Using a Pattern of Strengths and Weaknesses (PSW) for Specific Learning Disability (SLD) Identification

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Outline for Today's Workshop

- Brief overview of SLD identification
- Review of foundational sources of information necessary for making informed decisions about PSW method for SLD identification, with an introduction to the assessment – intervention connection
- Description of the PSW method and conceptual similarities among PSW methods; description of the Dual Discrepancy/Consistency (DD/C) operational definition of SLD – a PSW method; and
- The PSW-A Component of the Cross-Battery Assessment Software System (X-BASS)
- Summary and conclusions

The Cross-Battery Assessment Approach

OVERVIEW OF SLD IDENTIFICATION

Cross-Battery Assessment XBA

U.S. (IDEIA) – Federal Definition of SLD

"A *disorder in one or more of the basic psychological processes* involved in understanding or using language, spoken or written, which manifests itself in the imperfect ability to listen, think, speak, read, write, spell, or do mathematical calculations. Such terms include such conditions as perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia"

Federal Regulations (2006) Include Three Methods of SLD Identification

(34 CFR 300.311(a)(5)), (34 CFR 300.309(a)(2(ii))

- Ability-Achievement Discrepancy (AAD)
  - May allow
  - Cannot mandate
- Response-to-Intervention (RTI)
  - Must allow
  - "as part of" a comprehensive evaluation
- Alternative Research-based Approach (PSW)

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All Methods of SLD Identification Are…

WTF

Methods

Ability-Achievement Discrepancy

WAIT TO FAIL

Response to Intervention

WATCH THEM FAIL

Pattern of Strengths and Weaknesses

WHY THEY FAIL

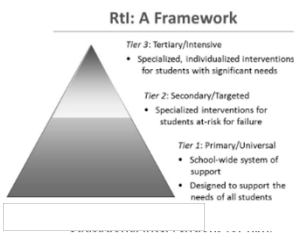
Third Option is PSW
Federal Regulations Permit the Use of a PSW Model

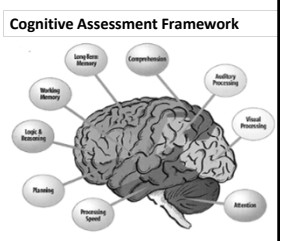
(34 CFR 300.311(a)(5)), (34 CFR 300.309(a)(2(ii))

- Evaluation documentation must consider whether the student exhibits a pattern of strengths and weaknesses
  - In performance, achievement or both
  - Relative to age, State approved grade levels standards, *or intellectual development*
  - That is determined by the group to be relevant to the identification of SLD using appropriate instruments

RTI and Cognitive Assessment Data – Important for SLD Identification

Why Do Some Not Understand the Value of A Comprehensive Evaluation?





RTI and Cognitive Assessment Data – Important for SLD Identification

Why Do Some Not Understand the Value of A Comprehensive Evaluation?

- **Psychologist to Parent:**
  - *It's been six months and your son is still not as far along as we anticipated based on the interventions we've been trying. At this time, we have two options.*
    - One, we can try another intervention that is supported by research and, therefore, is expected to work (like the other interventions we tried).
    - Or two, we can take a more comprehensive look at how your son approaches tasks, how he learns, how he is smart, and what difficulties he may have when faced with new problems. That means that we can do a *comprehensive evaluation* of your son and get a better understanding of his strengths and weaknesses in cognitive areas that are important for learning and achievement. We believe this additional information can help us understand why your son did not respond well to intervention and what we can do differently as we continue to plan and develop educational interventions for him.

Source:

Flanagan, D. P. (February, 2009). *A Theory- and Research-based Approach to SLD Identification: Integrating Data from RTI and Comprehensive Assessment, Including Measures of Cognitive Abilities and Processes.* Topical Public Policy Workshop at the 46th Annual International Conference of the Learning Disabilities Association of America, Salt Lake City, UT.

RTI and Cognitive Assessment are Not Mutually Exclusive

- There will undoubtedly be countless arguments on each side, but none will be strong enough to convince people that one approach is clearly better than the other.
- An increasingly widespread view will likely emerge that embraces each approach as different but ***complementary*** in the identification, diagnosis, and treatment of specific learning disability.

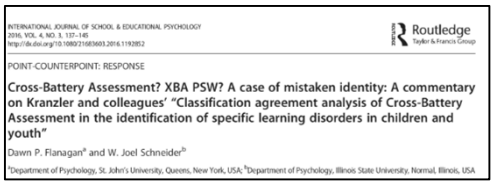
D. P. Flanagan, 2008

Some Housekeeping

- Clarification of terms
  - XBA v. PSW

XBA ≠ PSW

- Flanagan and colleagues' operational definition was often called by others "XBA," rather than being conceived of as a method that was separate from yet *compatible with* XBA
- To assist with clarification, Flanagan and colleagues (2013) gave it a name—the *Dual Discrepancy/Consistency operational definition of SLD*.


INTERNATIONAL JOURNAL OF SCHOOL & EDUCATIONAL PSYCHOLOGY
2016, VOL. 4, NO. 3, 137–145
http://dx.doi.org/10.1080/21683603.2016.1192852

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POINT-COUNTERPOINT: RESPONSE

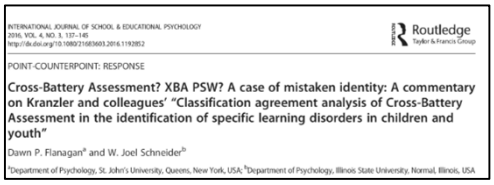
Cross-Battery Assessment? XBA PSW? A case of mistaken identity: A commentary on Kranzler and colleagues' "Classification agreement analysis of Cross-Battery Assessment in the identification of specific learning disorders in children and youth"

Dawn P. Flanagan[a] and W. Joel Schneider[b]

[a]Department of Psychology, St. John's University, Queens, New York, USA; [b]Department of Psychology, Illinois State University, Normal, Illinois, USA

XBA

- XBA is a method for *combining tests from different batteries* and predates DD/C by several years (Flanagan & McGrew, 1997; Flanagan & Ortiz, 2001).
- The XBA approach is grounded mainly in Cattell-Horn-Carroll (CHC) theory and research (McGrew, 2005; 2009; Schneider & McGrew, 2012).
- Unlike other "flexible battery" practices, rigorous procedures and methods accompany XBA to insure that any assessment that expands beyond the confines of a single battery is *psychometrically and theoretically defensible*.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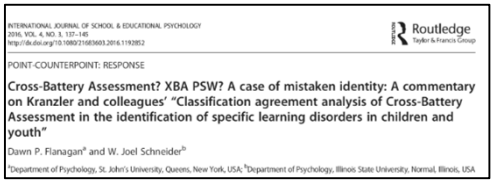
XBA

- To assist in XBA and in interpretation of cross-battery data, X-BASS was developed (Ortiz, et al., 2015). **X-BASS** is an integration and substantial revision of the software programs that accompanied the second and third editions of *Essentials of Cross-Battery Assessment* (Flanagan et al., 2007, 2013).
- Although XBA can be used in the context of SLD identification, it has many other applications.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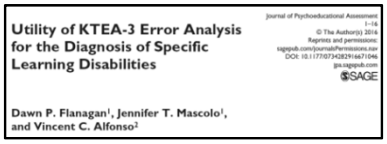
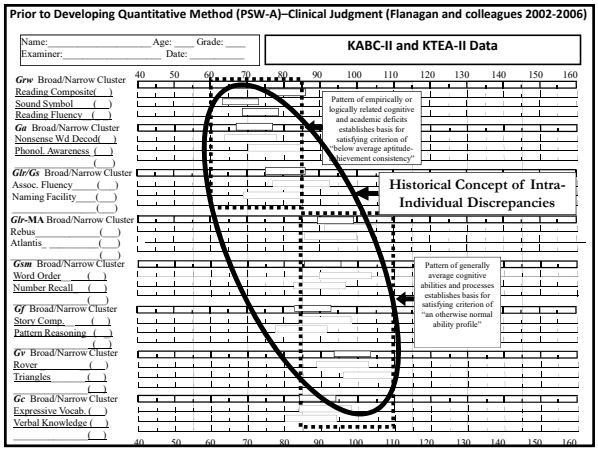
SLD Cannot be Diagnosed with a Formula

- Diagnosis of SLD can be made based on a systematic, theory- and research-based approach to examining results of a comprehensive evaluation
- A diagnosis of SLD is *a clinical judgment* that is made by a private independent psychologist or a multi-disciplinary team based on a *convergence of data sources* that appear to be consistent with the SLD construct.
- Due to federal statutory and regulatory requirements, a classification of SLD is made in the schools following one of three methods – *methods that necessitate quantification for purposes of consistency in identification and accountability – The third option (i.e., PSW) is one such method*

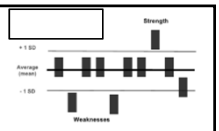




What's Next?

- Review of foundational sources of information necessary for making informed decisions about PSW method for SLD identification, with emphasis on the assessment – intervention connection

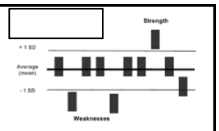
Interpretation of PSW



- Requires an understanding of contemporary theory
- Requires an understanding of the theoretical constructs that are measured by cognitive batteries
- Requires understanding of cognitive processes and abilities related to achievement
- May require cross-battery assessment to assess all the abilities and processes considered important based on referral and to follow up on aberrant test performances

D. P. Flanagan, 2017

Interpretation of PSW



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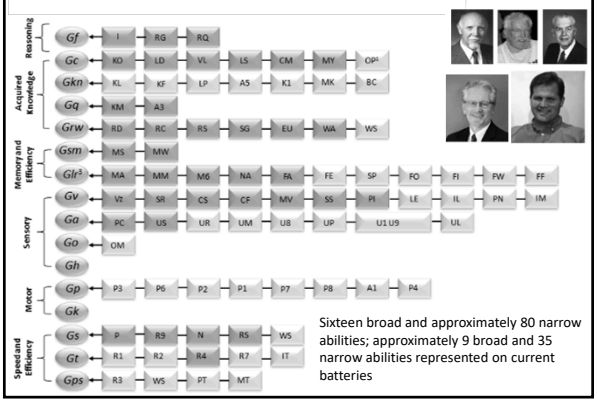
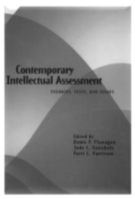
D. P. Flanagan, 2017

Current and Expanded Cattell-Horn-Carroll (CHC) Model of Cognitive Abilities
(adapted from Schneider & McGrew, 2012) – Reviewed in Unit I



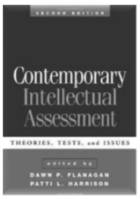
Sixteen broad and approximately 80 narrow abilities; approximately 9 broad and 35 narrow abilities represented on current batteries

Over Two Decades of Revisions and Refinements to Gf-Gc/CHC Theory



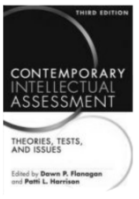
1997

Chapter by **McGrew**: First attempt at Integrating Cattell-Horn Gf-Gc Theory and John Carroll's Three-Stratum Theory



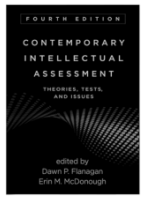
2005

Chapter by **McGrew**: Documentation of how the integrated model presented in 1997 and again in 2000 became known as CHC theory



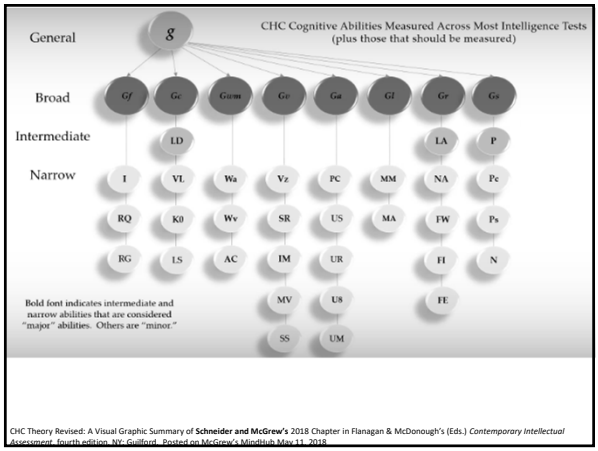
2012

Chapter by **Schneider and McGrew**: Careful review of the literature led to some substantial modifications



2018

Chapter by **Schneider and McGrew**: Most significant revisions to CHC theory to date and criteria for revisions to the CHC taxonomy



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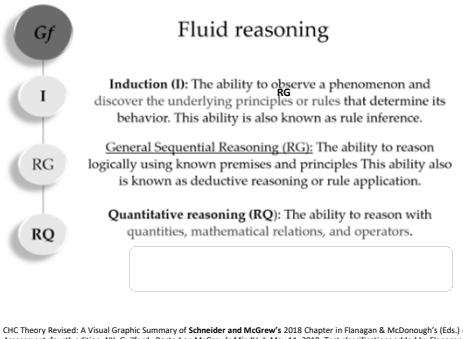
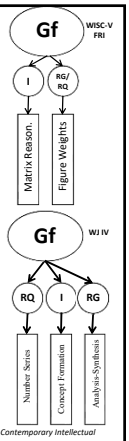
Fluid Reasoning (Gf). Gf refers to a type of thinking or reasoning that individuals use when faced with a relatively new or novel task that cannot be performed automatically. It requires the use of inductive, deductive, and quantitative reasoning when solving unfamiliar problems that are minimally dependent on prior knowledge.





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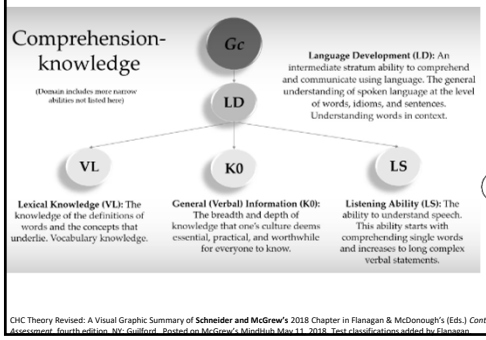
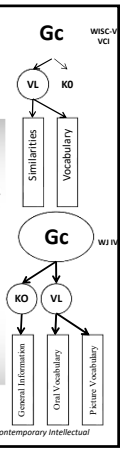
Comprehension-Knowledge (Gc). Gc refers to the breadth and depth of knowledge and skills (e.g., words, general information) that are acquired as a result of exposure to language, culture, general life experiences, and formal schooling. It represents the ability to comprehend and communicate culturally-valued knowledge.





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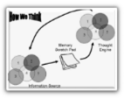
Working memory capacity

The ability to maintain and manipulate information in active attention. The mind's mental "scratchpad" or "workbench."

- A limited capacity system
- Mental scratch pad or workspace
- Loses information quickly through decay of memory traces, unless individual activates other cognitive resources to maintain the information in immediate awareness



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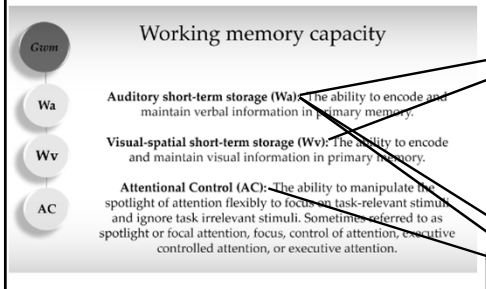
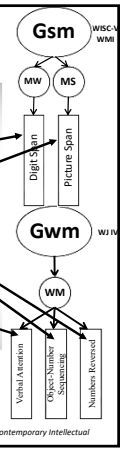
Working Memory Capacity (Gwm). The ability to encode and maintain verbal or visual information in immediate awareness and then manipulate or transform it in some way within a few seconds, which is dependent in part on focus of attention. It also includes the ability to focus attention on task-relevant stimuli and ignore task irrelevant stimuli.





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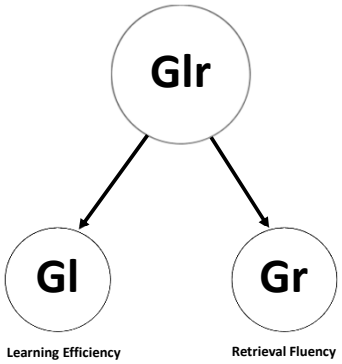
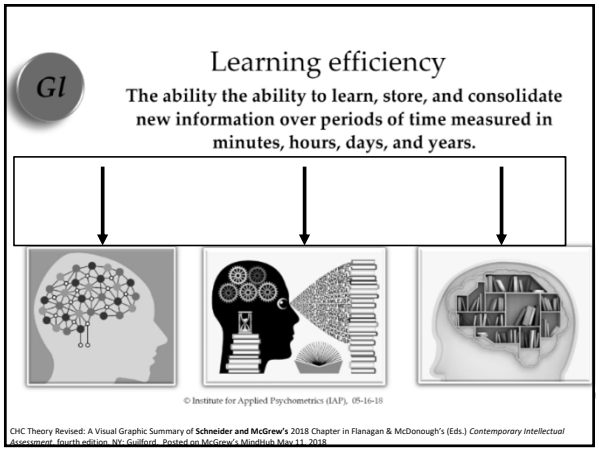
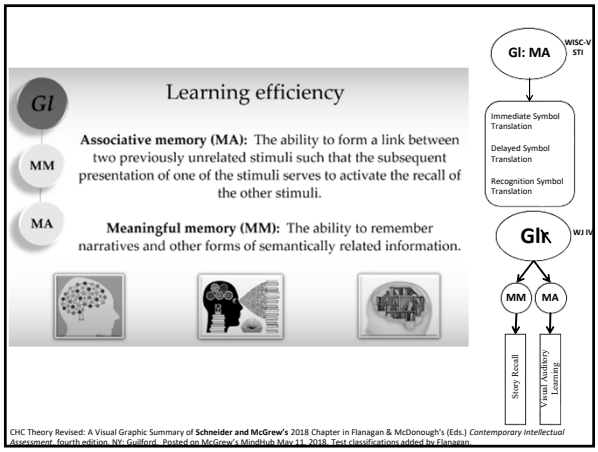
Long-term Storage and Retrieval Has Been Separated Because it has been Shown that it Encompasses Two Relatively Distinct Abilities

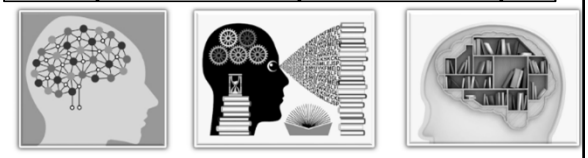






Gr — Retrieval fluency

The rate and fluency at which individuals can access information stored in long-term memory.



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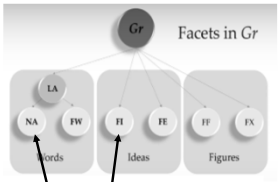
Gr — Facets in Gr

Speed of lexical access (LA): The ability to rapidly retrieve words from an individual's lexicon. Verbal efficiency or automaticity of lexical access. An intermediate stratum level ability.



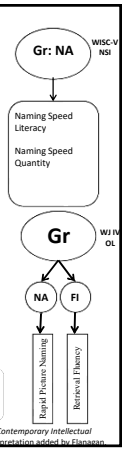
Naming facility (NA): The ability to rapidly call objects by their names.

Word fluency (FW): The ability to rapidly produce words that share a phonological (e.g., fluency of retrieval of words via a phonological cue) or semantic feature (e.g., fluency of retrieval of words via a meaning-based representation).

Ideational fluency (FI): The ability to rapidly produce a series of ideas, words, or phrases related to a specific condition or object.

Expressional fluency (FE): The ability to rapidly think of different ways of expressing an idea.

The oral language composite made up of Rapid Picture Naming and Retrieval Fluency is called "Speed of Lexical Access" (LA) – It is broader than LA.



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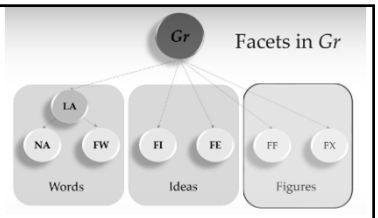


Figural fluency (FF): The ability to rapidly draw or sketch as many things (or elaborations) as possible when presented with a nonmeaningful visual stimulus (e.g., a set of unique visual elements).

Figural flexibility (FX): The ability to rapidly draw different solutions to figural problems.

CHC Theory Revised: A Visual Graphic Summary of **Schneider and McGrew's** 2018 Chapter in Flanagan & McDonough's (Eds.) *Contemporary Intellectual Assessment*, fourth edition, NY: Guilford. Posted on McGrew's MindHub May 11, 2018.

Schneider and McGrew's CHC-based Conceptualization of Gsm and Glr with WISC-V Subtests and Corresponding Memory Construct Highlighted

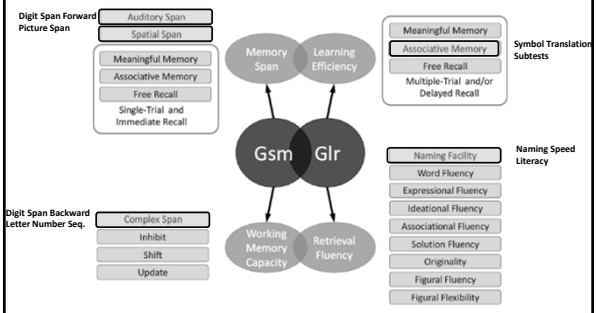
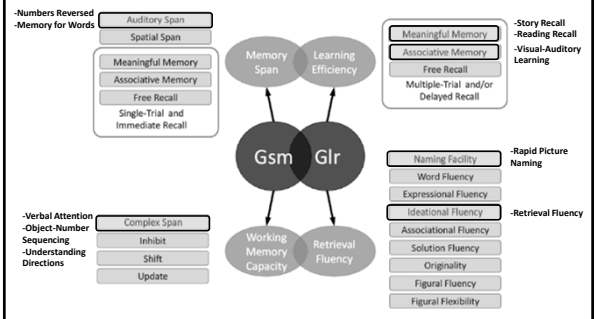


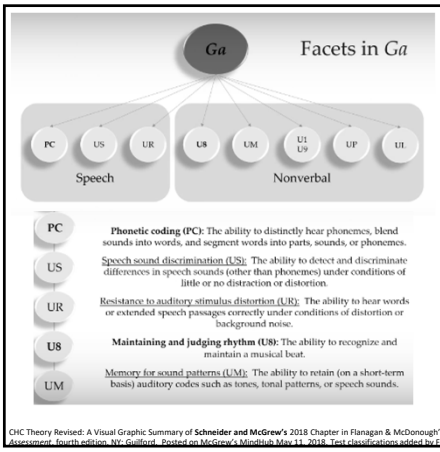
Figure 4.6. Conceptual map of memory-related abilities in CHC theory.

In Flanagan & Harrison (2012). ***Contemporary Intellectual Assessment: Theories, Tests, and Issues (3rd ed.).*** New York: Guilford.

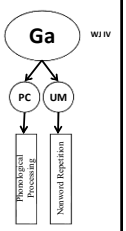
Schneider and McGrew's CHC-based Conceptualization of Gsm and Glr with WJ IV COG, OL, ACH Subtests and Corresponding Memory Construct Highlighted



In Flanagan & Harrison (2012). ***Contemporary Intellectual Assessment: Theories, Tests, and Issues (3rd ed.).*** New York: Guilford.

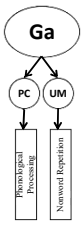


Supplement WISC-V with Ga tests from another battery (e.g., CTOPP-2; FAR; WJ IV OL)



CHC Theory Revised: A Visual Graphic Summary of **Schneider and McGrew's** 2018 Chapter in Flanagan & McDonough's (Eds.) *Contemporary Intellectual Assessment*, fourth edition. NY: Guilford. Posted on McGrew's MindHub May 11, 2018. Test classifications added by Flanagan.

WJ IV measures both Phonetic Coding and Memory for Sound Patterns: Phonological Processing Test May be Influenced by Gr and Gwm



Test 5A. Phonological Processing – **Word Access**.

Tell me a word that starts/middle/ends with the /b/ sound. /b/

Ga: Phonetic Coding (PC) – the ability to hear phonemes distinctly

Test 5B. Phonological Processing – **Word Fluency**.

Item 1: words that begin with /m/ sound as in *milk* (in one minute)

Item 2: words that begin with /d/ sound as in *dog* (in one minute)

Gr: Word Fluency (FW) – fluency of retrieval of words via a phonological cue

Test 5C. Phonological Processing – **Word Substitution.**

If I say "Penny" and then change *pen* to *sun*, the new word would be…what?

Ga: Phonetic Coding (PC) – the ability to segment words into parts (also requires working memory)

Areas of Processing Deficit and Their Link to Areas of Academic Achievement

Phonological Processing Model

Wagner, R.K., Torgesen, J.K., & Rashotte, C.A. (1999). Comprehensive Test of Phonological Processing. Austin, TX: PRO-ED; Wagner, R.K., Torgesen, J.K., & Rashotte, C.A. (1994). Development of reading-related phonological processing abilities: New evidence of bi-directional causality from a latent variable longitudinal study. Developmental Psychology, 30, 73-87; Wagner, R.K., & Torgesen, J.K. (1987). The nature of phonological processing and its causal role in the acquisition of reading skills. Psychological Bulletin, 101, 192-212.

