Unit 3, Part 2 Objectives

• To understand that XBA and PSW are independent and conceptually distinct procedures that are often used together
• To understand that the data gathered through XBA complements other data sources, such as data from RTI or MTSS
• To understand the purpose of the PSW-A component of X-BASS and related tabs
• To understand when and how to use the PSW-A component of X-BASS and related tabs
• To be able to interpret PSW-A output
Unit 3, Part 2 Content

• Overview of specific learning disability identification
• Introduction and functionality of the PSW-A
• Entering scores and interpreting output step-by-step
• Guidance on determining what scores to include in a PSW analysis and how to ensure that a student’s range of strengths and weaknesses are included

Unit 3, Part 2 Learning Outcomes

Participants will be able to:

• Demonstrate knowledge of the purpose of the PSW-A and the method upon which it was based
• Demonstrate knowledge of when to use the PSW-A
• Use the PSW-A appropriately when given a set of data to enter
• Interpret PSW-A output
The Cross-Battery Assessment Approach

OVERVIEW OF SLD IDENTIFICATION

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”
(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)**

---

**Ability-Achievement Discrepancy is Insufficient for SLD Identification Because:**

- It fails to adequately differentiate between students with LD from students who are low achievers.
- It is based on the erroneous assumption that IQ is a near-perfect predictor of achievement and is synonymous with an individual’s potential.
- It is applied inconsistently across states, districts, and schools, rendering the diagnosis arbitrary and capricious.
- A discrepancy between ability and achievement may be statistically significant, but not clinically relevant.
- It is a wait-to-fail method because discrepancies between ability and achievement typically are not evident until the child has reached the 3rd or 4th grade.
- It does not identify the area of processing deficit.
- It leads to over-identification of minority students.
- It does not inform intervention.

RTI Cannot Be Used Alone For SLD Identification Because:

- RTI advocates cannot agree whether a standard protocol or a problem-solving RTI approach should be used.
- There is no agreed-upon curriculum, instructional methods, or measurement tools with adequate technical quality for use in an RTI model.
- RTI research has primarily focused on word reading, and methods across grades and different content areas have not been examined sufficiently.
- There is no consensus on what constitutes an empirically based approach, and whether using a single-subject design is sufficient to make any approach "empirical."
- There is no consensus on how to determine response, or lack of response, with different methods, resulting in different children being labeled as responders or nonresponders.
- There is no consensus on establishing appropriate achievement benchmarks or intervention timelines to determine the aim line slope (a critical component of determining individual responsiveness).
- There are no agreed-upon methods for teacher training or supervision methods to ensure interventions are carried out with integrity.
- There is no possible way to determine whether a child who is nonresponsive to intervention meets SLD statutory requirements.
- Failure to respond to intervention can happen for multiple reasons, only one of which is SLD.


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
“At the current state of scientific knowledge, it is only through a comprehensive evaluation of a student’s cognitive and psychological abilities and processes that insights into the underlying proximal and varied root causes of [academic] difficulties can be ascertained and then specific interventions be provided targeted to each student’s individual needs, a process long advocated.”

From Reynolds and Shaywitz (2009)

RTI and Cognitive Assessment Data – Both Important for SLD Identification

RTI has us look through a wide-lens telescope at the entire school population [and where the student is represented within that population] whereas cognitive assessments provide a microscope with a direct intensive focus on an individual's specific needs [relative to same age peers from the general population.]

Nancy Mather and Alan Kaufman, 2006, p. 751

Parenthetic information added
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.

**RTI and Cognitive Assessment Data – Both Important for SLD Identification**

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

**Source:**

---

**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.

**Source:**
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.
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 both psychometrically and theoretically defensible.

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.
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.

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.
- Requires understanding of what SLD is and is not.

D. P. Flanagan, 2017
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
  - Requires understanding of what SLD is and is not

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
Learning efficiency (GA): The ability to learn, store, and consolidate new information over periods of time measured in minutes, hours, days, and years.

- Associative memory (MA): The ability to form a link between two previously unrelated stimuli such that the subsequent presentation of one of the stimuli serves to activate the recall of the other stimuli.
- Meaningful memory (MM): The ability to remember narratives and other forms of semantically related information.
- Free recall memory (MR): The ability to recall lists in any order.

Retrieval fluency (Gr): The rate and fluency at which individuals can access information stored in long-term memory.

- 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.
- Associational fluency (FA): The ability to rapidly produce a series of original or useful ideas related to a particular concept.
- Sensitivity to problems/alternative solution fluency (SP): The ability to rapidly think of several alternative solutions to a practical problem.
- Originality/creativity (FO): The ability to rapidly produce original, clever, and insightful responses (expressions, interpretations) to a given topic, situation, or task.
- 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).
- 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.

For the latest Revisions and Refinements to CHC Theory see Schneider and McGrew’s chapter in:


Publication Date: 2018

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
- Requires understanding of what SLD is and is not
CHC Factors on the WJ IV COG

Gf/Gc Composite

Gc  Gf  Gwm  Glr  Ga  Gv  Gs

VL  KD  RQ  I  MW  MM  MA  PC  Vz  MV  P  P

Contribute to GIA

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

Narrow Ability an Other Clinical Clusters on the WJ IV COG

Gf  Gwm  Gs  Gs  Gc  CE

RQ  MS  N  P  VL/LD

Cognitive Efficiency with Numbers

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

Composition of the WISC-V Full Scale IQ

Allowable Substitutions for Core FSIQ Subtests (Only 1 Permitted)
**WISC-V Primary Index Scales**

- **VCI** (Similarities, Vocabulary)
- **VSI** (Block Design, Visual Puzzles)
- **FRI** (Matrix Reasoning, Figure Weights)
- **WMI** (Digit Span, Picture Span)
- **PSI** (Coding, Symbol Search)

**No Substitutions are Permitted**

- **Gc** (Similarities, Vocabulary)
- **Gv** (Block Design, Visual Puzzles)
- **Gf** (Matrix Reasoning, Figure Weights)
- **Gsm** (Digit Span, Picture Span)
- **Gs** (Coding, Symbol Search)

---

### 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
- Requires understanding of what SLD is and is not

---

D. P. Flanagan, 2017
Math Achievement

Executive functions, such as attention, planning, and self-monitoring are also important.

Orthographic Processing (often measured by tests of perceptual speed that use orthographic units as stimuli) is very important for math problem solving at all ages. Executive functions, such as set shifting and cognitive inhibition are also important.

Language development (LD), lexical knowledge (VL), and listening abilities (LS) are important at all ages for reading acquisition and development. These abilities become increasingly important with age.

Visual memory or WM for visual and sound-based information is also important for reading comprehension.

Perceptual speed (P) abilities are important during all school years, especially the elementary school years for basic math calculation fluency.

Motor memory are needed for spelling, whereas working memory has shown relations with advanced writing skills (e.g., written expression, synthesizing multiple ideas, ongoing self-monitoring). Working memory 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). Working memory is important for overall writing success.

