scores varied by 10 points with all scores between 66 and 76. The WISC-V and WJ-III scores varied by 13 and 14 points, respectively, but nearly all the scores were in the average to low average ranges with Processing Speed the lowest. The PASS scales showed the most variation from a high of 98 on Planning to a low of 83 on Attention. The examination of these profiles provides a preliminary picture of the extent to which samples with different diagnoses are associated with different intelligence test results.

Huang, Bardos, and D'Amato (2010) examined PASS scores from the CAS standardization sample, referred to as the general education group (N = 1,692) and a collection of students identified as having a learning disability (N = 367) from research by Brams (1999), Johnson (2001) and Politikos et al. (2003). They used a cluster analysis methodology to identify unique groups based on their PASS scores. Ten distinct groups were found for the general education sample and 12 different groups were identified for the sample with learning disabilities as shown in Tables 4 and 5, respectively. The profiles which were found provide some indication of the relationship between PASS score variability and different diagnostic groups.

TABLE 4. PASS PROFILES FOR THE GENERAL EDUCATION SAMPLE.

Cluster	1	2	3	4	5	6	7	8	9	10
Planning	*120*	116	105	103	100	*111*	*102*	**87**	93	**79**
Simultaneous	118	103	114	99	*114*	102	**86**	101	92	***82***
Attention	119	*121*	96	107	106	106	99	**87**	*96*	**81**
Successive	115	102	*117*	*113*	100	**89**	99	*103*	**82**	**81**
Average PASS	118	110	108	106	105	102	96	94	91	81
Range	5	**19**	**21**	**14**	**14**	**23**	**15**	**16**	**14**	3

Note: PASS scores less than 90 are in bold font. Range of PASS scores within each group greater than 10 are in bold.

TABLE 5. PASS PROFILES FOR THE LEARNING-DISABLED SAMPLE.

Cluster	1	2	3	4	5	6	7	8	9	10	11	12
Planning	99	112	101	99	95	**86**	**87**	**82**	**85**	**88**	**78**	**76**
Simultaneous	115	106	100	105	95	103	97	**84**	96	**83**	**76**	**81**
Attention	99	117	103	102	95	97	**80**	**73**	**81**	91	**76**	**71**
Successive	118	98	102	**90**	100	**85**	**85**	98	97	**75**	**90**	**79**
Average PASS	108	108	102	99	96	93	87	84	90	84	80	77
Range	**19**	**19**	3	**15**	6	**18**	**17**	**25**	**15**	**16**	**14**	10

Note: PASS scores less than 90 are in bold font. Range of PASS scores within each group greater than 10 are in bold.

The 10 clusters of students identified in the general education sample vary from those with consistently high PASS scores (clusters 1 and 2) to those with all low PASS scores (cluster 10). These two clusters have PASS scores that could have implications for instruction and eligibility determination. For example, the cluster 1 in the General Education (GE) sample would likely include students with scores high enough to qualify for a gifted education program. There is also the possibility that students within this cluster with overall high scores might also show significant variability in PASS scores that have instructional implications and even may suggest a learning disability as shown by Georgiou, et. al, (2022). They found that 54% of their sample had a PASS score that was significantly lower than each student's average PASS score; 8% had a PASS score that was low in relation to the student's average and less than 90 (which suggests a disorder in a basic psychological process); and 4% had both a PASS disorder and similarly low academic score which could support the presence of a specific learning disability. Clusters 2-5 in the GE sample show variability of 14-21 points with the smallest range found being cluster 10. This group's scores ranged from 79 to 81 and suggests a sample which likely includes students with intellectual disabilities.

Huang concluded that the 10 profiles in the general education sample suggest that there were groups of students with different PASS patterns reflecting different learning strengths and weaknesses which could have implications for instruction. Similarly, the 12 profiles for the sample of students with different kinds of learning disorders support the idea of associating PASS scores with different learning disabilities. They stated that: "the presence of various patterns of PASS cognitive processes provides initial, yet promising evidence that interpretation at the composite level using the CAS is useful for the cognitive assessment approach for identifying LD in children" (p. 27).