Three Kind of Phonological Processing

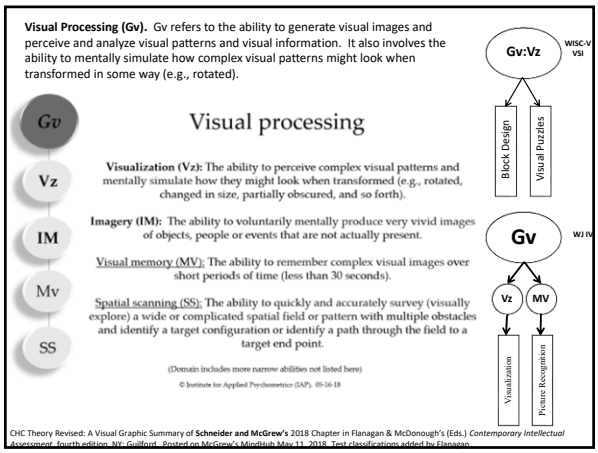
Phonological Awareness: Phonological awareness refers to an individual's awareness of and access to the sound structure of his/her oral language. This awareness proceeds from word length phonological units in compound words (e.g., cowboy), to syllables within words, to onset-rimes units within syllables to individual phonemes within rimes, and finally to individual phonemes within consonant clusters.

Phonological Memory: Phonological memory refers to coding information phonologically for temporary storage in working memory. A deficient phonological memory does not appear to impair either reading or listening to a noticeable extent, provided the words involved are already in the individual's vocabulary. However, phonological memory impairments can constrain the ability to learn new written or spoken vocabulary.

Rapid Naming: Rapid naming of objects, colors, digits, or letters requires efficient retrieval of phonological information from long-term memory. The efficiency with which individuals are able to retrieve phonological codes associated with individual phonemes, word segments, or entire words should influence the degree to which phonological information is useful in decoding printed words. Measures of rapid naming require speed and processing of visual as well as phonological information.

Memory for Sound Patterns/Phonological Memory and Reading

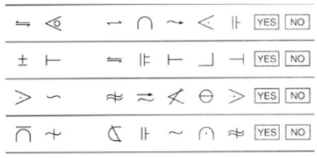
Storage of phonological information during reading involves creating a sound-based representation of written words in working memory. Deficits in storage of phonological information result in faulty representations in memory, which lead to inaccurate application of sound rules during reading tasks. A deficit in phonological memory does not inevitably lead to poor reading of familiar material, but is more likely to impair decoding of new words, particularly words that are long enough to decode bit by bit as a means of storing intermediate sounds. A deficit in phonological memory may impair reading comprehension for more complex sentences.

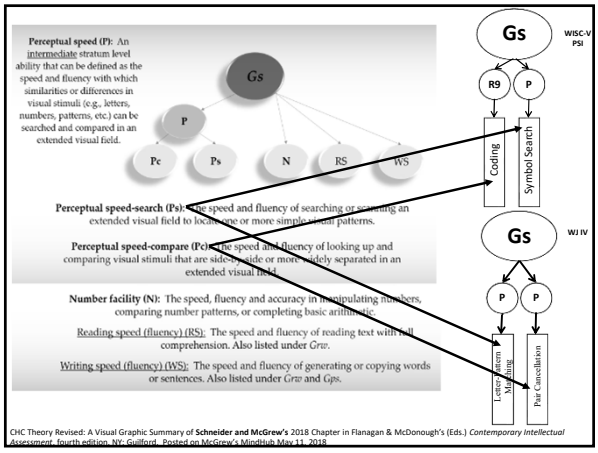


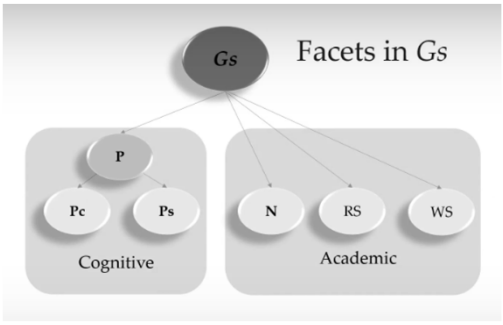
Processing Speed (Gs)

FAST THINKING

- The ability to control attention to automatically perform simple and repetitive clerical-type tasks quickly. It may be thought of as mental speed or the fluency with which simple, over-learned tasks are performed.







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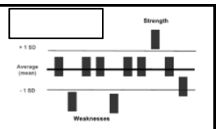
Interpretation of PSW



- Requires an understanding of contemporary theory
- Requires an understanding of the theoretical constructs that are measured by cognitive batteries
- Requires understanding of cognitive processes and abilities related to achievement
- May require cross-battery assessment to assess all the abilities and processes considered important based on referral and to follow up on aberrant test performances

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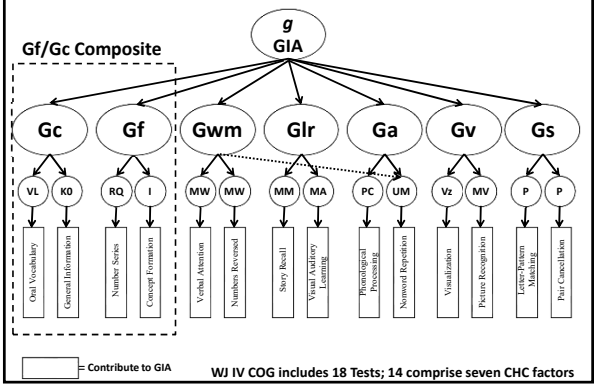
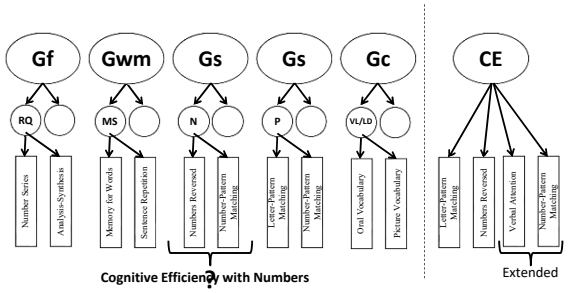
CHC Factors on the WJ IV COG



WJ IV COG includes 18 Tests; 14 comprise seven CHC factors

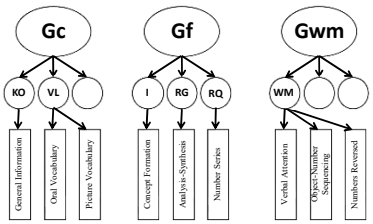
Narrow Ability an Other Clinical Clusters on the WJ IV COG



Number Facility (Gs:N) – The speed at which basic arithmetic operations are performed accurately

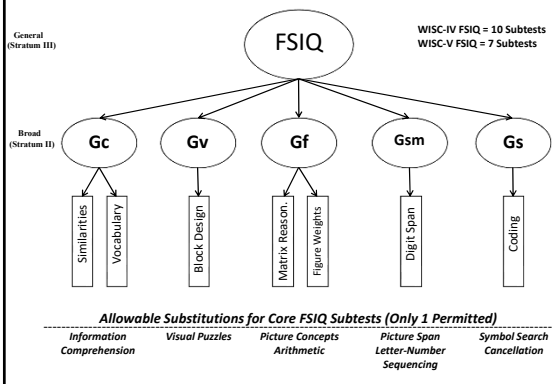
= Test from WJ IV OL

CHC Extended Factors on the WJ IV COG



= Test from WJ IV OL

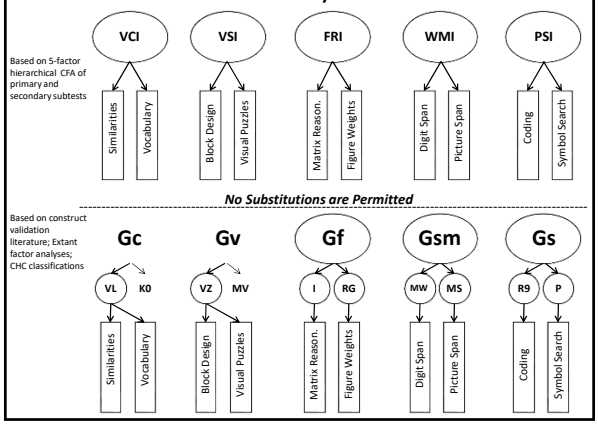
Composition of the WISC-V Full Scale IQ



Allowable Substitutions for Core FSIQ Subtests (Only 1 Permitted)

Information	*Visual Puzzles*	*Picture Concepts*	*Picture Span*	*Symbol Search*
Comprehension		*Arithmetic*	*Letter-Number Sequencing*	*Cancellation*

WISC-V Primary Index Scales



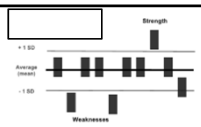
A Comparison of WISC-V Family and WJ IV Family of Batteries by CHC Construct: When To Supplement Via XBA

Broad	Narrow	WISC-V (KTEA-3*, CELF-5*)	WJ IV COG (ACH*, OL*)	Need XBA?
Crystallized Knowledge (Gc)	General Information (K0)	Information Comprehension	General Information	Yes on WJ IV if necessary to follow up on low K0 subtest performance
	Lexical Knowledge (VL)	Vocabulary Similarities ^Word Classes ^Word Definitions	Oral Vocabulary *Picture Vocabulary	Probably not, unless specific task characteristics and task demands suggest otherwise
	Listening Ability (LS)	*Listening Comprehension *Following Directions *Linguistic Concepts *Sentence Comprehension *Understanding Spoken Paragraphs *Word Structure *Semantic Relationships	*Oral Comprehension	Not necessary for WISC-V if using CELF-5; Necessary for WJ IV
	Communication Ability (CM)	*Oral Expression *Formulated Sentences	None	Probably not when using WISC-V with KTEA-3 and CELF-5; Necessary for WJ IV
	Grammatical Sensitivity (MY)	*Sentence Assembly	None	Yes on WISC-V and related batteries to follow up on low MY subtest performance; Necessary for WJ IV
Fluid Reasoning (Gf)	Induction (I)	Matrix Reasoning Picture Concepts	Concept Formation	Probably not on WISC-V, unless specific task characteristics and task demands suggest otherwise; Necessary for WJ IV to follow up on low I subtest performance
	General Sequential Reasoning (RG)	Figure Weights	Analysis-Synthesis	Necessary for WISC-V and WJ IV to follow up on low RG subtest performance
	Quantitative Reasoning (RQ)	None (although Pearson classifies Arithmetic as RQ)	Number Series *Number Matrices	Necessary for WISC-V; Probably not for WJ IV, unless specific task characteristics and task demands suggest otherwise

A Comparison of WISC-V Family and WJ IV Family of Batteries by CHC Construct: When To Supplement Via XBA

Broad	Narrow	WISC-V (KTEA-3*, CELF-5*)	WJ IV COG (ACH*, OL*)	Need XBA?
Short-term (Working) Memory (Gsm/Gwm)	Memory Span (MS)	Digit Span Forward Picture Span *Recalling Sentences	Memory for Words Nonword Repetition *Sentence Repetition	Not necessary for WISC-V or WJ IV, unless specific task characteristics and task demands suggest otherwise (e.g., visual vs. auditory input)
	Working Memory Capacity (MW)	Arithmetic Digit Span Backward Digit Span Sequencing Letter-Number Sequencing	Numbers Reversed Object-Number Sequencing Verbal Attention *Understanding Directions	Not necessary for WISC-V or WJ IV, although more variability in task demands and task characteristics is evident on WJ IV MW subtests
Long-term Storage and Retrieval (Glr)	Associative Memory (MA)	Immediate Symbol Translation Delayed Symbol Translation Recognition Symbol Translation	Visual Auditory Learning	Coverage of MA is similar for WISC-V and WJ IV, although more clinical information may be garnered from WISC-V; Necessary for WISC-V and WJ IV to follow up on low MA subtest performance
	Meaningful Memory (MM)	None	Story Recall	Necessary for WISC-V; Necessary for WJ IV to follow up on low MM subtest performance
	Ideational Fluency (FI)	*Associational Fluency	*Retrieval Fluency	Necessary for WISC-V and WJ IV to follow up on low FI subtest performance
	Naming Facility (NA)	Naming Speed Literacy *Letter Naming Facility ^Object Naming Facility	*Rapid Picture Naming	Probably not on WISC-V, unless specific task characteristics suggest otherwise; Necessary for WJ IV to follow up on low NA subtest performance
Visual Processing (Gv)	Visualization (Vz)	Block Design Visual Puzzles	Visualization	Not necessary for WISC-V; Necessary for WJ IV to follow up on low Vz subtest performance
	Visual Memory (MV)	None	Picture Recognition	Necessary for WISC-V; Necessary for WJ IV to follow up on low MV subtest performance
Auditory Processing (Ga)	Phonetic Coding (PC)	*Phonological Processing	Phonological Processing *Segmentation *Sound Awareness *Sound Blending	Necessary for WISC-V and related batteries to follow up on low PC subtest performance; Not necessary for WJ IV
Processing Speed (Gs)	Perceptual Speed (P)	Symbol Search Cancellation	Letter-Pattern Matching Number-Pattern Matching Pair Cancellation	Not necessary for WISC-V or WJ IV
	Rate of Test Taking (R9)	Coding	None	Existence and utility of this narrow ability (not subtest) is questionable
	Number Facility (N)	Naming Speed Quantity *Math Fluency	*Math Facts Fluency	Probably not for WISC-V; Necessary for WJ IV to follow up on low N subtest performance

Interpretation of PSW



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- Requires an understanding of the theoretical constructs that are measured by cognitive batteries
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Summary of Relations between CHC Abilities and Neuropsychological Processes and Reading Achievement and the Etiology of Reading Functions

CHC Broad Ability	Reading Achievement	Etiology of Reading Functions
Gf	**Inductive (I)** and **general sequential reasoning (RG)** abilities play a moderate role in **reading comprehension**. Executive functions such as planning, organization, and self-monitoring are also important.	Several cortical and subcortical structures are frequently implicated in **basic reading skills** and **word reading accuracy.** Recent work appears to identify dysfunction in a left hemispheric network that includes the occipitotemporal region, inferior frontal gyrus, and inferior parietal region of the brain (Silani et al., 2005; Shaywitz et al., 2000; Fletcher, Simos, Papanicolaou, & Denton, 2004; Richlan et al., 2009; Richlan, 2012). Numerous imaging studies have also found that dysfunctional responses in the left inferior frontal and temporo-parietal cortices play a significant role with regard to phonological deficits (Skeide et al., 2015). Similar brain regions are activated on tasks involving **reading fluency**, but additional activation is observed in areas involved in eye movement and attention (Jones, Ashby, & Branigan, 2013). Further, there is also evidence for increased activation in the left occipitotemporal region, in particular, the occipitotemporal sulcus, which is important for rapid processing of letter patterns (Shaywitz et al., 2004; Dehaene & Cohen, 2011). Brain regions often associated with **reading comprehension** include the anterior temporal lobe, inferior temporal gyrus, inferior frontal gyrus, inferior frontal sulcus, and middle and superior frontal and temporal regions (Ferstl et al., 2008; Gernsbacher & Kaschak, 2003). More recent research has revealed a relationship between listening and reading comprehension and activation along the left superior temporal sulcus, which has referred to by some as the "comprehension cortex" (Berl et al., 2010). However, broader pathways are also activated in reading
Gc	**Language development (LD)**, **lexical knowledge (VL)**, and **listening ability (LS)** are important at all ages for **reading acquisition and development**. These abilities become increasingly important with age. Oral Language, Listening Comprehension, and EF (planning, organization, self-monitoring) also important for **reading comprehension**.	
Gwm	**Memory span (MS)** and **working memory capacity (WM)** or attentional control are important for **overall reading** success. Phonological memory or WM for verbal and sound-based information may also be important. WM is important for **reading comprehension**, which involves holding words and sentences in awareness, while integrating prior knowledge with incoming information.	
Gv	Orthographic processing (often measured by tests of perceptual speed that use orthographic units as stimuli) is related to **reading rate and fluency.** Orthographic processing involves the ability to process units of words based on visual long-term memory representations, which is critical for automatic word recognition.	
Ga	**Phonetic coding (PC)** or phonological awareness / processing is very important during the elementary school years for the development of **basic reading skills and word reading accuracy**. Phonological memory or WM for verbal and sound-based information may also be important.	

Summary of Relations between CHC Abilities and Neuropsychological Processes and Reading Achievement and the Etiology of Reading Functions (Cont'd)

Glr	**Naming facility (NA)** or **rapid automatic naming** (RAN; also called speed of lexical access) is very important during the elementary school years for **reading rate and fluency or word recognition skills. Associative memory (MA)** is also important.	comprehension, reflecting increased cognitive demand compared to listening. Family and genetic factors have long been identified as crucial in reading achievement, with some researchers suggesting that a child with a parent with a reading disability is eight times more likely to be dyslexic compared to the general population (Pennington & Olson, 2005). Shared environmental factors include: language and literacy environment during childhood (Wadsworth et al., 2000), and quality of reading instruction.
Gs	**Perceptual speed (P)** abilities are important throughout school, but particularly during the elementary school years.	

Note: Information in this table was culled from the following sources: Flanagan, Ortiz, Alfonso, & Mascolo, 2006; Flanagan, Ortiz, & Alfonso, 2013; McDonough, Flanagan, Sy, & Alfonso, 2017; McGrew & Wendling, 2010; McGrew et al., 2014)

Summary of Relations between CHC Abilities and Neuropsychological Processes and Math Achievement and the Etiology of Math Functions

CHC Broad Ability	Math Achievement	Etiology of Math Functions
Gf	**Reasoning inductively (I)** and **deductively with numbers (RQ)** is very important for **math problem solving**. Executive functions such as set shifting and cognitive inhibition are also important.	The intraparietal sulcus in both hemispheres is widely viewed as crucial in processing and representing numerical quantity (**number sense**), although there may be differences in activation as a function of age (Ansari & Dhital, 2006; Ansari, Garcia, Lucas, Hamon, & Dhital, 2005; Dehaene et al., 2004; Kaufmann et al., 2008; Kucian, von Aster, Loenneker, Dietrich, & Martin, 2008; Price & Ansari, 2013; Mussolin et al., 2010).
Gc	**Language development (LD)**, **lexical knowledge (VL)**, and **listening ability (LS)** are important at all ages for **math problem solving**. These abilities become increasingly important with age.	Regions of the left fronto-parietal cortex, including the intraparietal sulcus, angular gyrus, and supramarginal gyrus have been consistently associated with **math calculation** (Ansari, 2008; De Smedt, Holloway, & Ansari, 2011; Dehaene, Molko, Cohen, & Wilson, 2004; Dehaene et al., 2004). The dorsolateral prefrontal cortex has also been found to show increased activation during calculation, implying that executive functioning and working memory may be playing a role in the process (Davis et al., 2009).
Gwm	**Memory span (MS)** and **working memory capacity (WM)** or attentional control are important for **math problem solving** and overall success in math. (Including **math calculation**)	
Gv	**Visualization (VZ)**, including mental rotation, is important primarily for higher level math (e.g., geometry, calculus) and **math problem solving**.	A left hemisphere network that includes the precentral gyrus, inferior parietal cortex, and intraparietal sulcus, is often implicated in **math fact retrieval** (Dehaene & Cohen, 1992; Dehaene & Cohen, 1997; Dehaene et al., 1999). Further, some researchers believe that rote math facts are retrieved from verbal memory, thereby requiring activation of the angular gyrus and other regions associated with linguistic processes (Dehaene, 1992; Dehaene & Cohen, 1995; Dehaene et al., 1999).
Ga		
Glr	**Naming facility (NA;** also called speed of lexical access) and **associative memory (MA)** are important for memorization and rapid retrieval of **basic math facts** and for accurate and fluent **calculation**.	Prevalence of math disabilities is about 10 times higher in those with family members who had math disabilities (Shalev et al., 2001).
Gs	**Perceptual speed (P)** is important during all years, especially the elementary school years for **math calculation fluency**.	Environmental factors, including motivation, emotional functioning (e.g., math anxiety), and suboptimal or inadequate teaching may also contribute to math difficulties (Szucs & Goswami, 2013; Vukovic et al., 2013). Further, math achievement may be associated with cultural or gender-based attitudes that may be transmitted in the family environment (e.g., Chiu & Klassen, 2010; Gunderson et al., 2011).
Gr/Gs	Number representation (e.g., quantifying sets without counting, estimating relative magnitude of sets) and number comparisons are related to overall **number sense**.	

Summary of Relations between CHC Abilities and Neuropsychological Processes and Writing Achievement and the Etiology of Writing Functions

CHC Broad Ability	Writing Achievement	Etiology of Writing Functions
Gf	**Inductive (I)** and **general sequential reasoning (RG)** are consistently related to **written expression** at all ages. Executive functions such as attention, planning, and self-monitoring are also important.	Neural correlates of writing are less understood, but some studies have suggested that the cerebellum and parietal cortex, particularly the left superior parietal lobe, may be involved (Katanoda et al., 2001; Magrassi et al., 2010). In addition, the frontal lobes have also been implicated and are considered crucial in planning, brainstorming, organizing, and goal setting, which are important for **written expression** (Shah et al., 2013).
Gc	**Language development (LD)**, **lexical knowledge (VL)**, and **general information (K0)** are important primarily after 2nd grade and become increasingly important with age. Level of knowledge of syntax, morphology, semantics, and VL has a significant impact on clarity of **written expression** and text generation ability.	Functional neuroimaging studies have provided substantial evidence for the role of the ventral-temporal inferior frontal gyrus and the posterior inferior frontal gyrus in **spelling** (Rapp et al., 2015; van Hoorn et al., 2013). Other areas that have been identified include the left ventral cortex, bilateral lingual gyrus, bilateral fusiform gyrus (Planton et al., 2013; Purcell et al., 2014; Richards et al., 2005; Richards et al., 2006). However, many of these regions have also been associated with reading and are not distinct to spelling / writing disorders.
Gwm	**Memory span (MS)** is important to writing, especially **spelling** skills whereas **working memory (WM)** has shown relations with **advanced writing skills** (e.g., written expression; synthesizing multiple ideas, ongoing self-monitoring).	
Gv	Orthographic processing (often measured by tests of perceptual speed that use orthographic units as stimuli) is particularly important for **spelling**.	While there is a significant genetic component involved in the development of writing skills, this etiology is often shared with a broad variety of reading and language skills (Olson et al., 2013).
Ga	**Phonetic coding (PC)** or phonological awareness / processing is very important during the elementary school years (primarily before 5th grade) for both **basic writing skills** and **written expression**.	
Glr	**Naming facility (NA;** also called speed of lexical access) has demonstrated relations with **writing fluency**. Storing and retrieving commonly occurring letter patterns in visual and motor memory are needed for **spelling**.	
Gs	**Perceptual speed (P)** is important during all school years for **basic writing skills** and is related to **written expression** at all ages.	

General and Specific Manifestations of Broad Ability Weaknesses and

Recommendations That May Facilitate Learning and Aid in Bypassing or Minimizing the Effects of Broad Ability Weaknesses

Rapid Reference 1.5 General and Specific Manifestations of Fluid Reasoning (Gf) Weaknesses

CHC Broad Cognitive Abilities/ Neuropsychological Functions	Brief Definition	General Manifestations of Cognitive/ Neuropsychological Weakness	Specific Manifestations of Cognitive/ Neuropsychological Weakness
Fluid Reasoning (Gf)	Novel reasoning and problem solving; ability to solve problems that are unfamiliar. Processes are minimally dependent on prior learning. Involves manipulating rules, abstracting, generalizing, and identifying logical relationships. Fluid reasoning is evident in inferential reasoning, concept formation, classification of unfamiliar stimuli, categorization, and extrapolation of reasonable estimates in ambiguous situations (Schneider & McGrew, 2012). Narrow Gf abilities include Induction, General Sequential Reasoning (Deduction), and Quantitative Reasoning.	***Difficulties with:*** Higher-level thinking and reasoning Transferring or generalizing learning Deriving solutions for novel problems Extending knowledge through critical thinking Perceiving and applying underlying rules or process(es) to solve problems	***Reading Difficulties:*** Drawing inferences from text Abstracting main idea(s) ***Math Difficulties:*** Reasoning with quantitative information (word problems) Internalizing procedures and processes used to solve problems Apprehending relationships between numbers ***Writing Difficulties:*** Essay writing and generalizing concepts Developing a theme Comparing and contrasting ideas

See Chapter 4 in *Essentials of Cross-Battery Assessment* (Flanagan, Ortiz, & Alfonso, 2013)
See Chapter 1 in *Essentials of Planning, Selecting, and Tailoring Interventions for Unique Learners* (Mascolo, Alfonso, & Flanagan, 2014)

Rapid Reference 1.14 Recommendations That May Facilitate Learning and Aid in Bypassing or Minimizing the Effects of a Fluid Reasoning (Gf) Deficit

Classroom Instruction	Instructional Materials	Environmental	Strategies
Use demonstrations to externalize the reasoning process (think-aloud)	Expanded answer keys containing the "reason" for correct/incorrect choices	Problem-solving charts (hanging or taped to desk)	Use metacognitive strategies (mnemonics that are memorable and that accurately represent the learning task)
Gradually offer guided practice (e.g., guided questions list) to promote internalization of procedures or process(es)	Guided lists for implementing procedures, formulas	Procedural charts/lists (hanging or taped to desk)	Use tools that help them categorize objects and concepts to assist in drawing conclusions (e.g., graphic organizers, concept maps)
Offer targeted, explicit feedback	Models/examples	Preferred seating arrangements that provide easy access to a peer model with strong reasoning skills (e.g., for cooperative learning activities)	Listen to and separate the steps in completing a problem from the actual content used in a problem
Offer opportunities for learning formats that allow for reasoning to be modeled for the student (e.g., cooperative learning, reciprocal teaching)	Text features (boldface, italics)		
Compare new concepts to previously learned concepts (same vs. different)	Graphic organizers that allow for a visual depiction of relationships between and among concepts		
Use analogies, similes, metaphors, paired with concrete explanations, to support understanding when presenting tasks (e.g., "We are going to learn our math facts with *lightning* speed, that means we are going to learn them *fast*")	Manipulatives to demonstrate relationships (e.g., part to whole relationships)		

Mascolo, Flanagan, and Alfonso (2014). A systematic method of analyzing assessment results for tailoring interventions (SMAARTI), in Mascolo, Alfonso, & Flanagan, *Essentials of Planning, Selecting, and Tailoring Interventions for Unique Learners* (pp. 3-55). Hoboken, NJ: Wiley.