Dyscalculic children born pre-term – less gray matter in IPS (Isaacis, Edmonds & Lucey, 2001)

Dyscalculic adults born pre-term – less gray matter in IPS (Isaacis, Edmonds & Lucey, 2001)

Brain bases of dyscalculia

Dyscalculic children – less grey matter in IPS (Rotzer et al., 2008)

Dyscalculic adults born pre-term – less gray matter in IPS (Isaacis, Edmonds & Lucey, 2001)

Dyscalculic children born pre-term – less gray matter in IPS (Isaacis, Edmonds & Lucey, 2001)

Dyscalculic children – less activation in IPS during magnitude tasks (Kucian et al., 2006)

IPS = Intra-parietal sulcus

SLD has neurobiological influences, is a brain-based disorder, and is defined by specific cognitive processing weaknesses
Neural Systems for Reading

**Rapid naming**—some researchers have found that phonological awareness and rapid naming both uniquely predict word recognition skills (Chiebaker, Pucheler, Alain, & Foorman, 2004; Wagner, Torgesen, & Rashotte, 1994). Wagner, Torgesen, Rashotte, & Hecht, 1997). Moreover, a meta-analysis of studies examining the relationship between rapid naming and phonological awareness found evidence to support a central and persistent deficit in naming speed in individuals with dyslexia (Chiebaker, 2004). On the other hand, there are findings to suggest that phonological awareness and rapid naming, although correlated, are distinct variables and combine uniquely to word recognition (Perfetti, Berndt, Thompson, & Share, 1991).

**Phonological memory**—reading accuracy for verbal and visual-based information has also been found to be significantly related to word recognition, although it may not uniquely contribute to phonological processing as assessed for (Wagner, Torgesen, & Rashotte, 1994; Willett, et al., 1997).
### SLD Area

#### Reading comprehension
- Several brain regions are often implicated in reading comprehension. These include the inferior temporal lobe, inferior temporal gyrus, inferior frontal gyrus, inferior frontal sulcus, and middle and superior frontal and temporal regions (Perfetti et al., 2008; Gernsbacher & Kaushik, 2003).
- 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” (Bridgers et al., 2010). However, broader pathways are also activated in reading comprehension, reflecting increased cognitive demand compared to listening comprehension.
- Genetic factors are said to account for 45 to 70 percent of the variance in comprehension performance (e.g., Perfetti et al., 2008; Badura, Duker, & Mattia, 2007; Jentsl et al., 2007). While genetic factors that influence decoding and listening comprehension account for nearly 45 percent of the variance in reading comprehension, there is little evidence for an independent source of genetic influence on comprehension alone (Hunt et al., 2017; Kersna et al., 2009).
- However, estimating the genetic influence on reading comprehension may be particularly sensitive using a twin type developmental test size (Perfetti, Koen, Olson, & DeFries, 2011).

#### Math
- Number sense: Researches differentiate between the symbolic processing of numerical information and processes involved in math calculation and problem solving, suggesting that there are both structurally and functionally distinct (Ansari, 2010). The intraparietal sulcus in both hemispheres is widely viewed as crucial in processing and representing numerical quantity, although there may be differences in activation as a function of age (Ansari & Dhind, 2005; Ansari, Coates, Lussu, Hamon, & Dhind, 2005; Dehnane et al., 2004). Kaufmann et al., 2008; Klassen, von Aster, Loomrocker, Domet, & Martin, 2010; Pinto & Ansari, 2013, Morin, et al., 2010.

### Associated Impairments / Cognitive Correlates

#### Oral language - difficulties in reading comprehension are frequently associated with deficits in oral language in general, including areas such as vocabulary, morphological, and phonetic deficits (Catts et al., 1999; Cutting & Scarborough, 2006; Gough & Tunmer, 2006; Torgesen, 2000; Wimmer et al., 2013).

#### Listening comprehension - several studies have demonstrated that a unique portion of the variance in reading comprehension can be explained by listening comprehension (Cutting & Scarborough, 2006; Bendor, van den Broek, White, & Lynch, 2009).

### Working memory - comprehension involves holding words and sentences in awareness, while integrating prior knowledge with incoming information (Cawelti et al., 2005). Poor comprehension may have particular difficulty updating and revising information already in working memory (Pellegrino et al., 2014).

### Executive functioning - several executive functions are involved in reading comprehension, including planning, organization, and self-monitoring (Cutting & Scarborough, 2006; Locascio, et al., 2005; Seena et al., 2009). Weakness in these executive functions result in difficulties with higher-order comprehension skills such as inferring, integrating prior knowledge, monitoring comprehension, and adapting to text structure or genre (Rice et al., 2007).

---

### SLD Area

#### Number sense
- Number representation - math disorders are associated with weaknesses in fundamental number representation and processing, which manifest as difficulties with quantifying sets without counting, using non-verbal processes to complete simple numerical operations, and estimating the relative magnitude of sets (Geary, 2004; Geary, Aquilino, & Byrnes, 2001; Geary et al., 2000; Geary et al., 2003; Halford et al., 2006; Rabin & Geary, 2014; Faglione, Dabene, & Spelke, 2004; Macaruso, Faglione, & Halford, 2011).

#### Memory
- Long-term retrieval - weak or impaired long-term retrieval of facts and increased errors in recall (Geary, 1995; Petmecky, Reynolds, & McIvor, 2000). Because fact retrieval mechanisms fail to develop adequately, fluency is impaired and these with dyslexia continue to utilize procedural memory strategies that are memory-based strategies (Geary, Nowell, & Yan, 1992; Geary, Hamson, & How, 2006; Jordan & Halich 2009; Halich et al., 2001; Lumer, Bever, & Butterworth, 2004).
<table>
<thead>
<tr>
<th>SLD Area</th>
<th>Skill</th>
<th>Etiology</th>
<th>Associated impairments / Cognitive correlates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Accuracy on fluent calculation</td>
<td>Regions of the left fronto-parietal cortex, including the intraparietal sulcus, angular gyrus, and supramarginal gyrus, have been consistently associated with math calculation (Annett, 2008; De Smedt, Holloway, &amp; Ansari, 2011; Delanie, Melko, Cohen, &amp; Wilson, 2004; Delmano et al., 2004). However, there is evidence to suggest that math fluency, while related to other skills, may be genetically distinct and may reflect variance above and beyond arithmetic calculation abilities (Har, Perrett, &amp; Thompson, 2010; Perrett et al., 2012). The dysplasia of the 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).</td>
<td>Long term retrieval - weak or impaired long-term retrieval of facts and increased errors in recall (Gorny, 1993; Mazocco, Devlin, &amp; McKenney, 2009). Because the retrieval mechanisms fail to develop adequately, fluency is impaired and those with dyscalculia continue to utilize procedural strategies rather than memory-based strategies (Gray, Bow Thomas, &amp; Tao, 1992; Gory, Harmsen, &amp; Hoed, 2000; Jordan &amp; Hanich 2000; Hanich et al., 2001; Landers, Bevins, &amp; Sherwood, 2004).</td>
</tr>
</tbody>
</table>

