New Developments in CHC Theory, Cross-Battery Assessment for Intervention, and Identification of SLD

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Progress in Methods of Interpretation

Clinical Profile Analysis (Second Wave)  Psychometric Profile Analysis (Third Wave)  Application of Theory to Interpretation (Fourth Wave)  Application of Refinements to Theory and CHC-Based Research to Psychological Test Interpretation (Fifth Wave)

Refrainements and Extensions to the Cross-Battery Approach

Significantly improved evidence base

Significantly improved and expanded software programs
Current and Expanded Cattell-Horn-Carroll (CHC) Model of Cognitive Abilities
(adapted from Schneider & McGrew, 2012)

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

Integration of CHC and neuropsychological theory for cognitive test interpretation and identification/diagnosis of SLD

• Dan Miller
• Scott Decker
• Brad Hale
• Cyndi Riccio
• George McCloskey
• Denise Maricle
CHC Theory

- Guides Test Development
- Guides Test Interpretation
- Foundation of Cross-Battery Assessment
- Cognitive Ability-Achievement Link Facilitates SLD Identification
- Cognitive Processing-Achievement Link Facilitates SLD Identification
- **CHC-based Cognitive Assessment Informs both Diagnosis and Intervention**
Brain Regions involved in Dyslexia

The five “big ideas” of the reading process (Grizzle & Simms, 2009)

1. **Phonemic Awareness**: the ability to detect, manipulate, and process acoustical information in words
2. **Alphabetic Principle**: associating sounds with letters, and blending graphemes into words
3. **Reading Fluency**: the ability to automatically read words within text using minimal effort and with full comprehension
4. **Vocabulary**: a working knowledge of word meanings also mapped to oral vocabulary
5. **Reading Comp**: the ability to derive meaning from text

As cited in Feifer (2012).
Reading Disability Subtypes

- **Dysphonetic Dyslexia** – difficulty sounding out words in a phonological manner
- **Surface Dyslexia** – difficulty with the rapid and automatic recognition of words in print
- **Mixed Dyslexia** – multiple reading deficits characterized by impaired phonological and orthographic processing skills. It is probably the most severe form of dyslexia.
- **Comprehension Deficits** – the mechanical side of reading is fine but difficulty persists deriving meaning from print


### Selecting Interventions Based on Reading Disorder Subtype

<table>
<thead>
<tr>
<th>Subtype</th>
<th>Brain relationship</th>
<th>Description of Disorder</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dysphonetic Dyslexia</td>
<td>Supramarginal gyrus, located at the juncture of the temporal and parietal lobes</td>
<td>Difficulty sounding out words in a phonological manner, inability to use phonological route to bridge letters and sounds; over-reliance on visual or orthographic cues; tend to guess on words based on initial letters observed; typically memorize whole words</td>
<td>Intervention should include an explicit phonological approach, especially with younger children (e.g., Wilson Reading System; Fundations; Fast Forword; Earobics I). Modality based: Horizons (visual phonics approach). Lindamood (tactile cues). Secondary Level (morphological cues emphasized - Read 180).</td>
</tr>
<tr>
<td>Surface Dyslexia</td>
<td>Left fusiform gyrus</td>
<td>Difficulty with the rapid and automatic recognition of words in print; can sound out words, but cannot recognize words in print automatically and effortlessly; letter-by-letter and sound-by-sound readers; over-reliance on phonological properties and underappreciation of orthographic or spatial properties of the word; reading is slow and laborious</td>
<td>Intervention should focus on automaticity and fluency goals (not necessarily an explicit phonological approach); build sight words. Early ages: Reading Recovery; Ages 7-12: Read Naturally; Over Age 12: Read 180; Wilson.</td>
</tr>
<tr>
<td>Mixed Dyslexia</td>
<td>Show weaker modulatory effects from the left fusiform gyrus to the left inferior parietal lobes, suggesting deficits integrating both the phonological representation and orthographical representation of words</td>
<td>Multiple reading deficits characterised by impaired phonological and orthographic processing skills. Most likely the most severe form of dyslexia; characterised by a combination of poor phonological processing skills, slower rapid and automatic word recognition skills, inconsistent language comprehension skills; bizarre error patterns in reading; double-deficit.</td>
<td>Intervention should incorporate a balanced literacy approach</td>
</tr>
<tr>
<td>Comprehension Deficits</td>
<td>The brain’s executive attention network—modulated primarily by the anterior cingulate gyrus in the frontal lobes</td>
<td>The mechanical side of reading is fine, but difficulty deriving meaning from print</td>
<td>Intervention should be at the language level, not the phonological level; externalize the reasoning process – Summarize, Clarify, Question and Predict</td>
</tr>
</tbody>
</table>
Amy’s cognitive testing shows a significant deficit in **phonetic coding** – she doesn’t know how to translate symbols into sounds

*Ga* deficit impacts her fluency – labored reading

Lack of decoding and fluency impacts comprehension

**Intervention should focus on Phonemic Awareness (phoneme-grapheme correspondence)** – **Remediate Ga**

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**Amy’s Profile**

**Dysphonetic Dyslexia**

Interventions selected should be based, in part, on the developmental level of the student

– Intervention should include an **explicit phonological approach**, especially with younger children (e.g., Wilson Reading System; Fundations; Fast Forward; Earobics I; Alphabetic Phonics [Uhry & Clark, 2005]). Modality based: Horizons (visual phonics approach). Lindamood (tactile cues). Secondary Level (morphological cues emphasized - Read 180)

Programs/Techniques for Ga-Phonetic Coding Deficits

• When selecting a program or a technique to intervene with a student with a Ga-Phonetic Coding deficit, consider one that
  – Teaches students to manipulate sounds by using letters (i.e., phoneme-grapheme correspondence)
  – Uses individual or small group format
  – Focuses on reading and spelling development (again, the phoneme-grapheme connection)
  – Explicitly teaches student how to blend sounds

Better Understanding of the Problem Leads to Better Diagnosis and Intervention Planning

What Parents and Teachers Should Know About Cognitive Abilities and Their Impact on Academic Skills and Academic Success


## Summary of Relations between CHC Abilities and Specific Areas of Academic Achievement

(Berninger, 2013; Flanagan, Ortiz, Alfonso & Mascolo, 2006; McGrew & Wendling, 2010)

<table>
<thead>
<tr>
<th>Ability</th>
<th>Reading Achievement</th>
<th>Math Achievement</th>
<th>Writing Achievement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gf</strong></td>
<td>Inductive (I) and general sequential reasoning (RG) abilities play a moderate role in reading comprehension.</td>
<td>Inductive (I) and general sequential reasoning abilities (RG) are consistently very important for math problem solving at all ages.</td>
<td>Inductive (I) and general sequential reasoning abilities (RG) are consistently related to written expression at all ages.</td>
</tr>
<tr>
<td><strong>Gc</strong></td>
<td>Language development (LD), lexical knowledge (VL), and listening ability (LS) are important at all ages. These abilities become increasingly important with age.</td>
<td>Language development (LD), lexical knowledge (VL), and general information (KI) are important primarily after the 2nd grade. These abilities become increasingly important with age.</td>
<td></td>
</tr>
<tr>
<td><strong>Gsm</strong></td>
<td>Memory span (MS) and working memory capacity.</td>
<td>Memory span (MS) and working memory capacity.</td>
<td>Memory span (MS) is important to writing, especially spelling skills whereas working memory has shown relations with advanced writing skills (e.g., written expression).</td>
</tr>
<tr>
<td><strong>Gv</strong></td>
<td>Orthographic Processing - reading fluency</td>
<td>Visualization is important primarily for higher level or advanced mathematics (e.g., geometry, calculus).</td>
<td>Orthographic Processing - spelling</td>
</tr>
<tr>
<td><strong>Ga</strong></td>
<td>Phonetic coding (PC) or “phonological awareness/processing” is very important during the elementary school years.</td>
<td>Phonetic coding (PC) or “phonological awareness/processing” is very important during the elementary school years for both basic writing skills and written expression (primarily before about grade 5).</td>
<td></td>
</tr>
<tr>
<td><strong>Glr</strong></td>
<td>Naming facility (NA) or “rapid automatic naming” is very important during the elementary school years. Associative memory (MA) is also important.</td>
<td>Naming Facility (NA); Associative Memory (MA)</td>
<td>Naming facility (NA) or “rapid automatic naming” has demonstrated relations with written expression, primarily writing fluency.</td>
</tr>
<tr>
<td><strong>Gs</strong></td>
<td>Perceptual speed (P) abilities are important during all school years, particularly the elementary school years.</td>
<td>Perceptual speed (P) abilities are important during all school years, particularly the elementary school years.</td>
<td>Perceptual speed (P) abilities are important during all school years for basic writing and related to all ages for written expression.</td>
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### Definitions of CHC Broad and Narrow Abilities

<table>
<thead>
<tr>
<th>Broad Ability</th>
<th>Definition</th>
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<tr>
<td><strong>Fluid Reasoning (Gf)</strong></td>
<td>The deliberate but flexible control of attention to solve novel, “on-the-spot” problems that cannot be performed by relying exclusively on previously learned habits, schemas, and scripts.</td>
</tr>
<tr>
<td><strong>Induction (I)</strong></td>
<td>The ability to observe a phenomenon and discover the underlying principles or rules that determine its behavior.</td>
</tr>
<tr>
<td><strong>General Sequential Reasoning (RG)</strong></td>
<td>The ability to reason logically, using known premises and principles.</td>
</tr>
<tr>
<td><strong>Quantitative Reasoning (RQ)</strong></td>
<td>The ability to reason, either with induction or deduction, with numbers, mathematical relations, and operators.</td>
</tr>
</tbody>
</table>

**Refinements**: Piagetian Reasoning (RP) and Reasoning Speed (RE) were deemphasized, primarily because there is little evidence that they are distinct factors.
What is Fluid Reasoning (Gf)?

Fluid Reasoning (Gf) refers to a type of thinking that an individual may use when faced with a relatively new task that cannot be performed automatically.

- forming and recognizing concepts (e.g., how are a dog, cat, and cow alike?)
- identifying and perceiving relationships (e.g., sun is to morning as moon is to night)
- drawing inferences (e.g., after reading a story, answering the question, “What will John do next?”)
- reorganizing or transforming information (e.g., selecting one of several pictures to complete a puzzle).

Relations between Gf and Reading Achievement

Gf – Induction (I) and general sequential reasoning (RG) play a moderate role in reading comprehension
Relations between Gf and Achievement

Quantitative Reasoning (RQ) consistently related to math achievement

Induction (I) and General Sequential Reasoning (RG; Deduction) consistently related to written expression

Jobs/Careers involving High Gf

- Judges
- Surgeons
- Lawyers
- Chief Executives
## Definitions of CHC Broad and Narrow Abilities

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<tr>
<td>Crystallized Intelligence (Gc)</td>
<td>The depth and breadth and of knowledge and skills that are valued by one's culture.</td>
</tr>
<tr>
<td>General Verbal Information (K0)</td>
<td>The breadth and depth of knowledge that one’s culture deems essential, practical, or otherwise worthwhile for everyone to know.</td>
</tr>
<tr>
<td>Language Development (LD)</td>
<td>General understanding of spoken language at the level of words, idioms, and sentences.</td>
</tr>
<tr>
<td>Lexical Knowledge (VL)</td>
<td>Extent of vocabulary that can be understood in terms of correct word meanings.</td>
</tr>
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</table>

## Additional Gc Narrow Abilities

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<td>The depth and breadth and of knowledge and skills that are valued by one's culture.</td>
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<tr>
<td>Listening Ability (LS)</td>
<td>The ability to understand speech.</td>
</tr>
<tr>
<td>Communication Ability (CM)</td>
<td>The ability to use speech to communicate one’s thoughts clearly.</td>
</tr>
<tr>
<td>Grammatical Sensitivity (MY)</td>
<td>Awareness of the formal rules of grammar and morphology of words in speech.</td>
</tr>
</tbody>
</table>
What is Crystallized Intelligence (Gc)?

• a person’s knowledge base (or general fund of information) that has built up over time, beginning in infancy.
• your own personal library or everything you know.

What is Crystallized Intelligence (Gc)?

• Having well developed or good Crystallized intelligence means that one understands and uses language well, has an average or better vocabulary, has good listening skills, and is able to use language well via verbal expression.
Relations between Gc Abilities and Reading Achievement

- **Gc** – Language development (LD), lexical knowledge (VL), general information (K0) and listening ability (LS) are important at all ages. These abilities become increasingly important with age.

Relations between Gc Abilities and Achievement

- **Gc** – Language development (LD), lexical knowledge (VL), general information (K0) and listening ability (LS) are important for reading achievement at all ages. These abilities become increasingly important with age.
Jobs/Careers involving High Gc

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

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

Definitions of CHC Broad and Narrow Abilities

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<tbody>
<tr>
<td>Auditory Processing (Ga)</td>
<td>The ability to detect and process meaningful nonverbal information in sound.</td>
</tr>
<tr>
<td>Phonetic coding (PC)</td>
<td>The ability to hear phonemes distinctly.</td>
</tr>
<tr>
<td>Speech Sound Discrimination (US)</td>
<td>The ability to detect and discriminate differences in speech sounds (other than phonemes) under conditions of little distraction or distortion.</td>
</tr>
<tr>
<td>Resistance to Auditory Stimulus Distortion (UR)</td>
<td>The ability to hear words correctly even under conditions of distortion or loud background noise.</td>
</tr>
</tbody>
</table>
What is Auditory Processing (Ga)?

- Auditory processing (Ga) refers to the ability to perceive, analyze, and synthesize a variety of auditory information (e.g., sounds).
  - auditory processing include listening to words with missing letters and saying the correct word (e.g., hearing “olipop” and saying “lollipop”)
  - listening to piano music and identifying the key in which the piece is being played (e.g., C sharp)

Relations between Ga and Reading Achievement

- **Ga** – Phonetic Coding (PC) or phonological awareness; phonological processing – very important during the elementary school years.
### Relations between Ga and Achievement

**Spelling isn’t EZ**

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Assessing Phonological Processing Related to Reading

• Examples of assessments of phonological processing directly related to reading:
  – PAL-II Rhyming, Syllables, Phonemes, Rimes
  – KTEA-II Phonological Awareness Subtest
  – NEPSY-II Phonological Processing Subtest
  – WJ III Sound Awareness, Sound Blending, and Incomplete Words Subtests
  – DAS-II Phonological Processing Subtest
  – CTOPP Blending and Segmenting Subtests

Jobs/Careers involving High Ga

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

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

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<th>Broad Ability</th>
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<tr>
<td>Short-Term Memory (Gsm)</td>
<td>The ability to encode, maintain and manipulate information in one’s immediate awareness.</td>
</tr>
<tr>
<td>Memory Span (MS)</td>
<td>The ability to maintain information in primary memory and immediately reproduce the information in the same sequence in which it was represented.</td>
</tr>
<tr>
<td>Working Memory Capacity (MW)</td>
<td>The ability to direct the focus of attention to perform relatively simple manipulations, combinations, and transformations of information within primary memory, while avoiding distracting stimuli and engaging in strategic/controlled searches for information in secondary memory.</td>
</tr>
</tbody>
</table>

Revisions and Refinements to Gsm Domain

- In the area of **Gsm**, the name Working Memory (MW) was changed to **Working Memory Capacity**, as Schneider and McGrew believe this term is more descriptive of the types of tasks that are used most frequently to measure MW (e.g., Wechsler Letter-Number Sequencing).

Sample Items From The Letter-Number Sequencing Test

<table>
<thead>
<tr>
<th>Item</th>
<th>Correct response</th>
</tr>
</thead>
<tbody>
<tr>
<td>LNS-Forward: 9 - A - 6 - J - 3 - P</td>
<td>9 - A - 6 - J - 3 - P</td>
</tr>
<tr>
<td>LNS-Reordered: E - 1 - R - 8 - M - 7</td>
<td>1 - 7 - 8 - E - M - R</td>
</tr>
</tbody>
</table>
What is Short-term Memory (Gsm)?

- A child with short-term memory difficulties may have a hard time
  - Following directions
  - understanding long reading passages (e.g., a story read aloud by the teacher)
  - Spelling
  - sounding out words
  - and doing math problems (e.g., remembering the steps required to solve long math problems
- Children who have difficulties with short-term memory do better when they are taught how to use strategies to help them remember things.
  - Mnemonics

Relations between Gsm and Achievement

- **Gsm** – Memory span (MS) and working memory capacity are important at all ages

![Diagram of memory processes]

<table>
<thead>
<tr>
<th>Gsm Ability</th>
<th>Reading Achievement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Memory span (MS) and working memory capacity (MW).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Math Achievement</th>
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<td>Memory span (MS) is important to writing, especially spelling skills whereas working memory (MW) has shown relation with advanced writing skills (e.g., written expression).</td>
</tr>
</tbody>
</table>
Jobs/Careers involving High Gsm

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

Based on logical deductions given demands of the job

Revisions and Refinements to Glr Domain

Revisions to Glr.

– Learning Abilities (L1) was dropped from both Glr and Gsm. Carroll conceived of L1 as a superordinate category consisting of different kinds of long-term learning abilities.

– Schneider and McGrew refer to L1 as “Glr-Learning Efficiency,” which includes the narrow abilities of Free Recall Memory, Associative Memory, and Meaningful Memory.

– The remaining Glr narrow abilities are referred to as “Retrieval Fluency” abilities.
What is Long-term Storage and Retrieval (Glr)?

• Refers to an individual’s ability to take in and store a variety of information (e.g., ideas, names, concepts) in one’s mind and then retrieve it quickly and easily at a later time by using association.

What is Long-term Storage and Retrieval (Glr)?

• This ability does not represent what is stored in long-term memory or what you know. Rather, it represents the process of storing and retrieving information.

• When someone says, “It’s on the tip of my tongue,” they are having a hard time retrieving something that they know.
Definitions of CHC Broad and Narrow Abilities

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</thead>
<tbody>
<tr>
<td>Long-Term Storage and Retrieval (Glr)</td>
<td>The ability to store, consolidate, and retrieve information over periods of time measured in minutes, hours, days, and years.</td>
</tr>
</tbody>
</table>

Learning Efficiency

<table>
<thead>
<tr>
<th>Broad Ability</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Associative Memory (MA)</td>
<td>The ability to remember previously unrelated information as having been paired.</td>
</tr>
<tr>
<td>Meaningful Memory (MM)</td>
<td>The ability to remember narratives and other forms of semantically related information.</td>
</tr>
<tr>
<td>Free Recall Memory (M6)</td>
<td>The ability to recall lists in any order.</td>
</tr>
</tbody>
</table>

Additional Glr Narrow Abilities

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Retrieval Fluency

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<tr>
<th>Broad Ability</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Ideational Fluency (FI)</td>
<td>The ability to rapidly produce a series of ideas, words, or phrases related to a specific condition or object.</td>
</tr>
<tr>
<td>Word Fluency (FW)</td>
<td>The ability to rapidly produce words that share a non-semantic feature.</td>
</tr>
<tr>
<td>Figural Fluency (FF)</td>
<td>Ability to rapidly draw or sketch as many things (or elaborations) as possible when presented with a non-meaningful visual stimulus (e.g., a set of unique visual elements).</td>
</tr>
<tr>
<td>Naming Facility (NA)</td>
<td>The ability to rapidly name pictures, letters or objects that are known to the individual.</td>
</tr>
</tbody>
</table>
Relations between Glr and Reading Achievement

Glr – Naming facility (NA) or “rapid automatic naming” is very important during the elementary school years. Associative memory (MA) also appears to be important in the early elementary school years.