Rapid Reference 1.6 General and Specific Manifestations of Crystallized Intelligence (Gc) Weaknesses

CHC Broad Cognitive Abilities/ Neuropsychological Functions	Brief Definition	General Manifestations of Cognitive/ Neuropsychological Weakness	Specific Manifestations of Cognitive/ Neuropsychological Weakness
Crystallized Intelligence (Gc)	Breadth and depth of knowledge and skills that are valued by one's culture. Developed through formal education as well as general learning experiences. Stores of information and declarative and procedural knowledge. Reflects the degree to which a person has learned practically useful knowledge and mastered valued skills (Schneider & McGrew, 2012). Narrow Gc abilities include General Verbal Information, Language Development, Lexical Knowledge, Listening Ability, Information about Culture, Communication Ability, and Grammatical Sensitivity.	***Difficulties with:*** Vocabulary acquisition Knowledge acquisition Comprehending language or understanding what others are saying Fact-based/informational questions Using prior knowledge to support learning Finding the right words to use/say	***Reading Difficulties:*** Decoding (e.g., word student is attempting to decode is not in his/her vocabulary) Comprehending (e.g., poor background knowledge about information contained in text) ***Math Difficulties:*** Understanding math concepts and the "vocabulary of math" ***Writing Difficulties:*** Grammar (syntax) Bland writing with limited descriptors Verbose writing with limited descriptors Inappropriate word usage ***Language Difficulties:*** Understanding class lessons Expressive language—"poverty of thought"

See Chapter 4 in *Essentials of Cross-Battery Assessment* (Flanagan, Ortiz, & Alfonso, 2013)
See Chapter 1 in *Essentials of Planning, Selecting, and Tailoring Interventions for Unique Learners* (Mascolo, Alfonso, & Flanagan, 2014)

Rapid Reference 1.15 Factors That May Facilitate Learning and Aid in Bypassing or Minimizing the Effects of a Crystallized Intelligence (Gc) Deficit

Classroom Instructional Factors	Instructional Materials	Environmental Factors	Strategies
Provides an environment rich in language and experiences	Contains chapter Glossaries	Word-of-the-day calendar	Use KWL strategy to increase background knowledge
Incorporates frequent practice with and exposure to words	E-Glossaries available	Word walls	Use context when reading to ascertain meaning
Reads aloud to children	Provides vocabulary building activities (print or online)		Capitalize on opportunities to practice new words (listening for their use in television shows and other media, purposely using them in conversation)
Varies reading purpose (leisure, information)	Contains tools for priming background knowledge (e.g., Harcourt)	Distraction-free seating	Engage in activities such as word searches containing related terms (e.g., travel terms) and crosswords (note: puzzlemaker.com can create customized puzzles)
Works on vocabulary building	Includes story starters	Closed doors	Write a new word and its definition along with a drawing
Teaches morphology	Includes text features (boldface, italics)	Closed windows	
Capitalizes on opportunities to define words within instruction (e.g., "the *composition* of igneous rock, that is, *what it is made* of, is . . .")	Availability of video clips		

Mascolo, Flanagan, and Alfonso (2014). A systematic method of analyzing assessment results for tailoring interventions (SMAARTI), in Mascolo, Alfonso, & Flanagan, *Essentials of Planning, Selecting, and Tailoring Interventions for Unique Learners* (pp. 3-55). Hoboken, NJ: Wiley.

Gc Continued

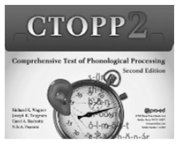
Rapid Reference 1.15 Factors That May Facilitate Learning and Aid in Bypassing or Minimizing the Effects of a Crystallized Intelligence (Gc) Deficit

Includes supportive modalities (e.g., visuals, gestures) to increase understanding of language used	Audio glossaries
Embeds instruction within a meaningful context (e.g., relating words to learner experiences, increasing listening ability through game-like format)	Dictionaries
Develops vocabulary through naturalistic extension of language (e.g., if a student asks, "Can I start my work," the teacher might respond, "Yes, you can *begin* your work," naturally building synonym knowledge)	Thesaurus
Uses extension and expansion strategies (Mather, Lynch, & Richards, 2001)	Encyclopedias
	Use vocabulary cartoons (Burchers, 2000)
	Use text talks

Most Intelligence and Cognitive Batteries do not Measure Ga

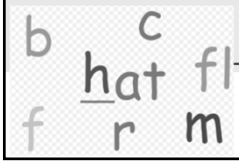
Assessing Phonological Processing Related to Reading

- Examples of assessments of phonological processing directly related to reading:
  - **PAL-II** Rhyming, Syllables, Phonemes, Rimes
  - **KTEA-II** Phonological Awareness Subtest
  - **NEPSY-II** Phonological Processing Subtest
  - **WJ IV** Phonological Processing Test
  - **DAS-II** Phonological Processing Subtest
  - **CTOPP-II** Blending and Segmenting Subtests
  - **FAR** – Feifer Assessment of Reading



Rapid Reference 1.7 General and Specific Manifestations of Auditory Processing (Ga) Weaknesses

CHC Broad Cognitive Abilities/ Neuropsychological Functions	Brief Definition	General Manifestations of Cognitive/ Neuropsychological Weakness	Specific Manifestations of Cognitive/ Neuropsychological Weakness
Auditory Processing (Ga)	Ability to analyze and synthesize auditory information. One narrow aspect of Ga is a precursor to oral language comprehension (i.e., parsing speech sounds or Phonetic Coding). In addition to Phonetic Coding, other narrow Ga abilities include Speech Sound Discrimination, Resistance to Auditory Stimulus Distortion, Memory for Sound Patterns (and others related to music).	***Difficulties with:*** Hearing information presented orally, initially processing oral information Paying attention especially in the presence of background noise Discerning the direction from which auditory information is coming Discriminating between simple sounds Foreign-language acquisition	***Reading Difficulties:*** Acquiring phonics skills Sounding out words Using phonetic strategies ***Math Difficulties:*** Reading word problems ***Writing Difficulties:*** Spelling Note-taking Poor quality of writing



Rapid Reference 1.16 Factors That May Facilitate Learning and Aid in Bypassing or Minimizing the Effects of an Auditory Processing (Ga) Deficit

Classroom Instructional Factors	Instructional Materials	Environmental Factors	Strategies
Enunciates sounds in words in an emphatic manner when teaching new words for reading or spelling	Video clips	Rules for talking and listening	Use comprehension monitoring (e.g., Does the word I heard/read make sense in context?)
Uses instructional techniques (e.g., work preview/text preview) to clarify unknown words	Read aloud texts/ features	Spelling lists	Engage in self-advocacy (e.g., asking for information to be repeated and/or clarified in regard to the misheard part)
Provides instructional supports (e.g., guided notes) during note-taking activities	Audio glossaries	Closed doors	Physically positioning oneself toward/close to the speaker
Builds in time for clarification questions related to "missed" or "misheard" items during lecture	Supplement oral instructions with written instructions	Closed windows	Attending to speaker's mouth and/or gestures, facial expressions, during the delivery of information
Shortens instructions	Phonemic awareness activities	Distraction-free seating	Recording notes via audio methods to allow a mechanism for being able to fill in notes for completeness
Makes an effort to minimize background noise via the use of instructional commands (e.g., work quietly, refrain from talking with your neighbor)	Electronic textbooks	Noise minimizers (carpet, noise-reducing headphones)	Following along with written directions/text during the provision of oral instruction
Repeats or rephrases questions asked by other students to ensure that all students "hear" the question that is associated with the teacher's given response	Guided notes, graphic organizers	Preferential seating (close to teacher, away from heaters, fans)	Practicing spelling lists with visually based techniques
Emphasizes sight-word reading		Localize sound source for student by standing closer when delivering instructions	Use visualization strategies to remember things
Pauses when delivering oral instruction to allow time for student to process auditory information			Use written mediums (e.g., email, text) to preserve content/integrity of information communicated

Rapid Reference 1.11 General and Specific Manifestations of Short-Term Memory (Gsm) Weaknesses

CHC Broad Cognitive Abilities/ Neuropsychological Functions	Brief Definition	General Manifestations of Cognitive/ Neuropsychological Weakness	Specific Manifestations of Cognitive/ Neuropsychological Weakness
Short-Term Memory (Gsm)	Ability to hold information in immediate awareness and use or transform it within a few seconds.	***Difficulties with:*** Following multistep oral and written instructions; Remembering information long enough to apply it; Remembering the sequence of information; Rote memorization; Maintaining one's place in a math problem or train of thought while writing	***Reading Difficulties:*** Reading comprehension (i.e., understanding what is read); Decoding multisyllabic words; Orally retelling or paraphrasing what one has read; ***Math Difficulties:*** Rote memorization of facts; Remembering mathematical procedures; Multistep problems and regrouping; Extracting information to be used in word problems; ***Writing Difficulties:*** Spelling multisyllabic words; Redundancy in writing (word and conceptual levels); Identifying main idea of a story; Note-taking

See Chapter 4 in *Essentials of Cross-Battery Assessment* (Flanagan, Ortiz, & Alfonso, 2013)
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Rapid Reference 1.20 Factors That May Facilitate Learning and Aid in Bypassing or Minimizing the Effects of a Short-Term Memory (Gsm) Deficit

Classroom Instructional Factors	Instructional Materials	Environmental Factors	Strategies
Offers repetition of information	Practice guides	Color-coded Information	Apply rote strategies (e.g., basic rehearsal, simple repetition) for information to be learned in the short-term
Reviews information and newly presented concepts often	Guided study	Math-facts tables (e.g., multiplication)	Encourage use of relational strategies (e.g., mnemonics)
Delivers information in manageable parts	Online review	Written schedules	Use elaborative rehearsal (associating new information with prior knowledge)
Evidences use of consistent instructional routines	Flash cards	Visual schedules (e.g., pictures)	Semantic rehearsal (creating a sentence using things to be remembered)
Uses meaningful stimuli to assist with encoding and allow for experiential learning (i.e., learning while doing)	Multisensory materials to facilitate encoding	Written reminders (homework)	Chunking
Provides opportunities for repeated practice and review			Paraphrasing
Provides supports (e.g., lecture notes, guided notes, study guides, written directions) to supplement oral instruction			Visual mnemonics (imagery, pegwords, loci, keyword method; Dehn)

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Rapid Reference 1.8 General and Specific Manifestations of Long-Term Retrieval (Glr) Weaknesses

CHC Broad Cognitive Abilities/ Neuropsychological Functions	Brief Definition	General Manifestations of Cognitive/ Neuropsychological Weakness	Specific Manifestations of Cognitive/Neuropsychological Weakness
Long-Term Retrieval (Glr)	Ability to store information (e.g., concepts, words, facts), consolidate it, and fluently retrieve it at a later time (e.g., minutes, hours, days, and years) through association. In Glr tasks, information leaves immediate awareness long enough for the contents of primary memory to be displaced completely. In other words, Glr tasks (unlike Gsm tasks) do not allow for information to be maintained continuously in primary memory (Schneider & McGrew, 2012). Glrabilities may be categorized as either "learning efficiency" or "fluency." Learning efficiency narrow abilities include Associative Memory, Meaningful Memory, and Free Recall Memory; fluency narrow abilities involve either the production of ideas (e.g., Ideational Fluency, Associational Fluency), the recall of words (e.g., Naming Facility, Word Fluency), or the generation of figures (e.g., Figural Fluency, Figural Flexibility) (Schneider & McGrew, 2012).	***Difficulties with:*** Learning new concepts; Retrieving or recalling information by using association; Performing consistently across different task formats (e.g., recognition versus recall formats); Rapid retrieval of information; Learning information quickly; Paired learning (visual-auditory); Recalling specific information (words, facts); Generating ideas rapidly	***Reading Difficulties:*** Accessing background knowledge to support new learning while reading; Slow to access phonological representations during decoding; Retelling or paraphrasing what one has read; ***Math Difficulties:*** Memorizing math facts; Recalling math facts and procedures; ***Writing Difficulties:*** Accessing words to use during essay writing; Specific writing tasks (compare and contrast; persuasive writing); Note-taking; Idea generation/production; ***Language Difficulties:*** Expressive—circumlocutions, speech filled with "umm" (word finding); Receptive—making connections throughout oral presentations (e.g., class lecture)

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Rapid Reference 1.17 Factors That May Facilitate Learning and Aid in Bypassing or Minimizing the Effects of a Long-Term Retrieval (Glr) Deficit

Classroom Instructional Factors	Instructional Materials	Environmental Factors	Strategies
Uses close-ended questions, yes/no, true/false	Guided lists for implementing procedures, formulas	Procedural charts	Organizes material to be learned by its visual aids (e.g., diagrams, flowcharts), auditory aids (e.g., chunking), or other tangibles (e.g., flash cards)
Uses consistent instructional routines	Practice guides	Word walls	Makes connections by relating material to be learned to oneself
Offers repeated practice with and review of newly presented information	Online review	Desk organizers	Relates concepts to be learned to one another via tools such as a concept map
Teaches memory strategies and encourages their use (verbal rehearsal to support encoding, use of mnemonic devices; Dehn, 2010)	Glossaries (electronic, audio, printed)	External memory aids (lists, audible timers)	Creates a schedule for distributed practice of material to be learned
Uses multiple modalities when teaching new concepts (pair written or visual with verbal information) to support dual recoding (Dehn, 2010)	Study guides	Calendars with visual references to due dates	Plans for regular review of material
Limits the amount of new material to be learned; introduces new concepts gradually and with a lot of context	Review sheets	Visual reminders (Post-its; color-coded systems)	Rehearses material to be learned via recitation, repetition

(continued)

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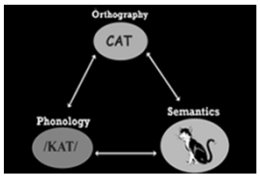
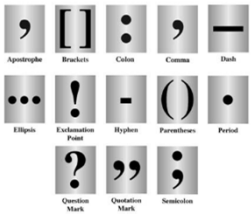
Relations between Gv Abilities and Reading Achievement

- ***Gv*** – Orthographic processing



Orthography (Wagner & Barker, 1994)

- The system of marks that make up the English language, including upper and lower case letters, numbers, and punctuation marks

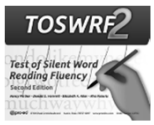


Assessing Visual Processing Related to Reading

- Visual processing must be assessed using *orthography* (letters, words and numbers) rather than abstract designs or familiar pictures

Assessing Orthographic Processing Related to Reading

- ***Examples of assessments of orthographic processing directly related to reading:***
  - Test of Silent Word Reading Fluency-2 (TOSWRF-2)
  - Test of Irregular Word Reading Efficiency (TIWRE)
  - Test of Orthographic Competence (TOC)
  - Process Assessment of the Learner (PAL-II)
  - Early Reading Assessment (ERA)
  - Feifer Assessment of Reading (FAR)



Rapid Reference 1.10 General and Specific Manifestations of Visual Processing (Gv) Weaknesses

CHC Broad Cognitive Abilities/ Neuropsychological Functions	Brief Definition	General Manifestations of Cognitive/ Neuropsychological Weakness	Specific Manifestations of Cognitive/ Neuropsychological Weakness
Visual Processing (Gv)	Ability to analyze and synthesize visual information. The ability to make use of simulated mental imagery (often in conjunction with currently perceived images) to solve problems (Schneider & McGrew, 2012). There are many narrow Gv abilities, some of which include Visualization, Speeded Rotation, Closure Speed, Flexibility of Closure, Visual Memory, and Spatial Scanning.	***Difficulties with:*** Recognizing patterns; Reading maps, graphs, charts; Attending to fine visual detail; Recalling visual information; Appreciation of spatial characteristics of objects (e.g., size, weight); Recognition of spatial orientation of objects	***Reading Difficulties:*** Orthographic coding (using visual features of letters to decode); Sight-word acquisition; Using charts and graphs within a text in conjunction with reading; Comprehension of text involving spatial concepts (e.g., social studies text describing physical boundaries, movement of troops along a specified route); ***Math Difficulties:*** Number alignment during computations; Reading and interpreting graphs, tables, and charts; ***Writing Difficulties:*** Spelling sight words; Spatial planning during writing tasks (e.g., no attention to margins, words that overhang a line); Inconsistent size, spacing, position, and slant of letters

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Rapid Reference 1.19 Factors That May Facilitate Learning and Aid in Bypassing or Minimizing the Effects of a Visual Processing (Gv) Deficit

Classroom Instructional Factors	Instructional Materials	Environmental Factors	Strategies
Provide oral explanation for visual concepts	Video clips	Color-coded information	Uses orthographic strategies for decoding (e.g., word length, shape of word); Uses "cover-copy-compare" technique—go to: http://www.ambleside primary.com/ambleweb/lookcover/lookcover.html
Reviews spatial concept and supports comprehension through use of hands on activities and manipulatives (e.g., using models to demonstrate the moon's orbital path).	Enlarged text (via online zoom feature or alternative print copy of textbook, worksheet)	Preferential seating aimed at allowing the student to access visual material (e.g., smart board) manipulatives, visual aids, and other materials to support learning	Capitalizes on intact or strong auditory skills during learning/studying (e.g., uses phonemic skills for decoding tasks)
Provides verbal label for visual representations (e.g., "The shaded red bars represent women's votes, the green bars represent men's votes)	Highlights margins during writing tasks	Assigned note-taking buddy	Pairs visual information with verbal (mnemonics)
Provides written copies of oral instructions, lectures	Provides direct handwriting practice	Readers or scribes, where needed	Labels visual charts/graphs with verbal labels
Auditory cueing to supplement visual information/cues (e.g., "Look at the bar graph for weekly sales")	Provides visual supports (graphic organizers, graph paper)	Reduce visual distraction	Highlights or color codes important information

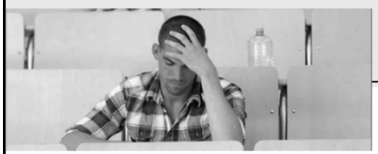
Gv Continued

Rapid Reference 1.19 Factors That May Facilitate Learning and Aid in Bypassing or Minimizing the Effects of a Visual Processing (Gv) Deficit

Provides graph-paper to assist with number alignment	Alternative lighting (natural light, non-fluorescent lighting)	Uses aids to support visual tracking (finger, index card, ruler)
Books on tape		Spaces items on a page
Text-to-speech technology (screen and text readers)		Uses applications or supports that allow for enlargement of fonts
Reading/scanning pens		Uses note-taking strategies (e.g., Cornell, outlining)

Rapid Reference 1.9 General and Specific Manifestations of Processing Speed (Gs) Weaknesses

CHC Broad Cognitive Abilities/ Neuropsychological Functions	Brief Definition	General Manifestations of Cognitive/ Neuropsychological Weakness	Specific Manifestations of Cognitive/ Neuropsychological Weakness
Processing Speed (Gs)	Speed of processing, particularly when required to focus attention for 1–3 minutes. Usually measured by tasks that require the ability to perform simple repetitive cognitive tasks quickly and accurately. Narrow Gs abilities include Perceptual Speed, Rate-of-Test-Taking, Number Facility, Reading Speed, and Writing Speed (note that the latter two abilities are also listed under other broad CHC domains, including Grw).	***Difficulties with:*** Efficient processing of information Quickly perceiving relationships (similarities and differences between stimuli or information) Working within time parameters Completing simple, rote tasks quickly	***Reading Difficulties:*** Slow reading speed, which interferes with comprehension Need to reread for understanding ***Math Difficulties:*** Automatic computations Computational speed is slow despite accuracy Slow speed can result in reduced accuracy due to memory decay ***Writing Difficulties:*** Limited output due to time factors Labored process results in reduced motivation to produce ***Language Difficulties:*** Cannot retrieve information quickly—slow, disrupted speech; cannot get out thoughts quickly enough Is slow to process incoming information, puts demands on memory store that can result in information overload and loss of meaning



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Rapid Reference 1.18 Factors That May Facilitate Learning and Aid in Bypassing or Minimizing the Effects of a Processing Speed (Gs) Deficit

Classroom Instructional Factors	Instructional Materials	Environmental Factors	Strategies
Focuses on features of work products that are unrelated to time parameters (e.g., quality or accuracy of a response)	Practice guides	Clocks	Plan for long-term projects by using a realistic schedule that allows for consistent movement toward completion
Repeated practice	Online review	Written schedules	Preview important parts of text (end-of-chapter questions, title, subtitles, glossary of terms) to facilitate reading speed
Offers speed drills		Desk organizers	Apply planning and time management strategies
	Use computer activities that require quick, simple decisions		Use techniques such as skimming and scanning for reading activities
Extended time	Books on tape		Use an outlining strategy for note-taking
Reduces the quantity of work required (including homework)	Online activities/games (e.g., http://www.academicskillbuilders.com/games/)		
Increases wait-times both after questions are asked and after responses are given			
Choral repeated reading			

You May Consider Using a Parent/Teacher Form to Assist in Documenting General and Specific Manifestations of Cognitive Weaknesses

General and Specific Manifestations of Cognitive Ability Weaknesses in SLD Identification

A specific learning disability (SLD) involves the presence of a cognitive processing weakness in one or more areas that is empirically or logically related to a documented academic weakness. While the primary form of data used to document cognitive ability weaknesses is standardized test scores, establishing ecological validity for a cognitive deficit involves the organization and analysis of additional data. For example, additional data that may be evaluated to support the presence of a cognitive ability weakness include information from behavior rating scales, parent and teacher interviews, classroom observations, prior evaluations, work sample analysis, and/or interviews with current or past teachers, counselors, and other paraprofessionals who have worked with the student. Below is a list of general and specific ways in which cognitive ability deficits manifest in real-world performance, specifically academic performance.

Directions: Complete the checklist below for any area identified as a cognitive ability weakness via standardized testing. Use the following codes next to a check-marked item to denote documentation source (P) = Parent; (T) = Teacher; (O) = Observations; (R) = Records review.[1] More than one code may be used for a check-marked item.

Fluid Reasoning (Gf) (Check All that Apply):

Refers to a type of thinking that an individual may use when faced with a relatively new task that cannot be performed automatically. This type of thinking includes such things as forming and recognizing concepts (e.g., how are a dog, cat, and cow alike?); identifying and perceiving relationships (e.g., sun is to morning as moon is to night); drawing inferences (e.g., after reading a story, answering the question, "What will John do next?"); and reorganizing, or transforming information (e.g., selecting one of several pictures to complete a puzzle). Overall, this ability can be thought of as a *problem solving* type of intelligence. Problem solving is important for reading comprehension (e.g., making inferences from text), math (e.g., figuring out how to set up a math problem by using information provided in a word problem), and writing, (e.g., writing a persuasive essay).

General Manifestations

- ☐ Higher-level thinking and reasoning
- ☐ Deriving solutions for novel problems
- ☐ Transferring or generalizing learning
- ☐ Extending knowledge through critical thinking
- ☐ Perceiving and applying underlying rules and processes to solve problems

Specific Manifestations

Reading Difficulties

- ☐ Drawing inferences from text
- ☐ Abstracting main ideas
- ☐ Making predictions

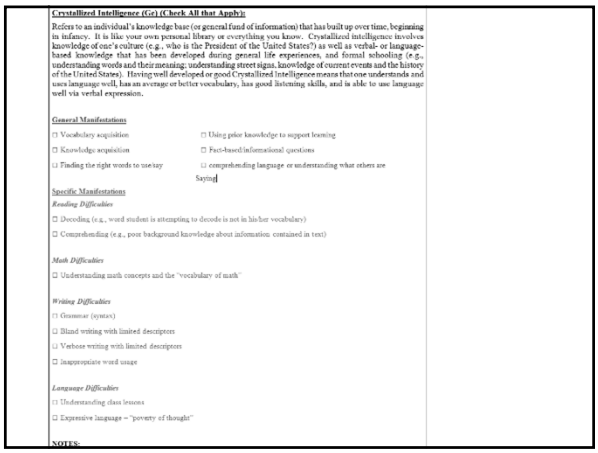
Math Difficulties

- ☐ Reasoning with quantitative information (word problems)
- ☐ Internalizing procedures and processes used to solve problems
- ☐ Apprehending relationships between numbers

Writing Difficulties

- ☐ Essay writing and generalizing concepts
- ☐ Developing a theme
- ☐ Comparing and contrasting ideas

NOTES:_____



Crystallized Intelligence (Gc) (Check All that Apply):

Refers to an individual's knowledge base (or general fund of information) that has built up over time, beginning in infancy. It is like your own personal library or everything you know. Crystallized intelligence involves knowledge of one's culture (e.g., who is the President of the United States?) as well as verbal- or language-based knowledge that has been developed during general life experiences, and formal schooling (e.g., understanding words and their meaning; understanding street signs, knowledge of current events and the history of the United States). Having well developed or good Crystallized Intelligence means that one understands and uses language well, has an average or better vocabulary, has good listening skills, and is able to use language well via verbal expression.