<p>|          | Math Problem Solving | As mentioned above, the intraparietal sulcus is often identified as a neural correlate of math disorders. However, it is likely that an entire network of brain regions is implicated, as the intraparietal sulcus plays a role in a variety of cognitive processes involved in math achievement (Sanz &amp; Greveni, 2013). It has been suggested that the posterior network is involved in manipulating numerical quantities (Lemer et al., 2005). Further, some studies have found that individuals with dyscalculia have structural abnormalities in the parietal cortex (Ritter et al., 2003; Rykhlevskaya et al., 2009). | Prevalence of math difficulties is about 10 times higher in those with family members who had math disabilities (Shalir et al., 2001). Twin studies suggest a moderate genetic influence, with some studies finding additive genetic influence shared between math calculation and problem solving and several working memory components (Kovas et al., 2007; Lakeresiva et al., 2017). Environmental factors, including motivation, emotional functioning (e.g., math anxiety), and suboptimal or inadequate teaching may also contribute to math difficulties (Sanz &amp; Greveni, 2013; Vaetor et al., 2013). Further, math achievement in particular may be associated with cultural or gender-based attributes that may be transmitted in the family environment (e.g., Chiu &amp; Kwan, 2010; Ganderson et al., 2011). | Working memory - because mathematical reasoning relies on concurrently maintaining multiple pieces of information while performing one or more procedures or mental operations, working memory is often implicated. Those with math difficulties tend to struggle with holding information in working memory, updating or revising the information, and tracking or monitoring the process, resulting in difficulties in sequencing, increasing errors in counting, and other procedural errors (Gory, 1993; Lukeswi et al., 2014; Palenques et al., 2014; Peng &amp; Pach, 2014; Righel, Franc, &amp; Herli, 2010; Svenow &amp; Jem, 2008; Willett et al., 201). Visual spatial ability - as visual spatial skills, such as visual perception, spatial reasoning, and mental rotation, have been found to influence math performance (Ganderson et al., 2012). Weaknesses in these may prevent or difficulty in representing numbers and aligning numerals, and problems in scene such as geometry in fractions (Gory, 2004; Svenow &amp; Jem, 2006). Attention and executive functioning - math difficulties often reflect weakening in executive functioning skills, such as shifting and cognitive inhibition (D’Amico &amp; Pascual-Font, 1999; van der Sk, de Jong, &amp; van der Leij, 2004; Willett et al., 2013). Further, poor attentional control (i.e., difficulty ignoring irrelevant information and focusing on goal-relevant information) is often observed (Gory, 2003). |</p>
<table>
<thead>
<tr>
<th>SLD Area</th>
<th>Skill</th>
<th>Etiology</th>
<th>Associated impairments / Cognitive correlates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Written Expression</td>
<td>Spelling accuracy</td>
<td>Functional neuroimaging studies have provided substantial evidence for the role of the central temporal inferior frontal gyrus and the posterior inferior frontal gyrus in spelling (Rapp et al., 2015; van Hoeij et al., 2013). Other areas that have been identified include the left middle frontal gyrus, bilateral inferior frontal gyrus (Bennett et al., 2012; Paccini et al., 2014; Richland et al., 2005; Richland et al., 2006). However, many of these regions have also been associated with reading and are not distinct to spelling-writing disorders.</td>
<td></td>
</tr>
</tbody>
</table>

There is evidence that links spelling to a region of chromosome 19 (Scharske-Kenze, 2005), although this region has also been reported in dyslexia (Grigorenko, 2005).

| Grammar and punctuation | With regard to English grammar, some researchers distinguish between the morphosyntactic (i.e., morphological and phonological) and semantic aspects. The former involves the application of rules to words, while the latter involves the use of context to determine the meaning of words. There is some evidence to support this view, with data indicating that the former involves the left-temporal-parietal regions, while the latter involves the left-hemisphere regions (Ullman et al., 2005). |

Long-term memory — It has been suggested that some components of long-term memory, particularly procedural and declarative memory, may be involved in spelling. However, much of this research has focused on children with language impairments (Coady, 2000).

| Clarity of written expression | Neural correlates of writing are less understood, but some studies have suggested that the cerebellum and parietal cortex, particularly the left inferior parietal lobe, may be involved (Kana and Adolphs, 2003). In addition, the frontal lobes have also been implicated in the recruitment of neuronal circuits for planning, brainstorming, organizing, and goal setting (Rhodes et al., 2013). |

While there is a significant genetic component involved in the development of writing skills, the extent to which is often shared with a broad variety of reading and language skills (Klein et al., 2013).

Attention and executive functioning — A variety of executive functions, including attention, planning, self-monitoring, and working memory, have been implicated in written expression (Allison, Jones, Albright, & Bremner, 2004; Graham, Gilmore, & McKeown, 2013; Graham & Harris, 2003; Roepker et al., 2002; Murnin, Harris, & Gerken, 2011; Bower, Tebo, & Lange, 2005; Rosebank et al., 2009; Trosky & Graham, 2002).

Language — The level of knowledge of syntax, morphology, semantics, vocabulary has a significant impact on text generation abilities (Doddrell, Lindsey, & Connelly, 2000; Fey, Catts, Proctor Williams, Tomika, & Zhang, 2004; O’Doherty & Wilson, 2017). Language impairments are associated with higher rates of grammatical error, less lexical diversity, and poorer overall content (Fey et al., 2004; Mackie & Doddrell, 2004).
Summary of Relations between CHC Abilities and Neuropsychological Processes and Reading Achievement and the Etiology of Reading Functions

<table>
<thead>
<tr>
<th>CHC Broad Ability</th>
<th>Reading Achievement</th>
<th>Etiology of Reading Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gf</strong></td>
<td>Inductive (I) and general sequential reasoning (RG) abilities play a moderate role in <em>reading comprehension</em>. Executive functions such as planning, organization, and self-monitoring are also important. Several cortical and subcortical structures are frequently implicated in <em>basic reading skills</em> and <em>word reading accuracy</em>. 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, Papanicolau, &amp; Denton, 2004; Richardson et al., 2000; Richlan, 2012). Numerous imaging studies have also found that dysfunctional responses in the left inferior frontal and tempo-parietal cortices play a significant role with regard to phonological deficits (Skrede et al., 2010). Similar brain regions are activated on tasks involving <em>reading fluency</em>, but additional activation is observed in areas involved in eye movement and attention (Jones, Ashby, &amp; Brangian, 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 &amp; Cohen, 2011). Brain regions often associated with <em>reading comprehension</em> include the anterior temporal lobe, inferior temporal gyrus, inferior frontal gyrus, inferior parietal, and middle and superior frontal and temporal regions (Furst et al., 2008; Gemmachers &amp; Kaschat, 2003). More recent research has revealed a relationship between <em>reading comprehension</em> and activation along the left superior temporal sulcus, which has referred to by some as the “comprehension cortex” (Bist et al., 2013). However, broader pathways are also activated in reading.</td>
<td></td>
</tr>
<tr>
<td><strong>Gc</strong></td>
<td>Language development (LD), lexical knowledge (VL), and listening ability (LS) are important at all ages for <em>reading acquisition and development</em>. These abilities become increasingly important with age. Oral Language, Listening Comprehension, and EF (planning, organization, self-monitoring) also important for <em>reading comprehension</em>.</td>
<td></td>
</tr>
<tr>
<td><strong>Gw</strong></td>
<td>Memory span (MS) and working memory capacity (WM) or attentional control are important for <em>overall reading</em> success. Phonological memory or WM for verbal and sound-based information may also be important. WM is important for <em>reading comprehension</em>, which involves holding words and sentences in awareness, while integrating prior knowledge with incoming information.</td>
<td></td>
</tr>
<tr>
<td><strong>Gy</strong></td>
<td>Orthographic processing (often measured by tests of perceptual speed that use orthographic units as stimuli) is related to <em>reading rate</em> and <em>fluency</em>. Orthographic processing involves the ability to process units of words based on visual long-term memory representations, which is critical for automatic word recognition.</td>
<td></td>
</tr>
<tr>
<td><strong>Gs</strong></td>
<td>Phonetic coding (PC) or phonological awareness / processing is very important during the elementary school years for <em>basic reading skills</em> and <em>word reading accuracy</em>. Phonological memory or WM for verbal and sound-based information may also be important.</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>CHC Broad Ability</th>
<th>Reading Achievement</th>
<th>Etiology of Reading Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gfr</strong></td>
<td>Naming facility (NA) or rapid automatic naming (RAN; also called speed of lexical access) is very important during the elementary school years for <em>reading rate</em> and <em>fluency</em> or <em>word recognition skills</em>. <em>Associative memory</em> (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 &amp; Clifton, 2005). Shared environmental factors include: language and literacy environment during childhood (Wadsworth et al., 2010), and quality of reading instruction.</td>
<td></td>
</tr>
<tr>
<td><strong>Gs</strong></td>
<td>Perceptual speed (P) abilities are important throughout school, but particularly during the elementary school years.</td>
<td></td>
</tr>
</tbody>
</table>