Most Intelligence and Cognitive Batteries do not Measure Glr

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>WISC-IV</td>
<td>Not Measured</td>
</tr>
<tr>
<td>WAIS-IV</td>
<td>Not Measured</td>
</tr>
<tr>
<td>WPPSI-III</td>
<td>Not Measured</td>
</tr>
<tr>
<td>KABC-II</td>
<td>Associative (MA); Token (MA); Token Delayed (MA)</td>
</tr>
<tr>
<td>WJ III NU</td>
<td>Visual-Auditory Learning (VA); Retrieval Fluency (FI); Visual-Auditory Learning Delayed (VA); Rapid Picture Naming (NA); QI, RFI</td>
</tr>
<tr>
<td>SB5</td>
<td>Not Measured</td>
</tr>
<tr>
<td>DAS-II</td>
<td>Rapid Naming (NA); Gt R5; Kernel of Objects-Immediate (56); Kernel of Objects-Delayed (56)</td>
</tr>
</tbody>
</table>

Measures Associative Memory only – Learning Efficiency

Measures Learning Efficiency (MA) and Retrieval Fluency (NA, FI)

Measures Learning Efficiency (M6) and Retrieval Fluency (NA)
Revisions and Refinements to Gv Domain

• Refinement to Gv.

• The name Spatial Relations (SR) was changed to “Speeded Rotation” (also “SR”) to more accurately describe this ability.
  – Speeded Rotation is the ability to solve problems quickly using mental rotation of simple images (Schneider & McGrew, 2012, p. 129).
  – This ability is similar to visualization because it involves rotating mental images but it is distinct because it has more to do with the speed at which mental rotation tasks can be completed (Lohman, 1996).
  – Speeded Rotation tasks typically involve fairly simple images. It is likely that the majority of tests that were classified as Spatial Relations in the past should have been classified as measures of Vz only (rather than SR, Vz).

What is Visual Processing (Gv)?

• Visual processing (Gv) is an individual’s ability to think about visual patterns (e.g., what is the shortest route from your house to school?) and visual images (e.g., what would this shape look like if I turned it upside down?).
What is Visual Processing (Gv)?

• This type of ability also involves generating, perceiving, and analyzing visual patterns and visual information.
  – putting puzzles together
  – completing a maze (such as the ones often seen on children’s menus in restaurants)
  – interpreting a graph or chart.

• Important when doing advanced math (e.g., geometry and calculus).

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<tr>
<td>Visual Processing (Gv)</td>
<td>The ability to make use of simulated mental imagery (often in conjunction with currently perceived images) to solve problems.</td>
</tr>
<tr>
<td>Visualization (Vz)</td>
<td>The ability to perceive complex patterns and mentally simulate how they might look when transformed (e.g., rotated, changed in size, partially obscured).</td>
</tr>
<tr>
<td>Speeded Rotation (SR)</td>
<td>The ability to solve problems quickly by using mental rotation of simple images.</td>
</tr>
<tr>
<td>Closure Speed (CS)</td>
<td>The ability to quickly identify a familiar meaningful visual object from incomplete (e.g., vague, partially obscured, disconnected) visual stimuli, without knowing in advance what the object is.</td>
</tr>
</tbody>
</table>
Additional Gv Narrow Abilities

<table>
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<tr>
<td>Visual Processing (Gv)</td>
<td>The ability to make use of simulated mental imagery (often in conjunction with currently perceived images) to solve problems.</td>
</tr>
<tr>
<td>Visual Memory (MV)</td>
<td>The ability to remember complex visual images over short periods of time (less than 30 seconds).</td>
</tr>
<tr>
<td>Spatial Scanning (SS)</td>
<td>The ability to visualize a path out of a maze or a field with many obstacles.</td>
</tr>
</tbody>
</table>

Relations between Gv Abilities and Achievement

- **Gv** – Orthographic processing
Assessing Visual Processing Related to Reading

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

![ABC123]

**Relationship Between Gv and Achievement**

<table>
<thead>
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<th>Reading Achievement</th>
</tr>
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<tbody>
<tr>
<td>Orthographic processing (e.g., visual processing using letters and sub-word sound units) is important for reading decoding.</td>
<td></td>
</tr>
</tbody>
</table>

Visualization (Gv) may be important primarily for higher level or advanced mathematics (e.g., geometry, calculus).

Orthographic processing (e.g., visual processing using letters and sub-word sound units) is important for spelling.

[Diagram of trigonometric functions]
Good representation of Gv abilities; three qualitatively different indicators

No measures of Orthographic Processing on Intelligence and Cognitive Batteries

Most under-represented in area of Gv

Jobs/Careers involving High Gv – Visual Spatial Ability

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

Based on logical deductions given demands of the job; see also McGrew and Flanagan (1998) for research support
Assessing Orthographic Processing Related to Reading

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

Latest Orthographic Processing Measure

Now available from PRO-ED!

Ages: 4-0 to 7-11 years
Testing Time: 10-15 minutes
Administration: Individual

The Early Reading Assessment (ERA) is an easily administered
What is Processing Speed (Gs)?

- Processing speed (Gs) refers to an individual’s ability to perform simple clerical tasks quickly, especially when under pressure to maintain attention and concentration.
- It can also be thought of as how quickly one can think or how quickly one can take simple tests that require simple decisions.
- Involves sustained/focused and selective attention.

Definitions of CHC Broad and Narrow Abilities

<table>
<thead>
<tr>
<th>Broad Ability</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processing Speed (Gs)</td>
<td>The speed at which visual stimuli can be compared for similarity or difference.</td>
</tr>
<tr>
<td>Perceptual Speed (P)</td>
<td>The ability at which visual stimuli can be compared for similarity or difference.</td>
</tr>
<tr>
<td>Rate-of-Test-Taking (R9)</td>
<td>The speed and fluency with which simple cognitive tests are completed.</td>
</tr>
<tr>
<td>Number Facility (N)</td>
<td>The speed at which basic arithmetic operations are performed accurately.</td>
</tr>
<tr>
<td>Reading Speed (RS)</td>
<td>The rate of reading text with full comprehension.</td>
</tr>
<tr>
<td>Writing Speed (WS)</td>
<td>The rate at which words or sentences can be generated or copied.</td>
</tr>
</tbody>
</table>
Relations between Gs and Achievement

- **Gs** – Perceptual speed (P) abilities are important during all school years, particularly the elementary school years.

<table>
<thead>
<tr>
<th>CHC Ability</th>
<th>Reading Achievement</th>
<th>Math Achievement</th>
<th>Writing Achievement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gs</td>
<td>Perceptual speed (P) is important during all school years, particularly the elementary school years.</td>
<td>Perceptual speed (P) is important during all school years, particularly the elementary school years.</td>
<td>Perceptual speed (P) is important during all school years for basic writing and written expression.</td>
</tr>
</tbody>
</table>

Other Revisions and Refinements to CHC Theory
Revisions and Refinements to CHC Theory

• **Grw revisions**
  – Verbal (Printed) Language Comprehension (V) was dropped because it appears to represent a number of different abilities (e.g., reading decoding, reading comprehension, reading speed) and, therefore, is not a distinct ability.
  – Cloze Ability (CZ) was dropped because it is not meaningfully distinct from reading comprehension (RC). Rather, CZ appears to be an alternative method of measuring reading comprehension.
  – Writing Speed (WS) was added to Grw, as this ability appears to cut across more than one broad ability (see Schneider & McGrew, 2012).

• **Six broad abilities were added** to CHC theory (McGrew, 2005; Schneider & McGrew, 2012)
  – General (Domain-Specific) Knowledge (Gkn)
  – Olfactory Abilities (Go)
  – Tactile Abilities (Gh)
  – Psychomotor Abilities (Gp)
  – Kinesthetic Abilities (Gk)
  – Psychomotor Speed (Gps)

• **Common cognitive and intelligence batteries do not measure these abilities directly** (e.g., they don’t contribute much to prediction of achievement)
<table>
<thead>
<tr>
<th>EXECUTIVE FUNCTIONING TRAIT</th>
<th>READING ATTRIBUTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning Skills</td>
<td>Read with a specific question or purpose in mind when seeking specific information. Also involves the strategies the reader uses to process new information</td>
</tr>
<tr>
<td>Organization Skills</td>
<td>Stitch together text in a cohesive manner. Also, when distracted, the ability to return back to the text and resume the story flow</td>
</tr>
<tr>
<td>Working Memory</td>
<td>Temporarily suspending previously read information in mind while simultaneously linking to new information being read</td>
</tr>
<tr>
<td>Cognitive Flexibility</td>
<td>Shifting patterns of thought processes to the organizational parameters of the text being read, and not perseverating on material.</td>
</tr>
<tr>
<td>Verbal Fluency</td>
<td>Speed of processing linguistic information at the word level to facilitate passage comprehension at the text level</td>
</tr>
<tr>
<td>Concept Formation</td>
<td>Depth of understanding of the text</td>
</tr>
</tbody>
</table>


Putting the Abilities Together

- **Students who Learn Quickly and Excel Academically**
  - **Gc** (good fund of knowledge; good vocabulary; communicate well)
  - **Glr** (learning is efficient; info is retrieved fluently)
  - **Gsm + Gf** (able to hold retrieved info; transform it; interact it with new info and draw conclusions based on inductive and deductive reasoning)

See Flanagan, Ortiz, and Alfonso (2013). *Essentials of Cross-Battery Assessment*, 3e
Top Four Most Important Abilities for Learning and Academic Success

- **Fluid Reasoning (Gf)**
- **Crystallized Knowledge (Gc)**
  - Weaknesses in these abilities constrain learning and achievement
- **Executive Functions** – lead to inconsistencies in Learning and Achievement
- **Short-Term Memory (Gsm)**
- **Long-Term Storage and Retrieval (Glr)**
  - Memory, Retrieval Fluency, and Learning Efficiency
  - Weaknesses in these abilities can be improved upon, bypassed or compensated for at least to some degree
- **Important Processes (related to reading)**
  - **Auditory Processing** – Phonetic Coding
  - **Visual Processing** – Orthographic Processing
  - **Processing Speed** – Reading Fluency/Automaticity
- Train processing deficits to point where they become skill

See Flanagan, Ortiz, and Alfonso (2013). Essentials of Cross-Battery Assessment, 3e

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### Broad and Narrow CHC Ability Representation on Seven Current Intelligence Batteries

<table>
<thead>
<tr>
<th>Gf</th>
<th>Ge</th>
<th>Gr</th>
<th>Gsm</th>
<th>Glr</th>
<th>Ga</th>
<th>Gc</th>
</tr>
</thead>
<tbody>
<tr>
<td>WISC-IV</td>
<td>Matris Reasoning (I)</td>
<td>Vocabulary (VL)</td>
<td>Information (Kb)</td>
<td>Black Design (Vb)</td>
<td>Digit Span (MS, MW)</td>
<td>Not Measured</td>
</tr>
<tr>
<td></td>
<td>Picture</td>
<td>Similarities (VL, GfI)</td>
<td>Comprehension (Kb)</td>
<td>Picture Completion (CF, GcKb)</td>
<td>Letter-Number Sequencing (MW)</td>
<td>Arithmetic (MW, Gf, RO)</td>
</tr>
<tr>
<td></td>
<td>Concepts (I)</td>
<td>Word Reasoning (VL, GfI)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| WAIS-IV | Matris Reasoning (I) | Vocabulary (VL) | Information (Kb) | Black Design (Vb) | Digit Span (MS, MW) | Not Measured | Not Measured |
| Figure Weights (RQ) | Similarities (VL, GfI) | Comprehension (Kb) | Picture Completion (CF, GcKb) | Letter-Number Sequencing (MW) | Arithmetic (MW, Gf, RO) |

| WPPSI-IV | Matris Reasoning (I) | Picture Concepts (Ge) | K0, GfI | Black Design (Vb) | Not Measured | Not Measured | Not Measured |
| | Vocabulary (VL) | Information (Kb) | Object Assembly (CS) | Not Measured | Animal Coding (R9) |
| | Similarities (VL, GfI) | Picture Memory (MV) | Bug Search (P) | Not Measured | Cancellation (P) |
| | Comprehension (Kb) | | (continued) |

• Gc deficit – speech-language impairment?
• Comprehension is poor b/c of low Gc
• Poor vocabulary – needs to re-read to gain meaning
• Gs deficit manifests as lack of automaticity; lack of fluency; orthographic processing deficit

Interventions should focus on fluency and orthography building as well as vocabulary development – Build Gc-VL, KO; improv'd fluency; train orthographic processing deficit

Mascolo and Flanagan (2011)

Belinda’s Profile

• Surface Dyslexia; possible Speech Language Impairment

• Interventions selected should be based, in part, on the developmental level of the student
  – Intervention should focus on automaticity and fluency goals (not necessarily an explicit phonological approach); build sight words. Early ages: Reading Recovery; Ages 7 - 12: Read Naturally; Over Age 12: Read 180; Wilson.
  – May need to change from Reading Recovery to Read Naturally

Orthographic Processing Interventions

• Fluency and Orthography Building Activities
  – Read Naturally
  – **RAVE-O**: Retrieval, Automaticity, Vocabulary, Engagement, Orthography is a comprehensive fluency program developed by Maryanne Wolf at Tufts University. The goal of the program is to expand upon fluency skills, increase comprehension, and develop confidence with both oral and written language.

Orthographic Processing Interventions

• **GREAT LEAPS READING**: Great Leaps Reading is a supplementary reading program that requires just 10 minutes per day, for a minimum of three days per week. The program is divided into three major sections: (1) **Phonics** for developing basic sound awareness skills; (2) **Sight-Phrases** for mastering sight words skills; and (3) **Fluency** which uses age-appropriate stories designed to build oral reading fluency and automaticity, as well as to enhance student motivation.
Other Interventions for Belinda

Interventions and Educational Strategies that are Supplemental to Fluency and Orthography Building

Florida Center for Reading Research

Text Talk

What is Text Talk?

Text Talk is an oral language instruction program intended for all students in grades K-3. It is designed to supplement a school’s core reading program with 20 minutes of daily whole or small group instruction delivered by the teacher. The goal of the program is to develop the student’s ability to construct meaning of sophisticated vocabulary words within the context of read-alouds and explicit vocabulary instruction. These vocabulary words and ideas are contextualized with explicit descriptions of how the words are used in the story and through interactive discussions.

The Text Talk instructional approach was developed by Drs. Isabel L. Beck and Margaret G. McKeown based on findings from their many years of research. These findings are depicted in their book, Bringing Words to Life which describes the rationale and methods for teaching children rich, robust vocabulary words. These words are not ordinarily found in their speaking vocabulary but would most likely be in their conceptual lexicon and appear in a variety of texts. Described as Tier 2 words in their book, Beck and McKeown underscore the importance of providing students repeated opportunities to hear and use these new vocabulary words in different contexts. The instructional strategies discussed in Bringing Words to Life are applied in the Text Talk program.
Different Cognitive Profiles Suggest Different Interventions

Other Interventions for Gc Deficit

<table>
<thead>
<tr>
<th>CHC Broad Cognitive Abilities/Neuropsychological Functions</th>
<th>Brief Definition</th>
<th>General Manifestations of Cognitive Neuropsychological Weakness</th>
<th>Specific Manifestations of the Cognitive Neuropsychological Weakness</th>
<th>Recommendations/Interventions</th>
</tr>
</thead>
</table>
| Crystallized Intelligence (IQ)                           | *Health and depth of knowledge and skills that are valued by one’s culture.*  
  - Developed through formal education as well as general learning experiences  
  - Stores of information and declarative and procedural knowledge  
  - Reflects the degree to which a person has learned practically useful knowledge and mastered valued skills (Schneider & McGrew, 2012)  
  - Narrow Gc abilities include General Verbal Information, Language Development, Lexical Knowledge, Listening Ability, Information about Culture, Communication Ability, and Grammatical Sensitivity | **Difficulties:**  
  - Vocabulary acquisition  
  - Knowledge acquisition  
  - Comprehending language or understanding what others are saying  
  - Text-based/informational questions  
  - Using prior knowledge to support learning  
  - Reading the right words to use/try | **Reading Difficulties:**  
  - Decoding (e.g., word student is attempting to decode is not in his/her vocabulary)  
  - Comprehending (e.g., poor background knowledge about information contained in text)  
  - Math Difficulties:  
    - Understanding math concepts and the “vocabulary of math”  
    - Writing Difficulties:  
      - Grammar (syntax)  
      - Handwriting with limited descriptors  
      - Verbose writing with limited descriptors  
  - Inappropriate word usage  
  - Language Difficulties:  
    - Understanding class lessons  
    - Expressive language – “poor of thought” | **Provide an environment rich in language and experiences***  
  - Frequent practice with and exposure to words  
  - Read aloud to children  
  - Very reading purpose (leisure, information)  
  - Work on vocabulary building  
  - Teach morphology  
  - Use text talks  
  - Instructive modalities (e.g., visuals, gestures) to increase understanding of language used  
  - Tailed instruction within a meaningful context (e.g., relating words to learner experiences, increasing listening ability through game-like format)  
  - Use Vocabulary Cartoons (Barchery, 2000) |


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**Brain Briefings**

- SES strong predictor of reading problems
- Low SES children with PA problems have reading areas intact and use the same reading areas as controls
- More about underdeveloped connections (due to lack of experience, etc.)
- Low SES same reading systems but delayed and never really catch up (Noble & McCandliss, 2005)

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Scientists think, based on accumulating research, that skilled reading requires certain patterns of activity in a network of areas located on the left side of the brain. These brain areas include the inferior frontal gyrus, parieto-temporal area, and occipito-temporal area. Some evidence suggests that the inferior frontal gyrus area and the parieto-temporal area help a reader analyze a word, while the occipito-temporal area helps a reader quickly recognize known words.

Illustrated by Lydia Hibiki.
“Use it or Lose it”

- Neurons that are weak or unused are pruned
- Neurons that are exercised get stronger and develop more connections

What Does It Look Like?

- **Pathology**
  - Low SES readers
  - Impoverished backgrounds
  - Bulk of students identified for RTI

- **Wellness**
  - Ready to read in Kindergarten
  - Know the alphabetic principle
  - Exposed to literacy
  - Eager and quick to learn
  - Consistent exposure

Information on this slide was presented by Elaine Fletcher-Janzen at the 3rd annual assessment conference, Fordham University. New York, NY (May, 2011).

The Early Catastrophe: The 30 Million Word Gap by Age 3

We observed the 42 children grow more like their parents in stature and activity levels, in vocabulary resources, and in language and interaction styles. Despite the considerable range in vocabulary size among the children, 86 percent to 98 percent of the words recorded in each child’s vocabulary consisted of words also recorded in their parents’ vocabulary. By the age of 14-18 months, the children were also talking and using numbers of different words very similar to the average of their parents (see the table below).

<table>
<thead>
<tr>
<th>Families’ Language and Use Differ Across Income Groups</th>
<th>Professional</th>
<th>Working-Class</th>
<th>Welfare</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measure &amp; Scores</td>
<td>Parent</td>
<td>Child</td>
<td>Parent</td>
</tr>
<tr>
<td>Percent score*</td>
<td>41</td>
<td>31</td>
<td>14</td>
</tr>
<tr>
<td>Recorded vocabulary size</td>
<td>2,176</td>
<td>1,116</td>
<td>1,498</td>
</tr>
<tr>
<td>Average utterances per hour*</td>
<td>487</td>
<td>310</td>
<td>301</td>
</tr>
<tr>
<td>Average different words per hour</td>
<td>382</td>
<td>297</td>
<td>251</td>
</tr>
</tbody>
</table>

“Neurons that Fire Together Wire Together”

- means that synapses- unions between neurons– get solidified the more often the respective neurons “talk” to each other

Early and sustained exposure to the alphabetic principle

Information on this slide was presented by Elaine Fletcher-Janzen at the 3rd annual assessment conference, Fordham University. New York, NY (May, 2011).

What Does it Look Like?

- **Wellness**
  - Polymaths
  - Thinking outside the box
  - Curiosity
  - Natural generalization
  - Quick long-term storage and retrieval

- **Pathology**
  - Poor initial learning
  - Long time needed for initial learning
  - Poor retrieval
  - Poor comprehension
  - Little imagination
  - Dependent learners
  - Concrete learners

Information on this slide was presented by Elaine Fletcher-Janzen at the 3rd annual assessment conference, Fordham University. New York, NY (May, 2011).
What Do You Do?

- Enrich
- Relate
- Create
- Ratify
- Mnemonic devices
- Multidisciplinary curricula

Information on this slide was presented by Elaine Fletcher-Janzen at the 3rd annual assessment conference, Fordham University. New York, NY (May, 2011).