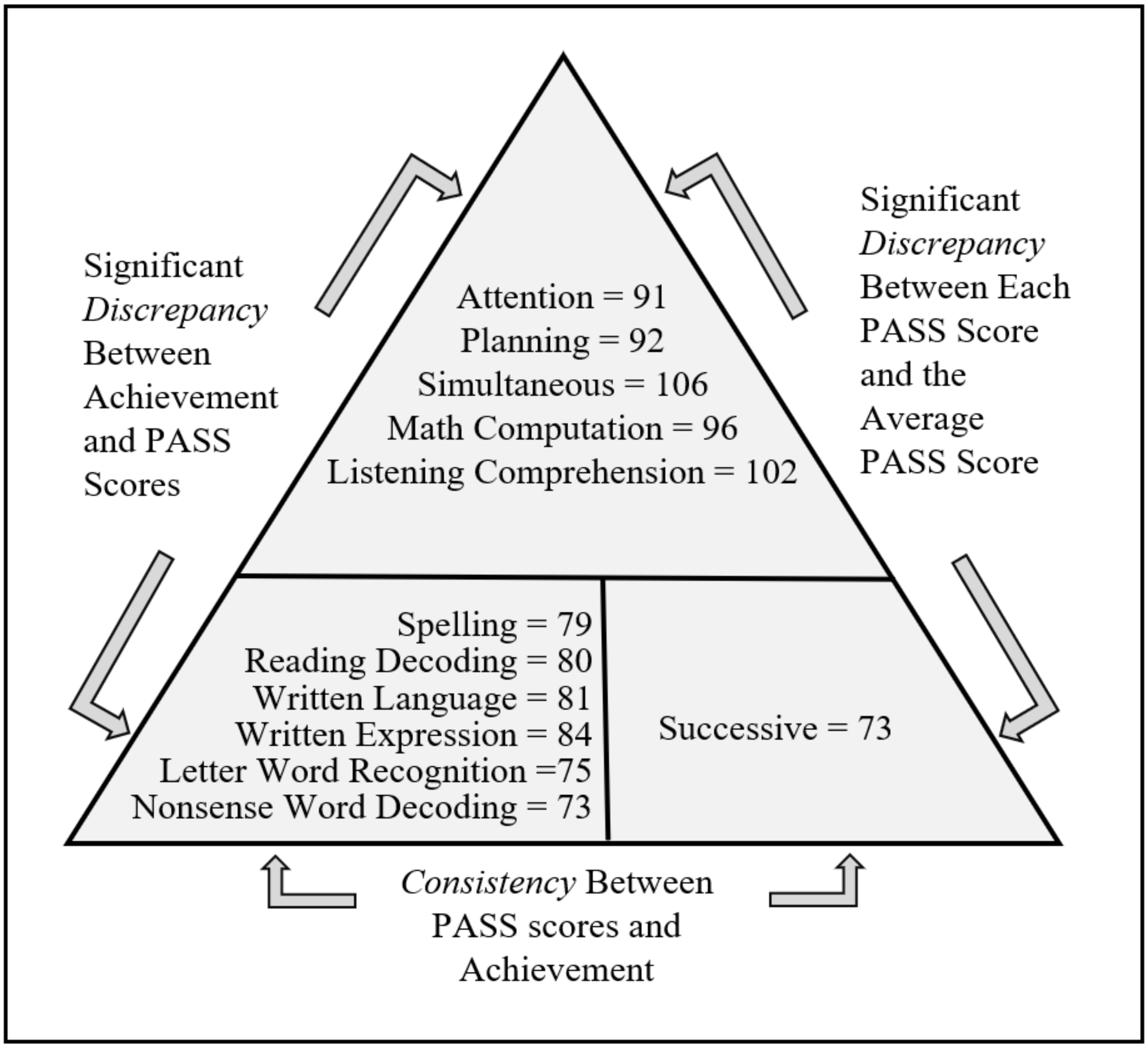
CHAPTER 5. DIAGNOSTIC IMPLICATIONS

An essential step in understanding if a neurocognitive processing strength corresponds to an academic strength and a neurocognitive processing weakness corresponds to an academic weakness is achieved by comparing PASS and achievement test scores. Comparisons between ability (PASS neurocognitive) and achievement (reading, math, etc.) can be efficiently accomplished using the CAS2 because the PASS test items do not rely heavily on knowledge. That is, there are no vocabulary, general information, or arithmetic questions on the CAS2 (see Naglieri & Otero, 2018, for more discussion), which makes the analysis of the pattern of strengths and weaknesses across intelligence and achievement measures free from content overlap. We recommend that practitioners use the PASS scores when considering identification of a specific learning disability described in the IDEA as a disorder in one or more of the basic psychological processes which are associated with academic failure.