General Manifestations

- ☐ Vocabulary acquisition
- ☐ Knowledge acquisition
- ☐ Finding the right words to use/say
- ☐ Using prior knowledge to support learning
- ☐ Fact-based/informational questions
- ☐ comprehending language or understanding what others are Saying

Specific Manifestations

Reading Difficulties

- ☐ Decoding (e.g., word student is attempting to decode is not in his/her vocabulary)
- ☐ Comprehending (e.g., poor background knowledge about information contained in text)

Math Difficulties

- ☐ Understanding math concepts and the "vocabulary of math"

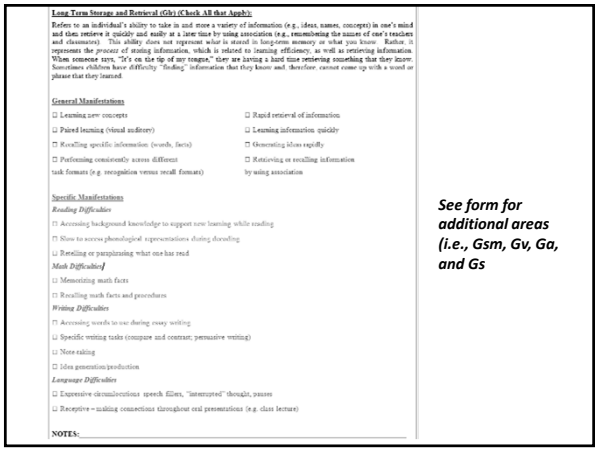
Writing Difficulties

- ☐ Grammar (syntax)
- ☐ Bland writing with limited descriptors
- ☐ Verbose writing with limited descriptors
- ☐ Inappropriate word usage

Language Difficulties

- ☐ Understanding class lessons
- ☐ Expressive language – "poverty of thought"

NOTES:



Long Term Storage and Retrieval (Glr) (Check All that Apply):

Refers to an individual's ability to take in and store a variety of information (e.g., ideas, names, concepts) in one's mind and then retrieve it quickly and easily at a later time by using association (e.g., remembering the names of one's teachers and classmates). This ability does not represent *what* is stored in long-term memory or what you know. Rather, it represents the *process* of storing information, which is related to learning efficiency, as well as retrieving information. When someone says, "it's on the tip of my tongue," they are having a hard time retrieving something that they know. Sometimes children have difficulty "finding" information that they know and, therefore, cannot come up with a word or phrase that they learned.

General Manifestations

- ☐ Learning new concepts
- ☐ Paired learning (visual auditory)
- ☐ Recalling specific information (words, facts)
- ☐ Performing consistently across different task formats (e.g. recognition versus recall formats)
- ☐ Rapid retrieval of information
- ☐ Learning information quickly
- ☐ Generating ideas rapidly
- ☐ Retrieving or recalling information by using association

Specific Manifestations

Reading Difficulties

- ☐ Accessing background knowledge to support new learning while reading
- ☐ Slow to access phonological representations during decoding
- ☐ Retelling or paraphrasing what one has read

Math Difficulties

- ☐ Memorizing math facts
- ☐ Recalling math facts and procedures

Writing Difficulties

- ☐ Accessing words to use during essay writing
- ☐ Specific writing tasks (compare and contrast; persuasive writing)
- ☐ Note taking
- ☐ Idea generation/production

Language Difficulties

- ☐ Expressive circumlocutions speech fillers, "interrupted" thought, pauses
- ☐ Receptive – making connections throughout oral presentations (e.g. class lecture)

NOTES:

See form for additional areas (i.e., Gsm, Gv, Ga, and Gs

Manifestations Form

Determination of the severity of educational impact (Note: Decision is typically made by a multidisciplinary team).

☐ **Minimal.** Difficulty in one or two academic areas but the student *is able to function well* when provided with support services (e.g., accommodations).

☐ **Moderate.** Marked difficulties in one or more academic areas and the student is not likely to become proficient without some *intervals of specialized instruction (e.g., Tier II small group)* throughout schooling. *Support services may be needed* across settings in order for activities involving the academic skills to be performed effectively.

☐ **Substantial.** Deficits in one or more academic areas and the student is not likely to acquire and develop those skills without individualized and specialized instruction (e.g., Tier III, special education) throughout schooling. Even with support services, these students may not be able to perform academic skills effectively.

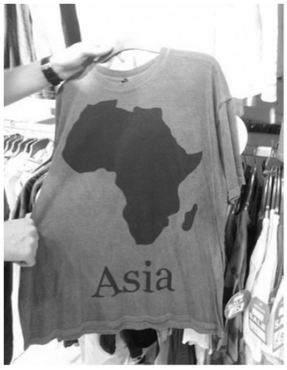
- ***Assists in understanding how cognitive weaknesses interfere with learning and performance in the classroom***
- ***Assists in obtaining ecological validity for test finds***
- ***Assists in identifying targets for intervention***
- ***Assists in determining severity of educational impact***

You are figuring out the "WHY"

When you know why, "HOW" is made easier

CHC QUIZ

The Person Who Made This Shirt Had Difficulty in What CHC Domain?



Gc

The Person Who Hung the Clock Had Difficulty in What CHC Domain?

The Person Who Placed Numbers on the Pole Had a Strength in What CHC Domain?

Gv

Gf

These Jobs/Careers Involve High Ability in What Primary CHC Domain?

- Librarian
- Short order cook
- Day Trader
- Receptionist, operator



Gsm

Based on logical deductions given demands of the job

These Jobs/Careers Involve High Ability in What Primary CHC Domain?

- Teaching English, language arts, drama, and debate at k-12 or postsecondary institutions
- professional writer; creative writer
- News correspondent

Gc

Based on logical deductions given demands of the job; see also McGrew and Flanagan (1998) for research support

These Jobs/Careers Involve High Ability in What Primary CHC Domain?

- Musician
- Conductor
- Music Teacher – fundamentals of pitch and rhythm
- Taking oral dictation

Ga

Based on logical deductions given demands of the job; see also McGrew and Flanagan (1998) for research support

These Jobs/Careers Involve High Ability in What Primary CHC Domain?

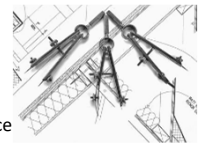
- Air Traffic Controllers
- Detectives/FBI Agents
- Researchers

Gf

Based on logical deductions given demands of the job

These Jobs/Careers Involve High Ability in What Primary CHC Domain?

- Architecture and engineering
- Mathematician
- Auto mechanics and machine maintenance
- Welding and plumbing



Gv

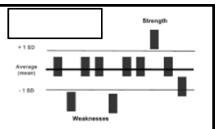
Based on logical deductions given demands of the job; see also McGrew and Flanagan (1998) for research support

The Person Who Created this Maze Had Difficulty in What CHC Domain?

Gv

Someone has difficulty with what CHC ability?

Interpretation of PSW

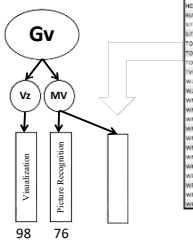


- Requires an understanding of contemporary theory
- Requires an understanding of the theoretical constructs that are measured by cognitive batteries
- Requires understanding of cognitive processes and abilities related to achievement
- May require cross-battery assessment to assess all the abilities and processes considered important based on referral and to follow up on aberrant test performances

D. P. Flanagan, 2017

Cross-Battery Assessment

- **Important for**
  - Testing Hypotheses
  - Following up on aberrant score performance
  - Measuring constructs not found on the core battery but considered important based on referral information



Visual Memory (MV)		Age Range
CAS-2	Figure Memory	5-18
DAS-II	Recall of Designs	7-17
DAS-II	Recognition of Pictures	2.6-13.5
KABC-II	Face Recognition	3-5
KBNA	Complex Figure 2	20-89
KBNA	Picture Recognition	20-89
KBNA	Spatial Location	20-89
NAS	Dots	18-97
NAS	Driving Scenes	18-97
NAS	Shape Learning	18-97
NEPSY-II	Memory for Designs	3-16
NEPSY-II	Memory for Faces	5-16
RAIS	Nonverbal Memory	3-94
SIT	Section A	6-17
SIT	Section B	6-17
TOMAL-2	Abstract Visual Memory	5-59
TOMAL-2	Facial Memory	5-59
TOMAL-2	Memory for Location	5-59
TOPAS	Visual Memory	4-16
WJ III NU COG	Picture Recognition	6-90+
WJ IV COG	Picture Recognition	2-80+
WMS-4	Designs I	16-69
WMS-4	Designs II Delayed Recall	16-69
WMS-4	Designs II Recognition	16-69
WMS-4	Spatial Addition	16-69
WMS-4	Visual Reproduction I	16-90
WMS-4	Visual Reproduction I Delayed Recall	16-90
WMS-4	Visual Reproduction I Recognition	16-90
WRAML2	Design Memory	4-7
WRAML2	Design Memory Recognition	5-85+
WRAML2	Picture Memory	5-85+
WRAML2	Picture Memory Recognition	5-85+

X-BASS v2.0 (Flanagan, Ortiz, & Alfonso, 2017)

HISTORY AND DEFINITION

The Cross-Battery Assessment Approach

Cross-Battery XBA Assessment

Findings of Woodcock's (1990) Joint Factor Analysis of Cognitive Batteries

- The WJ-R measured eight broad *Gf-Gc* cognitive abilities, while the other intelligence tests measured between three and five.
- When not using the WJ-R, it was suggested that clinicians "**cross**" batteries to obtain the information necessary for a particular evaluation.

Cross-Battery XBA Assessment

The **Need** for Cross-Battery Assessment

A WISC-III detective strives to use ingenuity, clinical sense, a thorough grounding in psychological theory and research, and a willingness to administer supplementary cognitive tests to reveal the dynamics of a child's scaled-score profile

(Kaufman, 1994)

Cross-Battery XBA Assessment

Representation of CHC Abilities on Batteries Published Prior to 2000 (Flanagan, 2003)

	Gf	Gc	Gv	Gsm	Glr	Ga	Gs
WISC-III	Not Measured	VOCABULARY (VL, LD) INFORMATION (KO) SIMILARITIES (LD) COMPREHENSION (LD, KO)	BLOCK DESIGN (SR, VZ) OBJECT ASSEMBLY (CS, SR) Mazes (SS)	DIGIT SPAN (MS, MW) Underrepresented	Not Measured	Not Measured	SYMBOL SEARCH (P, RS) CODING (RS)
WAIS-III	MATRIX REASONING (I) Underrepresented	VOCABULARY (VL, LD) INFORMATION (KO) SIMILARITIES (LD) COMPREHENSION (LD, KO)	BLOCK DESIGN (SR, VZ) OBJECT ASSEMBLY (CS, SR)	DIGIT SPAN (MS, MW) LETTER-NUM SEQUENCING (MW)	Not Measured	Not Measured	SYMBOL SEARCH (P, RS) DIGIT-SYMBOL CODING (RS)
WPPSI-R	Not Measured	VOCABULARY (VL, LD) INFORMATION (KO) SIMILARITIES (LD) COMPREHENSION (LD, KO)	BLOCK DESIGN (SR, VZ) OBJECT ASSEMBLY (CS, SR) Mazes (SS) Geometric Designs (Vs, P2)	Not Measured	Not Measured	Not Measured	Not Measured
KAIT	MYSTERY CODES (I) LOGICAL STEPS (RG)	FAMOUS FACES (K2)	MEMORY FOR BLOCK DESIGNS (MV)	Not Measured	REBUS LEARNING (MA) REBUS DELAYED RECALL (MA)	Not Measured	Not Measured
K-ABC	Not Measured	Not Measured	TRIANGLES (SR) Face Recognition (MV) Gestalt Closure (CS) Magic Window (P)	NUMBER RECALL (MS) WORD ORDER (MS)	Not Measured	Not Measured	Not Measured
CAS	Nonverbal Matrices Underrepresented	Not Measured	FIGURE MEMORY (CF, MV) Underrepresented	WORD SERIES (MS) Underrepresented	Expressive Attention Underrepresented	Not Measured	MATCHING NUMBERS (P, RS) RECEPTIVE ATTENTION (P, RA) PLANNED CODES (RS) NUMBER DETECTION (RT, RS)
DAS	MATRICES (I) Picture Similarities (I) SEQUENTIAL AND QUANTITATIVE REASONING (RQ, I)	SIMILARITIES (LD) Verbal Comprehension (LD, LE) WORD DEFINITIONS (VL, LD) Naming Vocabulary (VL, LD)	Pattern Construction (SR) Block Building (Vs) Matching Letter-Like Forms (Vs) RECALL OF DESIGNS (MV) Recognition of Pictures (MV)	Recall of Digits Underrepresented	Recall of Objects (MA) Underrepresented	Not Measured	Speed of Information Processing (RT, RS) Underrepresented
WJ-R COG Extended	CONCEPT FORMATION (I) ANALYSIS-SYNTHESIS (RG) Underrepresented	ORAL VOCAB. (VL) PICTURE VOCAB. (VL) Underrepresented	Picture Recognition (MV) Visual Closure (CS)	MEMORY FOR WORDS (MS) MEMORY FOR SENTENCES (MS) Underrepresented	MEMORY FOR NAMES (MA) VISUAL-AUDITORY LEARNING (MA) Underrepresented	INCOMPLETE WORDS (PC) SOUND BLENDING (PC) Underrepresented	VISUAL MATCHING (P, RS) CROSS-OUT (P)
SB:IV	MATRICES (I) EQUATION BLDG (RQ) Number Series (RQ)	VERBAL RELATIONS (LD) Comprehension (LD, KO) Absurdities (LD) VOCABULARY (VL, LD)	PATTERN ANALYSIS (SR) Bead Memory (MV) Memory for Objects (MV)	MEMORY FOR DIGITS (MS, MW) Underrepresented	Not Measured	Not Measured	Not Measured

The WJ-R provides additional tests to assist with adequate representation of Gc, Gsm, and Ga

103

Definition of Cross-Battery Assessment

- A time-efficient method of organizing and interpreting cognitive and academic abilities and neuropsychological processes using more than one instrument in a manner that is psychometrically and theoretically defensible.
- Allows practitioners to measure reliably a wider (and/or more in-depth) range of cognitive, academic, and neuropsychological constructs than that represented by any given stand alone assessment battery.

Cross-Battery XBA Assessment

XBA is used to systematically fill the holes in ability batteries to increase breadth and depth of measurement as may be required by the referral

	Gf	Gc	Gv	Gsm	Glr	Ga	Gs
WISC-III	XBA	VOCABULARY (VL, LD) INFORMATION (KO) SIMILARITIES (LD) COMPREHENSION (LD, KO)	BLOCK DESIGN (SR, VZ) OBJECT ASSEMBLY (CS, SR) Mazes (SS)	DIGIT SPAN (MS, MW) XBA	XBA	XBA	SYMBOL SEARCH (P, RS) CODING (RS)
WAIS-III	MATRIX REASONING (I) XBA	VOCABULARY (VL, LD) INFORMATION (KO) SIMILARITIES (LD) COMPREHENSION (LD, KO)	BLOCK DESIGN (SR, VZ) OBJECT ASSEMBLY (CS, SR)	DIGIT SPAN (MS, MW) LETTER-NUM SEQUENCING (MW)	XBA	XBA	SYMBOL SEARCH (P, RS) DIGIT-SYMBOL CODING (RS)
WPPSI-R	XBA	VOCABULARY (VL, LD) INFORMATION (KO) SIMILARITIES (LD) COMPREHENSION (LD, KO)	BLOCK DESIGN (SR, VZ) OBJECT ASSEMBLY (CS, SR) Mazes (SS) Geometric Designs (Vs, P2)	XBA	XBA	XBA	XBA
KAIT	MYSTERY CODES (I) LOGICAL STEPS (RG)	FAMOUS FACES (K2)	MEMORY FOR BLOCK DESIGNS (MV)	XBA	REBUS LEARNING (MA) REBUS DELAYED RECALL (MA)	XBA	XBA
K-ABC	XBA	XBA	TRIANGLES (SR) Face Recognition (MV) Gestalt Closure (CS) Magic Window (P)	NUMBER RECALL (MS) WORD ORDER (MS)	XBA	XBA	XBA
CAS	Nonverbal Matrices XBA	XBA	FIGURE MEMORY (CF, MV) XBA	WORD SERIES (MS) XBA	Expressive Attention XBA	XBA	MATCHING NUMBERS (P, RS) RECEPTIVE ATTENTION (P, RA) PLANNED CODES (RS) NUMBER DETECTION (RT, RS)
DAS	MATRICES (I) Picture Similarities (I) SEQUENTIAL AND QUANTITATIVE REASONING (RQ, I)	SIMILARITIES (LD) Verbal Comprehension (LD, LE) WORD DEFINITIONS (VL, LD) Naming Vocabulary (VL, LD)	Pattern Construction (SR) Block Building (Vs) Matching Letter-Like Forms (Vs) RECALL OF DESIGNS (MV) Recognition of Pictures (MV)	Recall of Digits XBA	Recall of Objects (MA) XBA	XBA	Speed of Information Processing (RT, RS) XBA
WJ-R COG Extended	CONCEPT FORMATION (I) ANALYSIS-SYNTHESIS (RG)	ORAL VOCAB. (VL) PICTURE VOCAB. (VL) WJ-R Listening Comp. or XBA	Picture Recognition (MV) Visual Closure (CS)	MEMORY FOR WORDS (MS) MEMORY FOR SENTENCES (MS) WJ-R Numbers Reversed or XBA	MEMORY FOR NAMES (MA) VISUAL-AUDITORY LEARNING (MA) XBA	INCOMPLETE WORDS (PC) SOUND BLENDING (PC) WJ-R Sound Patterns or XBA	VISUAL MATCHING (P, RS) CROSS-OUT (P)
SB:IV	MATRICES (I) EQUATION BLDG (RQ) Number Series (RQ)	VERBAL RELATIONS (LD) Comprehension (LD, KO) Absurdities (LD) VOCABULARY (VL, LD)	PATTERN ANALYSIS (SR) Bead Memory (MV) Memory for Objects (MV)	MEMORY FOR DIGITS (MS, MW) XBA	XBA	XBA	XBA

105

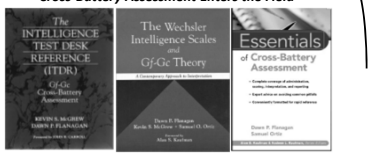
Construct Representation on the WISC

1974	1991	2003	2014
• WISC-R	• WISC-III	• WISC-IV	• WISC-V
• *Ga,Glr,Gf* Not represented	• *Ga,Glr,Gf* Not represented	• *Ga,Glr* Not represented	• *Ga* Not represented
• *Gq,Gs,Gsm* Underrepresented	• *Gq,Gsm* Underrepresented	• *Gq,Gf* Underrepresented	• *Gq* Underrepresented
• *Gc,Gv* Adequate Representation	• *Gc,Gv,Gs* Adequate Representation	• *Gc,Gv,Gs,Gsm* Adequate Representation	• *Gc,Gv,Gs,Gsm,Gf, Glr* Adequate Representation

VIQ/PIQ: Construct Irrelevant Variance

VIQ/PIQ Dropped

Cross-Battery Assessment Enters the Field



Most Current Contributions of the XBA Approach to Psychological Evaluation

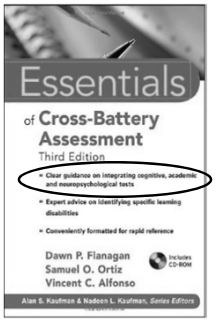
Refinements and Extensions to the Cross-Battery Approach

Cross-Battery Assessment XBA

Significantly improved evidence base

Significantly improved and expanded software programs

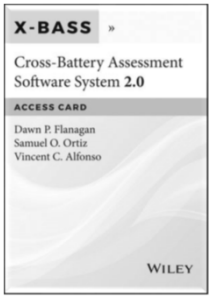
- *Data Management and Interpretive Assistant*
- *Pattern of Strengths and Weaknesses Analyzer*
- *Culture-Language Interpretive Matrix*

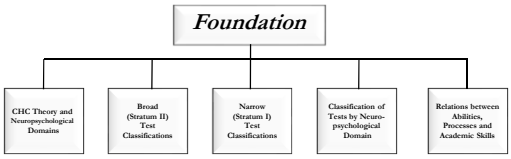


Most Current Contributions of the XBA Approach to Psychological Evaluation

- *Data Management and Interpretive Assistant*
- *Pattern of Strengths and Weaknesses Analyzer*
- *Culture-Language Interpretive Matrix*

- *All three programs have been integrated into one software system that substantially improves upon functionality and psychometrics*

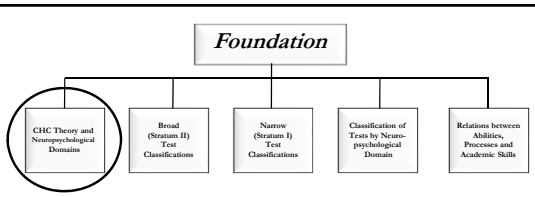




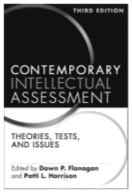
The Cross-Battery Assessment Approach

FOUNDATION: THEORY, CHC CLASSIFICATIONS OF TESTS, RELATIONS AMONG COGNITIVE ABILITIES, NEUROPSYCHOLOGICAL PROCESSES, AND ACADEMIC SKILLS

Cross-Battery XBA Assessment



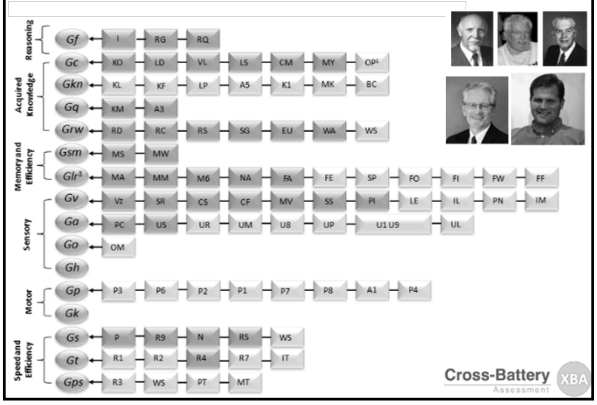
- The Cattell-Horn-Carroll (CHC) Theory as Defined by Schneider and McGrew (2012) with revisions and refinements underway based on their chapter in…



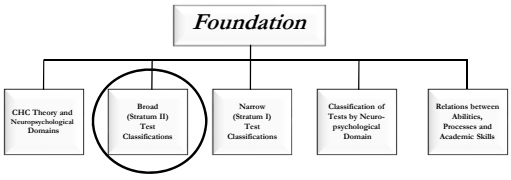
Contemporary Intellectual Assessment: Theories, Tests, and Issues, Fourth Edition (Flanagan & McDonough, in press). Publication expected July 2018

Cross-Battery XBA Assessment

Current and Expanded Cattell-Horn-Carroll (CHC) Model of Cognitive Abilities in the Foundation for the Cross-Battery Approach (adapted from Schneider & McGrew, 2012)

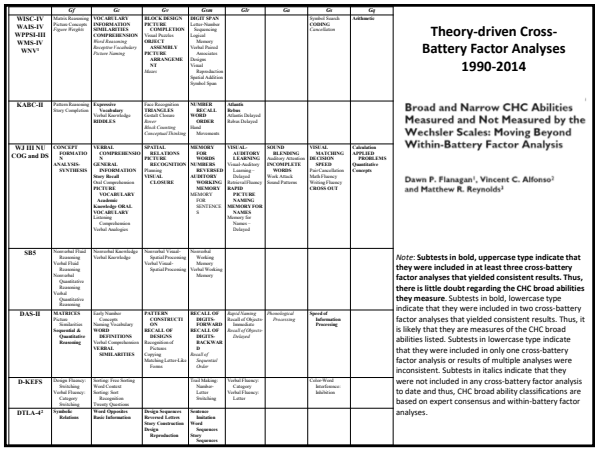


Cross-Battery XBA Assessment



- Broad ability classifications of tests were necessary to guard against *construct irrelevant variance* in assessment
- Broad ability classifications were based on theory-driven cross-battery factor analyses
- Broad ability classifications also informed by factor analyses reported in current test manuals and expert consensus (Flanagan et al., 2013)

Cross-Battery XBA Assessment



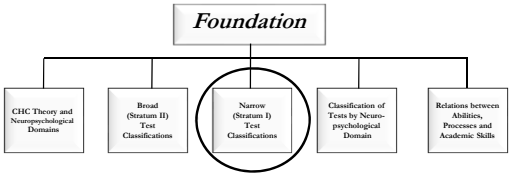
	Gf	Gc	Gv	Gsm	Glr	Ga	Gs	Gq
WISC-IV WAIS-IV WPPSI-III WMS-IV WNV[1]	Matrix Reasoning Picture Concepts *Figure Weights*	**VOCABULARY** **INFORMATION** **SIMILARITIES** **COMPREHENSION** *Word Reasoning* *Receptive Vocabulary* *Picture Naming*	**BLOCK DESIGN** **PICTURE COMPLETION** Visual Puzzles **OBJECT ASSEMBLY** **PICTURE ARRANGEMENT** Mazes	**DIGIT SPAN** Letter-Number Sequencing Logical Memory Verbal Paired Associates Faces Visual Reproduction Spatial Addition Symbol Span			Symbol Search **CODING** Cancellation	**Arithmetic**
KABC-II	Pattern Reasoning Story Completion	**Expressive Vocabulary** Verbal Knowledge **RIDDLES**	Face Recognition **TRIANGLES** Gestalt Closure *Block Counting* *Conceptual Thinking*	**NUMBER RECALL** **WORD ORDER** Hand Movements	**Atlantis** **Rebus** Atlantis Delayed Rebus Delayed			
WJ III NU COG and DS	**CONCEPT FORMATION** **ANALYSIS-SYNTHESIS**	**VERBAL COMPREHENSION** **GENERAL INFORMATION** **Story Recall** Oral Comprehension **PICTURE VOCABULARY** **Academic Knowledge** **ORAL VOCABULARY** Listening Comprehension Verbal Analogies	**SPATIAL RELATIONS** **PICTURE RECOGNITION** Planning **VISUAL CLOSURE**	**MEMORY FOR WORDS** **NUMBERS REVERSED** **AUDITORY WORKING MEMORY** MEMORY FOR SENTENCES	**VISUAL-AUDITORY LEARNING** Visual-Auditory Learning Delayed Retrieval Fluency **RAPID PICTURE NAMING** **MEMORY FOR NAMES** Memory for Names - Delayed	**SOUND BLENDING** Auditory Attention **INCOMPLETE WORDS** Word Attack Sound Patterns	**VISUAL MATCHING** **DECISION SPEED** Pair Cancellation Math Fluency Writing Fluency **CROSS OUT**	**Calculation** **APPLIED PROBLEMS** **Quantitative Concepts**
SB5	Nonverbal Fluid Reasoning Verbal Fluid Reasoning Nonverbal Quantitative Reasoning Verbal Quantitative Reasoning	Nonverbal Knowledge Verbal Knowledge	Nonverbal Visual-Spatial Processing Verbal Visual-Spatial Processing	Nonverbal Working Memory Verbal Working Memory				
DAS-II	**MATRICES** Picture Similarities **Sequential & Quantitative Reasoning**	Early Number Concepts Naming Vocabulary **WORD DEFINITIONS** Verbal Comprehension **VERBAL SIMILARITIES**	**PATTERN CONSTRUCTION** **RECALL OF DESIGNS** Recognition of Pictures Copying Matching Letter-Like Forms	**RECALL OF DIGITS-BACKWARD** **RECALL OF DIGITS-BACKWARD** *Recall of Sequential Order*	Rapid Naming Recall of Objects-Immediate *Recall of Objects-Delayed*	*Phonological Processing*	**Speed of Information Processing**	
D-KEFS	Design Fluency: Switching Verbal Fluency: Category Switching	Sorting: Free Sorting Word Context Sorting: Sort Recognition Twenty Questions		Tool Making: Number-Letter Switching	Verbal Fluency: Category Verbal Fluency: Letter		Color-Word Interference: Inhibition	
DTLA-4[2]	**Symbolic Relations**	**Word Opposites** **Basic Information**	**Design Sequences** **Reversed Letters** **Story Construction** **Design Reproduction**	**Sentence Imitation** **Word Sequences** **Story Sequences**				

Theory-driven Cross-Battery Factor Analyses 1990-2014

Broad and Narrow CHC Abilities Measured and Not Measured by the Wechsler Scales: Moving Beyond Within-Battery Factor Analysis

Dawn P. Flanagan[1], Vincent C. Alfonso[2] and Matthew R. Reynolds[3]

Note: **Subtests in bold, uppercase type indicate that they were included in at least three cross-battery factor analyses that yielded consistent results. Thus, there is little doubt regarding the CHC broad abilities they measure**. Subtests in bold, lowercase type indicate that they were included in two cross-battery factor analyses that yielded consistent results. Thus, it is likely that they are measures of the CHC broad abilities listed. Subtests in lowercase type indicate that they were included in only one cross-battery factor analysis or results of multiple analyses were inconsistent. Subtests in italics indicate that they were not included in any cross-battery factor analysis to date and thus, CHC broad ability classifications are based on expert consensus and within-battery factor analyses.