Recommendations for Gc (Verbal Ability) Deficit

- Work on vocabulary building
- Teach morphology
- Activities to build listening skills
- Explicitly teach listening strategies
Programs/Techniques for Gc (Verbal Ability) Deficits

• When selecting a program or a technique to intervene with a student with a Gc deficit, it may be helpful to consider one that
  – includes some sort of **vocabulary building**
  – includes **supportive modalities** to increase understanding of language used (e.g., visuals, gestures)
  – **embeds instruction within a meaningful context** (e.g., relating words to learner experiences, communicating word meanings with visuals, increasing listening ability through game-like format)

http://www.jumpstart.com/parents/worksheets/reading-worksheets
Using Instructional Materials - helps with lexical knowledge (Vocabulary; Gc) deficit
Vocabulary with Sound
http://www.harcourtschool.com/glossary/science/

Belinda has a Processing Speed (Gs)/Automaticity Deficit – Suggest Need to Work on Building Fluency

- **Choral Repeated Reading**
  - Students listen to the text being read and follow along by reading aloud and looking at the text (using their fingers to keep pace)
  - 10 to 15 minutes
  - Text can be higher than students’ instructional level
  - Comprehension activities can be added
  - Feedback and assistance can be provided
**WWC: Reading Fluency interventions**

- **Peer-Assisted Learning Strategies (PALS)**
  - Teachers train students
  - Students partner with peers, alternating the role of tutor while reading aloud, listening, and providing feedback in various structural activities

![Image of students engaged in peer-assisted learning]

**WWC: Reading Fluency interventions**

- **Fluency Formula™**
  - Grades 1-6
  - Emphasizes automatic recognition of words, decoding accuracy, and oral expression
  - 10-15 minutes daily; small groups
  - Uses workbooks, read-aloud anthologies, fluency activity cards and audio CDs

![Image of Fluency Formula™ materials]
• Gsm deficit – memory span and working memory are deficient; visual memory ok
• Decoding is poor – he cannot hold the complete phonemic string in mind long enough to say the word
• Comprehension is poor because he needs to allocate all memory space decoding words and therefore cannot focus on meaning
• Fluency is impaired because he must re-read the text to gain meaning
• Intervention should focus on developing a sight word vocabulary
• Carl needs to be taught compensatory strategies to assist with poor Gsm (text previews; guided notes; one comprehension question at a time)

Mascolo and Flanagan (2011)

Carl

• SLD in Reading – underlying Working Memory deficit
Build Sight Words

Go to: [http://www.mrsperkins.com/dolch.htm](http://www.mrsperkins.com/dolch.htm)

Print Flash Cards

Use folding-in technique (builds confidence)

<table>
<thead>
<tr>
<th>Pre-primer</th>
<th>Primer</th>
<th>First</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>all</td>
<td>after</td>
</tr>
<tr>
<td>and</td>
<td>am</td>
<td>again</td>
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<td>away</td>
<td>are</td>
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<td>big</td>
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<td>any</td>
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<td>brown</td>
<td>could</td>
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<td>but</td>
<td>every</td>
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<tr>
<td>for</td>
<td>came</td>
<td>fly</td>
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<tr>
<td>funny</td>
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<td>from</td>
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<td>go</td>
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<td>help</td>
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<td>going</td>
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<td>here</td>
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<td>have</td>
<td>him</td>
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<tr>
<td>it</td>
<td>he</td>
<td>his</td>
</tr>
<tr>
<td>jump</td>
<td>into</td>
<td>how</td>
</tr>
<tr>
<td>little</td>
<td>like</td>
<td>just</td>
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<tr>
<td>look</td>
<td>must</td>
<td>know</td>
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<tr>
<td>make</td>
<td>new</td>
<td>let</td>
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<tr>
<td>me</td>
<td>no</td>
<td>live</td>
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<tr>
<td>my</td>
<td>now</td>
<td>may</td>
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<td>not</td>
<td>on</td>
<td>of</td>
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<td>one</td>
<td>our</td>
<td>old</td>
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<tr>
<td>play</td>
<td>out</td>
<td>once</td>
</tr>
</tbody>
</table>

Build Sight Words: Good Visual Ability (Gv); Difficulty with Memory (Gsm)
Carl needs strategies for Gsm deficits (memory span; working memory)

- **Give Directions in Multiple Formats:**
  - visual and verbal
  - encourage him to paraphrase directions and explain what they mean
  - give examples of what needs to be done

Glenda Thorne, Ph.D., “10 Strategies to Enhance Students’ Memory”; CLD.org

Carl needs strategies for Gsm deficits (memory span; working memory)

- **Teach Students to Over-learn Material**
  - several error-free repetitions are needed to solidify the information

- **Teach Students to Use Visual Images and Other Memory Strategies**

Glenda Thorne, Ph.D., “10 Strategies to Enhance Students’ Memory”; CLD.org
Visual Images Used to Aid Vocabulary Development

• Reading
  – Vocabulary Cartoons II (Burchers, 2000)
    • Target word and definition are included along with a cartoon that reinforces the words meaning in a visual format
    • Grades 3+

**COLOSSAL**
(koh·LÖ·shəl) adj.
enormous, gigantic, huge in size, extent or degree
Sounds like: FOSSIL

*A COLOSSAL FOSSIL*
Sight Word Development Aided by Visual Images and Multiple Associations

**Strategies for Gsm deficits**
(memory span; working memory)

- Give Teacher-Prepared Handouts Prior to Class Lectures:
  - brief outline
  - guided notes
  - partially completed graphic organizer that the student would complete during the lecture

Glenda Thorne, Ph.D., “10 Strategies to Enhance Students’ Memory”; CLD.org
Strategies for Gsm deficits (memory span; working memory)

• **Teach Students to Be Active Readers:**
  – students should underline, highlight, or jot key words down in the margins
  – To consolidate this information in long-term memory, they can make outlines or use graphic organizers

Glenda Thorne, Ph.D., “10 Strategies to Enhance Students’ Memory”; CLD.org

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Strategies for Gsm deficits (memory span; working memory)

• **Help Students Develop Cues When Storing Information:**
  – HOMES can be used to represent the names of the Great Lakes – Huron, Ontario, Michigan, Erie and Superior

• **Prime the Memory Prior to Teaching/Learning:**
  – discuss the vocabulary and the overall topic before a reading comprehension task is given. This will allow them to focus on the salient information and engage in more effective depth of processing.

Glenda Thorne, Ph.D., “10 Strategies to Enhance Students’ Memory”; CLD.org
Strategies for Gsm deficits

• Review Material Before Going to Sleep:
  – information studied this way is better remembered
  – any other task that is performed after reviewing and prior to sleeping (such as getting a snack, brushing teeth, listening to music) interferes with consolidation of information in memory

Different Cognitive Ability Profiles Suggest Different Interventions

• All had same academic deficits (decoding, comprehension, fluency)
• All made slow gains with Reading Recovery
• All had different patterns of cognitive strengths and weaknesses
• Reading Recovery – allocating time to areas that do not need to be trained
• Not enough explicit instruction in main problem area because the intervention was not tailored

Glenda Thorne, Ph.D., “10 Strategies to Enhance Students’ Memory”; CLD.org

Mascolo and Flanagan (2010)
- Dylan
- Age 10, Grade 5
- General Education with Supplemental Reading and Math
- Reads at end of 1st grade/early 2nd grade level
  - Has been receiving “Wilson” for 3 years
- Math ability at early 2nd grade level
- Writing also significantly below grade level
- Receives “speech” weekly, presumably for articulation difficulties

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Adapted from XBA3 Flanagan (2013)
Look for Patterns in the Data that are Consistent with What is Known about SLD

IDEA – Disorder in one or more of the basic psychological processes....

Written Language Disorder Subtypes

Subtypes of Dysgraphia

• Impaired ability to learn to write
1. Graphomotor Dysgraphia

- Refers to a wide variety of motor skill deficits involved in the planning, organization, guidance, and automaticity to transcribe thoughts and ideas on paper – the physical act or output side of writing (Feifer, in press)
2. Dyslexic Dysgraphias

- Deficits in mastering the spelling patterns of words

  - **Dysphonetic Dysgraphia.** Stems from disruptions to the phonological processor, which hinders the ability to differentiate sounds in words, manipulate sounds in words, and combine together sounds in words.

  Feifer (in press)
2. Dyslexic Dysgraphias

- **Surface Dysgraphia.** Stems from deficits with the orthographic representations of words
  
  • In English over 1100 ways of representing 44 sounds (phonemes) using different letter combinations (Uhry & Clark, 2005)
Orthographic Spelling Miscues

<table>
<thead>
<tr>
<th>Target Word</th>
<th>Orthographic Spelling Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onion</td>
<td>Unnyun</td>
</tr>
<tr>
<td>Yacht</td>
<td>Yot</td>
</tr>
<tr>
<td>Debt</td>
<td>Det</td>
</tr>
<tr>
<td>Syrup</td>
<td>Cirrip</td>
</tr>
<tr>
<td>Please</td>
<td>Plez</td>
</tr>
<tr>
<td>Bridge</td>
<td>Breg</td>
</tr>
</tbody>
</table>

Feifer (in press)

Orthographic Representation of Words

• According to Uhry and Clark (2005), the orthographic representation of words assumes relative importance later in the developmental progression of the spelling process, though effective phonological mapping of sounds greatly enables the visual word form area to perform its job.

Feifer (in press)
Orthographic Representation of Words

- There is a symbiotic relationship between the sound mappings and visual-spatial mappings of the alphabetic principle in learning to spell

<table>
<thead>
<tr>
<th>SPELLING STAGE</th>
<th>EXAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-phonetic – random string of letters.</td>
<td>GXVBMERUIO</td>
</tr>
<tr>
<td>Semi-Phonetic - letters represent phonemes.</td>
<td>IY LV U (I love you)</td>
</tr>
<tr>
<td>Phonetic - all phonemes are represented.</td>
<td>I LYK IS CREM (I like ice cream)</td>
</tr>
<tr>
<td>Transitional – use of orthographical units.</td>
<td>THE PEPLE R LAWD (The people are loud)</td>
</tr>
<tr>
<td>Conventional – correct use of orthography.</td>
<td>THE PEOPLE ARE LOUD</td>
</tr>
</tbody>
</table>

Feifer (in press)

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Chart from Feifer (in press)
2. Dyslexic Dysgraphias

- Mixed Dysgraphia represents the most severe type of spelling disability for students as there is no usable key to unlock the functional code of literacy (Feifer, in press).

  - Generally, these spellers have difficulty across the entire literacy spectrum, and are characterized by a combination of poor phonological processing skills, poor orthographic skills, limited working memory, and rather bizarre error patterns in their spelling (Pugh et al, 2000).

### Mixed Dysgraphia Spelling Examples

<table>
<thead>
<tr>
<th>Target Word</th>
<th>Misspelling</th>
<th>Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>advantage</td>
<td>advangate</td>
<td>letter order reversal</td>
</tr>
<tr>
<td>cobweb</td>
<td>coweb</td>
<td>consonant omission</td>
</tr>
<tr>
<td>illusion</td>
<td>elushn</td>
<td>orthographic error</td>
</tr>
<tr>
<td>pocket</td>
<td>poet</td>
<td>syllable omission</td>
</tr>
<tr>
<td>work</td>
<td>wrok</td>
<td>letter order reversal</td>
</tr>
<tr>
<td>kitchen</td>
<td>kinchen</td>
<td>insertion error</td>
</tr>
<tr>
<td>worried</td>
<td>werie</td>
<td>consonant deletion</td>
</tr>
</tbody>
</table>

Feifer (in press)
Executive Dysgraphia

- Involves the actual production or output of text on paper
- an inability to master the implicit rules for grammar and syntax, difficulty planning and organizing extended passages, poor use of a topic sentence, little elaboration of detail, inability to use paragraph breaks appropriately, and poor understanding of how words and phrases can be combined.

Feifer (in press)

Three Cognitive Constructs in Executive Dysgraphia

1. **Verbal Retrieval Skills** - The brain tends to categorize language by way of semantic concepts or associations often stored in a hierarchical fashion. According to Blumenfield et al. (2006), activation of the medial temporal gyrus has been observed during semantic association tasks where children must determine if two words are related in some fashion.

2. **Working Memory Skills** - The ability of working memory to recall spelling rules and boundaries, remember grammatical procedures, maintain sentence structures, punctuate appropriately, monitor spacing between letters and words, and retain thoughts and ideas long enough to arrange in a syntactical fashion is perhaps the single most important cognitive attribute for the writer (Feifer & Defina, 2002). According to Ammoni et al. (1998), the degree to which a written language task has been “automated” plays a key role in the amount of working memory needed to accomplish a specific writing task.

3. **Executive Functioning Skills** - The syntactical arrangement of thought is driven by executive functioning. Syntax represents the brain’s hardwired ability to sequence mental representations (semantics), either verbally, nonverbally, or through writing.

Feifer (in press)
Executive Dysgraphia: An inability to master the implicit rules for grammar and syntax which dictate precisely how words and phrases can be combined. Specific errors include:

- *Word omissions.*
- *Word ordering errors.*
- *Incorrect verb and pronoun usage.*
- *Word ending errors.*
- *Lack of punctuation.*
- Lack of capitalization.
- *Discrepancy between elaboration in oral expression vs. written expression.*
- *Excessive time needed for minimal output.*
- *Simplistic sentence structure.*
- *Inability to craft a topic sentence.*
- *Poor paragraph breaks in narrative writing.*
- *Poor use of transitional words.*
- *Inability to shift from one topic to the next.*
- *Poor self-monitoring.*
- *Writing in conversational phrases rather than conventional sentences.*
- *Weak opinion development.*
- *Meandering style void of thematic development.*
Individual Differences ARE Important

• “A neuropsychological process that is important to reading skills development is working memory – it is a crucial process for early reading recognition and later reading comprehension. One must assess it if one is to develop the most appropriate method of intervention (Teeter et al., 1997).”

• “Given the findings from the neuroimaging and neuropsychological fields of deficient performance on measures of working memory, processing speed, auditory processing ability, and executive functions, evaluation of these skills is necessary to determine the most appropriate program to fit the individual child’s need.”

Semrud-Clikeman (2005)

Individual Difference ARE Important

• “The danger with not paying attention to individual differences is that we will repeat the current practice of simple assessments in curricular materials to evaluate a complex learning process and to plan for interventions with children and adolescents with markedly different needs and learning profiles.” (Semrud-Clikeman, 2005)

• “Nonresponders” provide sound evidence that one size DOES NOT fit all.
## Individual Differences

### Differential Diagnosis: Intellectual Disability, General Learning Difficulty (Slow Learner), and Specific Learning Disability

### Differential Diagnosis: Cognitive Ability and Adaptive Behavior

<table>
<thead>
<tr>
<th><strong>Intellectual Disability (ID)</strong></th>
<th><strong>General Learning Difficulty (Slow Learner)</strong></th>
<th><strong>Specific Learning Disability (SLD)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>General ability ≤ 70-75</td>
<td>General ability &gt; 75 and ≤ 89</td>
<td>General ability ≥ 90</td>
</tr>
<tr>
<td>Little variation in cognitive ability and processing profile</td>
<td>Little to moderate variation in cognitive ability and processing profile</td>
<td>Moderate to high (or statistically significant) variation in cognitive ability and processing profile</td>
</tr>
<tr>
<td>All or nearly all cognitive areas ≤ 75</td>
<td>May have normative deficits in one or more cognitive and academic areas (≤ 85)</td>
<td>Normative deficits (≤ 85) in specific cognitive abilities and processes; Normative deficits (≤ 85) in specific academic areas(s); Empirical or ecologically valid relationship between cognitive and academic deficits</td>
</tr>
<tr>
<td><em>Possible relative strengths in one or more processes or abilities that are not highly g saturated, such as Ga (e.g., phonemic awareness) and Gs (e.g., simple clerical-type tasks)</em></td>
<td>May have relative strengths in one or more processes or abilities</td>
<td>Intact functioning (≥ 90 and ≤ 115) in many processes and abilities and possible normative cognitive or academic strengths (&gt; 115)</td>
</tr>
<tr>
<td>Deficits (≤ 75) in Adaptive Behavior; little variation in performance across adaptive behavior domains</td>
<td>May have one or more deficits in Adaptive Behavior (but not in all domains)</td>
<td>Minimal to no deficits in Adaptive Behavior</td>
</tr>
</tbody>
</table>
### Differential Diagnosis: Etiology

<table>
<thead>
<tr>
<th>Intellectual Disability (ID)</th>
<th>General Learning Difficulty (Slow Learner)</th>
<th>Specific Learning Disability (SLD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normative cognitive deficits are explained by genetic conditions (e.g., PKU, chromosomal abnormalities, such as Down syndrome and fragile X syndrome); problems during pregnancy (e.g., use of alcohol or drugs, illnesses of the mother); problems at birth (prematurity, low birth weight); problems after birth (e.g., childhood diseases, head injuries; lead and mercury exposure); or poverty and cultural deprivation (e.g., malnutrition, inadequate medical care, environmental health hazards; under-stimulation). Note: in approximately 1/3 of individuals with ID, the cause is not known.</td>
<td>Underlying causes of generally low average cognitive and academic abilities are typically not known.</td>
<td>SLD has a neurobiological basis. The pattern of generally average or better overall cognitive ability and below average performance in related cognitive and academic areas cannot be explained by exclusionary factors (e.g., poor instruction; social/emotional factors; psychological disturbance; cultural or language differences, environmental deprivation, etc.), although one or more of these factors may contribute to weak academic performance.</td>
</tr>
</tbody>
</table>

### Differential Diagnosis: Response to Instruction/Intervention and Programming

<table>
<thead>
<tr>
<th>Intellectual Disability (ID)</th>
<th>General Learning Difficulty (Slow Learner)</th>
<th>Specific Learning Disability (SLD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Progress Monitoring (or other performance indicators) demonstrates very slow rate of response/learning; will not meet typical grade level benchmarks in any academic area</td>
<td>Progress Monitoring (or other performance indicators) demonstrates slow rate of response/learning; may meet typical grade level benchmarks in some, but not all, academic areas</td>
<td>Following a comprehensive evaluation and resultant provisions of tailored interventions, accommodations, compensatory strategies, and/or modifications, Progress Monitoring (or other performance indicators) demonstrates rate of response/learning similar to same grade peers; may approximate or meet typical grade level benchmarks</td>
</tr>
<tr>
<td>Special Education; Tier II and Tier III interventions in General Education; Remedial Programs; 504</td>
<td>Special Education; Remedial Programs; Inclusion (Tier II and Tier III interventions)</td>
<td>Special Education; Remedial Programs; Inclusion (Tier II and Tier III interventions)</td>
</tr>
<tr>
<td>Primary Fact: Self-Help Skills; Functional Academics; Social Skills</td>
<td>Primary Fact: Functional Academics; Vocational Training; Accommodations; Compensatory Strategies; Social Skills and Self-Esteem</td>
<td>Primary Fact: Grade Level Performance; College Preparation; Accommodations; Compensatory Strategies; Self-Esteem; Self-Advocacy</td>
</tr>
<tr>
<td>Use data from strengths-based assessment for intervention planning</td>
<td>Use data from strength-based assessment for intervention planning</td>
<td>Use data from strength-based assessment for intervention planning</td>
</tr>
</tbody>
</table>
### The Cross-Battery Assessment Approach


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#### CHC Diagnostic Reading XBA Assessment

<table>
<thead>
<tr>
<th>Broad CHC Markers</th>
<th>Narrow CHC Markers</th>
<th>Relevant WISC-IV tests</th>
<th>XBA with Selected Tests from WJ III and ERA</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \text{G}_m )</td>
<td>Working Memory (MW)</td>
<td>*Digit Span (MS/MW)</td>
<td>*14 Subtests – More Areas Assessed Than Any Stand Alone Battery</td>
</tr>
<tr>
<td>( \text{G}_s )</td>
<td>Perceptual Speed (P)</td>
<td>*Letter-Number Seq. (MW)</td>
<td></td>
</tr>
<tr>
<td>( \text{G}_c )</td>
<td>Language Dev. (LD)</td>
<td>*Coding (P)</td>
<td></td>
</tr>
<tr>
<td>( \text{G}_r )</td>
<td>Listening Ability (LS)</td>
<td>*Symbol Search (P)</td>
<td></td>
</tr>
<tr>
<td>( \text{G}_a )</td>
<td>General Information (K0)</td>
<td>*Cancellation (P)</td>
<td></td>
</tr>
<tr>
<td>( \text{G}_v )</td>
<td>Lexical Knowledge (VL)</td>
<td>*Vocabulary (VL)</td>
<td></td>
</tr>
<tr>
<td>( \text{G}_a )</td>
<td>Associative Mem. (MA)</td>
<td>*Similarities (VL)</td>
<td></td>
</tr>
<tr>
<td>( \text{G}_v )</td>
<td>Naming Facility (NA)</td>
<td>*Comprehension (LD)</td>
<td></td>
</tr>
<tr>
<td>( \text{G}_a )</td>
<td>Phonetic Coding (PC)</td>
<td>Information (K0)</td>
<td></td>
</tr>
<tr>
<td>( \text{G}_v )</td>
<td>Orthographic Processing</td>
<td>Word Reasoning (VL)</td>
<td></td>
</tr>
</tbody>
</table>

* *Visual-Auditory Learning (MA) |
* *Rapid Pic. Nam. (NA)* Fluency |
* *Retrieval Fluency (FI)* |
* *Digital Orthographic Naming* |
* *Silent Orthographic Efficiency* |

---

**Basic Reading Skills Referral for ages 6 to 8 – WISC-IV Selected as Core Battery**

*See Essentials of Cross-Battery Assessment, 3rd edition (Flanagan, Ortiz, & Alfonso, 2013) for more examples*
The CHC Cross-Battery Assessment (XBA) Approach

• Guidelines for Test Selection and Organization
• Classification of Subtests According to CHC Cognitive and Academic Abilities and Neuropsychological Processes
• Guidelines for Hypothesis Testing
• Guidelines for Test Interpretation
• Automated Program to Facilitate Data Management, Interpretation, and Reporting of Test Performance

What is Cross-Battery Assessment?