There are several methods for detecting a pattern of strengths and weaknesses (PSW) that can be used as part of the process of identifying a student with, for example, a specific learning disability (SLD). Naglieri (1999), Hale and Fiorello (2004), and Flanagan, Ortiz, and Alfonso (2007) put forth a method for finding a combination of differences as well as similarities in scores across academic and cognitive tests to establish the presence of a disorder in one or more cognitive processes and its correspondence to deficits in academic skills. The approach used to operationalize a PSW using PASS scores from the CAS2 is called the Discrepancy Consistency Method (DCM). The method involves an examination of the variability of PASS and academic achievement test scores, which has three parts; two discrepancies and one consistency that form a pattern of strengths and weaknesses. A PASS scale discrepancy is found if there is a significant difference among the four scales relative to the child's overall performance with one or two PASS scores that are substantially below what would be considered typical (the normal range). A second discrepancy could be found between the PASS strengths and academic weaknesses. The consistency portion of the DCM is found when achievement scores are consistent with the low PASS scores. Such a finding provides evidence that a child has a disorder in the basic psychological processes necessary for SLD identification (Naglieri, 2005, 2011a; Naglieri & Otero, 2017; Naglieri & Feifer, 2018).

Figure 3 provides an illustration of the Discrepancy Consistency Method. In this example the PASS and achievement test scores fall into three groups. First, we notice the student has strengths in Simultaneous processing with average scores in Attention and Planning. The Successive processing score of 73 is significantly lower than the average of the four PASS scores. It is important to note that the top of the triangle provides strengths in cognition and achievement; we always want to emphasize the strengths especially when designing interventions. There is ample evidence of weaknesses in academic skills ranging from a score of 73 on reading nonsense words to a score of 84 in written expression. These weaknesses are consistent with the Successive processing score of 73 according to the values required for significance provided by Naglieri and Otero (2017) and integrated into the PASS Score Analyzers for all tests of achievement using this method (Naglieri, 2020).

FIGURE 3. EXAMPLE OF THE DISCREPANCY CONSISTENCY METHOD FOR COMMUNICATING FINDINGS ACROSS PASS AND ACHIEVEMENT TEST SCORES.



INTERVENTION

One of the most important tasks associated with a comprehensive assessment is explaining how a student learns best, what obstacles to learning may exist, and how this information may inform instruction. Intellectual abilities that can be easily explained to teachers, parents and most importantly, the students, can make this task more informative. The PASS theory provides the practitioner with ways to explain how a person learns best (i.e., PASS strength), what obstacles to learning may exist (i.e., PASS weakness), and what can be done to maximize learning (Naglieri & Feifer, 2017). Interpretation of the PASS scales (not subtests) is based on the definitions of the constructs and the following descriptions that are easy to explain to a teacher, parent, and student: Planning is a kind of thinking used when you think about *how* to do something. Attention is used when you focus your thinking on something and resist distractions. Simultaneous processing is used when you think about how ideas or things go together. Successive processing is used when you think about the sequence of actions or sounds.

These PASS scores can form a profile of an individual student's learning strengths and weaknesses that can help determine which kinds of instruction should be considered (Naglieri & Feifer, 2017). Naglieri and Pickering (2010) provide resources for interventions which are aligned with the PASS theory rendered in brief handouts for teachers, parents, and students. There are also other resources for applying the PASS theory to academic instruction and remediation, for example, the PASS Remedial Program (PREP; Das, 1999) and Planning Facilitation (Naglieri & Pickering, 2010).

PREP was developed as a remedial program based on the PASS theory of cognitive functioning (Das et al., 1994). The program is designed to encourage the use of Simultaneous and Successive processes which underlie reading for students aged 7-10 years. The program avoids the direct teaching of word-reading skills such as phoneme segmentation or blending because it is based on the premise that the transfer of learning is best facilitated through inductive rather than deductive inference (Das, 2009). PREP is structured so that strategies used to solve nonacademic tasks are generalized to tasks that demand academic content. Students are provided the opportunity to develop strategies in their own way to use Simultaneous and Successive neurocognitive processes

(Das et.al., 1995) within the context of reading and spelling (Das et al., 1994). Several studies have demonstrated the efficacy of PREP for enhancement of reading and reading comprehension (Boden & Kirby, 1995; Carlson & Das, 1997; Das et al., 1995; Parrila et al., 1999).