Note: Information in this table was culled from the following sources: Flanagan, Ortiz, Alfonse, & Mascolo, 2000; Flanagan, Ortiz, & Alfonse, 2013; McDonough, Flanagan, Sy, & Alfonse, 2017; McGrow & Wendling, 2010; McGrow et al., 2014.)
## Summary of Relations between CHC Abilities and Neuropsychological Processes and Math Achievement and the Etiology of Math Functions

<table>
<thead>
<tr>
<th>CHC Broad Ability</th>
<th>Math Achievement</th>
<th>Etiology of Math Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Re</td>
<td>Reasoning inductively (R) and deductively with numbers (RQ) is very important for <strong>math problem solving</strong>. Executive functions such as set shifting and cognitive inhibition are also important.</td>
<td>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 &amp; Dhital, 2008; Ansari, Garcia, Lucas, Hamon, &amp; Dhital, 2005; Dehaene et al., 2004; Kaufmann et al., 2006; Kucian, von Aster, Loenneker, Dietrich, &amp; Martin, 2008; Price &amp; Ansari, 2013; Mussolin et al., 2010). Regions of the left fronto-parietal cortex, including the intraparietal sulcus, angular gyrus, and supramarginal gyrus have been consistently associated with <strong>math calculation</strong> (Ansari, 2008; De Swart, Holloway, &amp; Ansari, 2011; Dehaene, Mokro, Cohen, &amp; 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 (Dow et al., 2005). A left hemispheric network that includes the precentral gyrus, inferior parietal cortex, and intraparietal sulcus, is often implicated in <strong>math fact retrieval</strong> (Dehaene &amp; Cohen, 1992; Dehaene &amp; 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 &amp; Cohen, 1995; Dehaene et al., 1999). Prevalence of math disabilities is about 10 times higher in those with family members who had math disabilities (Shalev et al., 2001). Environmental factors, including motivation, emotional</td>
</tr>
<tr>
<td>Re</td>
<td>Language development (LD), lexical knowledge (VL), and listening ability (LS) are important at all ages for <strong>math problem solving</strong>. These abilities become increasingly important with age: Number representation (e.g., quantifying sets without counting, estimating relative magnitude of sets) and number comparisons are related to overall <strong>number sense</strong>.</td>
<td></td>
</tr>
<tr>
<td>Vis</td>
<td>Memory span (MS) and working memory capacity (WMC) or attention control are important for <strong>math problem solving</strong> and overall success in math.</td>
<td></td>
</tr>
<tr>
<td>Vis</td>
<td>Visualization (VZ), including mental rotation, is important primarily for higher level math (e.g., geometry, calculus) and <strong>math problem solving</strong>.</td>
<td></td>
</tr>
<tr>
<td>Na</td>
<td>Naming facility (NA; also called speed of lexical access) and associative memory (MA) are important for memorization and rapid retrieval of <strong>basic math facts</strong> and for accurate and fluent calculation.</td>
<td></td>
</tr>
<tr>
<td>Per</td>
<td>Perceptual speed (P) is important during all years, especially the elementary school years for <strong>math calculation fluency</strong>.</td>
<td></td>
</tr>
</tbody>
</table>
Summary of Relations between CHC Abilities and Neuropsychological Processes and Writing Achievement and the Etiology of Writing Functions

<table>
<thead>
<tr>
<th>CHC Broad Ability</th>
<th>Writing Achievement</th>
<th>Etiology of Writing Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>GR</td>
<td>Inductive (I) and general sequential reasoning (RS) are consistently related to written expression at all ages. Executive functions such as attention, planning, and self-monitoring are also important.</td>
<td>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). 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 (Plaxton et al., 2013; Purcell et al., 2014; Richards et al., 2005; Richards et al., 2008). However, many of these regions have also been associated with reading and are not distinct to spelling/writing disorders. 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).</td>
</tr>
<tr>
<td>GA</td>
<td>Language development (LD), lexical knowledge (VL), and general information (KI) 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.</td>
<td></td>
</tr>
<tr>
<td>WM</td>
<td>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).</td>
<td></td>
</tr>
<tr>
<td>GR</td>
<td>Orthographic processing (often measured by tests of perceptual speed that use orthographic units as stimuli) is particularly important for spelling.</td>
<td></td>
</tr>
<tr>
<td>GA</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>GR</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>GS</td>
<td>Perceptual speed (PS) is important during all school years for basic writing skills and is related to written expression at all ages.</td>
<td></td>
</tr>
</tbody>
</table>

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
- Requires understanding of what SLD is and is not

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

GUIDING PRINCIPLES – VERY BRIEF REVIEW

The Cross-Battery Assessment Approach
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*).
 EFI = Matrix Reasoning + Figure Weights + Picture Concepts + Arithmetic