• An approach that neuropsychologists, and astute clinicians in other assessment-related fields, have always followed
• Flanagan and colleagues transformed the practice of crossing batteries into a method that is both psychometrically and theoretically defensible
  – A systematic method of ensuring adequate construct representation across a wide range of cognitive and academic abilities and neuropsychological processes
  – A systematic method of interpreting test data from more than one battery
The Need for Cross-Battery Assessment

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

(Kaufman, 1994)

Three Pillars of XBA

1. CHC Theory
2. CHC Broad (Stratum II)
3. CHC Narrow (Stratum I)
XBA Guiding Principles

I. Select a battery that best addresses the referral concerns
   – 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)

XBA Guiding Principles

III. Select tests classified through an acceptable method
    – Factor Analyses or Expert Consensus
      • Use relatively pure CHC indicators
        – See Appendix B
      • Use 2 or more qualitatively different narrow ability indicators to represent each broad ability domain
        – Better representation with more diversity in narrow abilities
      • Use 2 or more qualitatively similar narrow ability indicators to represent each narrow ability domain
Excerpt from Appendix B in Cross-Battery Book (Flanagan et al., 2013)

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 CHC Analyzer Tab to create a broad ability composite
XBA Guiding Principles

V. When crossing batteries use tests developed and normed within a few years of one another
   – Flynn effect
   – All tests in Cross-Battery book were normed within about 10 years of one another (2001 – 2012)

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
**Manifestations of Cognitive Weaknesses and Examples of Recommendations and Interventions**

(Manifestations of Cognitive Weaknesses and Examples of Recommendations and Interventions (Flanagan, Alfonso, & Mascolo, 2011)

**Definitions of CHC Cognitive Abilities and Neuropsychological Functions, Manifestations of Cognitive Weaknesses and Examples of Recommendations and Interventions**

<table>
<thead>
<tr>
<th>CHC Broad Cognitive Abilities</th>
<th>Brief Definitions</th>
<th>General Manifestations of Cognitive Neuropsychological Weakness</th>
<th>Specific Manifestations of the Cognitive Neuropsychological Weakness</th>
<th>Recommendations/Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluid Reasoning (Gf)</td>
<td>Novel reasoning and problem solving; ability to solve problems that are unfamiliar. Processes are minimally dependent on prior learning. Involves manipulating rules, abstracting, generalizing, and identifying logical relationships. Fluid reasoning is evident in inferential reasoning, concept formation, classification of unfamiliar stimuli, categorization, and extrapolation of reasonable estimates in ambiguous situations (Shimadey &amp; Mcgrew, 2012)</td>
<td>Higher level thinking and reasoning.</td>
<td>Reading Difficulties: Drawing inferences from text. Abstracting main idea(s). Math Difficulties: Reasoning with quantitative information (word problems). Internalizing procedures and processes used to solve problems. Apprehending relationships between numbers. Writing Difficulties: Essay writing and generalizing concepts. Developing a theme. Comparing and contrasting ideas.</td>
<td>Develop student’s skill in categorizing objects and drawing conclusions. Use demonstrations to externalize the reasoning process. Gradually offer guided practice (e.g., guided questions list) to promote internalization of procedures or process(es). Targeted feedback. Cooperative learning. Reciprocal teaching. Use graphic organizers to arrange information in visual format. Teach metacognitive strategies (mnemonics that are measurable and that accurately represent the learning task). Comparison of new concepts to previously learned concepts (same vs. different). Use analogies, similes, metaphors when presenting tasks.</td>
</tr>
<tr>
<td>Narrow Gf abilities include Inductive, General Sequential Reasoning (Deduction), and Quantitative Reasoning</td>
<td>Difficulties with: Deriving solutions for novel problems. Extending knowledge through critical thinking. Perceiving and applying underlying rules or process(es) to solve problems.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


**IMPLEMENTING XBA STEP BY STEP**
Implementation of XBA: **Step 1**

- Select of a Cognitive Battery that is considered most relevant in light of referral concerns and unique examinee variables
  - Consider:
    - Age and Developmental level
    - Floor and Ceiling
    - English language proficiency
      - Cultural Loading
      - Linguistic Demand
    - Specific referral concerns
      - SLD
      - MR (Intellectually Disabled)
      - Gifted

Implementation of XBA: **Step 2**

- Identify the CHC *Broad Abilities* that are measured by the selected cognitive battery
  - **Adequate** = battery has at least 2 qualitatively different indicators of the broad ability.
  - **Underrepresented** = only one narrow aspect of the broad ability is included.
  - **Not measured**
Implementation of XBA:
Step 2 (Continued)

- If underrepresented or not measured:
  - Look out of battery to supplement core battery if necessary in light of referral
Implementation of XBA: Step 3

- Identify the CHC *Narrow Abilities and Processes* that are measured by the selected cognitive battery

- If those narrow abilities that are considered important to assess in light of the referral are underrepresented or not measured, go out of battery and supplement

---

Excerpt from Appendix B
In Cross-Battery Book (Flanagan et al., 2013)

<table>
<thead>
<tr>
<th>Inductive (I)</th>
<th>General Sequential Reasoning (IG)</th>
<th>Quantitative Reasoning (IQ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The ability to observe a phenomenon and discover the underlying principles or rules that determine its behaviors.</td>
<td>The ability to reason logically using known premises and principles.</td>
<td>The ability to reason, either with induction or deduction, with numbers, mathematical relations, and operators.</td>
</tr>
<tr>
<td>DAS-II MATRICIES</td>
<td>KABC-II STORY COMPLETION (7-18 YEARS) [Gc:Kg]*</td>
<td>DAS-II SEQUENTIAL &amp; QUANTITATIVE REASONING</td>
</tr>
<tr>
<td>DAS-II PICTURE SIMILARITIES</td>
<td>WI-II NU COG ANALYSIS-SYNTHESIS</td>
<td>6-17</td>
</tr>
<tr>
<td>KABC-II PATTEREN REASONING (7-18 YEARS) [Gc:Kg]*</td>
<td>CTONI-2 GEOMETRIC SEQUENCES</td>
<td>SBS NONVERBAL QUANTITATIVE REASONING [Gq:A3]*</td>
</tr>
<tr>
<td>SES NONVERBAL FLUID REASONING 2-85+</td>
<td>CTONI-2 PICTORIAL SEQUENCES</td>
<td>2.85+</td>
</tr>
<tr>
<td>SES VERBAL FLUID REASONING 2-85+</td>
<td>RINA CONCEPTUAL SHIFTING</td>
<td>WASM-IV Figure Weights</td>
</tr>
<tr>
<td>WISC-IV PICTURE CONCEPTS</td>
<td>NART-2 NAGUIERI NONVERBAL ABILITY TEST-SECOND EDITION (I)</td>
<td>15-90</td>
</tr>
<tr>
<td>WI-II NU COG CONCEPT FORMATION 4-90+</td>
<td>PLAI-2 REASONING</td>
<td>WI-III NU NS NUMBER SERIES 6-90+</td>
</tr>
<tr>
<td>CTONI-2 GEOMETRIC ANALOGIES</td>
<td>RIAS USE ITEM OUT</td>
<td>WI-III NU NS NUMBER MATRICES 4-90+</td>
</tr>
<tr>
<td>D-KEFS SORTING TEST: FREE SORTING 8-89</td>
<td>D-KEFS SORTING TEST: SORT RECOGNITION 8-89</td>
<td></td>
</tr>
</tbody>
</table>
Implementation of XBA: **Step 4**

- Administer and Score Selected Cognitive Battery and Supplemental tests
  - *Follow directions specified by the test publisher’s standardization procedures.*

Implementation of XBA: **Step 5**

- Enter Scores into the *XBA Data Management and Interpretive Assistant* (XBA DMIA v2.0)
Cross-Battery Assessment

- Based on CHC theory
- Classification System – Common nomenclature for test development and interpretation
- Allows for greater breadth and depth of measurement of cognitive abilities in assessment
- First systematic theoretically and psychometrically defensible means of “crossing” batteries
Rapid Reference 1.2

What's New to This Edition?

- Use of expanded CHC theory (e.g., Schneider & McGrew, 2012) and its research base as the foundation for organizing assessments and interpreting ability test performance.

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Rapid Reference 1.2

What's New to This Edition?

- Inclusion of all current intelligence batteries (i.e., WJ III NU, WPPSI-III, WPPSI-IV, WISC-IV, SB5, KABC-II, DAS-II, and WAIS-IV), major tests of academic achievement (e.g., WJ III NU ACH, KTEA-II, WIAT-III, KeyMath3, WRMT-3), selected neuropsychological instruments (e.g., D-KEFS, NEPSY-II), and numerous special-purpose tests (e.g., speech-language tests, memory tests, phonological processing tests, orthographic processing, and fine motor tests).
New Features in XBA3

CLASSIFIES ALL TESTS ACCORDING TO NEUROPSYCHOLOGICAL DOMAIN:

A KABC-II example

<table>
<thead>
<tr>
<th>Battery</th>
<th>Subtest</th>
<th>Attention</th>
<th>Sensory-Motor</th>
<th>Auditory Verbal</th>
<th>Language Receptive</th>
<th>Language Expressive</th>
<th>Executive Functions</th>
<th>Speed and Efficiency</th>
<th>Visual-Spatial</th>
<th>Memory and Learning</th>
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<tbody>
<tr>
<td>Atlantis</td>
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<td>Atlantis Delayed</td>
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<td>Conceptual Thinking</td>
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<td>Expressive Vocabulary</td>
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<td>Face Recognition</td>
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<td>Gestalt Closure</td>
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<td>Hand Movements</td>
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<tr>
<td>Number Recall</td>
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</tr>
<tr>
<td>Pattern Reasoning</td>
<td></td>
<td>✓</td>
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<td></td>
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<tr>
<td>Rebus</td>
<td></td>
<td>✓</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rebus Delayed</td>
<td></td>
<td>✓</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Riddles</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rover</td>
<td></td>
<td>✓</td>
<td></td>
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<tr>
<td>Triangles</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verbal Knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Word Order</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: A check mark (✓) indicates the authors’ classifications. A bullet (•) indicates the authors’ classification and Miller’s (in press) primary neuropsychological domain classification.
SUMMARY—Analysis of XBA Expert Consensus Procedure (Flanagan, Ortiz, & Alfonso, 2013)

<table>
<thead>
<tr>
<th>Classification of Broad Ability</th>
<th>Number of Classifications</th>
<th>Number Agree</th>
<th>Number Disagree</th>
<th>Number of Categories</th>
<th>Gwet’s AC1</th>
<th>Cohen’s Kappa</th>
<th>Scott’s Pi</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Broad Ability Domains</td>
<td>306</td>
<td>296</td>
<td>13</td>
<td>13</td>
<td>96</td>
<td>96</td>
<td>96</td>
</tr>
<tr>
<td>Classification of Narrow Abilities Within Broad Ability Area</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gf: Fluid Reasoning</td>
<td>24</td>
<td>23</td>
<td>4</td>
<td>3</td>
<td>89</td>
<td>76</td>
<td>76</td>
</tr>
<tr>
<td>Gc: Crystallized Knowledge</td>
<td>100</td>
<td>88</td>
<td>12</td>
<td>6</td>
<td>68</td>
<td>52</td>
<td>68</td>
</tr>
<tr>
<td>Glr: Long-Term Memory</td>
<td>25</td>
<td>19</td>
<td>6</td>
<td>11</td>
<td>76</td>
<td>67</td>
<td>76</td>
</tr>
<tr>
<td>Gsm: Short-Term Memory</td>
<td>31</td>
<td>31</td>
<td>0</td>
<td>2</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Gv: Visual Processing</td>
<td>32</td>
<td>31</td>
<td>1</td>
<td>11</td>
<td>97</td>
<td>96</td>
<td>97</td>
</tr>
<tr>
<td>Gs: Auditory Processing</td>
<td>26</td>
<td>19</td>
<td>7</td>
<td>8</td>
<td>73</td>
<td>62</td>
<td>73</td>
</tr>
<tr>
<td>Gs: Processing Speed</td>
<td>16</td>
<td>14</td>
<td>2</td>
<td>5</td>
<td>87</td>
<td>76</td>
<td>87</td>
</tr>
<tr>
<td>Gnc: Reading-Writing Ability</td>
<td>44</td>
<td>42</td>
<td>2</td>
<td>7</td>
<td>96</td>
<td>95</td>
<td>95</td>
</tr>
<tr>
<td>Gq: Quantitative Reasoning</td>
<td>16</td>
<td>16</td>
<td>0</td>
<td>2</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Gp: Psychomotor Abilities</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>8</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Gdm: Domain-Specific Knowledge</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>7</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>TOTAL or MEAN VALUE:</td>
<td>328</td>
<td>293</td>
<td>30</td>
<td>6</td>
<td>0.91</td>
<td>0.87</td>
<td>0.91</td>
</tr>
</tbody>
</table>

See Appendix L in Essentials of Cross-Battery Assessment for Details of Expert Consensus Study
What’s New to This Edition?

- Classification of all achievement, speech/language, phonological, and orthographic processing tests according to the Individuals with Disabilities Education Improvement Act (IDEIA, 2004) area of specific learning disability (e.g., reading decoding tests were classified as tests of Basic Reading Skill; math reasoning tests were classified as tests of Math Problem Solving).

New Features in XBA3

- Compares all achievement tests with regard to the nature of their task demands and task characteristics

Achievement Appendix Prepared by Jennifer T. Mascolo
Median Reliability Coefficients Used in Formulae to Calculate XBA Composites

<table>
<thead>
<tr>
<th>Broad Ability Domain</th>
<th>Number of Coefficients</th>
<th>Number of Narrow Abilities Represented</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gc</td>
<td>49</td>
<td>6</td>
<td>.88</td>
</tr>
<tr>
<td>Gf</td>
<td>29</td>
<td>3</td>
<td>.89</td>
</tr>
<tr>
<td>Gli</td>
<td></td>
<td></td>
<td>.81</td>
</tr>
<tr>
<td>Gsm</td>
<td></td>
<td></td>
<td>.87</td>
</tr>
<tr>
<td>Gv</td>
<td></td>
<td></td>
<td>.82</td>
</tr>
<tr>
<td>Ga</td>
<td></td>
<td></td>
<td>.89</td>
</tr>
<tr>
<td>Gs</td>
<td></td>
<td></td>
<td>.84</td>
</tr>
<tr>
<td>Gq</td>
<td></td>
<td></td>
<td>.93</td>
</tr>
<tr>
<td>Grw-R</td>
<td>10</td>
<td>3</td>
<td>.94</td>
</tr>
<tr>
<td>Grw-W</td>
<td>12</td>
<td>4</td>
<td>.87</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>221</strong></td>
<td><strong>40</strong></td>
<td></td>
</tr>
</tbody>
</table>

*Note*: The median values in this table were used in formulae to calculate CHC broad and narrow ability composites on the CHC Analyzer tab of the DMIA v2.0.

**Over 1750 Coefficients Gathered to Program the DMIA v2.0 and PSW-A v1.0**

**KABC-II Tab of XBA DMIA**

**KABC-II Data Automatically Transferred to CHC Analyzer**

**KABC-II/DAS-II Cross-Battery Data Analyzed**

**Estimate of Memory Span only**

**No More Averaging**
Table 3. Narrow Abilities Related to Reading Achievement Measured by Popular Batteries

<table>
<thead>
<tr>
<th>Diagnostic Reading Cross-Battery</th>
<th>Relevant Broad CHC Ability and Neuropsychological Domain</th>
<th>Relevant Narrow CHC Ability and Neuropsychological Process</th>
<th>Most Relevant WISC-IV and WAT-III Subtests</th>
<th>Most Relevant WI III COG and ACH Subtests</th>
<th>Most Relevant NEPSY-II Subtests</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fluid Reasoning</td>
<td>Matrix Reasoning</td>
<td>Concept Formation</td>
<td>Animal Sorting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gc - Comprehension-Knowledge</td>
<td>LS - Listening Ability</td>
<td>WAT-III Listening Comprehension</td>
<td>WI III NIJ ACH Oral Comprehension</td>
<td>Comprehension of Instructions</td>
</tr>
<tr>
<td></td>
<td>Related narrow abilities involve LI or Language Development</td>
<td>KD - General Information</td>
<td>Information</td>
<td>Body Part Naming and Identification</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gv - Short-term Memory</td>
<td>MV - Visual Memory</td>
<td>Letter-Number Sequencing</td>
<td>Auditory Working Memory</td>
<td>Auditory Attention and Response Set</td>
</tr>
<tr>
<td></td>
<td>Gv - Visual Processing</td>
<td>Orthographic Processing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gs - Auditory Processing</td>
<td>PC - Phonetic Coding</td>
<td>WAT-III Early Reading Skills</td>
<td>Incomplete Words</td>
<td>Phonological Processing</td>
</tr>
<tr>
<td></td>
<td>GLr - Long-term Storage and Retrieval</td>
<td>NA - Naming Facility (Rapid Naming)</td>
<td>Rapid Picture Naming</td>
<td>Speeded Naming</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Related narrow abilities involve LI or Language Development</td>
<td>MA - Associative Memory</td>
<td>Visual Auditory Learning</td>
<td>Memory for Names</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Related narrow abilities involve LI or Language Development</td>
<td>MG - Free Recall Memory</td>
<td>List Memory Delayed</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Related narrow abilities involve LI or Language Development</td>
<td>MM - Meaningful Memory</td>
<td>WI III NIJ ACH Story Recall</td>
<td>Narrative Memory</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gs - Processing Speed</td>
<td>RS - Reading Speed (with full comp)</td>
<td>WJ III NUACH Reading Fluency</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Related narrow abilities involve LI or Language Development</td>
<td>P - Perceptual Speed</td>
<td>Symbol Search</td>
<td>Visual Tracking</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Attention</td>
<td>Selective, Focused, Sustained</td>
<td>Consider Broad Attention</td>
<td>Auditory Attention and Response Set</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Executive Function</td>
<td>Consider Cascading Production Decrement/Increments Model</td>
<td>Consider Executive Processes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Rapid Reference 1.2

What's New to This Edition?
- Update and summary of current research on the relations among cognitive abilities, neuropsychological processes, and academic skills with greater emphasis on forming narrow CHC ability composites, given their importance in predicting academic performance.