Another intervention approach based on PASS is Planning Facilitation, an instructional method first studied by Naglieri and Gottling (1995) which encourages students to be strategic (use Planning) when they complete reading and math tasks. The initial concept for planning facilitation was inspired by the work of Cormier et al. (1990) and Kar et al. (1992). Cormier et al, (1990) found that overt verbalization improved scores on a complex task and that the intervention was particularly effective in improving scores for children low in Planning. Kar et al. (1992) examined the degree to which students with poor or good Planning scores benefited differently from a verbalization intervention like the one used by Cormier et al. (1990). They found that students who had low planning scores benefited more from the verbalizations of strategies than those with high planning. These studies suggested that an intervention that encourages verbalizations about how to complete a task, the value of noting the important parts of a problem, and increased awareness of new ways to achieve the goal was differentially effective based on a student's Planning score. These studies did not, however, involve academic tasks such as math or reading; a limitation addressed by Naglieri and Gottling (1995, 1997). Naglieri and Gottling (1995) provided students with learning disabilities one-on-one sessions using the Planning Facilitation method and math taken from the school curriculum. Students were given ten minutes to complete math work sheets followed by five minutes of self-reflection guided by a tutor, and then ten more minutes to complete another math work sheet. The tutor gave prompts such as, "What did you notice about how you did the work? and What could you have done to get more correct?" The results showed that the intervention helped all the students and especially those low in Planning. The second study by Naglieri and Gottling (1997), also included students with learning disabilities. The teachers facilitated group discussion in seven baseline sessions and 21 intervention sessions during which questions were presented to help students reflect on how they completed the math worksheets. The teachers asked questions such as, "What could you have done to get more correct" and "What will you do next time?" The intervention designed to facilitate a planful approach to math given by teachers to their classes had differential effects depending upon the PASS profile. That is, students with low planning scores improved more than those with high planning scores because this instruction met their need to be more strategic when completing math computation problems.

Naglieri and Johnson (2000) conducted a study to determine if the Planning Facilitation method given by the regular classroom teachers would have differential effects depending on the PASS profiles of the students with learning disabilities and mild mental impairments. The students completed math worksheets during baseline and intervention phases and PASS scores were obtained using the CAS. The findings confirmed previous research. Students with a cognitive weakness in Planning improved considerably (effect size of 1.4), those with an Attention weakness (effect size of 0.3), Simultaneous weakness (effect size of -0.2) and Successive (effect size of 0.4) and those without a weakness (effect size of 0.2). The authors concluded that the Planning Facilitation method “which does not use teacher scripts or rigidly formatted procedures, can be replicated” (p. 595) and that the cognitive strategy instruction is especially helpful for the students who need it the most; those with low Planning scores. The next study on this method involved reading comprehension.

The purpose of a study by Haddad et al. (2003) was to determine if the Planning Facilitation method would have a different impact on reading comprehension for students with different PASS profiles from the CAS. The students’ pre and post reading comprehension scores were compared by PASS weakness. The results showed that students with a weakness in planning benefited from the Planning Facilitation method (effect size = .52). Students with no weakness and those with a Successive processing weakness (effect size = .06) did not benefit from the intervention. This study showed that helping students utilize Planning while completing a reading comprehension task had beneficial results similar to the findings for math and nonacademic tasks.

Iseman and Naglieri (2011) examined the effectiveness of the Planning Facilitation method for students with learning disabilities and ADHD randomly assigned to a control or experimental group. The students in the experimental group were given the Planning Facilitation method and the control group received additional math instruction by the regular teacher. The results showed that students in the experimental group benefited (effect size = .85) from this instructional method that encourages students to reflect on how they complete the work (i.e., use executive function). The comparison group who received math instruction from the regular teacher did not do as well (effect size .26). The intervention helped students in the experimental group develop and use more effective planning strategies when completing the math worksheets. In addition, students in the experimental group also showed significantly greater improvement on the Math Fluency subtest of the Woodcock-Johnson Achievement test and the WIAT-II Numerical Operations subtest. The authors concluded, “These results indicate not only did those students with ADHD benefit from planning strategy instruction in classroom math, as shown by their improvement on the worksheets, but also that they were able to transfer learned strategies to other measures of mathematics, suggesting far transfer of skills” (p. 191). In addition, the experimental group’s math scores were significantly greater than the control group one year later.