- Narrow ability classifications of tests were necessary to guard against *construct underrepresentation* in assessment
- Narrow ability classifications were based largely on the results of content validity (expert consensus) studies
  - McGrew, 1997; Flanagan, Ortiz, & Alfonso, 2013; Flanagan, Ortiz, Alfonso, & Mascolo, 2006)

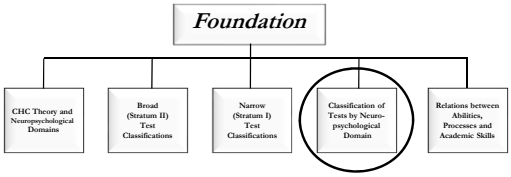
Cross-Battery XBA Assessment

SUMMARY—Analysis of XBA Expert Consensus Procedure (Flanagan, Ortiz, & Alfonso, 2013)

Classification of Broad Ability	Number of Classifications	Number Agree	Number Disagree	Number of Categories	Gwet's AC1	Cohen's Kappa	Scott's PI
All Broad Ability Domains	309	296	13	13	.96	.95	.95
Classification of Narrow Abilities Within Broad Ability Area	**Number of Classifications**	**Number Agree**	**Number Disagree**	**Number of Categories**	**Gwet's AC1**	**Cohen's Kappa**	**Scott's PI**
***Gf*: Fluid Reasoning**	34	29	5	3	.85	.75	.85
***Gc*: Crystallized Knowledge**	100	88	12	6	.88	.82	.88
***Glr*: Long-Term Memory**	25	19	6	11	.76	.67	.76
***Gsm*: Short-Term Memory**	31	31	0	2	1.0	1.0	1.0
***Gv*: Visual Processing**	32	31	1	11	.97	.96	.97
***Ga*: Auditory Processing**	26	19	7	8	.73	.62	.73
***Gs*: Processing Speed**	16	14	2	5	.87	.79	.87
***Grw*: Reading-Writing Ability**	44	42	2	7	.95	.95	.95
***Gq*: Quantitative Reasoning**	16	16	0	2	1.0	1.0	1.0
***Gp*: Psychomotor Abilities**	2	2	0	8	1.0	1.0	1.0
***Gkn*: Domain-Specific Knowledge**	2	2	0	7	1.0	1.0	1.0
TOTAL or MEAN VALUE:	328	293	35	6	0.91	0.87	0.91

See Appendix L in *Essentials of Cross-Battery Assessment (3e)* for Details of Expert Consensus Study

	Gf	*Gc*	*Gv*	*Gsm*	*Glr*	*Ga*	*Gs*
WISC-V	Matrix Reasoning (I) Figure Weights (RG, RQ) Picture Concepts (I) Arithmetic (MW; Gf:RQ)	Similarities (VL, Gf:I) Vocabulary (VL) Information (KO) Comprehension (KO)	Block Design (Vz) Visual Puzzles (Vz) **XBA** **Underrepresented**	Digit Span (MW) Picture Span (MS, WM) Letter-Number Sequencing (MW) Arithmetic (MW; Gf:RQ)	Naming Speed Literacy (NA) Naming Speed Quantity (NA; Gs:N) Immediate Symbol Translation (MA) Delayed Symbol Translation (MA) Recognition Symbol Translation (MA)	**XBA**	Symbol Search (P) Coding (RS) Cancellation (P)
WAIS-IV	Matrix Reasoning (I) Figure Weights (RQ)	Vocabulary (VL) Information (KO) Similarities (VL, Gf:I) Comprehension (KO)	Block Design (Vz) Picture Completion (CF, Gs:RS) Visual Puzzles (Vz)	Digit Span (MS, MW) Letter-Number Sequencing (MW) Arithmetic (MW; Gf:RQ)	**XBA**	**XBA**	Symbol Search (P) Coding (RS) Cancellation (P)
WPPSI-IV	Matrix Reasoning (I) **XBA** **Underrepresented**	Picture Concepts (Gc:KO, Gf:I) Vocabulary (VL) Information (KO) Similarities (VL, Gf:I) Comprehension (KO) Receptive Vocabulary (VL) Picture Naming (VL)	Block Design (Vz) Object Assembly (CS)	Picture Memory (MS, MW) Zoo Locations (MS, MW)	**XBA**	**XBA**	Bug Search (P) Cancellation (P)
KABC-II	Pattern Reasoning (I; Gv:Vz)[1] Story Completion (RG, Gc:KO) [1]	Expressive Vocabulary (VL) Verbal Knowledge (VL, KO) Riddles (VL, Gf:RG)	Face Recognition (MV) Triangles (Vz) Gestalt Closure (CS) Rover (SS, Gf:RG) Block Counting (Vz) Conceptual Thinking (Vz, Gf:I)	Number Recall (MS) Word Order (MS, MW) Hand Movements (MS, Gv:MV) **XBA** **Underrepresented**	Atlantis (MA) Rebus (MA) Atlantis Delayed (MA) Rebus Delayed (MA) **XBA** **Underrepresented**	**XBA**	**XBA**
WJ IV COG	Concept Formation (I) Number Series (RQ) Analysis-Synthesis (RG)	Oral Vocabulary (VL) General Information (KO)	Visualization (Vz) Picture Recognition (MV)	Verbal Attention (MW) Numbers Reversed (MW) Object-Number Sequencing (MW)	Visual-Auditory Learning (MA) Story Recall (MM)	Nonword Repetition (Gsm: MS; Gs:LM) Phonological Processing (PC; Glr: WF) **MIXED**	Letter-Pattern Matching (P) Pair Cancellation (P) Number-Pattern Matching (P)
SB5	Nonverbal Fluid Reasoning (I; Gv) Verbal Fluid Reasoning (I, RG, Gc:CM) Nonverbal Quantitative Reasoning (RQ, Gq:A3) Verbal Quantitative Reasoning (RQ, Gq:A3)	Nonverbal Knowledge (KO, LS, Gf:RG) Verbal Knowledge (VL,KO)	Nonverbal Visual-Spatial Processing (Vz) Verbal Visual-Spatial Processing (Vz, Gc:VL, KO) **XBA** **Underrepresented**	Nonverbal Working Memory (MS, MW) Verbal Working Memory (MS, MW)	**XBA**	**XBA**	**XBA**
DAS-II	Matrices (I) Picture Similarities (I) Sequential & Quantitative Reasoning (RQ)	Early Number Concepts (VL, Gq:A3) Naming Vocabulary (VL) Word Definitions (VL) Verbal Comprehension (LS) Verbal Similarities (VL, Gf:I)	Pattern Construction (Vz) Recall of Designs (MV) Recognition of Pictures (MV) Copying (Vz) Matching Letter-Like Forms (Vz)	Recall of Digits-Forward (MS) Recall of Digits-Backward (MW) Recall of Sequential Order (MW)	Rapid Naming (NA; Gs:RS) [1] Recall of Objects-Immediate (MA) Recall of Objects-Delayed (MA)	Phonological Processing (PC) **XBA** **Underrepresented**	Speed of Information Processing (P) **XBA** **Underrepresented**



- Neuropsychological domain classifications were intended to provide practitioners with more interpretive options and to facilitate the integration of psychometric and neuropsychological theories

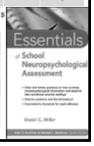
Cross-Battery Assessment XBA

CLASSIFIES ALL TESTS ACCORDING TO NEUROPSYCHOLOGICAL DOMAIN: **A KABC-II example**

Battery	Subtest	Attention	Sensory-Motor	Auditory-Verbal	Language Receptive	Language Expressive	Executive Functions	Speed and Efficiency	Visual-Spatial	Memory and Learning
Kaufman Assessment Battery for Children-Second Edition	Atlantis						✔		✔	•
	Atlantis Delayed						✔		✔	•
	Block Counting								•	
	Conceptual Thinking						✔		✔	
	Expressive Vocabulary			✔		•				✔
	Face Recognition	✔							✔	•
	Gestalt Closure								•	✔
	Hand Movements	✔	•						✔	✔
	Number Recall	✔		✔						•
	Pattern Reasoning						•		✔	
	Rebus			✔			✔			•
	Rebus Delayed			✔			✔			•
	Riddles			✔	✔	✔	✔			•
	Rover						•		✔	
	Story Completion						•		✔	✔
	Triangles		✔				✔		•	
	Verbal Knowledge			✔	✔					•
	Word Order	•		✔			✔			•

Note: A check mark (✔) indicates the authors' classifications. A bullet (•) indicates the authors' classification and Miller's primary neuropsychological domain classification.

Source: Appendix F in *Essentials of Cross-Battery Assessment*, third edition (Flanagan, Ortiz, & Alfonso, 2013)



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DOI: 10.1002/pits.20327

SCHOOL NEUROPSYCHOLOGY CONSULTATION IN NEURODEVELOPMENTAL DISORDERS

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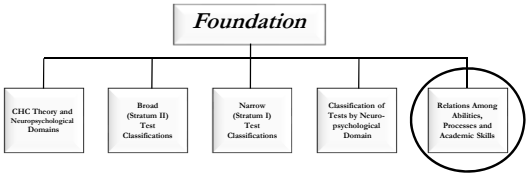
Georgia State University

Additionally, the Cattell-Horn-Carroll (CHC) theory of intelligence and its operationalization in a Cross-Battery Assessment procedure may also improve school psychology assessment practice and facilitate the integration of neuropsychological methodology in school-based assessments. The CHC model benefits from more than a half-century of validity research on psychometric, developmental, heritability, academic outcome, and neurocognitive evidence (Flanagan & Harrison, 2005; Flanagan & Ortiz, 2005; McGrew, Keith, Flanagan, & Vanderwood, 1997). The CHC model is a multitiered model of intelligence, with tiers typically referred to as strata I, II, and III (Carroll, 1997). The broad abilities of stratum II are functionally similar to constructs measured in neuropsychology, although labels used to describe the measurements may differ (Dean et al., 2003). For example, neuropsychologists are familiar with constructs like executive functions, with such tests as the Wisconsin Card Sorting Test, Halstead's Category Test, and the Trail Making Test, whereas school psychologists use equivalent concepts, like fluid intelligence. Psychometrically, these constructs are highly related but may differ in theoretical specifications (Decker, Hill, & Dean, 2007). The CHC and Cross-Battery Assessment approaches shift assessment practice from IQ composites to neurodevelopmental functions. This transition can be facilitated by training in contemporary psychometric models (Flanagan, Ortiz, & Alfonso, 2007). Furthermore, integrating Cross-Battery Assessment approaches within a global hypothesis-testing approach (Hale & Fiorello, 2004) may provide the best "alternative" method that meets federal requirements for a comprehensive evaluation.

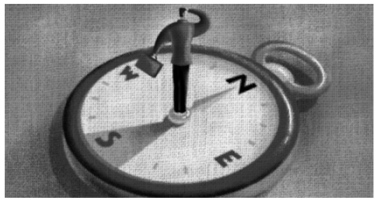


- Important for informing diagnosis of specific learning disabilities
- Important for developing educational strategies, and selecting and tailoring interventions

Cross-Battery Assessment XBA

Summary of Relations between CHC Abilities and Specific Areas of Academic Achievement
(Flanagan et al., 2006, 2013; McDonough, et al., 2016; McGrew & Wendling, 2010; McGrew et al., 2014; Niileksela et al., 2016)

	Reading Achievement	Math Achievement	Writing Achievement
Gf	Inductive (I) and general sequential reasoning (RG) abilities play a moderate role in **reading comprehension.** Executive functions, such as planning, organization, and self-monitoring are also important.	**Reasoning inductively and deductively with numbers (RQ) is very important for math problem solving at all ages.** Executive functions, such as set shifting and cognitive inhibition are also important.	Inductive (I) and general sequential reasoning abilities (RG) are consistently related to **written expression** at all ages. Executive functions, such as attention, planning, and self-monitoring are also important.
Gc	**Language development (LD), lexical knowledge (VL), and listening ability (LS) are important at all ages for reading acquisition and development. These abilities become increasingly important with age.** Oral Language, Listening Comprehension, and EF (planning, organization, self-monitoring) also important for **reading comprehension.**	**Language development (LD), lexical knowledge (VL), and listening abilities (LS) are important at all ages. These abilities become increasingly important with age.** Number representation (e.g., quantifying sets without counting, estimating relative magnitude of sets) and number comparisons related to overall **Number Sense.**	**Language development (LD), lexical knowledge (VL), and general information (K0) are important primarily after about the 2nd grade. These abilities become increasingly important with age.** Level of knowledge of syntax, morphology, semantics, and VL has a significant impact on clarity of **written expression** and text generation ability.
Gsm	Memory span (MS) and **working memory capacity (WM) or** attentional control, **Gsm important for overall reading success.** Phonological memory or WM for verbal and sound-based information may also be important.	Memory span (MS) and **working memory capacity (WM) or** attentional control, **Gsm important for math problem solving** and overall success in math.	Memory span (MS) is important to writing, especially **spelling** skills whereas working memory has shown relations with advanced writing skills (e.g., **written expression**; synthesizing multiple ideas, ongoing self-monitoring). Gmw important for overall writing success.
Gv	Orthographic Processing (often measured by tests of perceptual speed that use orthographic units as stimuli) – **reading rate and fluency.**	Visualization (VZ), including mental rotation, is important primarily for higher level (e.g., geometry, calculus) and **math problem solving.**	Orthographic Processing (often measured by tests of perceptual speed that use orthographic units as stimuli) - **spelling**
Ga	**Phonetic coding (PC) or "phonological awareness/processing" is very important during the elementary school years for the development of basic reading skills.** Phonological memory or WM for verbal and sound-based information may also be important.		**Phonetic coding (PC) or "phonological awareness/processing" is very important during the elementary school years for both basic writing skills and written expression (primarily before about grade 5).**
Glr	**Naming facility (NA) or "rapid automatic naming" (also called speed of lexical access) is very important during the elementary school years for reading rate and fluency.** Associative memory (MA) is also important.	Naming Facility (NA; or speed of lexical access); Associative Memory (MA) - **memorization and rapid retrieval of basic math facts; accurate and fluent calculation.**	Naming facility (NA) or "rapid automatic naming" **(also called speed of lexical access)** has demonstrated relations with written expression, primarily **writing fluency**. Storing and retrieving commonly occurring letter patterns in visual and motor memory are needed for **spelling**.
Gs	**Perceptual speed (P) abilities are important during all school years, particularly the elementary school years.**	**Perceptual speed (P) important during all years, especially the elementary school years for math calculation fluency.**	**Perceptual speed (P) abilities are important during all school years for basic writing and related to all ages for written expression.**



GUIDING PRINCIPLES – VERY BRIEF REVIEW

The Cross-Battery Assessment Approach

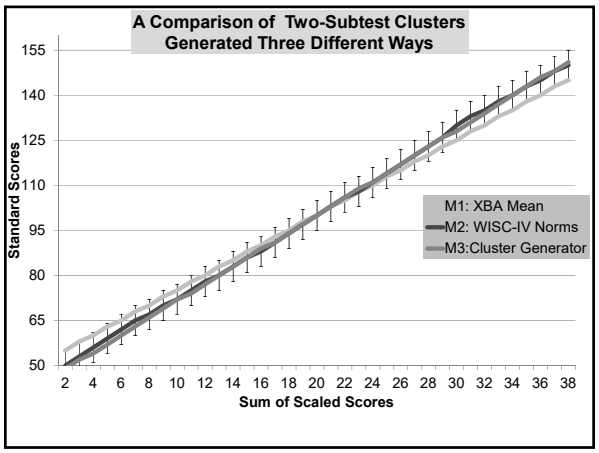
Cross-Battery XBA

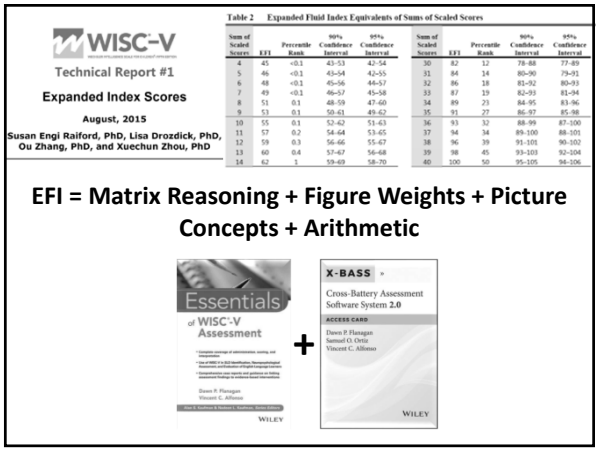
XBA Guiding Principles

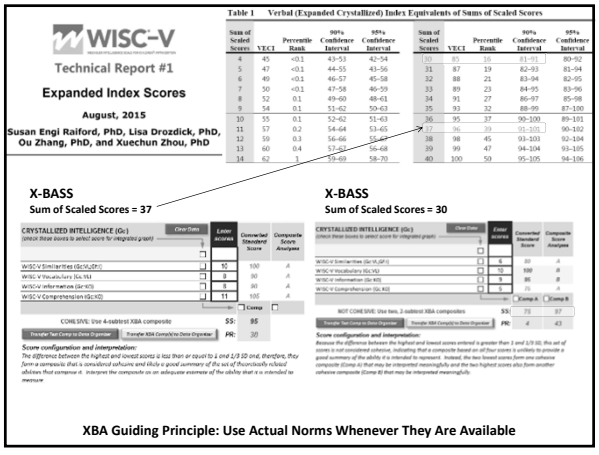
I. Select a battery that best addresses the referral concerns and that is the best fit for the student
   - Consider co-normed tests first

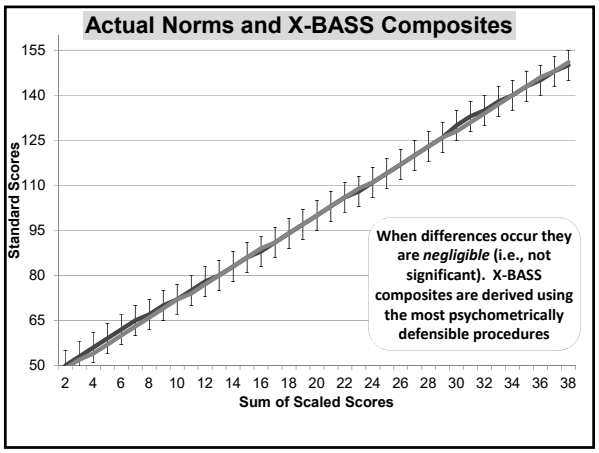
II. Use clusters based on ***actual norms*** when they are available
   - Clusters yielded from the actual test battery rather than formulae based on subtest reliabilities and intercorrelations (although differences between actual norm-based clusters and those generated via formulae are ***negligible***).

Cross-Battery XBA


A Comparison of Two-Subtest Clusters
Generated Three Different Ways
Standard Scores
155
140
125
110
95
80
65
50
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38
Sum of Scaled Scores
M1: XBA Mean
M2: WISC-IV Norms
M3:Cluster Generator

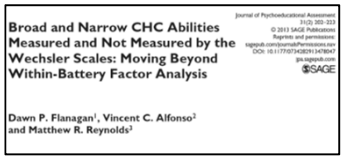

WISC-V
Technical Report #1
Expanded Index Scores
August, 2015
Susan Engi Raiford, PhD, Lisa Drozdick, PhD, Ou Zhang, PhD, and Xuechun Zhou, PhD
Table 2 Expanded Fluid Index Equivalents of Sums of Scaled Scores
EFI = Matrix Reasoning + Figure Weights + Picture Concepts + Arithmetic
Essentials of WISC-V Assessment
X-BASS
Cross-Battery Assessment Software System 2.0
Dawn P. Flanagan
Samuel O. Ortiz
Vincent C. Alfonso
WILEY


WISC-V
Technical Report #1
Expanded Index Scores
August, 2015
Susan Engi Raiford, PhD, Lisa Drozdick, PhD, Ou Zhang, PhD, and Xuechun Zhou, PhD
Table 1 Verbal (Expanded Crystallized) Index Equivalents of Sums of Scaled Scores
X-BASS
Sum of Scaled Scores = 37
X-BASS
Sum of Scaled Scores = 30
CRYSTALLIZED INTELLIGENCE (Gc)
XBA Guiding Principle: Use Actual Norms Whenever They Are Available

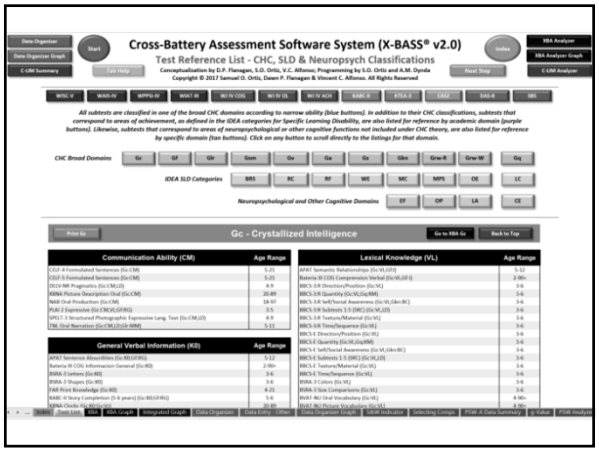


XBA Guiding Principles

III. Select tests classified through an acceptable method
- Joint or Cross-Battery Factor Analyses and/or Expert Consensus
  - *There is more agreement than disagreement in the field on the broad and narrow abilities that are measured by subtests on popular batteries*



- **See XBA-CHC Test List on the INDEX tab in *X-BASS v2.0***



Representation of Broad and Narrow Abilities

- Use two or more *qualitatively different* narrow ability indicators to represent each *broad* ability domain
- Use two or more *qualitatively similar* narrow ability indicators to represent each *narrow* ability domain
- ***Is a single subtest ever enough?***
  - Only when converging data sources exist to support the score – ecological validity
  - Risky with low scores
  - Remember: ***Single measures make for poor measurement***

Every rule has an exception. There is no exception to this rule.

XBA Guiding Principles

IV. When broad abilities are underrepresented, go out of battery
- ***Two qualitatively different indicators from another battery***
- ***Or one qualitatively different indicator and use XBA Analyzer Tab to create a broad ability composite***

Cross-Battery XBA

XBA Guiding Principles

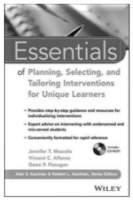
V. When crossing batteries use tests developed and normed within a few years of one another
- **Flynn effect**
- **All tests in Cross-Battery book and X-BASS were normed within about 10-12 years of one another**

VI. Select tests from the smallest number of batteries
- **to minimize error that may be the result of differences in norm sample characteristics**

VII. Establish ecological validity for test findings – e.g., manifestation of weaknesses or deficits

Cross-Battery XBA

Manifestations Tables Found in Mascolo, Flanagan, and Alfonso (2014). Chapter 1



Fluid Reasoning (Gf) (Check All that Apply):

Refers to a type of thinking that an individual may use when faced with a relatively new task that cannot be performed automatically. This type of thinking includes such things as forming and recognizing concepts (e.g., how are a dog, cat, and cow alike?), identifying and perceiving relationships (e.g., sun is to morning as moon is to night), drawing inferences (e.g., after reading a story, answering the question, "What will John do next?"), and reorganizing, or transforming information (e.g., selecting one of several pictures to complete a puzzle). Overall, this ability can be thought of as a *problem solving* type of intelligence. Problem solving is important for reading comprehension (e.g., making inferences from text), math (e.g., figuring out how to set up a math problem by using information provided in a word problem), and writing, (e.g., writing a persuasive essay).