Appendix K
Eugene, Oregon, School District Integrated Model for Specific Learning Disability Identification

Rapid Reference 1.2
What’s New to This Edition?
• Inclusion of examples of how the cross-battery approach is used within the context of various state and district criteria for SLD identification (see

Rapid Reference 2.6. WISC-IV/WIAT-III-based Diagnostic Reading Cross-Battery

<table>
<thead>
<tr>
<th>Relevant Broad NIC Ability and Neuropsychological Domain</th>
<th>Relevant Narrow NIC Ability and Neuropsychological Process</th>
<th>Most Relevant WISC-IV and WIAT-III Subtests</th>
<th>Supplemental Subtests for Generating Narrow Ability and Processing Composite and Testing Hypotheses</th>
</tr>
</thead>
<tbody>
<tr>
<td>GF - Fluid Reasoning</td>
<td>I - Induction Matrix Reasoning</td>
<td>Picture Concepts; check manifestation of GF weakness with WIAT-III Reading Comprehension (literal vs. inferential)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RG - General Sequential Reasoning (Deduction)</td>
<td>WJ III/NU COG Analysis Synthesis</td>
<td></td>
</tr>
<tr>
<td>Gc - Comprehension Knowledge</td>
<td>LS - Listening Ability WIAT-III Listening Comprehension</td>
<td>WJ III/NU ACH Oral Comprehension</td>
<td></td>
</tr>
<tr>
<td></td>
<td>KO - General Information Information</td>
<td>Comprehension</td>
<td></td>
</tr>
<tr>
<td></td>
<td>VL - Lexical Knowledge Vocabulary</td>
<td>Similarities; Word Reasoning</td>
<td></td>
</tr>
<tr>
<td>Core + Differentiation + Targeted 60 min/week minimum Instruction based on diagnostics Use of targeted instructional materials</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Core + Differentiation Same 40-90 min/day Use of supplemental materials to core Progress monitoring</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Core Reading 40-90 min/day Benchmark Screening min 2x/year</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figures and Content for Appendix Courtesy of Karen Apgar

86
Rapid Reference H.1
Selected Schools and Districts that Are Exemplars of the Effective Integration of RTI and Alternative Research-Based Approaches to SLD Identification

- Eugene School District 4J, Eugene, Oregon
- Greenville County Schools, Greenville, South Carolina
- Loudon County Public Schools, Virginia
- Portland Public Schools, Portland, Oregon
- Victoria Independent School District, Victoria, Texas
- Washington Elementary School District #6, Phoenix, Arizona

Department of Education, Minnesota
Merrick School District, Merrick, New York

Chapter Seven
CROSS-BATTERY ASSESSMENT CASE REPORT

Gail Cheramie

This chapter includes a psychological evaluation that was carried out by Gail Cheramie following the methods described in this book. The comprehensive psychological evaluation conducted by Gail highlights a student with a specific learning disability (SLD) in the area of writing and demonstrates
Appendix J: Case Studies by Practitioners

- **Specific Math Disability** – Jim Hanson
  - Based on the research of David Geary
  - Demonstrates use of PSW-A v1.0

- **English Language Learner Struggling Academically** – Karen Apgar
  - Demonstrates use of the C-LIM v2.0

- **SLD with a deficit in Glr** – John Garruto
  - Demonstrates use of DMIA v2.0 and PSW-A
For All Composites Entered Into DMIA v2.0

- Program Answers these Questions:
  - Is the Composite Cohesive?
  - Is there a Need for Follow-up Assessment?

### Rules for Cohesion for Two-Subtest Composites on Test Tabs

<table>
<thead>
<tr>
<th>Finding</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The difference between scores is not significant or uncommon</td>
<td>The difference between the scores that comprise the composite is not significant and occurs in more than 10% of the general population and, therefore, is common. The composite is cohesive and, therefore, provides a good summary of the theoretically related abilities it was intended to represent and should be interpreted.</td>
</tr>
<tr>
<td>The difference between scores is significant but not uncommon</td>
<td>Although the difference between the scores that comprise the cluster is significant, the magnitude of the difference occurs in at least 10% of the general population and, therefore, is common. Clinical judgment is needed to determine whether or not the composite is cohesive and, therefore, interpreted as an adequate summary of the theoretically related abilities it was intended to represent.</td>
</tr>
<tr>
<td>The difference between scores is significant and uncommon</td>
<td>The difference between the scores that comprise the composite is significant and occurs in &lt; 10% of the general population and, therefore, is considered uncommon. The composite is not cohesive, meaning that it is not a good summary of the theoretically related abilities it was intended to represent, and should not be interpreted.</td>
</tr>
</tbody>
</table>
Interpreting Three (or more)-Subtest Composites on the Test Tabs of the DMIA v 2.0

<table>
<thead>
<tr>
<th>Finding</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The magnitude of the difference between the highest and lowest score in the composite is <strong>uncommon</strong> in the general population</td>
<td>The difference between the scores that comprise the composite occurs in ≤ 10% of the general population and, therefore, is considered uncommon. The composite is <strong>not cohesive</strong>, meaning that it is not a good summary of the theoretically related abilities it was intended to represent, and should not be interpreted.</td>
</tr>
<tr>
<td>The magnitude of the difference between the highest and lowest score in the composite is <strong>common</strong> in the general population</td>
<td>The difference between the scores that comprise the composite occurs in more than 10% of the general population and, therefore, is common. The composite is <strong>cohesive</strong> and, therefore, provides a good summary of the theoretically related abilities it was intended to represent and should be interpreted.</td>
</tr>
</tbody>
</table>

---

**Appendix D on the CD of Essentials of Cross-Battery Assessment, 3e (Flanagan, Ortiz, & Alfonso, 2013)**

(44 pages; 11 batteries) – WJ III NU COG Gc Factor Example

<table>
<thead>
<tr>
<th>BATTERY Composite</th>
<th>Age in Years and Months</th>
<th>Statistical Significance Reported in Technical Manual (p &lt; .05)</th>
<th>Base Rate Reported in Technical Manual (≥ 10%)</th>
<th>Statistical Significance Based on Reliability Formula (p &lt; .05)</th>
<th>Base Rate Based on Formula (10%)</th>
<th>Statistical Significance Based on SD Difference Formula (ESD)</th>
<th>Base Rate Reported in DMIA (XBA II 2012)</th>
<th>Base Rate Reported in DMIA (XBA III 2013)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprehension-Knowledge</td>
<td>2-0–3:11</td>
<td>Not reported</td>
<td>Not reported</td>
<td>≥12 standard score points between tests</td>
<td>≥16 standard score points between tests</td>
<td>≥24 standard score points between tests</td>
<td>≥15 standard score points between tests</td>
<td>≥26 standard score points between tests</td>
</tr>
<tr>
<td></td>
<td>4-0–5:11</td>
<td>Not reported</td>
<td>Not reported</td>
<td>≥14 standard score points between tests</td>
<td>≥20 standard score points between tests</td>
<td>≥28 standard score points between tests</td>
<td>≥15 standard score points between tests</td>
<td>≥20 standard score points between tests</td>
</tr>
<tr>
<td></td>
<td>6-0–8:11</td>
<td>Not reported</td>
<td>Not reported</td>
<td>≥12 standard score points between tests</td>
<td>≥20 standard score points between tests</td>
<td>≥28 standard score points between tests</td>
<td>≥15 standard score points between tests</td>
<td>≥20 standard score points between tests</td>
</tr>
<tr>
<td></td>
<td>9-0–13:11</td>
<td>Not reported</td>
<td>Not reported</td>
<td>≥14 standard score points between tests</td>
<td>≥15 standard score points between tests</td>
<td>≥20 standard score points between tests</td>
<td>≥15 standard score points between tests</td>
<td>≥17 standard score points between tests</td>
</tr>
<tr>
<td></td>
<td>14-0–19:11</td>
<td>Not reported</td>
<td>Not reported</td>
<td>≥12 standard score points between tests</td>
<td>≥14 standard score points between tests</td>
<td>≥20 standard score points between tests</td>
<td>≥15 standard score points between tests</td>
<td>≥14 standard score points between tests</td>
</tr>
<tr>
<td></td>
<td>20-0–3:11</td>
<td>Not reported</td>
<td>Not reported</td>
<td>≥10 standard score points between tests</td>
<td>≥8 standard score points between tests</td>
<td>≥13 standard score points between tests</td>
<td>≥8 standard score points between tests</td>
<td>≥14 standard score points between tests</td>
</tr>
<tr>
<td></td>
<td>40+</td>
<td>Not reported</td>
<td>Not reported</td>
<td>≥10 standard score points between tests</td>
<td>≥8 standard score points between tests</td>
<td>≥13 standard score points between tests</td>
<td>≥8 standard score points between tests</td>
<td>≥13 standard score points between tests</td>
</tr>
</tbody>
</table>
Criteria in DMIA v2.0 for Follow-up on Lower Score within a Two-Subtest Composite (Subtests With Mean of 10 and Standard Deviation of 3)

Number-Letter Codes (e.g., 1A, 1B, 1C) are linked to Interpretive Statements
Criteria Used in DMIA v2.0 for Follow-up on Lower Score within a Three-Subtest Composite (when Subtests are on a Scale Having a Mean of 100 and Standard Deviation of 15)

<table>
<thead>
<tr>
<th>Subtest C</th>
<th>S5 ≤ 79</th>
<th>S5 ≥ 80 and ≤ 89</th>
<th>S5 ≥ 90</th>
</tr>
</thead>
<tbody>
<tr>
<td>S5 ≥ 79</td>
<td>MID-MIN &gt; 14 &lt; 35</td>
<td>MID-MIN &lt; 10</td>
<td>MID-MIN &lt; 10</td>
</tr>
<tr>
<td></td>
<td>YES (3A)</td>
<td>NO (1B)</td>
<td>NO (1B)</td>
</tr>
<tr>
<td>S5 ≥ 80</td>
<td>MID-MIN &gt; 14 &lt; 35</td>
<td>MID-MIN &lt; 10</td>
<td>MID-MIN &lt; 10</td>
</tr>
<tr>
<td>and</td>
<td>YES (4A)</td>
<td>NO (1B)</td>
<td>NO (1B)</td>
</tr>
<tr>
<td>S5 ≥ 89</td>
<td>MID-MIN &gt; 14 &lt; 35</td>
<td>MID-MIN &lt; 10</td>
<td>MID-MIN &lt; 10</td>
</tr>
<tr>
<td></td>
<td>YES (7A)</td>
<td>NO (1B)</td>
<td>NO (1B)</td>
</tr>
<tr>
<td>S5 ≥ 90</td>
<td>MID-MIN &gt; 14 &lt; 35</td>
<td>MID-MIN &lt; 10</td>
<td>MID-MIN &lt; 10</td>
</tr>
<tr>
<td></td>
<td>YES (7A)</td>
<td>NO (1B)</td>
<td>NO (1B)</td>
</tr>
</tbody>
</table>

If scores associated with Subtests A, B, and C are all within different ranges and MID-MIN > 14, YES (10A)

If scores associated with Subtests A and B are all within different ranges and MID-MIN > 10, NO (108)

If scores associated with Subtests A, B, and C are all within different ranges and MID-MIN > 5, MAYBE (10C)

Note: MIN = lowest score in the composite; MID = middle score in the composite; MAX = highest score in the composite. Number and letter combinations in parentheses within each cell correspond to the interpretive statements listed in rapid reference 3.6.

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Interpretive Output by DMIA 2.0</th>
<th>Ability Test Example</th>
<th>Examples of Practitioner Decision and General Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>6A</td>
<td>The lowest score in the composite is at least 15D lower than each of the other two scores and is reflective of a deficit. Therefore, follow-up assessment on the lowest score is considered necessary to obtain a better understanding of performance in this ability domain, including differences in specific or narrow abilities as well as differences in task characteristics and demands. WASIV Perceptual Reasoning Index = 90</td>
<td>Following the recommendations of the DMIA, the practitioner followed up on the lower score. The practitioner generated the following information upon which he based his follow-up assessment decision and a posteriori hypothesis a) Block Design and Visual Puzzles measure visualization (a 6G ability), whereas Matrix Reasoning measures mainly induction ([1 4 0] ability). b) Matt may have a weakness in his ability to reason, particularly with visual information; c) Matt may have difficulty with executive function. To test the first hypothesis, Matt was given the SBS Nonverbal Fluid Reasoning subtest. To test the second hypothesis, Matt was given the NEPSY II Animal Sorting subtest, which is a more sensitive measure of executive function as compared to Matrix Reasoning. The three Gf-I subtests were entered into the CHC tab of the DMIA for further analysis...</td>
<td></td>
</tr>
<tr>
<td>6B</td>
<td>The lowest score in the composite is suggestive of weak or deficient performance; however, the two lowest scores are not significantly different from one another, indicating similar performance. Therefore, follow-up is not considered necessary. WASIV Verbal Comprehension Index = 90</td>
<td>Jeremy has word retrieval difficulties and frustrates easily. Jeremy’s VCI appears to underemphasize his crystallized intelligence (9G). Although follow-up was not considered necessary, the practitioner wanted to test the “word retrieval” hypothesis by administering a 6G subtest that requires selecting the correct response in a Multiple Choice format, rather than a format that requires retrieval of a specific one-word response. Specifically, the practitioner wanted to minimize free recall retrieval from long-term storage in favor of recognition recall from long-term storage. If Jeremy has difficulty with free recall retrieval, as suspected, then he ought to do better on a test requiring recognition recall. CELF-4 Word Classes-Receptive requires the examinee to name the two words that go together after the examiner reads aloud three or four words. It is expected that CELF-4 Word Classes-Receptive performance will be within the normal limits of functioning and higher than Similarities, in particular...</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>S5 ≥ 90</th>
<th>MID-MIN &gt; 14 &lt; 35</th>
<th>MID-MIN &lt; 10</th>
<th>MID-MIN &lt; 10</th>
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<tr>
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<tr>
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<td>MID-MIN &lt; 10</td>
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<td>and</td>
<td>YES (6A)</td>
<td>NO (6A)</td>
<td>NO (6A)</td>
</tr>
<tr>
<td>S5 ≥ 89</td>
<td>MID-MIN &gt; 14 &lt; 35</td>
<td>MID-MIN &lt; 10</td>
<td>MID-MIN &lt; 10</td>
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<td></td>
<td>YES (6A)</td>
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<td>NO (6A)</td>
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Joe, age 6yr. 11 mos.

<table>
<thead>
<tr>
<th>Composite</th>
<th>Standard Score</th>
<th>Subject</th>
<th>Scaled Score</th>
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<tr>
<td>VCI</td>
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<td></td>
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<tr>
<td>PRI</td>
<td>89</td>
<td></td>
<td></td>
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<tr>
<td>WMI</td>
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<td></td>
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<tr>
<td>PRI</td>
<td>102</td>
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- Similarities: 7
- Vocabulary: 9
- Comprehension: 8
- Information: 9
- Word Reasoning: 7
- Block Design: 10
- Picture Concepts: 7
- Matrix Reasoning: 6
- Picture Completion: 9
- Digit Span: 10
- Letter-Number Seq.: 6
- Arithmetic: 7
- Coding: 10
- Symbol Search: 11

### Total Reading
- 74

### Basic Reading
- 75

### Written Expression
- 84

### Mathematics
- 89
  - Word Reading: 78
  - Pseudoword Decoding: 75
  - Reading Comp.: 79
  - Spelling: 84
  - Alphabetical Knowledge: 89
  - Sentence Comp.: 79
  - Math Problem Sol.: 86
  - Numerical Operations: 94

### WJ III Gf Factor
- 93

### WJ III Gs Factor
- 85

### Phonemic Awareness
- 89
  - Vis-Aud. Loading: 90
  - Retained Fluency: 90
  - Sound Blending: 80
  - Auditory Attention: 96
  - Incomplete Words: 85
  - Auditory Working Mem.: 82
### Evaluation of WISC-IV Data

| Name of Tester | Age: 9 years (3.6 months) | Score | PB | Criteria for Collection: Is variability... | Follow up Recommendations
<table>
<thead>
<tr>
<th></th>
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<td>9</td>
<td>10</td>
<td>93</td>
<td>Applicable</td>
<td>No</td>
</tr>
<tr>
<td>Working Memory</td>
<td>7</td>
<td>16</td>
<td>93</td>
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</tr>
<tr>
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<td>16</td>
<td>93</td>
<td>Applicable</td>
<td>No</td>
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<tr>
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<td>15</td>
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<td>Digit Symbol</td>
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<td>15</td>
<td>93</td>
<td>Applicable</td>
<td>No</td>
</tr>
</tbody>
</table>

**Clinical Clusters (Cluster Backgrounder)**

| Gyral Handedness Field Reasoning | 70 | 6 | 
|----------------------------------|----|----|------------------------------------------|
| Picture Concepts | 7 | 16 | 93 | Applicable | No | Not considered necessary |
| Matrix Reasoning | 6 | 15 | 93 | Applicable | No | Not considered necessary |
| Gyral Visual Field Reasoning | 84 | 15 | 93 | Applicable | No | Not considered necessary |
| Similarities | 7 | 16 | 93 | Applicable | No | Not considered necessary |
| Word Reasoning | 7 | 15 | 93 | Applicable | No | Not considered necessary |
| Gyral: Visual Knowledge | 97 | 42 | 93 | Applicable | No | Not considered necessary |
| Block Design | 10 | 50 | 93 | Applicable | No | Not considered necessary |
| Picture Completion | 9 | 37 | 93 | Applicable | No | Not considered necessary |
| Gyral: Logical Knowledge | 89 | 27 | 93 | Applicable | No | Not considered necessary |
| Vocabulary | 9 | 37 | 93 | Applicable | No | Not considered necessary |
| Word Reasoning | 7 | 15 | 93 | Applicable | No | Not considered necessary |
| Gyral: Information | 91 | 27 | 93 | Applicable | No | Not considered necessary |
| Comprehension | 0 | 25 | 93 | Applicable | No | Not considered necessary |
| Information | 9 | 27 | 93 | Applicable | No | Not considered necessary |

**Follow up Recommendations**

- **Language (Verbal Comprehension):**
  - Not considered necessary
  - The difference between the scores that comprise the composite is not statistically significant and a difference of this size occurs in more than 10% of the general population and therefore, is expected. Therefore, this difference is not considered necessary.

- **Working Memory:**
  - Not considered necessary
  - The difference between the scores that comprise the composite is not statistically significant and a difference of this size occurs in more than 10% of the general population and therefore, is expected. Therefore, this difference is not considered necessary.

- **Perceptual Reasoning (PRI):**
  - Not considered necessary
  - The difference between the scores that comprise the composite is not statistically significant and a difference of this size occurs in more than 10% of the general population and therefore, is expected. Therefore, this difference is not considered necessary.

- **Processing Speed (PS):**
  - Not considered necessary
  - The difference between the scores that comprise the composite is not statistically significant and a difference of this size occurs in more than 10% of the general population and therefore, is expected. Therefore, this difference is not considered necessary.

**Clinical Judgment Needed:**

- **Gyral Handedness Field Reasoning:**
  - Not considered necessary
  - The difference between the scores that comprise the composite is not statistically significant and a difference of this size occurs in more than 10% of the general population and therefore, is expected. Therefore, this difference is not considered necessary.

- **Gyral Visual Field Reasoning:**
  - Not considered necessary
  - The difference between the scores that comprise the composite is not statistically significant and a difference of this size occurs in more than 10% of the general population and therefore, is expected. Therefore, this difference is not considered necessary.

- **Gyral: Visual Knowledge:**
  - Not considered necessary
  - The difference between the scores that comprise the composite is not statistically significant and a difference of this size occurs in more than 10% of the general population and therefore, is expected. Therefore, this difference is not considered necessary.