Table 2: Expanded Fluid Index Equivalents of Sums of Scaled Scores

<table>
<thead>
<tr>
<th>Sum of Scaled Scores</th>
<th>EFI</th>
<th>Percentile Rank</th>
<th>95% Confidence Interval</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>46</td>
<td>&lt;0.1</td>
<td>43-53</td>
<td>42-54</td>
</tr>
<tr>
<td>5</td>
<td>46</td>
<td>&lt;0.1</td>
<td>43-54</td>
<td>42-55</td>
</tr>
<tr>
<td>6</td>
<td>46</td>
<td>&lt;0.1</td>
<td>43-56</td>
<td>42-57</td>
</tr>
<tr>
<td>7</td>
<td>46</td>
<td>&lt;0.1</td>
<td>43-57</td>
<td>42-58</td>
</tr>
<tr>
<td>8</td>
<td>51</td>
<td>0.1</td>
<td>48-59</td>
<td>47-60</td>
</tr>
<tr>
<td>9</td>
<td>51</td>
<td>0.1</td>
<td>48-60</td>
<td>47-61</td>
</tr>
<tr>
<td>10</td>
<td>55</td>
<td>0.1</td>
<td>52-62</td>
<td>51-63</td>
</tr>
<tr>
<td>11</td>
<td>57</td>
<td>0.2</td>
<td>54-64</td>
<td>53-65</td>
</tr>
<tr>
<td>12</td>
<td>59</td>
<td>0.3</td>
<td>56-66</td>
<td>55-67</td>
</tr>
<tr>
<td>13</td>
<td>60</td>
<td>0.4</td>
<td>57-67</td>
<td>56-68</td>
</tr>
<tr>
<td>14</td>
<td>62</td>
<td>0.5</td>
<td>59-69</td>
<td>58-70</td>
</tr>
<tr>
<td>15</td>
<td>65</td>
<td>0.6</td>
<td>62-70</td>
<td>61-71</td>
</tr>
<tr>
<td>16</td>
<td>68</td>
<td>0.7</td>
<td>65-72</td>
<td>64-73</td>
</tr>
<tr>
<td>17</td>
<td>70</td>
<td>0.8</td>
<td>67-73</td>
<td>66-74</td>
</tr>
<tr>
<td>18</td>
<td>72</td>
<td>0.9</td>
<td>69-74</td>
<td>68-75</td>
</tr>
<tr>
<td>19</td>
<td>75</td>
<td>1.0</td>
<td>72-75</td>
<td>71-76</td>
</tr>
</tbody>
</table>

Table 1: Verbal (Expanded Crystallized) Index Equivalents of Sums of Scaled Scores

<table>
<thead>
<tr>
<th>Sum of Scaled Scores</th>
<th>XECI</th>
<th>Percentile Rank</th>
<th>95% Confidence Interval</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>45</td>
<td>&lt;0.1</td>
<td>43-53</td>
<td>42-54</td>
</tr>
<tr>
<td>5</td>
<td>47</td>
<td>&lt;0.1</td>
<td>43-54</td>
<td>42-55</td>
</tr>
<tr>
<td>6</td>
<td>49</td>
<td>&lt;0.1</td>
<td>43-56</td>
<td>42-57</td>
</tr>
<tr>
<td>7</td>
<td>50</td>
<td>&lt;0.1</td>
<td>43-57</td>
<td>42-58</td>
</tr>
<tr>
<td>8</td>
<td>52</td>
<td>0.1</td>
<td>49-60</td>
<td>48-61</td>
</tr>
<tr>
<td>9</td>
<td>54</td>
<td>0.1</td>
<td>51-62</td>
<td>50-63</td>
</tr>
<tr>
<td>10</td>
<td>55</td>
<td>0.1</td>
<td>52-62</td>
<td>51-63</td>
</tr>
<tr>
<td>11</td>
<td>57</td>
<td>0.2</td>
<td>54-64</td>
<td>53-65</td>
</tr>
<tr>
<td>12</td>
<td>59</td>
<td>0.3</td>
<td>56-66</td>
<td>55-67</td>
</tr>
<tr>
<td>13</td>
<td>60</td>
<td>0.4</td>
<td>57-67</td>
<td>56-68</td>
</tr>
<tr>
<td>14</td>
<td>62</td>
<td>0.5</td>
<td>59-69</td>
<td>58-70</td>
</tr>
</tbody>
</table>

XBA Guiding Principle: Use Actual Norms Whenever They Are Available
When differences occur they are *negligible* (i.e., not significant). X-BASS composites are derived using the most psychometrically defensible procedures.

**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

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
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
- Requires understanding of what SLD is and is not
An Operational Definition of SLD
Flanagan, Ortiz, Alfonso, and Mascolo

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

• Revised and updated in 2011
• Updated and Renamed in 3e of Essentials of XBA3: Dual Discrepancy/Consistency (DD/C)
The Dual Discrepancy/Consistency (DD/C) Operational Definition of SLD (Continued)

IV. The specific learning disability is a discrete condition differentiated from processed learning ability 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: A full test of the student’s academic skills, cognitive abilities, and cooperative behaviors is essential. The PSW is marked by a pattern of significant strength and weakness, including specific cognitive areas.

Data gathered at all previous levels as well as any additional data following a series of educational evaluations to determine the student’s performance in the areas of reading, mathematics, and written language. The data is summarized below a range of achievement consistency, which is defined as the intersection of specific cognitive areas and academic skills.

Sufficient For SLD Identification

V. Specific learning disability has an adverse impact on educational performance.

Special Education Eligibility

Determination of Least Effective Environment (LRE) for delivery of instruction and educational services.

Data from all previous levels and this setting, 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

This column includes conceptualizations from the federal definition (IDEA, 2014), Kavale, Sprung, and Simons (2009) definition, Ramon and Bolmer (2012) conceptual definition, and other prominent definitions of SLD (see Sodel-Potenza, Flanagan & Alfonso, 2015 for a summary).
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**
  - **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**
Conceptual Understanding of the Dual Discrepancy/Consistency (DD/C) Method

COGNITIVE STRENGTHS
Aggregate of cognitive strengths suggest at least average general ability
May be supported by typically developing academic skills

ACADEMIC WEAKNESS/DEFICIT
Academic Skills
Weaknesses

Consistent

Actual cognitive area of weakness is significantly lower than expected based on estimated general cognitive ability
Cognitive deficit(s) is specific, not general or pervasive, because aggregate of cognitive strengths suggests at least average general ability (i.e., 85 or higher)

Actual academic area of weakness is significantly lower than expected based on estimated general cognitive ability
Academic deficit(s) is unexpected because aggregate of cognitive strengths is at least average (i.e., 85 or higher) (and other factors were ruled out, such as inadequate instruction)

COGNITIVE WEAKNESS/DEFICIT
Cognitive Ability and/or Processing Weaknesses

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

• 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

X-BASS (Flanagan, Ortiz, & Alfonso, 2015-2017) is necessary to conduct the DD/C PSW analysis
Essential Elements of PSW based on DD/C
Operational Definition of SLD
Flanagan, Ortiz, and Alfonso (2002-2017)

- **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

---

**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

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).


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


"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*”
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...


Two Automated PSW Methods

WIAT-III/KTEA-3/WISC-V and X-BASS
Q-global Platform

• PSW Analysis available as an option on WIAT-III and KTEA-3 score reports

Let’s Look at How WISC-V Data Can Be Used in a PSW Analysis (as Suggested by the Publisher)
Methodological and Statistical Requirements for the PSW Analysis According to WISC-V Technical and Interpretive Manual (p. 183)

- The scores within each of the following comparisons must be significantly different (discrepant) to fit the model’s criteria for SLD identification:
  - Processing strength vs. achievement weakness
  - Processing strength vs. processing weakness

- A third score comparison requiring consistency between the achievement weakness and the processing weakness is not included because it is not a statistical requirement of the model for identifying an SLD

D. P. Flanagan, 2017

Steps for Conducting a PSW Analysis with the WISC-V and WIAT-III or KTEA-3 Using the Q-global Platform

- Select the individual’s primary area of academic weakness (i.e., a subtest or composite score from either the WIAT-III or KTEA-3, depending on which battery was used in the assessment).
  - Select a weakness that is associated with a standard score below 85, if possible and appropriate
  - Select a subtest or composite that corresponds to one of the eight IDEA-specified areas of SLD
  - If the variability in scores that make up a composite is statistically significant, consider using a subtest score within that composite rather than the composite itself