General Manifestations

- ☐ Higher-level thinking and reasoning
- ☐ Deriving solutions for novel problems
- ☐ Transferring or generalizing learning
- ☐ Extending knowledge through critical thinking
- ☐ Perceiving and applying underlying rules and processes to solve problems

Specific Manifestations

Reading Difficulties

- ☐ Drawing inferences from text
- ☐ Abstracting main ideas
- ☐ Making predictions

Math Difficulties

- ☐ Reasoning with quantitative information (word problems)
- ☐ Internalizing procedures and processes used to solve problems
- ☐ Apprehending relationships between numbers

Writing Difficulties

- ☐ Essay writing and generalizing concepts
- ☐ Developing a theme
- ☐ Comparing and contrasting ideas

NOTES:_____

What's Next?

Description of the PSW method and conceptual similarities among PSW methods; description of the Dual Discrepancy/Consistency (DD/C) operational definition of SLD – a PSW method; and understanding of the SLD construct

An Operational Definition of SLD
Flanagan, Ortiz, Alfonso, and Mascolo

- Definition first presented in 2002
- Revised and updated in 2006
- Updated in 2007

An Operational Definition of SLD
Flanagan and Colleagues (2002 – 2018)

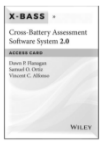
Revised and updated in 2011

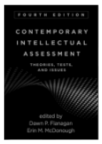
Updated in *Essentials of Cross-Battery Assessment*, 3e (2013) and renamed:
Dual Discrepancy/Consistency (DD/C) Method

Operationalized in X-BASS (2017) – most sophisticated and psychometrically defensible PSW model to date

Step-by-Step Guidance on Using X-BASS in SLD Evaluations in SLD book (2018)

Step-by-Step Guidance on Using X-BASS in SLD Evaluations in CIA 4e book (2018)





The Dual Discrepancy/Consistency (DD/C) Operational Definition of SLD

Level	Nature of SLD[1]	Focus of Evaluation	Examples of Evaluation Methods and Data Sources	Criteria for SLD	SLD Classification and Eligibility
I	Difficulties in one or more areas of academic achievement, including (but not limited to)[2] Basic Reading Skill, Reading Comprehension, Reading Fluency, Oral Expression, Listening Comprehension, Written Expression, Math Calculation, Math Problem Solving.	**Academic Achievement:** Performance in specific academic skills [e.g., *Grw-I: [reading decoding, reading fluency, reading comprehension; Grw-II: [spelling, written expression; Gq (math calculation, math problem solving; Gc (communication ability, listening ability)*].	Response to quality instruction and intervention via progress monitoring, performance on norm-referenced, standardized achievement tests, evaluation of work samples, observations of academic performance, teacher/parent/student interview, history of academic performance, data from other members of Multidisciplinary Team (MDT) (e.g., speech-language pathologist, interventionist, reading specialist).	Performance in one or more academic areas is *weak or deficient*[3] (despite attempts at delivering quality instruction) as evidenced by converging data sources. Results from the WJ IV *intra-achievement variation* procedure may be used as one data source, especially when academic area(s) identified as a weakness has an associated standard score that is weak or deficient.	Necessary
II	SLD does not include a learning problem that is the result of visual, hearing, or motor disabilities; of intellectual disability; of social or emotional disturbance; or of environmental, educational, cultural, or economic disadvantage.	**Exclusionary Factors:** Identification of potential primary causes of academic skill weaknesses or deficits, including intellectual disability, cultural or linguistic difference, sensory impairment, insufficient instruction or opportunity to learn, organic or physical health factors, social-emotional or psychological disturbance.	Data from the methods and sources listed at Levels I and III. Behavior Rating Scales; medical records; prior evaluations; interviews with current or past counselors, psychiatrists, etc.	Performance is *not primarily attributed* to these exclusionary factors, although one or more of them may contribute to learning difficulties. [Consider using the *Exclusionary Factors Form*, which may be downloaded from www.crossbattery.com under "resources."]	
III	A disorder in one or more of the basic psychological neuro-psychological processes involved in understanding or in using language, spoken or written; such disorders are presumed to originate from central nervous system dysfunction.	**Cognitive Abilities & Processes:** Performance in cognitive abilities and processes (e.g., *Gv, Ga, Gl, Gm, Gs*); specific neuropsychological processes (e.g., attention, executive functioning, orthographic processing; RAN; RAS) and learning efficiency (e.g., associative memory, free recall memory, meaningful memory).	Performance on norm-referenced tests, evaluation of work samples, observations of cognitive performance, task analysis, testing limits, teacher/parent/student interview, history of academic performance, records review.	Performance in one or more cognitive abilities and/or neuropsychological processes (related to academic skill deficiency) is *weak or deficient*[4] as evidenced by converging data sources.	

Flanagan, Ortiz, & Alfonso (2013). *Essentials of Cross-Battery Assessment, 3rd Edition*. Hoboken, NJ: Wiley.

The Dual Discrepancy/Consistency (DD/C) Operational Definition of SLD (Continued)

IV	The specific learning disability is a discrete condition differentiated from generalized learning failure by generally average or better ability to think and reason and a learning skill profile exhibiting significant variability, indicating processing areas of strength and weakness.	**Pattern of Strengths and Weaknesses (PSW) Marked by a Dual-Discrepancy/Consistency (DD/C)** Determination of whether academic skill weaknesses or deficits are related to specific cognitive area(s) of weakness or deficit; pattern of data reflects a below average aptitude-achievement *consistency* with otherwise average or better ability to think and reason.	Data gathered at all previous levels as well as any additional data following a review of initial evaluation results (e.g., data gathered for the purpose of hypothesis testing, data gathered via demand analysis and limits testing).	Circumscribed below average aptitude-achievement *consistency* (i.e., related cognitive processes and academic skills are generally about 1SD below the mean or lower), circumscribed ability-achievement and ability-cognitive aptitude *discrepancies*, with cognitive areas of strength represented by standard scores that are generally ≥90 (include SEM around score); clinical judgment supports the impression that the student's overall ability to think and reason will enable him or her to benefit from tailored or specialized instruction/intervention, compensatory strategies, and accommodations, such that his or her performance rate and level will likely approximate more typically achieving, non-disabled peers. Use the Cross-Battery Assessment Software System (X-BASS; Ortiz, Flanagan, & Alfonso, 2015) to conduct the PSW analysis.	**Sufficient For SLD Identification**
V	Specific learning disability has an adverse impact on educational performance.	**Special Education Eligibility**[5] Determination of Least Restrictive Environment (LRE) for delivery of instruction and educational resources.	Data from all previous levels and MDT meeting, including parents.	Student demonstrates significant difficulties in daily academic activities that cannot be remediated, accommodated, or otherwise compensated for *without* the assistance of individualized special education services.	**Necessary for Special Education Eligibility**

[1] This column includes concepts inherent in the federal definition (IDEA, 2004), Kavale, Spaulding, and Beam's (2009) definition, Hanson and Holmes' (2012) consensus definition, and other prominent definitions of SLD (see Sotelo-Dynega, Flanagan, & Alfonso, 2011 for a summary). Thus, all prominent SLD markers are included in this column.
[2] Poor spelling with adequate ability to express ideas in writing is often typical of dyslexia and/or dysgraphia. Even though IDEA 2004 includes only the broad category of written expression, poor spelling and handwriting are often symptomatic of a specific writing disability and should not be ignored (Wendling & Mather, 2009).
[3] Weak performance is typically associated with standard scores in the 85-89 range, whereas deficient performance is often associated with standard scores that are around 1SD below the mean or lower. Interpretations of weak or deficient performance based on standard scores that fall in these ranges are bolstered when they have ecological validity (e.g., when there is evidence that the abilities or processes identified as weak or deficient manifest in every-day classroom activities that require these abilities and processes).
[4] The major specific learning disability may be accompanied by secondary learning difficulties that also may be considered when planning the more intensive, individualized special education instruction directed at the primary problem. For information on linking assessment data to intervention, see Mascolo, Flanagan, and Alfonso (2014).

Flanagan, Ortiz, & Alfonso (2013). *Essentials of Cross-Battery Assessment, 3rd Edition*. Hoboken, NJ: Wiley.

Alternative Research-Based Approaches to SLD Identification

- PSW Methods:
  - *Flanagan, Ortiz, Alfonso, & Mascolo (2002-Present)*
    - *Dual-Discrepancy/Consistency (within the context of an Operational Definition of SLD and a broader approach to "best practices" in CHC-based assessment) – automated in X-BASS*
  - *Naglieri, 1999, 2013*
    - *Discrepancy/Consistency (PASS Model; CAS-2 battery) – battery specific*
  - *Hale & Fiorello, 2004, 2011*
    - *Concordance-discordance model (based on neuropsych theory within the context of an hypothesis testing approach) – not automated*
  - *Dehn & Szasz – Psychological Processing Analyzer-5*
    - *(remarkably similar to the PSW-A component of X-BASS, although not as comprehensive, or psychometrically sophisticated, or theoretically driven)*
  - *WISC-V*
    - *two discrepancy comparisons for PSW – automated in WIAT-III, KTEA-III scoring programs*

D. P. Flanagan, 2017

The Focus Here is on the DD/C Model

- PSW Methods:
  - *Flanagan, Ortiz, Alfonso, & Mascolo (2002-Present)*
    - *Dual-Discrepancy/Consistency (within the context of an Operational Definition of SLD and a broader approach to "best practices" in CHC-based assessment) – automated in X-BASS*
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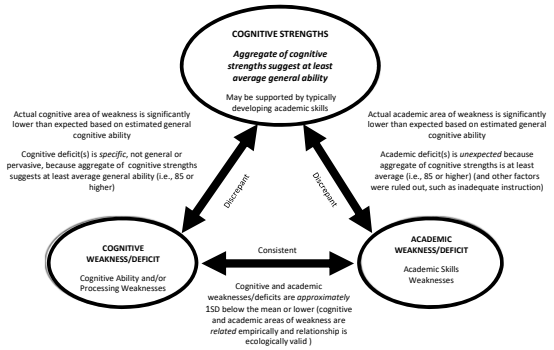
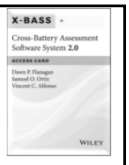
Conceptual Understanding of the Dual Discrepancy/Consistency (DD/C) Method



Flanagan, Ortiz, and Alfonso (2002 - 2017)

Essential Elements of PSW based on DD/C Operational Definition of SLD

Flanagan, Ortiz, and Alfonso (2002-2017)



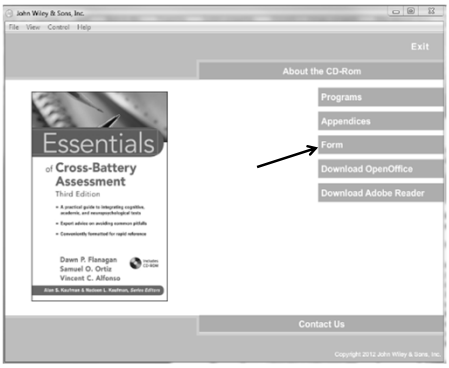
- Level I: Academic weakness (SS < 90; more typically below 85)
  - *Must also meet criteria for unexpected underachievement*
  - *Not all weaknesses are unexpected (to determine unexpected use X-BASS)*
- Level II: Exclusionary factors must be ruled out as the primary cause of the academic skill weakness(es)
  - It is not unusual to find one or more exclusionary factors that contribute to academic weaknesses
  - Use exclusionary factors form to ensure accountability

X-BASS (Flanagan, Ortiz, & Alfonso, 2015-2017) is necessary to conduct the DD/C PSW analysis

Identification of SLD

- **Involves more than just examining scores from standardized tests**
  - A convergence of data sources is necessary
  - Data should be gathered via different methods
  - ***Exclusionary factors must be considered and examined systematically***

Exclusionary Factors Form



Flanagan et al.'s DD/C Definition of SLD: Level II – Review of Exclusionary Factors

Evaluation and Consideration of Exclusionary Factors for SLD Identification

An evaluation of specific learning disability (SLD) requires an evaluation and consideration of factors, other than a disorder in one or more basic psychological processes that may be the primary cause of a student's academic skill weaknesses and learning difficulties. These factors include (but are not limited to), vision/ hearing[1], or motor disabilities, intellectual disability (ID), social/emotional or psychological disturbance, environmental or economic disadvantage, cultural and linguistic factors (e.g., limited English proficiency), insufficient instruction or opportunity to learn and physical/health factors. These factors may be evaluated via behavior rating scales, parent and teacher interviews, classroom observations, attendance records, social/developmental history, family history, vision/hearing exams[1], medical records, prior evaluations, and interviews with current or past counselors, psychiatrists, and paraprofessionals who have worked with the student. Noteworthy is the fact that students with (and without) SLD often have one or more factors (listed below) that ***contribute*** to academic and learning difficulties. However, the practitioner must rule out any of these factors as being the ***primary*** cause of a student's academic and learning difficulties to maintain SLD as a viable classification/diagnosis.

Form published in Flanagan, Alfonso, Mascolo, & Sotelo-Dynega (2012). Use of Intelligence Tests in the Identification of Specific Learning Disabilities Within the Context of An Operational Definition. *In Flanagan & Harrison (Eds.) , Contemporary Intellectual Assessment: Theories, Tests, and Issues (3rd edition). New York: Guilford.*

Flanagan et al.'s DD/C Definition of SLD: Level II – Review of Exclusionary Factors

Vision (Check All that Apply):

☐ Vision test recent (within 1 year)	☐ History of visual disorder/disturbance
☐ Vision test outdated (> 1 year)	☐ Diagnosed visual disorder/disturbance
☐ Passed	Name of disorder: _____
☐ Failed	☐ Vision difficulties suspected or observed
☐ Wears Glasses	(e.g., difficulty with far or near point copying, misaligned numbers in written math work, squinting or rubbing eyes during visual tasks such as reading, computers)

NOTES:_____

Form downloadable on CD that accompanies *Essentials of Cross-Battery Assessment*, 3e (Flanagan, Oritz, & Alfonso, 2013)

Flanagan et al.'s DD/C Definition of SLD: Level II – Review of Exclusionary Factors

Hearing (Check All that Apply)[2]:

☐ Hearing test recent (within 1 year)	☐ History of auditory disorder/disturbance
☐ Hearing test outdated (> 1 year)	☐ Diagnosed auditory disorder/disturbance
☐ Passed	☐ Name of disorder:_____
☐ Failed	☐ Hearing difficulties suggested in the referral
☐ Uses Hearing Aids	(e.g., frequent requests for repetition of auditory information, misarticulated words, attempts to self-accommodate by moving closer to sound source, obvious attempts to speech read)

NOTES:_____

Form downloadable on CD that accompanies *Essentials of Cross-Battery Assessment*, 3e (Flanagan, Oritz, & Alfonso, 2013)

Flanagan et al.'s DD/C Definition of SLD: Level II – Review of Exclusionary Factors

Motor Functioning (Check All that Apply):

☐ Fine Motor Delay/Difficulty	☐ History of motor disorder
☐ Gross Motor Delay/Difficulty	☐ Diagnosed motor disorder
☐ Improper pencil grip (Specify type: _____)	Name of disorder: _____
☐ Assistive devices/aids used (e.g., weighted pens, pencil grip, slant board)	☐ Motor difficulties suggested in the referral (e.g., illegible writing; issues with letter or number formation, size, spacing; difficulty with fine motor tasks such as using scissors, folding paper)

NOTES:_____

Form downloadable on CD that accompanies *Essentials of Cross-Battery Assessment*, 3e (Flanagan, Oritz, & Alfonso, 2013)

Flanagan et al.'s DD/C Definition of SLD: Level II – Review of Exclusionary Factors

Cognitive and Adaptive Functioning (Check All that Apply):

☐ Significantly "subaverage intellectual functioning" (e.g., IQ score of 75 or below)

☐ Pervasive cognitive deficits (e.g., weaknesses or deficits in many cognitive areas, including *Gf* ***and*** *Gc*)

☐ Deficits in adaptive functioning (e.g., social, communication, self-care)

Areas of significant adaptive skill weaknesses (check all that apply):

☐ Motor Skill	☐ Communication	☐ Socialization
☐ Daily Living Skills	☐ Behavior/Emotional Skills	☐ Other

NOTES:_____

Form downloadable on CD that accompanies *Essentials of Cross-Battery Assessment*, 3e (Flanagan, Oritz, & Alfonso, 2013)

Flanagan et al.'s DD/C Definition of SLD: Level II – Review of Exclusionary Factors

Social-Emotional/Psychological Factors (Check All that Apply):

☐ Diagnosed psychological disorder (Specify: _____)
☐ Date of Diagnosis
☐ Family history significant for psychological difficulties
☐ Disorder presently treated - specify treatment modality (e.g., counseling, medication): _____
☐ Reported difficulties with social/emotional functioning (e.g., social phobia, anxiety, depression)
☐ Social-Emotional/Psychological issues suspected or suggested by referral
☐ Home-School Adjustment Difficulties
☐ Lack of Motivation
☐ Emotional Stress
☐ Autism
☐ Present Medications (type, dosage, frequency, duration) _____
☐ Prior Medication Use (type, dosage, frequency, duration) _____
☐ Hospitalization for psychological difficulties (date(s): _____)
☐ Deficits in social, emotional, or behavioral [SEB] functioning (e.g., as assessed by standardized rating scales)
Significant scores from SEB measures: _____

NOTES:_____

Form downloadable on CD that accompanies *Essentials of Cross-Battery Assessment*, 3e (Flanagan, Oritz, & Alfonso, 2013)

Flanagan et al.'s DD/C Definition of SLD: Level II – Review of Exclusionary Factors

Environmental/Economic Factors (Check All that Apply):

- ☐ Limited access to educational materials in the home
- ☐ History of educational neglect
- ☐ Caregivers unable to provide instructional support
- ☐ Frequent transitions (e.g., shared custody)
- ☐ Economic considerations precluded treatment of identified issues (e.g., filling a prescription, replacing broken glasses, tutoring)
- ☐ Environmental space issues (e.g., no space for studying, sleep disruptions due to shared sleeping space)
- ☐ Temporary Crisis Situation

NOTES:_____

Form downloadable on CD that accompanies *Essentials of Cross-Battery Assessment*, 3e (Flanagan, Oritz, & Alfonso, 2013)

Flanagan et al.'s DD/C Definition of SLD: Level II – Review of Exclusionary Factors

Cultural/Linguistic Factors (Check All that Apply)[3]:

- ☐ Limited Number of Years in U.S. (___)
- ☐ Language(s) Other than English Spoken in Home
- ☐ No History of Early or Developmental Problems in Primary Language
- ☐ Lack of or Limited Instruction in Primary Language (# of years _____)
- ☐ Current Primary Language Proficiency: (Dates: _____ Scores: _____)
- ☐ Current English Language Proficiency: (Date: _____ Scores: _____)
- ☐ Acculturative Knowledge Development (Circle one: High – Moderate – Low)
- ☐ Parental Educational and Socio-Economic Level (Circle one: High – Moderate – Low)

NOTES:_____

Form downloadable on CD that accompanies *Essentials of Cross-Battery Assessment*, 3e (Flanagan, Oritz, & Alfonso, 2013)

Flanagan et al.'s DD/C Definition of SLD: Level II – Review of Exclusionary Factors

Physical/Health Factors (Check All that Apply):

- ☐Limited access to healthcare
- ☐Minimal documentation of health history/status
- ☐Chronic health condition (Specify: _____)
- ☐Migraines
- ☐Temporary health condition (Date/Duration: _____)
- ☐Hospitalization (Dates: _____)
- ☐History of Medical Condition (Date Diagnosed _____)
- ☐Medical Treatments (Specify: _____)
- ☐Repeated visits to the school nurse
- ☐Repeated visits to doctor
- ☐Medication (type, dosage, frequency, duration: _____)

NOTES:_____

Form downloadable on CD that accompanies *Essentials of Cross-Battery Assessment*, 3e (Flanagan, Oritz, & Alfonso, 2013)

Flanagan et al.'s DD/C Definition of SLD: Level II – Review of Exclusionary Factors

Instructional Factors (Check All that Apply):

☐ Interrupted schooling (e.g., mid-year school move) Specify why: _____

☐ New teacher (past 6 months) ☐ Retained or advanced a grade(s)

☐ Nontraditional curriculum (e.g., homeschooled) ☐ Accelerated curriculum (e.g., AP classes)

☐ Days Absent _____

NOTES: _____

Determination of Primary and Contributory Causes of Academic Weaknesses and Learning Difficulties (Check One):

☐Based on the available data, it is reasonable to conclude that one or more factors is *primarily* responsible for the student's observed learning difficulties. Specify: _____

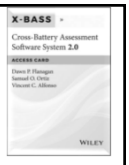
☐Based on the available data, it is reasonable to conclude that one or more factors *contributes* to the student's observed learning difficulties. Specify: _____

☐*No* factors listed here appear to be the primary cause of the student's academic weaknesses and learning difficulties

Form downloadable on CD that accompanies *Essentials of Cross-Battery Assessment*, 3e (Flanagan, Oritz, & Alfonso, 2013)

Essential Elements of PSW based on DD/C Operational Definition of SLD

Flanagan, Ortiz, and Alfonso (2002-2017)



- Level III: Cognitive weakness (SS < 90; more typically below 85)
  - *Must also meet criteria for domain-specific weakness*
  - *Not all cognitive weaknesses are domain-specific (to determine domain-specific use X-BASS)*
  - Generally low average ability across most cognitive areas does not meet the criterion of a domain-specific cognitive weakness
- Level IV: Data support a "dual discrepancy" and a "consistency" with at least average ability to think and reason
  - **Discrepancy 1**: Difference between cognitive strengths and cognitive weaknesses is significant; difference between actual and predicted (from general ability or the Facilitating Cognitive Composite [FCC]) performance is unusual (base rate of about 10%) – *supports domain-specific cognitive weakness*
  - **Discrepancy 2**: Difference between cognitive strengths and academic weaknesses is significant; difference between actual and predicted (from general ability or FCC) performance is unusual (base rate of about 10%) – *supports unexpected underachievement*
  - **Consistency**: Empirical or ecologically valid relationship between cognitive and academic weaknesses

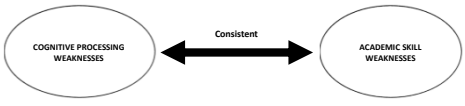
X-BASS (Flanagan, Ortiz, & Alfonso, 2015-2017) is necessary to conduct the DD/C PSW analysis

Consistency – Don't Assume a Perfect Prediction

Not all academic weaknesses have corresponding cognitive weaknesses

Cognitive processing weaknesses do not guarantee that there will be academic weaknesses – they simply ***raise the risk*** (Flanagan & Schneider, 2016)

*Relationship is **probabilistic**, not deterministic, as some have erroneously assumed (e.g., Kranzler et al., 2016)*



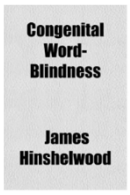
Not All Definitions of SLD Assume at Least Average Overall Ability

The Dual Discrepancy/Consistency (DD/C) Operational Definition of SLD Requires at Least Average Overall Ability to Think and Reason Despite Some Cognitive Processing Deficits

Is At Least Average Overall Ability Consistent with the SLD Construct?

Individuals with SLD have At Least Average Overall Ability

- The children often have average or above intelligence and good memory in other respects
- Hinshelwood, 1902



"Historical Perspective" Information from Nancy Mather, NYASP 2011

Individuals with SLD have At Least Average Overall Ability

Many of the children have a high degree of intelligence

Orton, 1937

"Historical Perspective" Information from Nancy Mather, NYASP 2011

Individuals with SLD have At Least Average Overall Ability

"it seems probably that psychometric tests as ordinarily employed give an entirely erroneous and unfair estimate of the intellectual capacity of these children" (p. 582)

Orton, 1925

Gf-Gc Composite Recommended in Comparison Procedures for students suspected of SLD

"Historical Perspective" Information from Nancy Mather, NYASP 2011

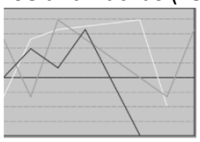
Individuals with SLD have At Least Average Overall Ability

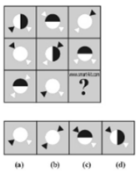
- Remedial training must continue until reading is in harmony with the child's other capacities and achievement
- Some children of superior intelligence struggle to learn to read
- Monroe, M. (1932)

"Historical Perspective" Information from Nancy Mather, NYASP 2011

Individuals with SLD have At Least Average Overall Ability

- "Sometimes children of good general intelligence show retardation in some of the specific skills which compose an intelligence test" (p. 22)
- Monroe and Backus (1937)





"Historical Perspective" Information from Nancy Mather, NYASP 2011

Individuals with SLD have At Least Average Overall Ability

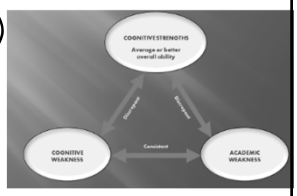
- "…generalized integrity and deficiency in learning (p. 9)…there is a deficit in learning in the presence of basic integrity" (p. 25).
- Source: Johnson, D. J., & Myklebust, H. R. (1967). *Learning disabilities: Educational principles and practices*. New York: Grune & Stratton.