- **Gyral: Logical Knowledge:**
  - Not considered necessary
  - The difference between the scores that comprise the composite is not statistically significant and a difference of this size occurs in more than 10% of the general population and therefore, is expected. Therefore, this difference is not considered necessary.

- **Gyral: Information:**
  - Not considered necessary
  - The difference between the scores that comprise the composite is not statistically significant and a difference of this size occurs in more than 10% of the general population and therefore, is expected. Therefore, this difference is not considered necessary.
**Evaluation of WISC-IV® Data**

**Date Evaluated**: 6/11/2013

<table>
<thead>
<tr>
<th>Scale of Index (check box graph)</th>
<th>T Score</th>
<th>Equivalent</th>
<th>Clinical Judgment (Circle)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal Comprehension</td>
<td>18</td>
<td>60</td>
<td>CONSERVED</td>
</tr>
<tr>
<td>Vocabualry</td>
<td>17</td>
<td>60</td>
<td>CONSERVED</td>
</tr>
<tr>
<td>Comprehension</td>
<td>18</td>
<td>60</td>
<td>CONSERVED</td>
</tr>
<tr>
<td>Information</td>
<td>17</td>
<td>60</td>
<td>CONSERVED</td>
</tr>
<tr>
<td>Block Design</td>
<td>19</td>
<td>60</td>
<td>CONSERVED</td>
</tr>
<tr>
<td>Picture Concepts</td>
<td>16</td>
<td>60</td>
<td>CONSERVED</td>
</tr>
<tr>
<td>Digit Span</td>
<td>16</td>
<td>60</td>
<td>CONSERVED</td>
</tr>
<tr>
<td>Arithmetic</td>
<td>17</td>
<td>60</td>
<td>CONSERVED</td>
</tr>
<tr>
<td>Symbol Search</td>
<td>11</td>
<td>60</td>
<td>CONSERVED</td>
</tr>
<tr>
<td>(Cancellation)</td>
<td>12</td>
<td>60</td>
<td>CONSERVED</td>
</tr>
</tbody>
</table>

**Working Memory (Short-Term Memory)**

<table>
<thead>
<tr>
<th>Test</th>
<th>Score</th>
<th>T Score</th>
<th>Clinical Judgment</th>
</tr>
</thead>
<tbody>
<tr>
<td>WISC-IV Digit Span (Good/MW)</td>
<td>1</td>
<td>60</td>
<td>CONSERVED</td>
</tr>
<tr>
<td>WISC-IV Letter-Number Sequencing (Good/MW)</td>
<td>6</td>
<td>60</td>
<td>CONSERVED</td>
</tr>
<tr>
<td>WISC-IV Arithmetic (Good/MW-GF SIQ)</td>
<td>7</td>
<td>60</td>
<td>CONSERVED</td>
</tr>
</tbody>
</table>

**Score Configuration and Interpretation**: Because the difference between the highest and lowest scores entered is greater than or equal to 15, this set of scores is not cohesive, indicating that a composite based on all these scores is unlikely to provide a valid summary of the ability it is intended to represent. Instead the two lowest scores form a cohesive composite that may be interpreted meaningfully and the highest value is a divergent score.

**Processing Speed (Grd)**

<table>
<thead>
<tr>
<th>Test</th>
<th>Score</th>
<th>T Score</th>
<th>Clinical Judgment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital</td>
<td>12</td>
<td>60</td>
<td>CONSERVED</td>
</tr>
<tr>
<td>Symbol Search</td>
<td>11</td>
<td>60</td>
<td>CONSERVED</td>
</tr>
</tbody>
</table>

**Score Configuration and Interpretation**: The difference between the highest and lowest scores that comprise the composite is less than 15, therefore, the composite is considered cohesive. The composite is a likely good summary of the set of test scores with an adequate index of the ability that is intended to represent.
Review of Test Performance

- **XBA Gc Composite** = 92 (Gf-verbal = 84)
- **XBA Gsm-MW Composite** = 78
- **WISC-IV Digit Span (MS)** = 10 (Average; 50th %ile)
  - **Teacher**: Able to follow simple, multi-step tasks
  - **Parent**: Did not report any difficulties with memory
  - **Evaluator**: Did not ask for directions to be repeated; appeared to understand all test directions
  - **Work Samples**: Demonstrate an understanding of one and two-step directions
- **Gf-nonverbal** = 79 (WISC-IV Clinical Cluster)
- **Gv** = 97 (WISC-IV Clinical Cluster)
- **WISC-IV PSI (Gs)** = 102
In the Broad Ability Domain of Ga, our Ability Tests Measure Mainly Phonetic Coding (PC)

### Phonetic Coding (PC)
- The ability to hear phonemes distinctly
  - WJ III RR ACH SOUND AWARENESS: 4.90+
  - WJ III RR COC INCOMPLETE WORDS: 6.90+
  - WJ III RR CSS SOUND BLENDS: 2.90+
  - APART PHONEMIC AWARENESS: 5.12
  - ASA BLENDING: 5.9
  - CEFU-4 PHONOGICAL AWARENESS: 5.12
  - CEFU-12 PHONOGICAL AWARENESS: 3.6
  - EBQ-3 PHONEMIC ANALYSIS: 6.14
  - DAS-5 PHONOCLOGICAL PROCESSING: 5.12
  - ERA PHONOMELIC AWARENESS: 4.7
  - GORT-7 PHONEMIC AWARENESS: 6.13
  - ITIREF-3 SOUND DELETION: 5.12
  - ITERA-4 PHONLOGICAL AWARENESS: 5.12
  - SCAN-3A FILTERED WORDS: 5.12
  - SCAN-3C FILTERED WORDS: 5.12
  - TAPS-3 PHONOCLOGICAL BLENDING: 4.18
  - TAPS-3 PHONOCLOGICAL SEGMENTATIONS: 4.18
  - TAPS-3 WORD IDENTIFICATION: 4.18
  - TOLD-P4 PHONEMIC ANALYSIS: 4.8
  - TORA-4 PHONOCLOGICAL AWARENESS: 5.18
  - TORA-4 INCOMPLETE WORDS: 5.10
  - TORA-4 PHONEMIC DELETION: 5.10
  - TORA-4 PHONEMIC REVERSAL: 5.10
  - WJ III RR DBH SOUND AWARENESS: 4.00+
  - WJ III RR DBH SOUND BLENDS: 2.90+
  - WMAT-3 PHONOCLOGICAL AWARENESS: 5.18
  - WMT-4 Phonological Processing (GroRe):
    - GroRe Word Recognition: 6.13
  - WMT-4 Phonological Processing (Gsm-MW):
    - GroRe Word Recognition: 3.16
  - WMT-4 Letter Sounds (GroRe):
    - GroRe Letter Sounds: 5.18
  - WMT-4 Sound Sequencing (GroRe):
    - GroRe Sound Sequencing: 6.10
  - WMT-5D Phonological Awareness (Gsm-MW):
    - GroRe Word Recognition: 3.5
  - WMT-5D Early Reading Skills (Gsm-MW):
    - GroRe Early Reading Skills: 4.9

### Sound Localization (SL)
- The ability to localize heard sounds in space
  - SCAN-3A COMPETING WORDS-DIRECTED EAR (US): 13.50
  - SCAN-3A COMPETING SENTENCES: 5.12
  - SCAN-3C COMPETING WORDS-DIRECTED EAR (US): 5.12

### Resistance to Auditory Stimulus Distortion (RSD)
- The ability to hear words correctly even under conditions of distortion or loud background noise
  - WJ III RR CDG AUDITORY ATTENTION: 2.50
  - SCAN-3A AUDITORY FIGURE-GROUND AT 0dB: 13.50
  - SCAN-3A AUDITORY FIGURE-GOUND AT 120dB: 13.50
  - SCAN-3A AUDITORY FIGURE-GOUND AT 120dB: 5.12
  - SCAN-3C AUDITORY FIGURE-GOUND AT 120dB: 5.12
  - SCAN-3C AUDITORY FIGURE-GOUND AT 120dB: 5.12
  - SCAN-3C AUDITORY FIGURE-GOUND AT 120dB: 5.12
  - SCAN-3C AUDITORY FIGURE-GOUND AT 120dB: 13.50
  - SCAN-3C Time Compressed Sentences (Gsm-MW): 13.50
  - SCAN-3C Time Compressed Sentences (Gsm-MW): 5.12

### Other Scores to Be Plotted on the Graph:
- **Name of Composite/Subtest**
- **Enter scores below**
- **Check if subtest**
- **Conv. Standard Score**

#### Other Scores to Be Plotted on the Graph:

<table>
<thead>
<tr>
<th>Name of Composite/Subtest</th>
<th>Enter scores below</th>
<th>Check if subtest</th>
<th>Conv. Standard Score</th>
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</thead>
<tbody>
<tr>
<td>WJ III RR Factor</td>
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<td>WJ III RR Auditory Attention (Ga-US)</td>
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<tr>
<td>XBA Gsm-MW Composite</td>
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**NOTE:** You must enter a composite/subtest name for the score to appear on the graph. Scores entered without corresponding names will not be graphed.
### Select Scores for Graphing

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<th>Scores</th>
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<td>GL Verbal Fluid Reasoning</td>
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### Scores Table

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</thead>
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<td>37</td>
</tr>
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<td>(Word Reasoning)</td>
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<td>16</td>
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<tr>
<td>Perceptual Reasoning (Gf/Gv)</td>
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<tr>
<td>Block Design</td>
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<td>50</td>
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<tr>
<td>Picture Concepts</td>
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<td>16</td>
</tr>
<tr>
<td>Matrix Reasoning</td>
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<td>9</td>
</tr>
<tr>
<td>(Picture Completion)</td>
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<td>37</td>
</tr>
<tr>
<td>Working Memory (Gsm)</td>
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<td>19</td>
</tr>
<tr>
<td>Digit Span</td>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>Letter-Number Sequencing</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>(Arithmetic)</td>
<td>7</td>
<td>16</td>
</tr>
<tr>
<td>Processing Speed (Gc)</td>
<td>102</td>
<td>55</td>
</tr>
<tr>
<td>Coding</td>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>Symbol Search</td>
<td>11</td>
<td>63</td>
</tr>
<tr>
<td>(Cancellation)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Select Desired Confidence Interval for Graph

- [ ] 68% CI (default)
- [ ] 90% CI
- [ ] 95% CI
Review of Test Performance

- **XBA Gc** Composite = 92 (Gf-verbal = 84)
- **XBA Gsm-MW** Composite = 78
- **WISC-IV Digit Span (Gsm-MS)** = 10 (Average; 50th percentile)
  - **Teacher:** Able to follow simple, multi-step tasks
  - **Parent:** Did not report any difficulties with memory
  - **Evaluator:** Did not ask for directions to be repeated; appeared to understand all test directions
  - **Work Samples:** Demonstrate an understanding of one and two-step directions
- **Gf nonverbal** = 79 (WISC-IV Clinical Cluster)
- **Gv** = 97 (WISC-IV Clinical Cluster)
- **WISC-IV PSI (Gs)** = 102
- **WJ III Gf** Factor = 93
- **WJ III Phonemic Awareness (Ga-PC) Cluster** = 80
- **WJ III Auditory Attention (Ga-US) Subtest** = 96
Examples of **TWO** Scores

Entered into (or Transferred to) the CHC Analyzer tab
Examples of Two Subtest Scores Entered into the CHC Analyzer Tab of DMIA v2.0: Program Automatically Checks for Cohesion and Provides an Explanation of Outcome

**Calculation and Interpretation of Composites Based on Two Subtests Entered into the CHC Analyzer Tab of the DMIA v2.0**

<table>
<thead>
<tr>
<th>Rule for Calculating a Composite</th>
<th>Interpretation of Two-Subtest Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>If difference between scores is &lt;15, then composite is calculated, OR</td>
<td>The difference between the scores that comprise the composite is &lt; 1SD and, therefore, the composite is considered cohesive. The composite is likely a good summary of the set of theoretically related abilities that comprise it. Interpret the composite as an adequate estimate of the ability that it is intended to measure.</td>
</tr>
<tr>
<td>If both scores are &lt;80 and the difference between them is &gt;14, then composite is calculated, OR</td>
<td>Although the difference between the scores is greater than or equal to 1SD, both scores are less than 80 and represent normative weaknesses or deficits. Therefore, the composite is still considered cohesive and may be interpreted as an adequate estimate of the ability that it is intended to measure.</td>
</tr>
<tr>
<td>If both scores are &gt;119 and the difference between them is &gt;14, then composite is calculated, OR</td>
<td>Although the difference between the scores is greater than or equal to 1SD, both scores are greater than 119 and represent normative strengths. Therefore, the composite is still considered cohesive and may be interpreted as an adequate estimate of the ability that it is intended to measure.</td>
</tr>
<tr>
<td>If both scores are &gt;79 and &lt;120 and the difference between them is &gt;14; then no composite is calculated.</td>
<td>The scores comprising the composite fall in different ability ranges and differ from one another by at least 1SD. Therefore, the composite is not considered cohesive. As such, the composite is not likely to be a good summary of the theoretically related abilities it is intended to represent. (Note: ability ranges are Below Average: 80-89; Average: 90-109; Above Average: 110-119).</td>
</tr>
</tbody>
</table>
Two-Subtest XBA Composites: Rules for Cohesion

Rule 1: Both scores are < 15

Clinical Judgment Needed

Interpretation: The difference between the scores that comprise the composite is < 1SD and, therefore, the composite is cohesive. The composite is likely a good summary of the set of theoretically related abilities that comprise it. Interpret the composite as an adequate estimate of the ability that it was intended to measure.

Rule 2: Both scores are between 80 and 120, inclusive, calculate composite only if scores are < 1SD

Interpretation: The difference between the scores that comprise the composite is < 1SD and, therefore, the composite is considered cohesive. The composite is likely a good summary of the set of theoretically related abilities that comprise it. Interpret the composite as an adequate estimate of the ability that it was intended to measure.
Two-Subtest XBA Composites: Rules for Cohesion

Rule 3: Both scores < 80 or > 120, calculate composite regardless of score difference

<table>
<thead>
<tr>
<th>Deficient Range</th>
<th>Average</th>
<th>High Average or Better</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 50</td>
<td>60</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>80</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>110</td>
</tr>
<tr>
<td></td>
<td></td>
<td>120</td>
</tr>
<tr>
<td></td>
<td></td>
<td>130</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; 140</td>
</tr>
</tbody>
</table>

**Interpretation:** Although the difference between the scores is > 1SD, both scores are less than 80 and represent normative weaknesses or deficits. Therefore, the composite is considered cohesive and may be interpreted as an adequate estimate of the ability that it was intended to measure.

Two-Subtest XBA Composites: Rules for Cohesion

Rule 3: Both scores < 80 or > 120, calculate composite regardless of score difference

<table>
<thead>
<tr>
<th>Deficient Range</th>
<th>Average</th>
<th>High Average or Better</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 50</td>
<td>60</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>80</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100</td>
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<tr>
<td></td>
<td></td>
<td>110</td>
</tr>
<tr>
<td></td>
<td></td>
<td>120</td>
</tr>
<tr>
<td></td>
<td></td>
<td>130</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; 140</td>
</tr>
</tbody>
</table>

**Interpretation:** Although the difference between the scores is > 1SD, both scores are greater than 120 and represent normative strengths. Therefore, the composite is considered cohesive and may be interpreted as an adequate estimate of the ability that it was intended to measure.
Two-Subtest XBA Composites: Rules for Cohesion

Rule 4: Scores are between 80 and 120, inclusive, and differences is > 14

Clinical Judgment Needed

Deficient Range

Average

High Average or Better

< 70  75  80  85  90  95  100  105  110  > 115

Interpretation: The scores comprising the composite fall in different ability ranges and differ from one another by at least 1SD. Therefore, the composite is considered noncohesive. As such, the composite is not a good summary of the theoretically related abilities it was intended to represent and cannot be interpreted meaningfully. However, interpretation could focus on the within-cluster difference and the possible reason(s) for the difference.

Examples of THREE Scores Entered into (or Transferred to) the CHC Analyzer tab
### Calculation and Interpretation of Composites Based on Three Subtests Entered into the CHC Analyzer Tab of the DMIA v2.0

<table>
<thead>
<tr>
<th>Rule for Calculating a Composite</th>
<th>Interpretation of Three-Subtest Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>If the difference between MIN and MAX is &lt; 15, then composite is calculated based on all scores, OR</td>
<td>The difference between the highest and lowest scores that comprise the composite is &lt; 1SD and, therefore, the composite is considered cohesive. The composite is likely a good summary of the set of theoretically related abilities that comprise it. Interpret the composite as an adequate estimate of the ability that it is intended to measure.</td>
</tr>
<tr>
<td>If all three scores are &lt; 80 and the difference between any two of them is &gt; 14, then composite is calculated, OR</td>
<td>Although the difference between the scores is greater than or equal to 1SD, all three scores are less than 80 and represent normative weaknesses or deficits. Therefore, the composite is still considered cohesive and may be interpreted as an adequate estimate of the ability that it is intended to measure.</td>
</tr>
<tr>
<td>If all three scores are &gt; 119 and the difference between any two of them is &gt; 14, then composite is calculated, OR</td>
<td>Although the difference between the scores is greater than or equal to 1SD, all scores are greater than 119 and represent normative strengths. Therefore, the composite is still considered cohesive and may be interpreted as an adequate estimate of the ability that it is intended to measure.</td>
</tr>
<tr>
<td>If the difference between MAX and MID is &gt; 14 and the difference between MIN and MID is &gt; 14, then no composite is calculated, OR</td>
<td>All scores that comprise the composite differ from one another by at least 1SD. Therefore, the composite is not considered cohesive. As such, the composite is not likely to be a good summary of the theoretically related abilities it is intended to represent.</td>
</tr>
<tr>
<td>If the difference between MIN and MAX is &gt; 14, and the difference between MAX-MID and MID-MIN is equal (and &lt; 15), then calculate composite for MID+MAX and report MIN as divergent (Chaplin Rule), OR</td>
<td>Because the difference between the highest and lowest scores entered is greater than or equal to 1SD, this set of scores is not considered cohesive, indicating that a composite based on all three scores is unlikely to provide a good summary of the ability it is intended to represent. Instead the two highest scores form a cohesive composite that may be interpreted meaningfully and the lowest value is a divergent score.</td>
</tr>
<tr>
<td>If the difference between MIN and MAX is &gt; 14, and the difference between MAX-MID and MID-MIN is &lt; 15, then calculate composite for MID+MAX and report MIN as divergent (Cheramie Rule A), OR</td>
<td>Because the difference between the highest and lowest scores entered was greater than or equal to 1SD, this set of scores is not considered cohesive, indicating that a composite based on all three scores is unlikely to provide a good summary of the ability it is intended to represent. Instead the two lowest scores form a cohesive composite that may be interpreted meaningfully and the highest value is a divergent score.</td>
</tr>
<tr>
<td>If the difference between MIN and MAX is &gt; 14, and the difference between MID-MIN is &lt; 15 and MAX-MID is &lt; 15, then calculate composite for MID+MIN and report MAX as divergent (Cheramie Rule B).</td>
<td></td>
</tr>
</tbody>
</table>

### Three-Subtest XBA Composites: Rules for Cohesion

- **Deficient Range**: ≤ 70
- **Clinical Judgment Range**: 75 to 80
- **Average**: 85 to 90
- **High Average or Better**: 95 to 115
- **Within Normal Limits**: > 115

**Difference between Highest and Lowest scores is less than 1SD, composite is calculated on CHC Tab of DMIA v2.0**
Three-Subtest XBA Composites: Rules for Cohesion

Clinical Judgment Range

Deficient Range

High Average or Better

≤ 70  75  80  85  90

Within Normal Limits

All scores less than 80 or greater than 120, composite is calculated on CHC Tab of DMIA v2.0, regardless of score differences.