- Select the individual’s primary area of cognitive processing weakness (based on the WISC-V).
  - Consider current theory and research to ensure that the cognitive area of weakness is related to the academic area of weakness
  - Use cohesive index scores whenever possible

- Select the individual’s primary area of processing strength (based on the WISC-V).
  - Avoid using the WMI, PSI, AWMI, Naming Speed process or subtest scores, or SRI
  - Consider selecting a cognitive area of strength that is not typically related to the academic area of weakness
  - Use cohesive index scores whenever possible

Source:
D. Wechsler, WISC-V Technical and Interpretive Manual. Copyright © 2014 NCS Pearson, Inc. Adapted and reproduced by permission. All rights reserved.
Third Method WISC-V PSW Model

Avoid using the WMI, PSI, AWMI, SRI, or Naming Speed process or subtest scores due to relatively lower g-loadings as compared to other abilities

May Use Any Index, but VCI, VSI, FRI, and QRI are recommended

Consistency Component not Directly Addressed

Processing Weakness May be Represented by Any Index

Statistically Significant Difference set at p < .01

Academic Weaknesses May be Represented by Any WIAT-III or KTEA-III Subtest or Composite

Statistically Significant Difference set at p < .01

Difference Required for Significance may be set at p < .05


D. P. Flanagan, 2015

Need KTEA-3 or WIAT-III to Conduct PSW Analysis via Q-Global Score Reports
Third Method WISC-V PSW Model

Visual Spatial Index

Simple-Difference Method for Calculating Statistical Significance

Processing Speed Index

WIAT-III Word Reading

Use of Simple-Difference Method in SLD Identification will Over-Identify Students

D. P. Flanagan, 2016

<table>
<thead>
<tr>
<th>VSI &gt; PSI</th>
<th>P &lt; .05/.01</th>
<th>Base Rate</th>
<th>Difference needed for Base Rate of &lt; 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age 7</td>
<td>13/17 points</td>
<td>23/16%</td>
<td>22 points</td>
</tr>
<tr>
<td>Age 10</td>
<td>14/18 points</td>
<td>22/15%</td>
<td>22 points</td>
</tr>
<tr>
<td>Age 13</td>
<td>15/19 points</td>
<td>19/14%</td>
<td>22 points</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VSI &gt; Word Reading</th>
<th>P &lt; .05/.01</th>
<th>Base Rate</th>
<th>Difference needed for Base Rate of &lt; 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stdz Sample</td>
<td>10/13 points</td>
<td>&gt;25%/20%</td>
<td>23 points</td>
</tr>
</tbody>
</table>

Pattern of Strengths and Weaknesses Analysis

<table>
<thead>
<tr>
<th>Area of Achievement Weakness</th>
<th>WIAT-III</th>
<th>Basic Reading: 85</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area of Processing Weakness</td>
<td>WISC-V</td>
<td>VSI: 81</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Relative Strength Score</th>
<th>Relative Weakness Score</th>
<th>Difference</th>
<th>Critical Value</th>
<th>Significant Difference</th>
<th>Y/N</th>
<th>Supports SLD Hypothesis?</th>
<th>Yes/No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processing Strength/Achievement Weakness</td>
<td>100</td>
<td>85</td>
<td>15</td>
<td>9.00</td>
<td>Y</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Processing Strength/Processing Weakness</td>
<td>100</td>
<td>81</td>
<td>19</td>
<td>12.00</td>
<td>Y</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The PSW model is intended to help practitioners generate hypotheses regarding clinical diagnoses. The analysis should always be used within a comprehensive evaluation that incorporates multiple sources of information.

Pattern of Strengths and Weaknesses Model

15pt difference occurs in about 15% of the population

Is this relationship supported by research? Is it ecologically valid?

19pt difference occurs in about 10% of the population

Occurs in 20% of the population

Occurs in > 25% of the population
Limitations of the PSW Model Recommended for Use with the WISC-V

- Not clear why NVI and GAI cannot be used as area of “cognitive strength”
- Not clear why CPI and STI cannot be used as “cognitive weakness”
- Allows for VCI as a processing weakness, but VCI is Vocabulary Knowledge
- Because two subtests (e.g., VSI) can be used to represent a cognitive processing strength, SLD may be identified in students who have more pervasive cognitive weaknesses, not specific cognitive weaknesses
- Despite having completed 20-40 subtests, only three scores, or approximately 5-6 subtests are considered in the PSW analysis – what about everything else?
- Simple-difference method is not considered the best method for examining score differences for purposes of SLD determination
- Below Average Aptitude (Processing)-Achievement Consistency Component of PSW model is not directly addressed (may lead to Type 1 error – identifying SLD in error)

D. P. Flanagan, 2017

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

- Entering scores and interpreting output, step-by-step
- 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
- These 7 are necessary for the calculation of the g-value, FCC, and ICC
- Other areas that may be included in the PWS Analysis, but do not contribute to the g-value, ICC, or FCC
  - Executive Functions
  - Orthographic Processing
  - Speed of Lexical Access
  - Cognitive Efficiency
- Estimates Do Not Need to be Broad Cognitive Ability Estimates. Examples:
  - Broa 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
Additional Subtests were Administered

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

<table>
<thead>
<tr>
<th>Clinical Composite</th>
<th>Subtest Composition</th>
<th>Brief Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gc (Verbal Expression – Low)</td>
<td>Vocabulary + Information</td>
<td>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.</td>
</tr>
<tr>
<td>Gc (Verbal Expression – High)</td>
<td>Similarities + Comprehension</td>
<td>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.</td>
</tr>
<tr>
<td>Fluid-Crystallized Gf-Gc</td>
<td>Vocabulary + Information + Matrix Reasoning + Figure Weights</td>
<td>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, &amp; Schrank, 2014).</td>
</tr>
<tr>
<td>Working Memory (Alternative)</td>
<td>Digit Span Backwards + Digit Span Sequencing + Letter-Number Sequencing</td>
<td>Provides an alternative to the Auditory Working Memory Index (AWMI) by eliminating Digit Span Forward (a test of memory span).</td>
</tr>
<tr>
<td>Memory Span-Working Memory</td>
<td>Digit Span Forward + Digit Span Backward</td>
<td>Provides a balance of Memory Span and Working Memory and is consistent with the composition of the Digit Span subtest on the WISC-IV.</td>
</tr>
<tr>
<td>Working Memory (Cognitive Complexity – High)</td>
<td>Arithmetic + Picture Span</td>
<td>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.</td>
</tr>
</tbody>
</table>

**Note**: The table continues with additional composites not fully visible in the image.
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

The more scores you have, the greater the difference between highest minus lowest needs to be to warrant a non-cohesive composite; clinical judgment suggests that there are substantial differences between subtests within Gc (and lower scores are suggestive of weaknesses)

Use clinical judgment to explore variation

Transfer XBA Gc Composite to Data Organizer Tab
It is also necessary to represent this part of Gc in PSW analysis.

Transfer XBA Gc Composite to Data Organizer Tab
After transferring one composite from a CHC domain, you cannot delete the information, enter new information (thereby generating a new composite) and then transfer that one to Data Organizer tab.

**Use “Other Data Entry Tab”**

Type the name of your composite; enter score; transfer to Data Organizer 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?