Cited in: Mather, N. (2016). *Using the WJ IV to Diagnose Specific Reading Disabilities*. Webinar – Houghton Mifflin Harcourt. bcove.me/g81r4scv

Individuals with SLD have At Least Average Overall Ability

"The clearest expression of a special disability is consistently low scores on a series of tests in a given subject conjoined with average or superior scores on tests in other subjects. Such scores can be arranged in an 'educational profile.' For example, in case of a reading disability, a child might obtain scores placing him in the ninth grade in arithmetic…and in the third grade in reading. Here we would have evidence of a striking reading disability." (p. 43).

Source: Travis, L. E. (1935). Intellectual factors. In G. M. Whipple (Ed.), *The thirty-fourth yearbook of the National Society for the Study of Education: Educational Diagnosis* (pp. 37-47). Bloomington, IL: Public School Publishing Company.



"Historical Perspective" Information from Nancy Mather, NYASP 2011

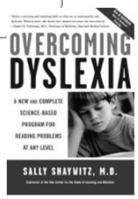
Individuals with SLD have At Least Average Overall Ability

All historical approaches to SLD *emphasize the spared or intact abilities* that stand in stark contrast to the deficient abilities

Kaufman, 2008, pp. 7-8

Individuals with SLD have At Least Average Overall Ability

"Weaknesses in word reading and spelling surrounded by a ***sea of strengths***"

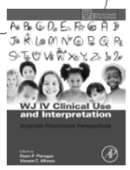


Individuals with SLD have At Least Average Overall Ability

- **Learning Disabilities Association of Canada**
- "Learning Disabilities refer to a number of disorders which may affect the acquisition, organization, retention, understanding or use of verbal or nonverbal information. ***These disorders affect learning in individuals who otherwise demonstrate at least average abilities essential for thinking and/or reasoning***"
- Source: www.ldac-acta.ca/en/learn-more/ld-defined.html

Individuals with SLD have At Least Average Overall Ability

By failing to differentially diagnose SLD from other conditions that impede learning, such as intellectual disability, pervasive developmental disorders, and overall below average ability to learn and achieve, the SLD construct loses its meaning and there is a tendency (albeit well intentioned) to accept anyone under the SLD rubric who has learning difficulties for reasons other than specific cognitive dysfunction…



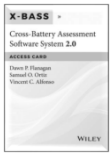
McDonough, E. M., & Flanagan, D. P. (2016). Use of the Woodcock-Johnson IV in the identification of specific learning disabilities in school-age children. In Flanagan & Alfonso (Eds.), *WJ IV Clinical Use and Interpretation: Scientist-Practitioner Perspectives*. Burlington, MA: Elsevier.

What's Next?

The PSW-A Component of X-BASS

Introduction and Functionality of the PSW-A Component of X-BASS

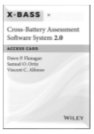
- Entering scores and interpreting output
- Guidance on selecting scores for inclusion in PSW Analysis



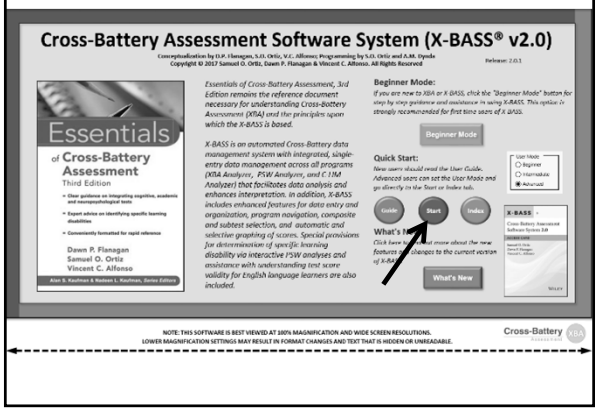
PWS Analysis Following the Dual Discrepancy/Consistency (DD/C) Model Using X-BASS

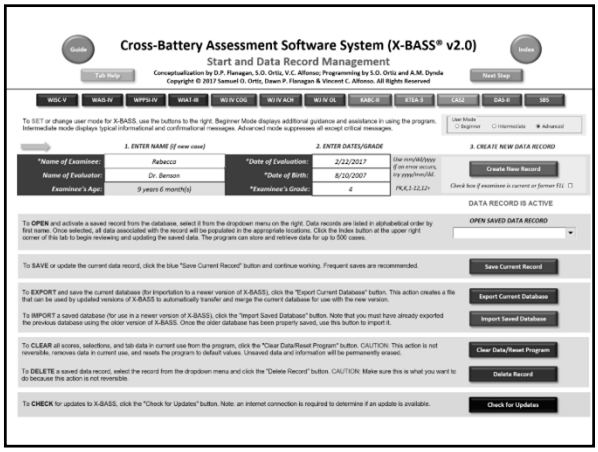
- Requires Estimates of Seven Cognitive Abilities and Processes
  - Gf
  - Gc
  - Glr
  - Gsm
  - Gv
  - Ga
  - Gs

  Encompasses approximately 20 frequently measured cognitive abilities and processes
- These 7 are necessary for the calculation of the g-value, FCC, and ICC
  - Other areas that may be included in the PSW Analysis, but do not contribute to the g-value, ICC, or FCC
    - Orthographic Processing
    - Speed of Lexical Access
    - Cognitive Efficiency
- Estimates Do Not Need to be Broad Cognitive Ability Estimates. Examples:
  - Broad CHC Estimate
    - Most likely in the areas of Gf, Gc, and Gv
    - WISC-V Gv is estimate of Vz only. Ok if no Gv difficulties are suspected and referral is reading
  - Narrow CHC Estimate
    - Likely in Ga (e.g., Phonetic Coding; Phonological Processing) and Gs (e.g., Perceptual Speed)
  - More than one CHC Estimate is ok
    - For example, in the area of Glr, one estimate of MA and one estimate of NA is ok



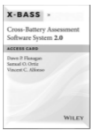
X-BASS Welcome Screen

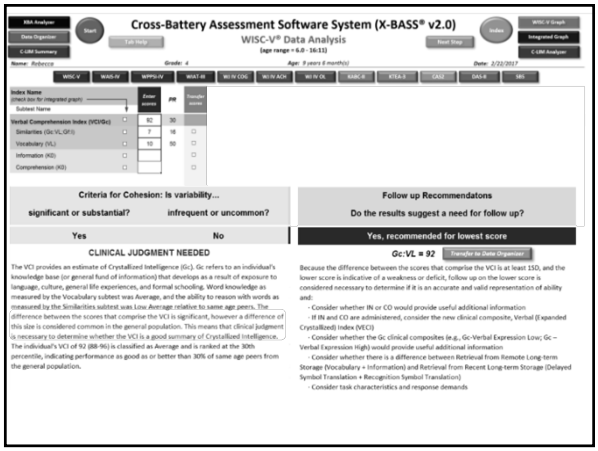


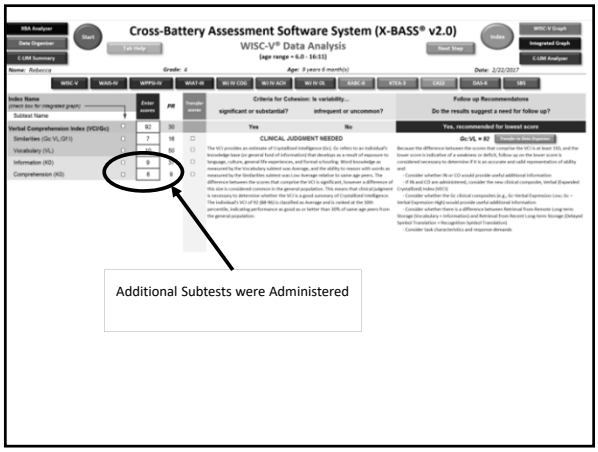


PSW Component of X-BASS

- Transfer best estimates of CHC abilities and academic scores to XBA Organizer Tab
- From XBA Organizer tab, select estimates to be used in PSW analysis (use select all button)
- View output
- Select different cognitive and academic weaknesses for analysis if necessary
- Print interpretation of results



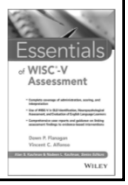




10 New Clinical Composite Based on Actual Norms Calculated Automatically on the WISC-V Tab

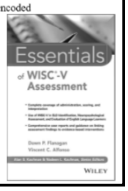
Summary of the New Clinical Composites for the WISC-V

Clinical Composite	Subtest Composition	Brief Description
Gc (Verbal Expression – Low) Gc-VEL	Vocabulary + Information	These two subtests form a broad Gc ability and require less verbal expression compared to the other Gc subtests (e.g., one or two word responses as compared to multi-word responses or sentences). An alternative label for this composite is Retrieval from Remote Long-term Storage (RFLT-Remote), which provides an estimate of an individual's ability to retrieve information from long-term storage that was encoded weeks, months, or years ago.
Gc (Verbal Expression – High) Gc-VEH	Similarities + Comprehension	These two subtests require greater verbal expression to earn maximum credit compared to the other Gc subtests and typically involve some degree of reasoning ability.
Fluid-Crystallized Gf-Gc	Vocabulary + Information + Matrix Reasoning + Figure Weights	Provides an alternative to the FSIQ and GAI. Balances Gf and Gc about equally. Contains only subtests with high g loadings. Because Gf and Gc are highly correlated with g and are considered to be the cornerstones of general intelligence, research supports use of a Gf-Gc composite as an estimate of general ability (e.g., McGrew, LaForte, & Schrank, 2014).
Working Memory (Alternative) Gsm-MW(Alt)	Digit Span Backwards + Digit Span Sequencing + Letter-Number Sequencing	Provides an alternative to the Auditory Working Memory Index (AWMI) by eliminating Digit Span Forward (a test of memory span).
Memory Span-Working Memory Gsm-MS.MW	Digit Span Forward + Digit Span Backward	Provides a balance of Memory Span and Working Memory and is consistent with the composition of the Digit Span subtest on the WISC-IV.
Working Memory (Cognitive Complexity – High) WM-CC:H	Arithmetic + Picture Span	Provides an estimate of working memory with tests that are more cognitively complex than Digit Span. Arithmetic involves Gf (i.e., Quantitative Reasoning), Gc, and Gsm (Working Memory Capacity). Picture Span involves Gv (Visual Memory), Memory Span, and Working Memory due to proactive interference.



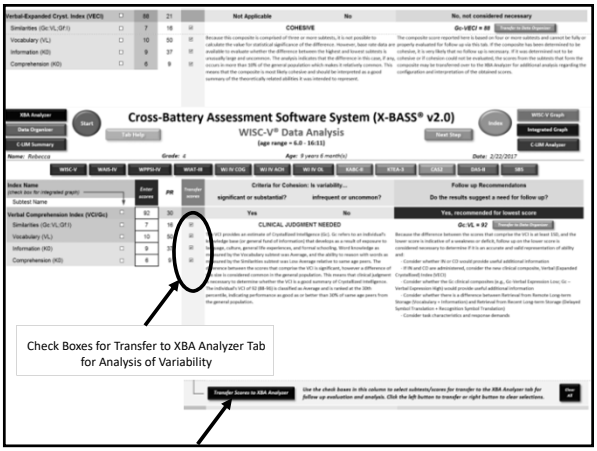
Summary of the New Clinical Composites for the WISC-V (Cont'd)

Verbal (Expanded Crystallized) Index VECI*	Similarities + Vocabulary + Information + Comprehension	Provides a robust estimate of Gc as compared to the Verbal Comprehension Index (VCI), spanning two narrow ability domains (VL – Lexical Knowledge and KO – General Information). Requires reasoning with verbal information. Involves tests that have low to high demands for verbal expression.
Expanded Fluid Index EFI*	Matrix Reasoning + Figure Weights + Picture Concepts + Arithmetic	Provides a more robust estimate of Gf as compared to the Fluid Reasoning Index (FRI), spanning three narrow ability domains, including Induction (I), General Sequential Reasoning (RG), and Quantitative Reasoning (RQ). Places more emphasis on quantitative reasoning as compared to FRI.
Perceptual Speed Gs-P**	Symbol Search + Cancellation	Provides an alternative to the PSI, eliminating the memory and motor dexterity demands inherent mainly in the Coding subtest.
Retrieval From Recent Long-Term Storage RFLT-Recent	Delayed Symbol Translation + Recognition Symbol Translation	Provides an estimate of an individual's ability to retrieve recently encoded information from long-term storage.

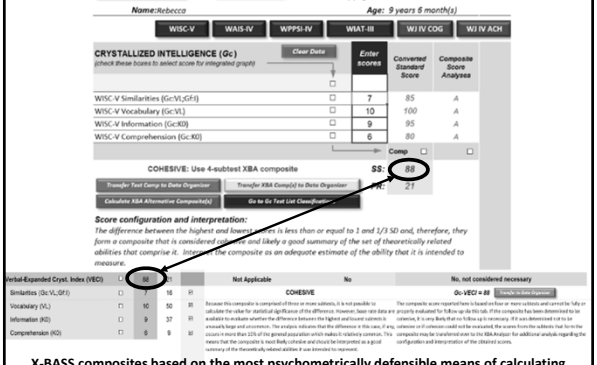


10 New Clinical Composite Based on Actual Norms Calculated Automatically on the WISC-V Tab

Note: The more scores that make up a composite, the larger the difference needs to be between highest minus lowest score for a noncohesive composite. Large differences are common in the general population. Nevertheless, when large differences are present, the composite may obscure important information about the individual's strengths and weaknesses.



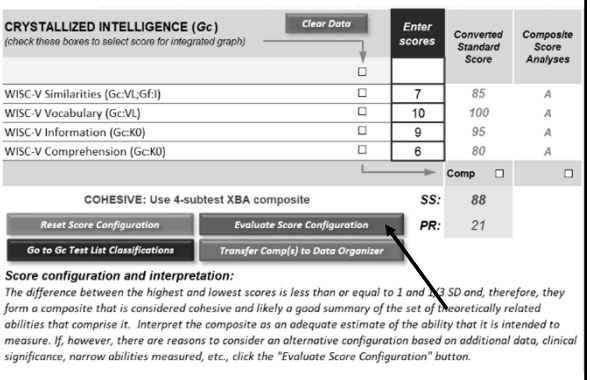
XBA Analyzer Tab Provides the SAME Composite
No difference between Actual Norms and the Composite Generated by X-BASS



X-BASS composites based on the most psychometrically defensible means of calculating composites when actual norms are not available

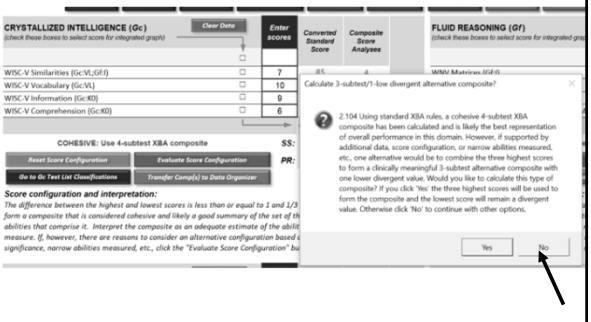
What if I wanted to do something else? Can I Generate a Different Composite or Composites Based on my Clinical Judgment?

X-BASS: "XBA Analyzer Tab"

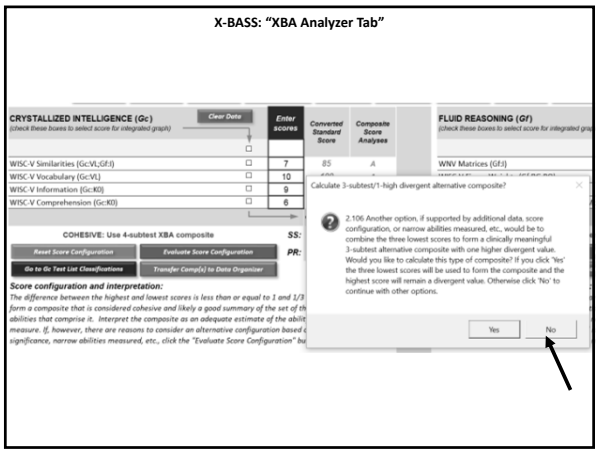


Note: This version of X-BASS not yet released; available to X-BASS v2.0 users free in 4-6 weeks

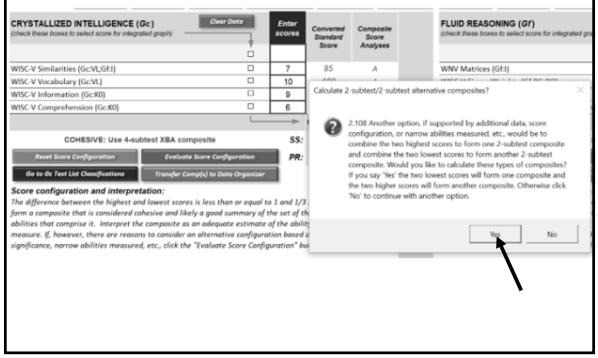
X-BASS: "XBA Analyzer Tab"



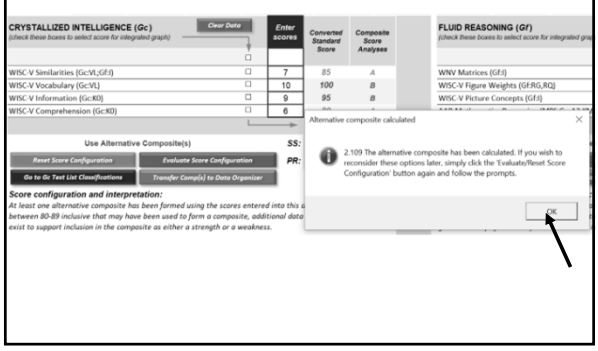
X-BASS: "XBA Analyzer Tab"



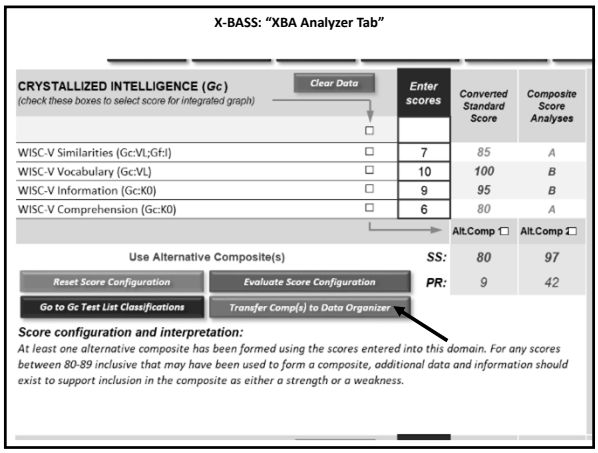
X-BASS: "XBA Analyzer Tab"

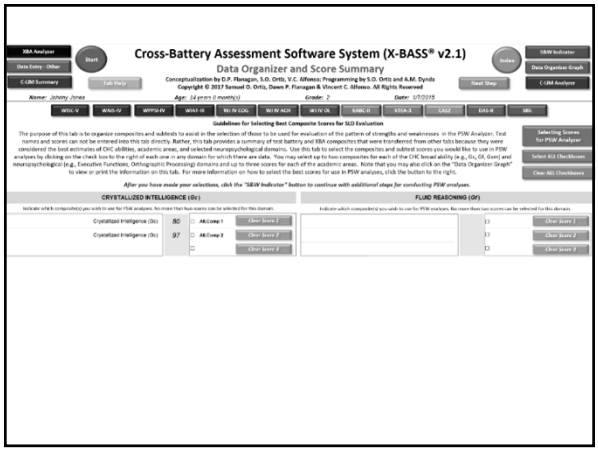


X-BASS: "XBA Analyzer Tab"

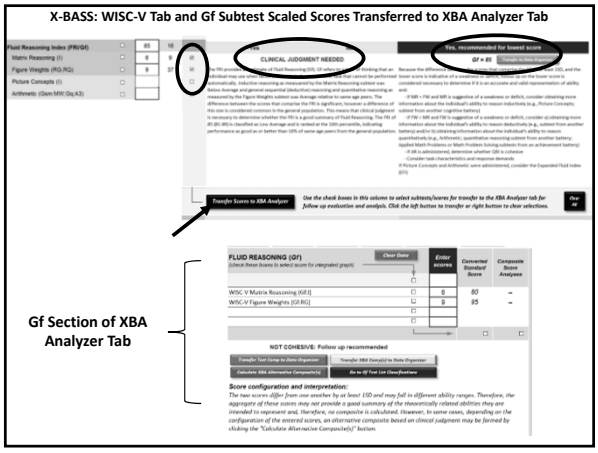


X-BASS: "XBA Analyzer Tab"



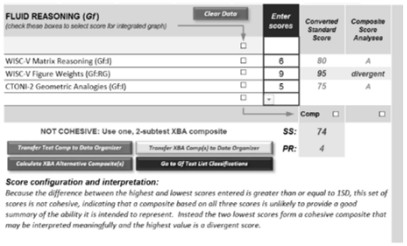


X-BASS: WISC-V Tab and Gf Subtest Scaled Scores Transferred to XBA Analyzer Tab



Gf Section of XBA Analyzer Tab

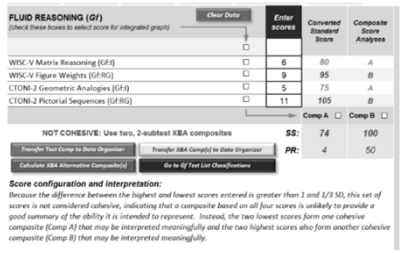
X-BASS: Gf Section of XBA Analyzer Tab



This is a situation where some have claimed that XBA leads to "over-testing." [The apparent "need" to follow up with another Gf subtest – in this case Gf:RG – is to get a cohesive composite. However, this may or may not be necessary, depending on available data sources.] *Note that over-testing only happens when the practitioner does not understand his or her data*.

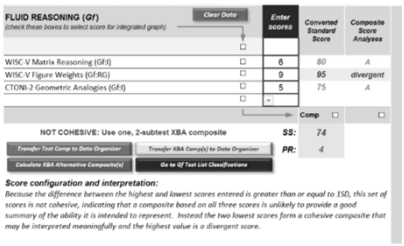
The question in this situation is: ***How do I represent the "average" part of Gf in my PSW analysis without "over-testing" in "average" areas?***

X-BASS: Gf Section of XBA Analyzer Tab



Is administration of Pictorial Sequences "chasing" the high score? No, not unless there is solid ecological validity for the initial Gf:RG performance. If ecological validity is available, then consider the following….

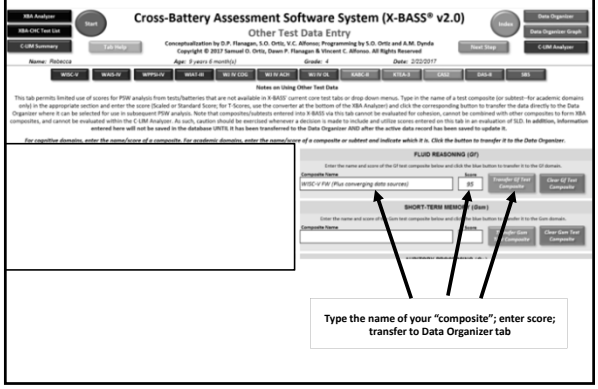
X-BASS: Gf Section of XBA Analyzer Tab

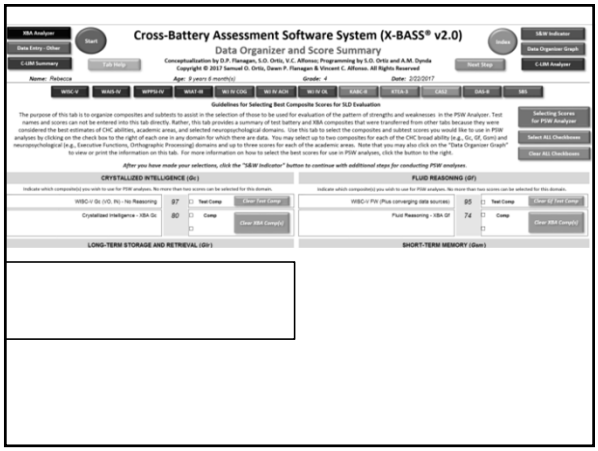


Evidence from multiple data sources indicates that Gf:RG (and reasoning with numbers) is not posing any problems for the student at this time.

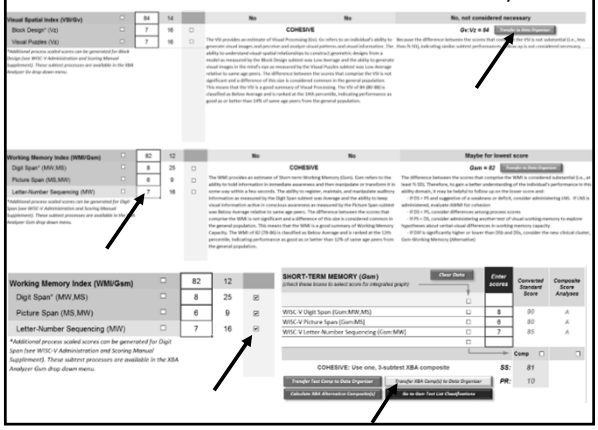
Multiple data sources include: Teacher report, multiple work samples, math problem solving, grades in math

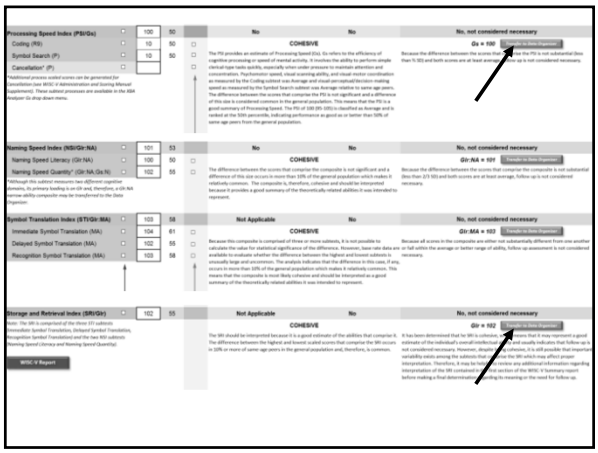
Use “Other Data Entry Tab”

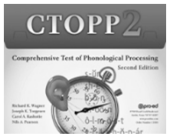




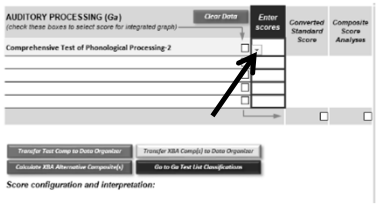
X-BASS: WISC-V Tab and Gsm Subtest Scaled Scores Transferred to XBA Analyzer Tab



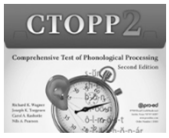




Supplement the WISC-V with tests from CTOPP-2 for Ga: Phonetic Coding



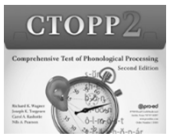
Top Row for all areas in XBA Analyzer Tab includes the names of Tests and Batteries that do not have their own separate tab in X-BASS. Use the drop down menu in the top row in the Ga domain to find the CTOPP-2.