No Composite is Calculated by the XBA DMIA v2.0
Three-Subtest XBA Composites: Rules for Cohesion

Within Normal Limits

Composite based on two highest scores is calculated by XBA DMIA v2.0: Chaplin Rule

Composite is Calculated by the XBA DMIA v2.0 based on the smallest difference of a score from the middle score when MAX-MID and MID-MIN differences are less than 15 points and MAX-MIN is > 14:

Cheramie Rule
On original version of DMIA, Divergent Scores were termed “Outliers” – misleading to some.

**Divergent Score** – Substantially Different from the Composite

**Examples of FOUR Scores**

**Entered into (or Transferred to)**

**the CHC Analyzer tab**
Four Subtest Scores in CHC Analyzer Tab

- **Outcomes**
  - One composite
  - No composite
  - Two composites
  - One composite and one divergent score
  - One composite and two divergent scores

---

### Calculation of Composites Based on Four Subtests Entered into the CHC Analyzer Tab of the XBA DMIA v2.0

**Rule for Calculating a Composite**

If the difference between **MAX** and **MIN** is \(<\ 21\)**, composite is calculated based on all scores (4 subtest composite), OR

If all four scores are \(<\ 80\) and the difference between **MAX** and **MIN** is \(\geq 20\), composite is calculated for all four scores (4 subtest composite). OR

**Interpretation of Four-Subtest Configuration**

The difference between the highest and lowest scores that comprise the composite is less than or equal to \(1\frac{1}{3}\) SD, therefore, the composite is **cohesive**. The composite is likely a good summary of the set of theoretically related abilities that comprise it. Interpret the composite as an adequate estimate of the ability that it is intended to measure.

Although the difference between the highest and lowest scores is greater than or equal to \(1\frac{1}{3}\) SD, all four scores are less than 80 and represent normative weaknesses or deficits.
Is this pattern consistent with SLD?
XBA is Commonplace – Acknowledge the Procedure in Your Report

• The results presented in this report were compiled from tests that do not share a common norm group; however, test results have been interpreted following the cross-battery approach and integrated with data from other sources including educational records, parent/teacher interviews, behavioral observations, work samples, and other test findings to ensure ecological validity. Standardization was followed for all test administrations. No single test or procedure was used as the sole criterion for classification, eligibility or educational planning. Unless otherwise noted, the results of this evaluation are considered a reliable and valid estimate of [Student’s Name] demonstrated skills and abilities at this time.

Adapted from D. Miller (2010)

Conceptual Similarities Among Alternative Research-based Approach to SLD

Figure 4.2. Flanagan and colleagues’ Dual-Discrepancy-Consistency (DD-C) Operational Definition of SLD

<table>
<thead>
<tr>
<th>Level</th>
<th>Nature of SLD</th>
<th>Focus of Evaluation</th>
<th>Examples of Evaluation Methods and Data Sources</th>
<th>Criteria for SLD</th>
<th>SLD Classification and Eligibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Difficulties in one or more areas of academic achievement, including but not limited to Basic Reading Skill, Reading Comprehension, Reading Fluency, Oral Expression, Listening Comprehension, Written Expressions, Math Calculation, Math Problem Solving</td>
<td>Academic Achievement: Performance on specific academic skills (e.g., Gmem, Gci, Gs)</td>
<td>Response to quality instruction and intervention; prior instruction; standardized achievement tests; evaluation of work samples; observations of academic performance by parents, student interview, history of academic performance; data from other members of multidisciplinary team (MDT) (e.g., speech-language pathologist, interventionist, reading specialists).</td>
<td>Performance in one or more academic areas is weak or deficient (despite attempts at delivering quality instruction) as evidenced by converging data sources.</td>
<td>Necessary</td>
</tr>
<tr>
<td>II</td>
<td>SLD does not include a learning problem that is the result of visual, hearing, or motor disabilities, of intellectual disability, of social or emotional disturbance, or of environmental, educational, cultural, or economic disadvantage.</td>
<td>Exclusionary Factors: Identification of potential primary causes of academic skill weaknesses or deficits, including intellectual disability, cultural or linguistic differences, sensory impairment, insufficient instruction or opportunity to learn, organic or physical health factors, social or emotional disturbance.</td>
<td>Data from the methods and sources listed at Levels I and III: Behavior Rating Scales, medical records, prior evaluations, interviews with current and past caregivers, psychological, etc.</td>
<td>Performance is not primarily attributed to these exclusionary factors, although one or more of them may contribute to learning difficulties.</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>A disorder in one or more of the basic psychological processes involved in understanding or using language, spoken or written, such disorders are presumed to originate from neurological system dysfunctions.</td>
<td>Cognitive Abilities &amp; Processes: Performance on cognitive abilities (e.g., Gmem, Gvi, Gcom, Giu), specific neuropsychological processes (e.g., attention, executive functioning, orthographic processing, RAN, RAR, and reasoning)</td>
<td>Performance on norm-referenced tests: evaluation of work samples; observations of cognitive performance; task analysis; testing limits; teacher parent-student interview, history of academic performance, records review.</td>
<td>Performance in one or more cognitive abilities and/or neuropsychological processes (other than academic skill deficiencies) is weak or deficient as evidenced by converging data sources.</td>
<td></td>
</tr>
</tbody>
</table>


IV The specific learning disability is a discrete condition differentiated from generalized learning disability by a pattern of significantly better cognitive ability than one’s learning disability. Patterns of Strengths and Weaknesses Shown by a Dual-Discrepancy-Consistency (DD-C) Determination of whether academic skill weaknesses or deficits are related to specific cognitive competencies or weaknesses or deficits; patterns of data reflect a pattern of strength and achievement consistency with otherwise average or better ability to think and reason. Data gathered at all previous levels as well as new additional data following a review of initial evaluation results (e.g., data gathered for the purpose of hypothesis testing; data gathered via demand analysis and feedback testing). Sufficient for SLD Identification

Circumstantial evidence of average achievement consistency (i.e., related cognitive processes and academic skills are generally similar to those of students who score below the mean or lower), circumstantial evidence of academic skill weaknesses or deficits, and evidence of cognitive areas of strength (e.g., by standardized tests that are generally <90% clinical judgment supports the impression that the student’s overall ability to think and reason will be average or better but less than the standard of 67% identified by federal guidelines). This PBR is a global谥义 program on the CD-ROM that allows the examiner to use this data to determine if the individual has a DD-C pattern of strengths and weaknesses that is consistent with SLD.

V Specific learning disability has an adverse impact on educational performance. Special Education Eligibility: Determination of Least Restrictive Environment (LRE) for delivery of instruction and educational resources. Data from all previous levels and MDI meeting, including parents. Necessary for Special Education Eligibility. Student demonstration significant difficulties in daily academic activities that cannot be remediated, accommodated, or otherwise compensated for without the assistance of individualized special education services.

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

**CHC Broad Abilities**

**g-Value = 0.86**

The g-Value reflects overall cognitive ability, based on the broad CHC abilities judged by the evaluator to be "sufficient." The g-Value is interpreted according to the table below:

- 0.80 or above overall ability is likely
- 0.50 or more overall ability is unlikely

Note: An asterisk (*X*) next to a broad ability code indicates that the ability was judged as "insufficient" by the evaluator.

**Interpretation of g-Value = 0.86**

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 ability domains, this individual displays average or better functioning in cognitive ability domains considered important for acquiring the academic skills typical for this grade level. The individual's overall cognitive ability is likely to be average or better and, therefore, ought to enable learning and achievement, especially when specific cognitive weaknesses are minimized through compensatory efforts, accommodations, and the like.

**Pattern of Strengths and Weaknesses Data Entry**

**1. Intact Ability Estimate**

The construct is estimated using median residuals and transformations among the CHC broad abilities scores, judged as sufficient ability, using the g-Value:

- 0.86

**2. Cognitive Weakness**

Enter the raw score/transformed score or percent correct on the test (the right-hand test represents the student's cognitive weaknesses). If using the T-score, convert to standard scores before entering (see Tab.20).

**3. Frequency of Difference**

Select the initial probability level to evaluate the novelty (i.e., frequency) of the size of difference between actual and predicted cognitive performance. The default starting value is 0.05, meaning a difference should occur about 5% of the time or less. The final value, however, will be corrected statistically to account for test unreliability.

**4. Academic Weakness**

Enter the raw score/coefficiential score and the percent correct or standard score as the associated difference in academic weaknesses or academic performance.

**5. Frequency of Difference**

Select the level to be used in PSA analysis for determining the size of difference between hypertrophy or hypovasculature. The default value is 0.05 and will be adjusted to test unreliability to avoid overestimation or underestimation of differences. If a second comparison being made on a subject is used, consider using a stricter value.
Cross-Battery Pattern of Strengths and Weaknesses Analyzer (XBA PSW-A® v1.0)
Conceptualized by D.P. Flanagan, S.O. Ortiz, and V.C. Alfonso
Copyright © 2013 Wiley. All Rights Reserved

**AGGREGATE OF COGNITIVE STRENGTHS**

The aggregate is either the intact Ability Estimate (IA-e) or a user-entered alternative value that represents the individual's overall ability.

g-Value = 0.86

**Difference Critical Value**

<table>
<thead>
<tr>
<th>Difference</th>
<th>Critical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>18.76</td>
<td>9.24</td>
</tr>
</tbody>
</table>

Yes, domain specific

Critical value set at 5%

---

**Academic Weakness**

Below are the individual's Actual and Predicted performance in the area of:

Basic Reading

<table>
<thead>
<tr>
<th>Actual</th>
<th>Predicted</th>
</tr>
</thead>
<tbody>
<tr>
<td>75</td>
<td>97</td>
</tr>
</tbody>
</table>

Is there a BELOW AVERAGE aptitude-achievement consistency?

The box above addresses this component of learning disability through consideration of the degree to which the meaning of the scores is similar (e.g., indicative of weakness or deficit) and the position of the scores is consistent.

---

**Domain Specific Weakness?**

Yes

**Aggregate of Cognitive Strengths**

96

**g-Value** = 0.86

**Unexpected Underachievement?**

Yes

---

**Is there evidence of domain specific weaknesses in cognitive functioning?**

Yes. The difference between the individual's estimate of intact cognitive abilities and the score representing the area of specific cognitive weakness (e.g., specific cognitive process or ability) is statistically significant. This finding means that there is likely a true or real difference between the estimate of overall cognitive strengths and the identified area of specific cognitive weakness for the individual. In addition, there is an unusually large difference between actual performance in the specific academic area and expected performance (as predicted by overall cognitive strengths). That is, based on the individual's estimate of cognitive strengths, it was predicted that the individual would perform much better in the specific cognitive area. In fact, the size of the difference between the individual's actual and predicted performance in the specific cognitive area occurs very infrequently. The results of these analyses suggest that the individual's PSW consists of a domain-specific cognitive weakness (particular when the actual 55+96), an inclusionary criterion for SLD.

---

**Is there evidence of unexpected underachievement?**

Yes. The difference between the individual's estimate of intact cognitive abilities and the score representing the area of specific academic weakness (e.g., a specific academic skill) is statistically significant. This finding means that there is likely a true or real difference between the estimate of overall cognitive strengths and the identified area of specific academic weakness for the individual. In addition, there is an unusually large difference between actual performance in the specific academic area and expected performance (as predicted by overall cognitive strengths). That is, based on the individual's estimate of cognitive strengths, it was predicted that the individual would perform much better in the specific academic area. In fact, the size of the difference between the individual's actual and predicted performance in the specific academic area occurs very infrequently. The results of these analyses suggest that the individual's PSW is marked by unexpected underachievement (particularly when the actual 55+96), an inclusionary criterion for SLD.

---

**Is there evidence of a below average aptitude-achievement consistency?**

Yes. The scores representing the areas of specific cognitive and academic weakness are below average (55 ≤ 95) and are indicative of normative deficits. These scores provide evidence of a below average aptitude-achievement consistency and may be used to support an overall SLD pattern of strengths and weaknesses. However, additional evidence is necessary to verify that there is an empirical or ecologically valid relationship between the areas of specific cognitive and academic weakness.
PSW-A v1.0
Flanagan, Ortiz, and Alfonso (2013)

• Based on the most psychometrically defensible analyses of score differences
  
  

Evaluation of Cognitive Ability-Achievement Consistency

• Three ranges
  – < 85
  – 85-89
  – > 90

• Does the pattern include consistency?
  – 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

• Final determination based on clinical judgment, which is bolstered by empirical evidence supporting the relationship and ecological validity
Interpretation of PSW

Below Average Aptitude-Achievement Consistency
(scores approximately 1SD below the mean or lower)

Evaluation of consistency is not determined by a non-significant difference between the cognitive and academic weaknesses


Interpretation of PSW

Below Average Aptitude-Achievement Consistency
(scores approximately 1SD below the mean or lower)

Difference between related cognitive areas of weakness or deficit and academic areas of weakness or deficit are statistically significant

Student may be using compensatory strategies or benefiting from accommodations or curricular modifications

Interpretation of PSW

Below Average Cognitive Aptitude-Achievement Consistency
(scores approximately 1SD below the mean or lower)

Difference between related cognitive areas of weakness or deficit and academic areas of weakness or deficit are statistically significant

There may be one or more exclusionary (or other) factors inhibiting performance


Factors that may affect learning

1. Executive functioning (e.g., time management skills, organizational skills)
2. Ability to complete tasks within a specified time period (e.g., classwork, tests, homework)
3. Sensory-motor integration (e.g., visual-motor coordination)
4. Ability to attend and concentrate on academic tasks in school
5. Match between student’s learning needs and instructional environment
6. Relationships with same age and grade peers
7. Receptive to corrective feedback
8. Uses educational supports in school (e.g., before/after school programs)
9. Uses educational supports outside of school (e.g., tutoring, community programs)
10. Familial support (e.g., parent involvement, assistance from family members)
11. Self-esteem or self-concept
12. School climate (e.g., safety, peer group)
13. Motivation and level of effort
Level IV of Flanagan et al.’s DD/C Operational Definition of SLD: Pattern of Strengths and Weaknesses

**Pattern not consistent with SLD construct**

Domain-specific aspect of SLD is not present.

Similar to traditional ability-achievement discrepancy.


---

Level IV of Flanagan et al.’s DD/C Operational Definition of SLD: Pattern of Strengths and Weaknesses

**Pattern not consistent with SLD construct**

Unexpected underachievement is not present.

Area of cognitive weakness or deficit is likely not particularly important for academic skill acquisition and development at this age/grade level.

Alternatively, student compensates well for area of cognitive weakness or deficit (history is important in making SLD determination).

Level IV of Flanagan et al.’s DD/C Operational Definition of SLD: Pattern of Strengths and Weaknesses

*Pattern not consistent with SLD construct*, although scores appear to suggest “the pattern”

Unexpected underachievement is not present.

Domain-specific cognitive weakness as a primary contributing factor to poor achievement not present

All performances are similar – expected achievement

Likely general learning difficulty (slow learner), especially in an average to high achieving school

Level IV of Flanagan et al.’s Operational Definition of SLD: Pattern of Strengths and Weaknesses

All Scores/Areas Approximately 85 or Lower

General Learning Difficulty

- Overall cognitive ability
  - In the 80s range
- Academic Performance
  - In the 80s range
- Pervasive below average performance
- May have splinter skills (relative strengths)

Goal of intervention is to:
* Remediate academic deficits
* Teach compensatory strategies to assist in minimizing effects of cognitive deficits
* Achieve overall cognitive ability-achievement consistency
Level IV of Flanagan et al.’s Operational Definition of SLD: Pattern of Strengths and Weaknesses

All Scores/Areas Suggest Deficiency (generally 70-75 or lower)

Pattern is Not Consistent with SLD—Consider Intellectual Disability
All scores suggestive of deficiency
– Assess adaptive behavior


<table>
<thead>
<tr>
<th>CHC ABILITY COMPOSITES</th>
<th>Enter Standard Scores (Range 40 - 160)*</th>
<th>Select Yes or No</th>
<th>Determining Sufficiency:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ge - Crystallized Knowledge</td>
<td>71</td>
<td>Yes</td>
<td>An ability is considered &quot;sufficient&quot; when it is judged by the evaluator to contribute meaningfully to the individual's overall cognitive functioning, particularly for the purpose of facilitating academic performance (e.g., acquisition and development of academic skills). Typically, standard scores around 90 or higher are sufficient, as abilities associated with scores in this range (≥ 90) often contribute meaningfully to the individual's overall cognitive functioning and, therefore, support learning. When standard scores are around 90 or lower, clinical judgment is necessary to determine if the broad ability constrains or inhibits learning and achievement.</td>
</tr>
<tr>
<td>Gf - Fluid Reasoning</td>
<td>70</td>
<td>Yes</td>
<td>Markedly insufficient</td>
</tr>
<tr>
<td>Gw - Long-Term Storage &amp; Retrieval</td>
<td>72</td>
<td>Yes</td>
<td>Inefficient</td>
</tr>
<tr>
<td>Gm - Short-Term Memory</td>
<td>68</td>
<td>Yes</td>
<td>Sufficient</td>
</tr>
<tr>
<td>Gv - Visual Processing</td>
<td>60</td>
<td>Yes</td>
<td>Efficient</td>
</tr>
<tr>
<td>Ga - Auditory Processing</td>
<td>89</td>
<td>Yes</td>
<td>Proficient</td>
</tr>
<tr>
<td>Gs - Processing Speed</td>
<td>79</td>
<td>No</td>
<td>Markedly Proficient</td>
</tr>
</tbody>
</table>

*Note: if using T-Scores, convert them to Standard Scores (Deviation IQ) metric here: $z = \frac{X - \mu}{\sigma}$

---

1. Clinical judgment is likely necessary to determine if an ability reflected by a score in this range constrains learning and achievement for the individual.

2. Scores between 85-115 (inclusive) fall within the normal limits of functioning.
Level IV of Flanagan et al.’s DD/C Operational Definition of SLD: Pattern of Strengths and Weaknesses

Not consistent with SLD – No Below Average Cognitive Aptitude-Achievement Consistency

More likely to see this pattern in older students (and adults) who were identified early and who either compensate for their weaknesses, overcome their weaknesses, or receive accommodations and modifications in the educational setting

All Scores/Areas Approximately 90 or higher

LIKELY SUGGESTS NORMAL VARIATION

Normal Variation: To Err is Human

- **To Err is Human: “Abnormal” Neuropsychological Scores and Variability are Common in Healthy Adults**
  - Binder, Iverson, and Brooks (2009)
- At least two statistically significant differences in one’s cognitive ability profile is common in the general population
  - Oakley (2000)
Research on G/LD  
(Lovett & Sparks, 2010, in press)

- Nearly 1000 studies on G/LD since 1970’s
  - Only about 5% were data based
  - Most were case studies
- Data show that samples of G/LD have IQ’s of about 120 and achievement in the Average range

<table>
<thead>
<tr>
<th>SD</th>
<th>IQ &lt; 120</th>
<th>IQ &gt; 120</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 SD</td>
<td>35.6</td>
<td>66.3</td>
</tr>
<tr>
<td>1.5 SD</td>
<td>16.2</td>
<td>47.1</td>
</tr>
<tr>
<td>2.0 SD</td>
<td>6.3</td>
<td>19.2</td>
</tr>
<tr>
<td>DSM-IV</td>
<td>8.3</td>
<td>4.8</td>
</tr>
</tbody>
</table>

Research on G/LD  
(Lovett & Sparks, 2010, in press)

- Most G/LD met 1SD ability-achievement discrepancy criterion
- The higher the IQ, the greater the likelihood of meeting discrepancy criterion
- Very few met DSM criteria due to absence of low achievement
No Consensus on How to Identify Students Who Should be G/LD

Evidence of Impairment Relative to Most People (or the Average Person) is Necessary (Lovett & Sparks)

McCloskey’s Representation of a Cognitive Neuropsychological Discrepancy Model for SLD Identification

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

**DD/C Definition: Bottom Right Oval (Level I)**

**Examples**

- Standardized Achievement Tests (Indiv. and Group)
- Progress Monitoring Data; CBM Data
- Work Samples; Classroom Observations: Parent/Teacher/Student Report
- Criterion Referenced: Benchmark Assessment

**ACADEMIC WEAKNESS-FAILURE**
About ONE Standard Deviation below the mean or lower

**Factors that FACILITATE**
(e.g., motivation/effort; familial support; determination; perseverance; self-esteem/worth; teacher beliefs in student capabilities)

**Factors that INHIBIT**
(e.g., exclusionary factors that are contributory, such as social/emotional; psychological; culture and language difference)
**Flanagan et al.’s Operational Definition: Level II – Review of Exclusionary Factors**

**Evaluation and Consideration of Exclusionary Factors for SLD Identification**

An evaluation of specific learning disability (SLD) requires an evaluation and consideration of factors, other than a disorder in one or more basic psychological processes that may be the primary cause of a student’s academic skill weaknesses and learning difficulties. These factors include (but are not limited to), vision/hearing, or motor disabilities, intellectual disability (ID), social/emotional or psychological disturbance, environmental or economic disadvantage, cultural and linguistic factors (e.g., limited English proficiency), insufficient instruction or opportunity to learn and physical/health factors. These factors may be evaluated via behavior rating scales, parent and teacher interviews, classroom observations, attendance records, social/developmental history, family history, vision/hearing exams, 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.