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....
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”**

This tab permits limited use of scores for PIRDA analysis from tests/batteries that are not available in X-BASS, using core test tabs or drop down menus. Type in the name of a test composite (or subtotal) for academic domains only in the appropriate section and enter the score (Scaled or Standard Score for T Scores, use the converter at the bottom of the XBA Analyst) and click the corresponding button to transfer the data directly to the Data Organizer where it can be selected for use in subsequent PIRDA analysis. Note that composites/subtotals entered into X-BASS via this tab cannot be evaluated for inclusion, cannot be combined with other composites in form XBA composites, and cannot be evaluated within the CCM Analyst. As such, caution should be exercised whenever a decision is made to include and utilize scores entered on this tab in an evaluation of SD. In addition, information entered here will not be saved in the database. Once it has been transferred to the Data Organizer XBA after the active data record has been saved to update it.

Type the name of your “composite”; enter score; transfer to Data Organizer tab
**Cross-Battery Assessment Software System (X-BASS) v2.0**

The purpose of the task is to organize compatibly and subjects to assist in the selection of those to be used for evaluation of the pattern of strengths and weaknesses, in the XBA Assessor. Test names and scores can not be entered into this tab. Rather, this tab provides a summary of a first battery and subtests that were selected from the selected tab incorrectly by the user. The user would be considered the best estimates of the battery, academic area, and selected sensibly, psychologists and any other tab that the user would like to use in the XBA Assessor. According to the user, the chosen test battery will be used in the XBA Assessor.

**Guidelines for Selecting Best Composite Scores for SSI Evaluation**

1. **Crystallized Intelligence (g)**
   - **Visual Spatial Index (VISI)**
     - Box Design (Vis): 7
     - Visual Matching (Vis): 7
     
   *Additional scores can be found in the XBA Assessor’s drop down menu.

2. **Fluid Reasoning (gF)**
   - **Visual Matching (Vis)**
     - Visual Matching (Vis): 7
     - Visual Matching (Vis): 7

3. **Long-Term Storage and Retrieval (gL)**
   - **Working Memory Index (WMI)**
     - Digit Span (MMSV): 8
     - Picture Span (MMSV): 8
     - Letter-Number Sequencing (LNS): 7
   
   *Additional scores can be found in the XBA Assessor’s drop down menu.

4. **Short-Term Memory (gS)**
   - **WMIs Digit Span (Com, MMSV):**
     - Digit Span (Com, MMSV): 8
     - Digit Span (Com, MMSV): 8
   
   *Additional scores can be found in the XBA Assessor’s drop down menu.

5. **Composite Scores**
   - **COHESIVE**
   - **Mayo for short score**

   *Scores can be found in the XBA Assessor’s drop down menu.

---

*All scores are scaled scores generated by the XBA Assessor. Additional scores are available in the XBA Assessor’s drop down menu.*
Don’t Forget

- **Cognitive**: Only **composites** can be transferred to the Data Organizer Tab
  - You must transfer composites for a minimum of seven CHC domains to run a PSW analysis (i.e., Gc, Gf, Glr, Gsm, Gv, Ga, and Gs)
  - You may transfer broad or narrow ability composites
  - You may also include other cognitive data in the PSW Analysis (i.e., Executive functions, Orthographic Processing, Speed of Lexical Access, Cognitive Efficiency)
  - You may use “Other Data Entry” Tab for an average or better subtest score to represent an aspect of a broad ability when converging data are available to support average ability

- **Achievement**: Composites and subtest scores can be transferred to the Data Organizer 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.

Subtests
- Elision
- Blending Words
- Phoneme Awareness

Composite
- 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

- Elision (ss = 8)
- Blending Words (ss = 9)
- Phoneme Awareness (ss = 9)

Composite

- 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**
### WIAT-III Tab

#### Basic Reading (Grow-R)
- Word Reading (BRs): 102
- Pseudoword Decoding (PWS): 103

#### Reading Comprehension (RC)
- Reading Comprehension (RC): 82
- Cloze Reading Fluency (CRF): 88
- Early Reading Skills (ERS): 12

#### Written Expression (Grow-W)
- Spelling (HE): 100
- Alphabet Writing Fluency (WE): 98
- Sentence Composition (HSC): 96
- Essay Composition (HSC): 95

---

#### WIAT-III Tab

#### Basic Reading (Grow-R)
- Word Reading (BRs): 151
- Pseudoword Decoding (PWS): 133

#### Reading Comprehension (RC)
- Reading Comprehension (RC): 90
- Cloze Reading Fluency (CRF): 88

#### Written Expression (Grow-W)
- Spelling (HE): 97
- Alphabet Writing Fluency (WE): 88
- Sentence Composition (HSC): 96
- Essay Composition (HSC): 95

---

**COHESIVE**

**MR** = 102

- The difference between the scores that comprise the composite is not significant and a difference of this size occurs in more than 50% of the general population which makes it relatively common. This composite is therefore, unlikely and should be interpreted because it provides a good summary of the theoretically related abilities it was intended to represent.

**MR = 98**

- The difference between the scores that comprise the composite is not significant and a difference of this size occurs in more than 50% of the general population which makes it relatively common. This composite is therefore, unlikely and should be interpreted because it provides a good summary of the theoretically related abilities it was intended to represent.

---

**Not applicable**

- All scores in the composite are either not meaningful different from use another or not within the average or better range of ability. Follow up assessment is not considered necessary.

---

**Transfer to New Domain**

- The check boxes in this column mean two functions: 1) transfer of selected subtests to the EAI Answer Key for follow up assessment and analysis; or 2) transfer of selected subtests to the Composite Operation key for PWR analysis. Once subtests have been selected, click the gray or green button to the left to complete the desired transfer or the gray button to the right to clear all checkboxes.
Don’t Forget

• **Cognitive**: Only composites can be transferred to the Data Organizer Tab
  - You must transfer composites for a minimum of seven CHC domains to run a PSW analysis (i.e., Gc, Gf, Glr, Gsm, Gv, Ga, and Gs)
  - You may transfer broad or narrow ability composites
  - You may also include other cognitive data in the PSW Analysis (i.e., Executive functions, Orthographic Processing, Speed of Lexical Access, Cognitive Efficiency)
  - You may use “Other Data Entry” Tab for an average or better subtest score to represent an aspect of a broad ability when converging data are available to support average ability

• **Achievement**: Composites and subtest scores can be transferred to the Data Organizer 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
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.
How Are the FCC and ICC Calculated?