The results from this study support the previous studies on this instructional method called Planning Facilitation. The method was designed to avoid the direct teaching of strategies because transfer of learning is best achieved through inductive rather than deductive inference as described in the section above about PREP (Das, 2009). The study by Iseman and Naglieri (2011) is especially important because it used a randomized design and showed transfer from classroom math to norm referenced tests of math achievement. In addition, the improvement Iseman and Naglieri found for students with ADHD is particularly important because researchers have found small effect size improvement in academic skills for students with ADHD (DuPaul et al., 2012; Reid & Maag, 1998). Collectively, these intervention studies illustrate a relationship between PASS test scores and classroom instruction as well as suggesting a connection between intervention effectiveness and PASS profiles.

CHAPTER 6. CONCLUSIONS

We have provided an historical perspective on the state of intelligence testing in the 2020s and emphasized that the tests most widely used since the early 1900s have two critical limitations. Traditional IQ tests were not built on a theory of intelligence, and they include content that is indistinguishable from questions on achievement tests (Schneider, 2013) which distorts the tests' scores for those with limited opportunity to learn. This appears to be a factor in the differences observed across race and ethnicity. The possible consequences of these limitations were anticipated by Bonner, et al, in 1927 when they wrote: "inaccuracy of psychological diagnosis [may result] in positive harm to the individual and hinders the development of scientific psychology (p. v)". This caution foretold American Psychological Association's Apology to People of Color for APA's Role in Promoting, Perpetuating, and Failing to Challenge Racism, Racial Discrimination, and Human Hierarchy in the U.S.

We have presented summaries of research which suggests that a theory of intelligence that focuses on basic psychological processes defined by brain function and explicitly developed to minimize formal knowledge may offer the potential for greater validity and equity and thereby provide a possible remedy to address APA's Apology.

Change in any field is not always easy. Perhaps the hardest part is looking at how we currently conduct the assessment of intelligence from a fresh perspective. We suggest that the information summarized here provides enough evidence to support a consideration of a significant change. It is also important to recognize that standards for the practice of psychology inform us of our professional obligations which, according to the American Psychological Association, "are intended to facilitate the continued systematic development of the profession and to help facilitate a high level of practice by psychologists." (https://www.apa.org/practice/guidelines/child-protection). Kelly (2023) described the National Association of School Psychologists (NASP) Ethical Standards related to the practice of intellectual assessment and especially as it relates to equitable assessment. He noted that the NASP standards state that school psychologists should promote fairness and social justice (Guiding Principle 1.3), that they work as change agents to correct school practices that are unjustly discriminatory, and they do not engage in or condone actions or policies that discriminate (Standard I.3.2). It is, therefore, imperative for all professionals of any specialty who use cognitive measures, to carefully examine all aspects of validity of intelligence tests, especially as it relates to fairness, when making test selection decisions.

It is easy to rely on tests that are popular and already familiar to us. However, as we have shown, after a century of use, intelligence tests built without a firm basis in theory of intelligence to guide test content have limitations. We suggest that researchers and practitioners recognize that an evolutionary step in the field of intelligence testing is most definitely needed considering all we have learned in the past 100 years. Only through substantial change can we improve the evaluation of human intelligence. The research presented here suggests that the PASS theory may provide a viable alternative to traditional intelligence tests. "To change our legacy [especially] with regard to systematic racism, we need to further heed the call and strongly pursue with the utmost urgency [new] streams of research and quickly leverage the findings to put into practice the mechanisms needed to drive real change (Goldstein et al., p. 12)."

For a more information about the PASS theory and the CAS2 please refer to:

1. Naglieri, J.A., Otero, T.M. (2017). *Essentials of CAS2 Assessment*. Hoboken, NJ: Wiley.
2. YouTube Channel, @JackNaglieriPhD was created to provide tools and resources for both psychologist and educators alike. Here you will find a variety of videos including topics such as PASS and the CAS2.
3. To Download ***free*** PASS Score Analyzers*, visit: JackNaglieri.com/pass-score-analyzers

   * PASS Score Analyzer is a ***free*** Excel Spreadsheet that calculates the difference among four PASS scores and the differences between the four PASS scores and achievement test scores.
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