Supplement the WISC-V with tests from CTOPP-2 for Ga: Phonetic Coding

Subtests	**Composite**
Elision Blending Words Phoneme Awareness	Phonological Awareness

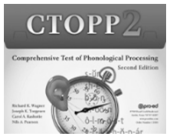
CTOPP2 Manual does not include critical values for determining cohesion of composites



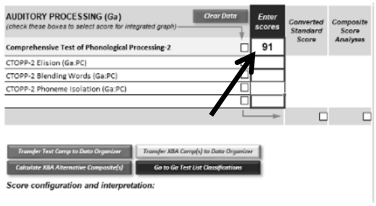
Supplement the WISC-V with tests from CTOPP-2 for Ga: Phonetic Coding

Subtests	Composite
Elision (ss = 8) Blending Words (ss = 9) Phoneme Awareness (ss = 9)	Phonological Awareness (SS = 91)

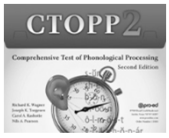
CTOPP2 Manual does not include critical values for determining cohesion of composites



Supplement the WISC-V with tests from CTOPP-2 for Ga: Phonetic Coding

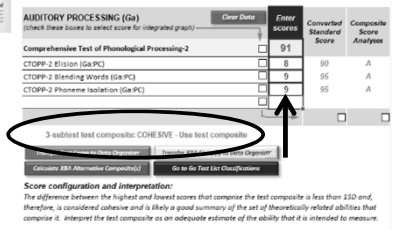


CTOPP2 Manual does not include critical values for determining cohesion of composites. ***Enter the composite in the top row; select the subtests that make up the composite; and enter the scaled scores for each subtest and X-BASS will evaluate cohesion***

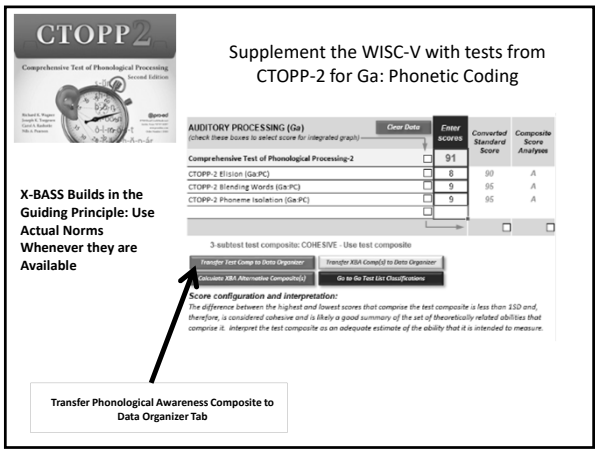


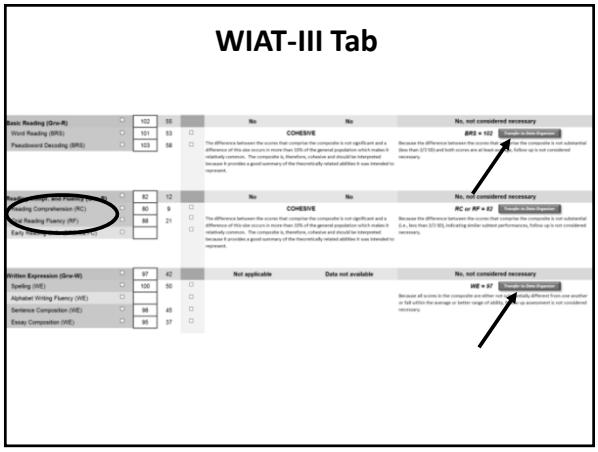
Supplement the WISC-V with tests from CTOPP-2 for Ga: Phonetic Coding

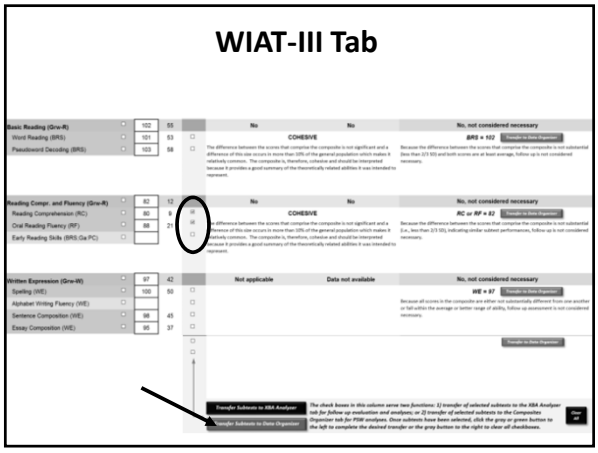
X-BASS Builds in the Guiding Principle: Use Actual Norms Whenever they are Available



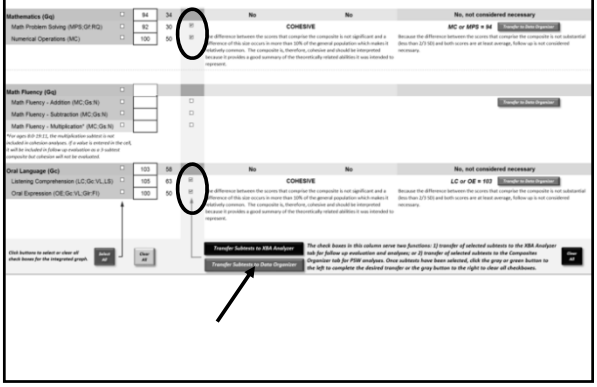
CTOPP2 Manual does not include critical values for determining cohesion of composites. ***Enter the composite in the top row; select the subtests that make up the composite; and enter the scaled scores for each subtest and X-BASS will evaluate cohesion***


CTOPP 2
Comprehensive Test of Phonological Processing
Second Edition
Supplement the WISC-V with tests from CTOPP-2 for Ga: Phonetic Coding
X-BASS Builds in the Guiding Principle: Use Actual Norms Whenever they are Available
AUDITORY PROCESSING (Ga)
(check these boxes to select score for integrated graph)
Clear Data
Enter scores
Converted Standard Score
Composite Score Analyses
Comprehensive Test of Phonological Processing-2
91
CTOPP-2 Elision (Ga:PC)
8
90
A
CTOPP-2 Blending Words (Ga:PC)
9
95
A
CTOPP-2 Phoneme Isolation (Ga:PC)
9
95
A
3-subtest test composite: COHESIVE - Use test composite
Transfer Test Comp to Data Organizer
Transfer XBA Comp(s) to Data Organizer
Calculate XBA Alternative Composite(s)
Go to Go Test List Classifications
Score configuration and interpretation:
The difference between the highest and lowest scores that comprise the test composite is less than 1SD and, therefore, is considered cohesive and is likely a good summary of the set of theoretically related abilities that comprise it. Interpret the test composite as an adequate estimate of the ability that it is intended to measure.
Transfer Phonological Awareness Composite to Data Organizer Tab

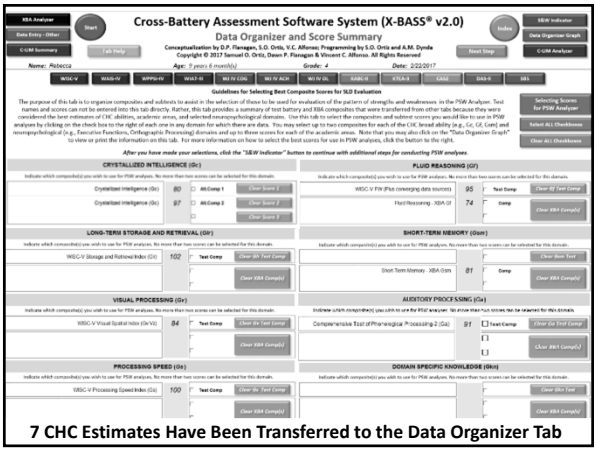

WIAT-III Tab


WIAT-III Tab

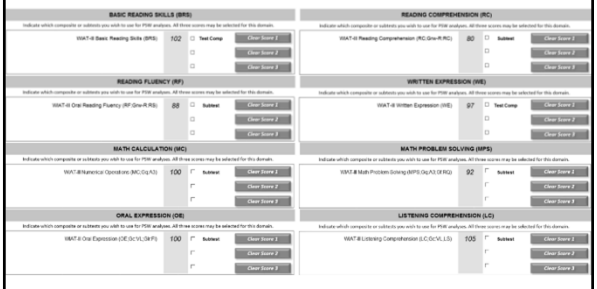
WIAT-III Tab



7 CHC Estimates Have Been Transferred to the Data Organizer Tab

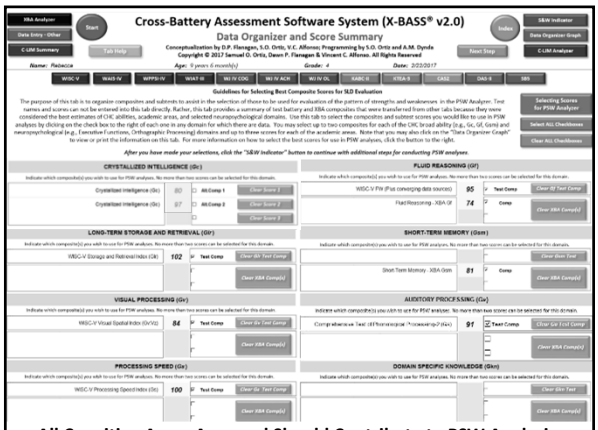


Scroll below the cognitive domains to see the academic/SLD areas

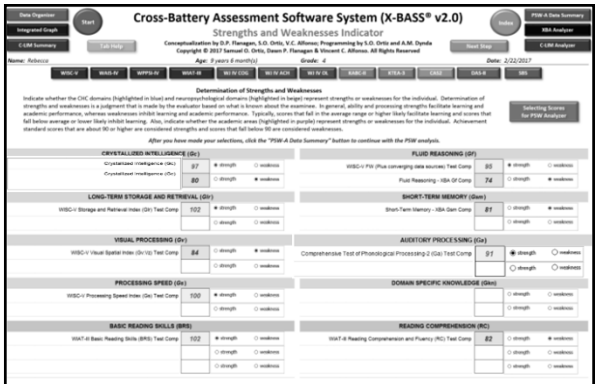


8 Achievement Subtest Scores Have Been Transferred to the Data Organizer Tab

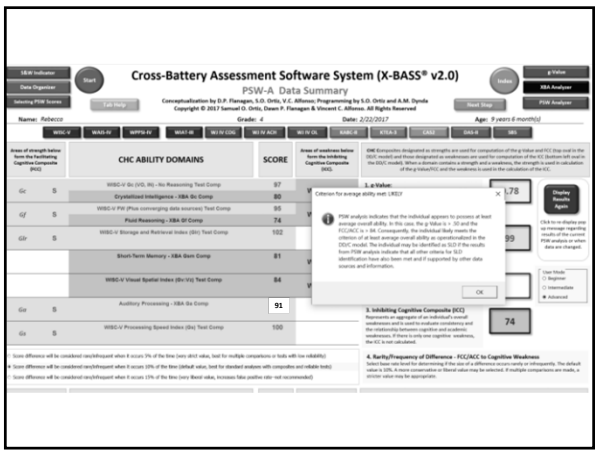
There is no requirement that all 8 areas of SLD (listed in IDEIA) be evaluated for the purpose of conducting a PSW analysis.

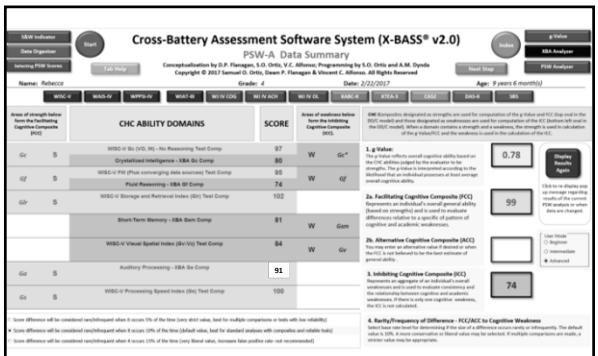


All Cognitive Areas Assessed Should Contribute to PSW Analysis

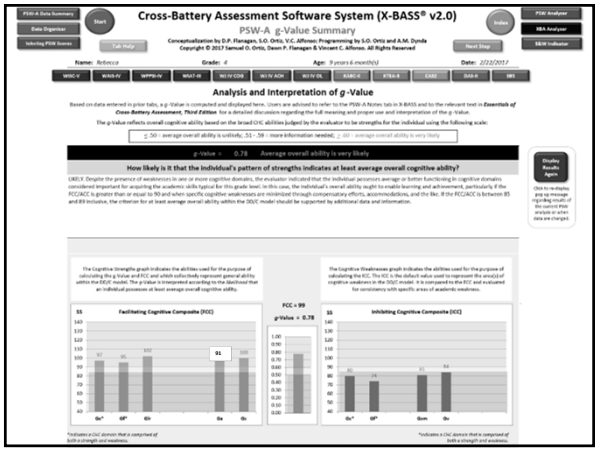


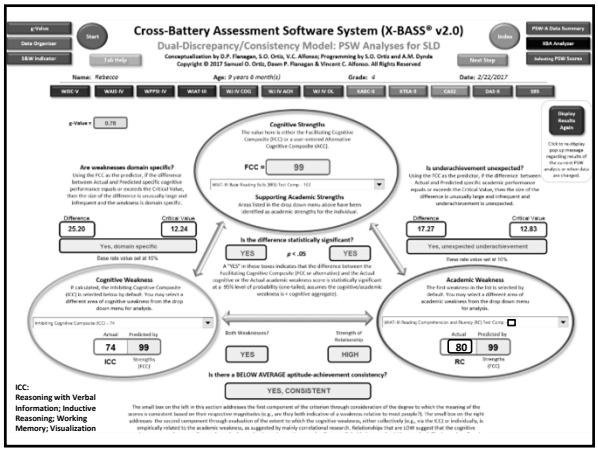
When determining cognitive areas of strength and weakness, consider whether an ability or process likely *facilitates or inhibits* overall learning and specific academic skill acquisition and development



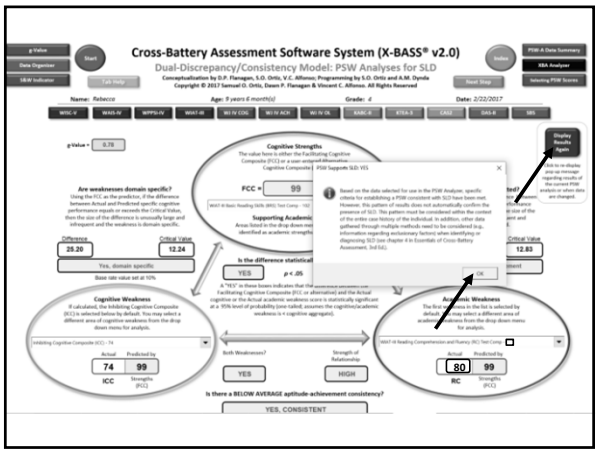


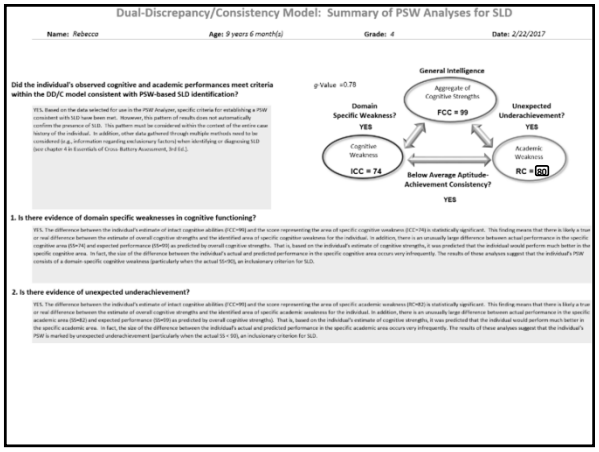
Note: You may have a strength **and** a weakness within a broad ability domain (Gf and Gc in this example) – the score representing a strength contributes to the FCC and the score representing a weakness contributes to the ICC





ICC:
Reasoning with Verbal Information; Inductive Reasoning; Working Memory; Visualization

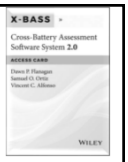

Cross-Battery Assessment Software System (X-BASS® v2.0)
Dual-Discrepancy/Consistency Model: PSW Analyses for SLD
Conceptualization by D.P. Flanagan, S.O. Ortiz, V.C. Alfonso; Programming by S.O. Ortiz and A.M. Dynda
Copyright © 2017 Samuel O. Ortiz, Dawn P. Flanagan & Vincent C. Alfonso. All Rights Reserved
Name: Rebecca
Age: 9 years 6 month(s)
Grade: 4
Date: 2/22/2017
g Value = 0.78
Cognitive Strengths
FCC = 99
Are weaknesses domain specific?
Difference 25.20
Critical Value 12.24
Yes, domain specific
Is the difference statistically significant?
YES
p < .05
Cognitive Weakness
Actual 74
Predicted by 99
ICC
Academic Weakness
Actual 80
Predicted by 99
RC
Both Weaknesses?
YES
Strength of Relationship
HIGH
Is there a BELOW AVERAGE aptitude-achievement consistency?
YES, CONSISTENT


Dual-Discrepancy/Consistency Model: Summary of PSW Analyses for SLD
Name: Rebecca
Age: 9 years 6 month(s)
Grade: 4
Date: 2/22/2017
Did the individual's observed cognitive and academic performances meet criteria within the DD/C model consistent with PSW-based SLD identification?
YES, Based on the data selected for use in the PSW Analyser, specific criteria for establishing a PSW consistent with SLD have been met. However, this pattern of results does not automatically confirm the presence of SLD. This pattern must be considered within the context of the entire case history of the individual. In addition, other data gathered through multiple methods need to be considered (e.g., information regarding exclusionary factors) when identifying or diagnosing SLD (see chapter 4 in Essentials of Cross-Battery Assessment, 3rd Ed.).
g Value =0.78
General Intelligence
Aggregate of Cognitive Strengths
FCC = 99
Domain Specific Weakness?
YES
Unexpected Underachievement?
YES
Cognitive Weakness
ICC = 74
Academic Weakness
RC = 80
Below Average Aptitude-Achievement Consistency?
YES
1. Is there evidence of domain specific weaknesses in cognitive functioning?
YES. The difference between the individual's estimate of intact cognitive abilities (FCC=99) and the score representing the area of specific cognitive weakness (ICC=74) is statistically significant. This finding means that there is likely a true or real difference between the estimate of overall cognitive strengths and the identified area of specific cognitive weakness for the individual. In addition, there is an unusually large difference between actual performance in the specific cognitive area (SS=74) and expected performance (SS=99) as predicted by overall cognitive strengths. That is, based on the individual's estimate of cognitive strengths, it was predicted that the individual would perform much better in this specific cognitive area. In fact, the size of the difference between the individual's actual and predicted performance in the specific cognitive area occurs very infrequently. The results of these analyses suggest that the individual's PSW consists of a domain specific cognitive weakness (particularly when the actual SS<90), an inclusionary criterion for SLD.
2. Is there evidence of unexpected underachievement?
YES. The difference between the individual's estimate of intact cognitive abilities (FCC=99) and the score representing the area of specific academic weakness (RC=80) is statistically significant. This finding means that there is likely a true or real difference between the estimate of overall cognitive strengths and the identified area of specific academic weakness for the individual. In addition, there is an unusually large difference between actual performance in the specific academic area (SS=80) and expected performance (SS=99) as predicted by overall cognitive strengths). That is, based on the individual's estimate of cognitive strengths, it was predicted that the individual would perform much better in the specific academic area. In fact, the size of the difference between the individual's actual and predicted performance in the specific academic area occurs very infrequently. The results of these analyses suggest that the individual's PSW is marked by unexpected underachievement (particularly when the actual SS < 90), an inclusionary criterion for SLD.


3. Is there evidence of a below-average aptitude-achievement consistency?
YES. The specific cognitive (SS=74 for ICC) and academic (SS=82 for RC) scores are indicative of normative weaknesses or deficits compared to same age peers (SS<85). There is research that supports a high relationship between the Inhibiting Cognitive Composite and Reading Comprehension which indicates that the ICC is comprised of two or more areas that are strongly related to Reading Comprehension. Therefore, this combination of scores provides evidence that assists in explaining the nature of the individual's observed learning difficulties. Based on all of these considerations, these findings appear to indicate overall support for the criterion regarding below average aptitude-achievement consistency.
Start
Data Organizer
Selecting PSW Scores
S&W Indicator
PSW-A Data Summary
g Value
PSW-A Notes
Index
Return to Top
Print PSW-A Results
Save Current Record
Cross-Battery

Summary and Conclusions

PSW Model Provides Information About Important Markers for SLD



- *Overall cognitive ability is at least average* despite specific cognitive processing weaknesses – FCC (top oval)
- Specific cognitive processing weaknesses – ICC or individual weaknesses as reported in bottom left oval
  - Weaknesses relative to most people (< 90)
  - Weaknesses because they are significantly lower than FCC
  - Weaknesses because difference between actual and predicted performance is unusual in the general population
  - SLD is *specific, not general*
- Academic weaknesses – as reported in bottom right oval
  - Weaknesses relative to most people (< 90)
  - Weaknesses because they are significantly lower than FCC
  - Weaknesses because difference between actual and predicted performance is unusual in the general population
  - *Unexpected underachievement*
- *May have academic areas of strength* (reported in top oval as they are expected to be consistent with the FCC)
- *Consistency between* cognitive processing weakness (or weaknesses; e.g., ICC) and academic area of weakness (bottom two ovals)
  - Specific learning disabilities are caused by underlying cognitive processing weaknesses
  - "Disorder in one or more of the basic psychological processes" - IDEIA

PSW Models: The Controversy

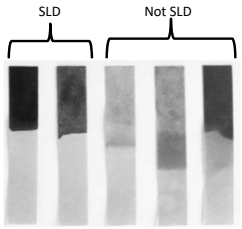
- Given its increasing popularity, research on the PSW approach is emerging.
- One emerging body of research indicates that there is a *lack of agreement among PSW models*.
  - This research also suggests that PSW models are effective at determining who *is not SLD*, but they are not as effective at determining *who is SLD*.
  - Valid points are made about *potential weaknesses of PSW* models in this literature (e.g., Stuebing, Fletcher, Branum-Martin, & Francis, 2012).
- Another emerging body of research provides support for a neuropsychological/cognitive processing PSW approach (Hale et al., 2010 White Paper).
  - This research shows the relevance of PSW methods for differential diagnosis of learning disability in
    - **reading** (e.g., Feifer, Gerhardstein, Flanagan, Fitzer, & Hichs, 2014),
    - **math** (e.g., Kubas, Drefs, Poole, Schmid, Holland, & Fiorello, 2014), and
    - **written expression** (e.g., Fenwick, Kubas, Witzke, Fitzer, Miller, Maricle, & Hale, 2015).
  - Valid points are made about the *potential strengths of PSW* models in this literature.
- While valid points are made for and against the use of PSW models, the results of the studies that have been published to date are impacted by methodological preferences used to analyze the data as well as the accuracy/inaccuracy of the assumptions made about each PSW model.

PSW Models: The Controversy

- There will be arguments for and against PSW over the next several years.
- All methods have limitations; PSW is no exception. Nevertheless, it most certainly can be used effectively *to inform SLD diagnosis*.
- Until the critics produce a ***better method***, PSW will predominate and the battles will focus on which PSW method should be used in the schools.

Bottom Line

- ***There is no SLD litmus test***; the more well-versed you are in different approaches and methods, the more information you will gain about the student (including how to best help him or her)



Identification of SLD

- **Involves more than just examining scores from standardized tests or progress monitoring data**
  - A convergence of data sources is necessary
  - Data should be gathered via different methods
  - Exclusionary factors must be considered and examined systematically

Three Important Tasks for All School Personnel

- Work to ensure that RTI is up and running well, most especially in the early grades
- Work closely with teachers to create a supportive environment for students where they can access the curriculum at their instructional level

Three Important Tasks for All School Personnel

- Conduct comprehensive assessments of students who do not respond as expected to quality instruction and intervention
  - Include cognitive/neuropsychological tests
  - Connect assessment findings to instructional strategies and interventions

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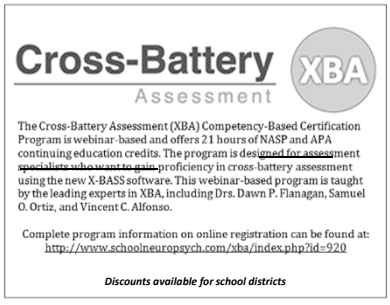

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Questions?

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