• X-BASS uses a standard formula that incorporates median inter-correlations among and reliabilities of those CHC composites that were judged to be strengths and weaknesses by the evaluator
  – Median *inter-correlations* among each CHC ability and every other CHC ability were derived from an investigation of over 350 coefficients reported in the technical manuals of cognitive batteries and included in within-battery and cross-battery independent factor analyses.
  – Median *reliability coefficients* were derived from a total of 60 coefficients gathered from the technical manuals of cognitive batteries

Important Note About the Facilitating Cognitive Composite (FCC)

• In previous versions of X-BASS, FCC was only reported if it was 85 or higher; if it was lower than 85, the program would not conduct the PSW analysis

\[
85 \pm 5 (80-90)
\]

90-110 = Average

*X-BASS v2.0 will report an FCC that is lower than 85 and will run the PSW analysis, but a pop up message will make it clear that you are no longer following the DD/C model*
$g$-Value =

- **Sum of $g$-weights** for each of the CHC ability domains
  - Program uses average $g$-weights from four sources (WJ III Technical Manual and three separate Cross-Battery joint factor analysis studies – all included the seven main cognitive domains)

- The abilities and their corresponding $g$-weights are as follows:
  - $G_c = .2355$
  - $G_f = .1870$
  - $G_{lr} = .1572$
  - $G_{sm} = .1152$
  - $G_v = .1167$
  - $G_a = .1029$
  - $G_s = .0864$
  - SUM = 1.0009
Abilities that are Considered Most Important to Learning and Academic Success in School are Given More Weight in the Calculation of the g-Value

- Grades K-2
  - \( Gc \) – Crystallized Intelligence
  - \( Glr \) – Long-term Storage and Retrieval
  - \( Gsm \) – Short-term Memory
  - \( Gs \) – Processing Speed

- Grades 3+
  - \( Gc \) – Crystallized Intelligence
  - \( Glr \) – Long-term Storage and Retrieval
  - \( Gsm \) – Short-term Memory
  - \( Gf \) – Fluid Reasoning

**g-Value Tab**

**Analysis and Interpretation of g-Value**

Based on data entered in prior tabs, g-Value is computed and displayed here. Users are advised to refer to the PSW-A Notes tab in K-BEAS and to the relevant text in Essentials of Cross-Battery Assessment, Third Edition, for a detailed discussion regarding the full meaning and proper use and interpretation of the g-Value.

The g-Value reflects overall cognitive ability based on the broad CHC abilities judged by the evaluator to be strengths for the individual using the following matrix:

<table>
<thead>
<tr>
<th>g-Value</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 0.45</td>
<td>Average overall ability is well below average.</td>
</tr>
<tr>
<td>0.46 - 0.70</td>
<td>Average overall ability is below average.</td>
</tr>
<tr>
<td>0.71 - 0.80</td>
<td>Average overall ability is average.</td>
</tr>
<tr>
<td>0.81 - 0.90</td>
<td>Average overall ability is above average.</td>
</tr>
<tr>
<td>0.91 - 1.00</td>
<td>Average overall ability is very likely.</td>
</tr>
</tbody>
</table>

How likely is it that the individual’s pattern of strengths indicates at least average overall cognitive ability?

**Likely.** Despite the presence of weaknesses in one or more cognitive domains considered important for acquiring the academic skills typical for this grade level, this case, the individual’s overall ability ought to enable learning and achievement, particularly if the FIC/ACC is greater than or equal to 90 and when specific cognitive weaknesses are minimized through compensatory efforts, accommodations, and the like. If the FIC/ACC is between 80 and 89 inclusive, the criteria for at least average overall ability, within the ILDF, model should be supported by additional data and information.

- “Strength” selected for all seven CHC domains
  - \( g\)-Value = 1.0
- “Weakness” selected for all seven CHC domains
  - \( g\)-Value = 0


**g-Value and FCC**

- When *g*-Value is .60 or higher (reported in the color **green**), then
  - The FCC is almost always in the average range or higher (and reported in the color **green**)

---

**g-Value and FCC**

- When *g*-Value is .60 or higher (reported in the color **green**), then
  - The FCC is almost always in the average range or higher (and reported in the color **green**)


- **g-Value may be .60 or higher (reported in the color **green**)**
  - **FCC may be in the low average range and appear in the color **yellow****
  - This happens in cases where you designate scores in the upper 80s and low 90s as “facilitators/strengths”
Don’t Forget:

- g-Value is based on the *g-weights* associated with the CHC abilities that were judged to be facilitators/strengths

- FCC is based on the CHC *obtained scores* that were judged to be facilitators/strengths

---

FCC in Perspective

- The FCC appears in **green** when it is ≥ 90 and the g-Value is ≥ .60.
- The FCC appears in **yellow** when it is between 85-89, inclusive, or the g-Value is between .51 - .59, inclusive.
- “**N/A**” appears if the FCC is < 85 or the g-Value is ≤ .50, or if there are too few abilities judged to be sufficient.
Evaluation of Below Average Aptitude-Achievement Consistency

- Three score ranges
  - < 85
  - 85-89
  - > 90

- Are cognitive and academic scores considered weaknesses?
  - both scores < 85 = yes
  - Both scores ≥ 90 = no
  - One score < 85; one score 85-89 = likely
  - Both scores 85-89 = possibly
  - One score < 85; one score ≥ 90 = possibly
  - One score 85-89; one score ≥ 90 = unlikely

- The answer to the “Are both weaknesses?” question is considered within the context of the research on the relationship between the cognitive and academic areas reported as weaknesses and the program makes a determination about consistency.
Based on the most psychometrically defensible analyses of score differences


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” - IDEA

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/hearing¹, 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 exams¹, 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.

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:_____________________________________________________________________
______________________________________________________________________

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

Hearing (Check All that Apply):

☐ 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, Ortiz, & 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
☐ Gross Motor Delay/Difficulty
☐ Improper pencil grip (Specify type: __________) Name of disorder: __________
☐ Assistive devices/aids used (e.g., weighted pens, pencil grip, slant board)

☐ History of motor disorder
☐ Diagnosed motor disorder
☐ 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, Ortiz, & Alfonso, 2013)

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, Ortiz, & Alfonso, 2013)
Form download on CD that accompanies Essentials of Cross-Battery Assessment, 3e (Flanagan, Ortiz, & Alfonso, 2013)
Flanagan et al.’s DD/C Definition of SLD: Level II – Review of Exclusionary Factors

Cultural/Linguistic Factors (Check All that Apply):

☐ 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: __________)

☐ Aculturative Knowledge Development

☐ Parental Educational and Socio-Economic Level

(Circle one: High – Moderate – Low) (Circle one: High – Moderate – Low)

NOTES:

________________________________________________________________________

Form downloadable on CD that accompanies Essentials of Cross-Battery Assessment, 3e (Flanagan, Ortiz, & 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 __________) ☐ Hospitalization (Dates: ________)

☐ 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, Ortiz, & 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 contribute 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, Ortiz, & Alfonso, 2013)

---

**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, Fitz, & Hichs, 2014),
  - math (e.g., Kubas, Drefs, Poole, Schmid, Holland, & Fiorello, 2014), and
  - written expression (e.g., Fenwick, Kubas, Witzke, Fitz, Miller, Maricle, & Hale, 2015).
  - Valid points are made about the potential strengths of PSW models in this literature.
- While valid points are made both 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.

End of Unit III, Part 2
Cross-Battery Assessment (XBA) Certification Program

UNIT III: Cross-Battery Assessment Software System (X-BASS)

There are three parts to Unit III

- **Part 1: Introduction to X-BASS and Cross-Battery Data Management, Interpretation, and Analyses (DMIA)** (Dr. Vincent Alfonso)
- **Part 2: Introduction to X-BASS and the Pattern of Strengths and Weaknesses Analyzer (PSW-A)** (Dr. Dawn Flanagan)
- **Part 3: Introduction to X-BASS and the Culture-Language and Interpretive Matrix (C-LIM)** (Dr. Samuel Ortiz)