**DD/C Definition: Bottom Left Oval (Level III)**

**Examples**

- Standardized Intelligence or Cognitive Tests
- More than one subtest of the presumed ability deficit
- Manifestations of the deficit
- Previous reports/evaluation corroborate finding

**COGNITIVE WEAKNESS/DEFICIT**

About ONE Standard Deviation below the mean or lower
A New XBA Guiding Principles

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

Necessary to Guide Intervention

DD/C Definition: Top Oval (Part of Level IV – PSW)

Examples

- Total Test Score on Intelligence Test (e.g., FSIQ)
- Alternative Ability Score (e.g., GAI)
- IA-e
- Strengths in Some Academic Areas

Factors that INHIBIT
(e.g., low SES/environmental disadvantage; lack of familial support; lack of motivation/effort; ESL; lack of encouragement; poor self-esteem/worth)

Factors that FACILITATE
(e.g., motivation/effort, perseverance; determination; familial support; language; early enrichment; creativity)
Is At Least Average Overall Ability Consistent with the SLD Construct?

Overall Ability and RTI


**Implications for Research and Practice**

So, findings from our review suggest that IQ frequently predicts responsiveness to reading instruction, and it can explain important variance in such responsiveness. Put differently, IQ often mediates or influences the effectiveness of reading instruction such that it is more or less effective for children with higher versus lower IQ scores. By
Overall Ability and RTI

The rate of progress under remedial instruction was found to be a function of:

- the child’s intelligence
- how early intervention is provided
- number of hours of training
- severity of the disability
- behavior and personality difficulties
- supervision of the remedial techniques
(Source: Monroe, 1932, p. 157)

“Historical Perspective” Information from Nancy Mather, NYASP 2011

RESPONSE-TO-INTERVENTION: SEPARATING THE RHETORIC OF SELF-CONGRATULATION FROM THE REALITY OF SPECIFIC LEARNING DISABILITY IDENTIFICATION

Kenneth A. Kavale, James M. Kauffman, Randy J. Bachmeier, and Gretchen B. LeFever

When a student does not meet the discrepancy criterion and, therefore, cannot be deemed an underachiever, there is the strong possibility that the student is a “slow learner” (SL; i.e., a student with an IQ level between about 70 and 85). About 14% of the school population may be deemed SL, but this group does not demonstrate unexpected learning failure, but rather an achievement level consonant with IQ level. Although NCLB makes such low achievement problematic, slow learner has never been a special education category, and “What should not happen is that a designation of SLD be given to a slow learner” (Kavale, 2005, p. 555).

Learning Disability Quarterly, Summer, 2008
DD/C Definition (Level V)
Criteria for Eligibility Under SLD Label

- Child demonstrates significant difficulties in daily academic activities that cannot be remediated, accommodated, or otherwise compensated for without the assistance of individualized special education services.

Determining a Specific Learning Disability

- Discrepancy between “ability” and “achievement”
- Failure to respond to scientific research-based intervention
- May permit the use of other alternative research-based procedures for determining whether a child has a specific learning disability [PSW], as defined in §300.8(c)(10) (OSERS Final Regulations-8/06)
  - Flanagan and colleagues
  - Hale and Fiorello
  - McCloskey
  - Naglieri
  - Feifer and Della Tofallo
  - Miller
  - Berninger
  - Geary
  - Mather

All value RTI approach; All consider RTI data for diagnosis and treatment
Don’t Forget

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

![Diagram showing LD and Not LD]

Don’t Forget

- Differential Diagnosis is Important

A diagnosis identifies the nature of a specific learning disability and has implications for its probable etiology, instructional requirements, and prognosis. Ironically, in an era when educational practitioners are encouraged to use evidence-based instructional practices, they are not encouraged to use evidence-based differential diagnoses of specific learning disabilities.

Instructional Planning is Complex and Requires a Team of Experts

- Knowledge of and Access to Appropriate Resources
- Multiple Data Sources

Mascolo and Flanagan (2011)

Linking Assessment to Intervention

- Requires good instruments
- Well trained clinicians
- Well trained teachers and special educators
- A mechanism in place for bringing data together to problem-solve in an attempt to offer the most effective instruction and interventions to children

Mascolo and Flanagan (2011)
Intervention Types

- Need to differentiate between
  - Direct Interventions (remediation)
  - Accommodations
  - Compensation
  - Instructional/Curricular Modifications

- **Intervention**: any technique, product, or approach that intends to address directly an identified area of weakness through remediation

- **Accommodations**: any technique or support that intends to alleviate the symptomatology associated with an identified area of weakness (e.g., circumventing the impact of a processing speed weakness via extended time - the symptom is not “Gs deficit” – that’s the problem; the symptom is “unfinished assignments” - when you extend time you alleviate the symptom and assignments are completed.

- **Compensation**: strategies taught to a student that he or she is expected to apply independently to bypass or minimize weaknesses

Mascolo and Flanagan (2011)

<table>
<thead>
<tr>
<th>Intervention Term</th>
<th>Definition</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modification</td>
<td>Changes content of material to be taught or measured; Typically involves changing or reducing learning or measurement expectations; Modifications can change the depth, breadth, and complexity of learning and measurement goals</td>
<td>Reducing the amount of material that a student is required to learn</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Simplify complexity of material to be learned, such as teaching mixed fractions with like denominators versus using unlike denominators that are taught to peers</td>
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<tr>
<td></td>
<td></td>
<td>Requiring only literal (as opposed to critical/interferential) questions from an end of chapter comprehension check</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Simplifying test instructions and content</td>
</tr>
<tr>
<td>Accommodation</td>
<td>Changes conditions under which learning occurs or is measured. Does not change or reduce learning or assessment expectations. A general rule of thumb for identifying accommodations is that the learning or measurement product looks identical to that of a student without accommodations. Accommodations may include timing, flexible scheduling, presentation (e.g., enlarged text), setting (e.g., a separate room to work), response accommodations (e.g., circling answers in test booklet instead of using a scantron).</td>
<td>Extending time on exams</td>
</tr>
<tr>
<td>(leveling the playing field; fairness)</td>
<td></td>
<td>Assigning a project in advance or allowing more time to complete the a project</td>
</tr>
<tr>
<td>Don't know the extent to which accommodations alter the construct being measured</td>
<td></td>
<td>Aligning math problems vertically, as opposed to horizontally</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Having a student dictate responses to a scribe</td>
</tr>
<tr>
<td>Remediation</td>
<td>Techniques or programs used to ameliorate cognitive and academic deficits. Academic interventions typically focus on developing a skill, increasing automaticity of skills, or improving the application of skills. Cognitive interventions typically focus on improving cognitive processes such as working memory capacity and phonological processing. There are many techniques, published programs, and software designed for the purpose of remediation.</td>
<td>Evidence-based programs listed at What Works Clearing House: <a href="http://ies.ed.gov/ncee/wwc">http://ies.ed.gov/ncee/wwc</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reading programs appearing on the Florida Center for Reading Research website: <a href="http://www.fcrord">www.fcrord</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Techniques and materials from the Reading Rockets website: <a href="http://www.readingrockets.org">www.readingrockets.org</a></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CogMed (Pearson)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spotlight on Listening Comprehension (LinguistSystems, 2006)</td>
</tr>
<tr>
<td>Compensation</td>
<td>Aimed at providing the learner with procedures, techniques, and strategies that are intended to bypass or minimize the impact of a cognitive or academic deficit.</td>
<td>Teaching the use of mnemonic devices</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Organizational aids or techniques</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Teaching a student to outline or use graphic organizers</td>
</tr>
</tbody>
</table>
General Manifestation of Deficit in Fluid Reasoning (Gf)

- Difficulties with deductive reasoning (general to specific)
- Difficulties with inductive reasoning (specific to general)
- Transferring or generalizing learning
- Deriving solutions for novel problems
- Extending knowledge through critical thinking
- Perceiving and applying underlying rules or processes to solve problems
Academic Manifestations of Fluid Reasoning (Gf) Deficit

• **Reading**
  – Difficulties with inferential reading comprehension
  – Difficulty abstracting main idea

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**Recommendations for Fluid Reasoning Gf Deficit**

• Develop student’s skill in categorizing objects and drawing conclusions
• Use demonstrations to externalize the reasoning process
  – Gradually offer guided practice (e.g., guided questions list) to promote internalization of procedures or processes
**Recommendations for Fluid Reasoning Gf Deficit**

- Targeted feedback
- Cooperative learning
- Think Alouds
- Reciprocal teaching
- Graphic organizers to arrange information in visual format

**Targeted Feedback**

- Feedback to students is important and needs to be *concrete* and *specific*
  - Highlight parts of the task that they executed appropriately
  - Identify where things went “wrong” or off-course
  - Describe how to correct the mistakes
  - Provide opportunity for self-correction and/or practice
Cooperative Learning

• Can be in pairs or small group
• Students with Gf deficits can be matched with students who have good reasoning skills and who are comfortable with “thinking aloud” and contributing to the group
• Important to assign tasks that capitalize upon student’s strengths and assist in accomplishing your goal (e.g., student who needs help with reasoning may read well)
• Feedback/Processing of experience is important

Reciprocal Teaching Cards
www.adrianbruce.com/reading/room4/recip
Graphic Organizers

- Make use of graphic organizers (Venn diagrams, concept maps) to help the student
  - Understand the information conceptually through a visual modality
  - More readily link new information to known information
  - Make links from specific to general
Programs/Techniques for Gf Deficits

• When selecting a program or a technique to intervene with a student with a Gf deficit, it may be helpful to consider one that
  – includes explicit strategy instruction
  – focuses on the application of higher level thinking skills to the reading process (e.g., making predictions, drawing inferences, abstracting, inferring character feelings)
  – is multi-staged and includes modeling up through independent application of the strategy/technique

Reading and Writing Examples (Gf)

• Inspiration/Kidspiration software (www.inspiration.com)
  – “Created for K-5 learners, Kidspiration” develops thinking, literacy and numeracy skills using proven visual learning principles. In reading and writing, Kidspiration strengthens word recognition, vocabulary, comprehension and written expression. With new visual math tools, students build reasoning and problem solving skills.”
**Manifestations of Cognitive Ability Weaknesses and Empirically-based Recommendations and Interventions (Flanagan, Alfonso, & Mascolo, 2011)**

<table>
<thead>
<tr>
<th>CBC Broad Cognitive Abilities/Neuropsychological Functions</th>
<th>Brief Definition1</th>
<th>General Manifestations of Cognitive Neuropsychological Weaknesses</th>
<th>Specific Manifestations of the Cognitive Neuropsychological Weaknesses</th>
<th>Recommendations: Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditory Processing (Gs)</td>
<td>Ability to analyze and synthesize auditory information, One narrow aspect of Gs is a precursor to oral language comprehension (i.e., parsing speech sounds or phonetic coding). in addition to phonetic coding, other narrow Gs abilities include speech sound discrimination, resistance to auditory stimulus distortion, memory for sound patterns, and others related to music.</td>
<td>Difficulties with: Hearing information presented orally, initially processing oral information, Paying attention especially in the presence of background noise, Decoding the direction from which auditory information is coming, Discriminating between simple sounds, Foreign language acquisition.</td>
<td>Reading Difficulties: Acquiring phonics skills, Sounding out words, Using phonetic strategies. Math Difficulties: Reading word problems. Writing Difficulties: Spelling, Note taking, Poor quality of writing.</td>
<td>Phonemic awareness activities, Emphasis on sight-word reading, Teach comprehension monitoring (e.g., does the word I heard/ read make sense in context?), Announcing sounds in words in an emphatic manner when teaching new words for reading or spelling, Use work preview/test preview to clarify unknown words, Provide guided notes during note taking activities, Build in time for clarification questions related to “missed” or “missed” items during lecture, Supplement oral instructions with written instructions, Shorten instructions, Preferential seating, Localizing sound source for student, Minimizing background noise.</td>
</tr>
</tbody>
</table>

### Manifestations of Cognitive Ability Weaknesses and Empirically-based Recommendations and Interventions

(Flanagan, Alfonso, & Mascolo, 2011)

<table>
<thead>
<tr>
<th>CHC-Based Cognitive Ability/Neuropsychological Functions</th>
<th>Brief Definition and General Manifestations of Cognitive Neuropsychological Weaknesses</th>
<th>Specific Manifestations of the Cognitive Neuropsychological Weaknesses</th>
<th>Recommendations and Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long-Term Retrieval (Glr)</td>
<td>Ability to store information (e.g., concepts, words, facts), consolidate it, and fluently retrieve it at a later time (e.g., minutes, hours, days, and years) through association&lt;br&gt;- In Glr tasks, information loses immediate awareness long enough for the contents of primary memory to be displaced completely. In other words, Glr tasks (unlike Gm tasks) do not allow for information to be maintained continuously in primary memory (Schneider &amp; McGrew, 2012)&lt;br&gt;- Glr abilities may be categorized as either “learning efficiency” or “fluency”. Learning efficiency narrow abilities include Associative Memory, Meaningful Memory, and Free Recall Memory; fluency narrow abilities involve either the production of ideas (e.g., Ideational Fluency, Associational Fluency), the recall of words (e.g., Naming Facility, Word Fluency), or the generation of figures (e.g., Figure Fluency, Figure Flexibility) (Schneider &amp; McGrew, 2012)</td>
<td>Difficulty with:&lt;br&gt;- Learning new concepts&lt;br&gt;- Retrieving or recalling information by using association&lt;br&gt;- Performing consistently across different task formats (e.g., recognition versus recall format)&lt;br&gt;- Rapid retrieval of information&lt;br&gt;- Learning information quickly&lt;br&gt;- Paired learning (visual-auditory)&lt;br&gt;- Recalling specific information (words, facts)&lt;br&gt;- Generating ideas rapidly</td>
<td>Reading Difficulties:&lt;br&gt;- Accessing background knowledge to support new learning while reading&lt;br&gt;- Show to access phonological representations during decoding&lt;br&gt;- Retelling or paraphrasing what one has read&lt;br&gt;Math Difficulties:&lt;br&gt;- Memorizing math facts&lt;br&gt;- Recalling math facts and procedures&lt;br&gt;Writing Difficulties:&lt;br&gt;- Accessing words to use during essay writing&lt;br&gt;- Specific writing tasks (compare and contrast; persuasive writing)&lt;br&gt;- Note-taking&lt;br&gt;- Idea generation/production&lt;br&gt;Language Difficulties:&lt;br&gt;- Expressive – circumlocutions, speech fillers, “interrupted” thought, pauses&lt;br&gt;- Receptive – making connections throughout oral presentations (e.g., class lecture)</td>
</tr>
</tbody>
</table>


### Academic Manifestations (Glr)

- **Language**
  - Expressive – circumlocutions, speech fillers, “interrupted” thought, pauses
  - Receptive – making connections throughout oral presentations (e.g., class lecture)
Interventions for Glr

- **Active learning** *(Marzano, et al., 2001)*
- **Rehearsal, overlearning, elaboration** *(Squire & Schacter, 2003)*
- **Mnemonics** *(Wolfe, 2001)*
- **Visual representation** *(Greenleaf & Wells-Papanek, 2005)*
- **Organizational strategies**

Wendling and Miller (2010)

Glr Recommendations

- Repeated practice with and review of newly presented information
- Teach memory strategies (verbal rehearsal to support encoding, use of mnemonic devices)
- Use multiple modalities when teaching new concepts (pair written with verbal information)
- Limit the amount of new material to be learned; introduce new concepts gradually and with a lot of context
- Make associations between newly learned and prior information explicit
- Use lists to facilitate recall (prompts)
**Glr Recommendations**

- Expand vocabulary to minimize impact of word retrieval deficits
- Build in wait-time for student when fluency of retrieval is an issue
- Provide background knowledge first before asking a question to “prime” student for retrieval

**Programs/Techniques for Glr Deficits**

- When selecting a program or a technique to intervene with a student with a Glr deficit, it is helpful to ensure that it
  - includes encoding strategies (e.g., mnemonics, visuals)
  - uses some form of strategy instruction for accessing information
Reading and Writing Intervention
Examples (Glr)

• Reading
  – Teaching text structure which, “organizes the reader’s thinking, and enhances understanding and recall of the information” (Wendling & Mather, 2009, p. 108)

Reading and Writing Examples (Glr)

• Story Map
  • Type of graphic organizer that can be used to teach narrative text structure
  • Focuses on 4 elements including (1) characters and their personalities/ motivations; (2) main problem; (3) characters’ attempts to problem solve; (4) outcome/conclusion
Reading and Writing Examples (Glr)

• Writing
  – Use programs with generated word banks so that the retrieval demands during writing are lessened and vocabulary is indirectly expanded by having the student use target words in sentences (e.g., ClozePro)
Using Instructional Materials (Glr)

• Use chapter terms such as “word banks” for writing activities to facilitate retrieval
• Use chapter previews to “prime” background knowledge and help student make associations
• Use online tools (e.g., writing prompts)
**Harcourt Language (Grade 4)**

**Ideas for Personal Narratives**

**Grade 4**

**Ideas**

Need ideas? Find lots of writing ideas right here.

- Picture Prompts
- Title Ideas
- Mind Nudgers
- Starters

Let one of these questions nudge your mind into writing a personal narrative:

- What happened when you had to pass a hard test?
- What did you do that surprised your parent?
- What happened when you got mad?
- What happened when you lost the big game?
- What happened when you were a stranger?
- What happened when you helped someone?
- What happened when you worked very hard?
- What happened when someone helped you?

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**Manifestations of Cognitive Ability Weaknesses and Empirically-based Recommendations and Interventions (Flanagan, Alfonso, & Mascolo, 2011)**

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<th>Brief Definition*</th>
<th>General Manifestations of Cognitive-Neuropsychological Weaknesses</th>
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<th>Recommendations/Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Processing (Vs)</td>
<td>Ability to analyze and synthesize visual information.</td>
<td>Difficulties with: Recognizing patterns, Reading maps, graphs, charts, Attending to fine visual detail, Recalling visual information, Appreciation of spatial characteristics of objects (e.g., size, length), Recognition of spatial orientation of objects</td>
<td>Reading Difficulties: Orthographic coding (using visual features of letters to decode), Sight-word acquisition, Using charts and graphs within a text in conjunction with reading, Comprehension of text involving spatial concepts (e.g., social studies text describing physical boundaries, movement of troops along a specified route)</td>
<td>Capitalize on students’ phonetic skills for decoding tasks. Teach orthographic strategies for decoding (e.g., word length, shape of word). Use “cover, copy, compare” technique. Provide oral explanation for visual concepts. Review spatial concepts and support comprehension through use of hands-on activities and manipulatives (e.g., using models to demonstrate the moon’s elliptical path). Highlight margins during writing tasks. Provide direct handwriting practice. Use graph paper to assist with number alignment.</td>
</tr>
</tbody>
</table>

How to Use Instructional Materials

• Visual Features of texts (maps, graphs, models)
• Graphic Organizers online
• “Using Tables, Charts, and Graphs” in Harcourt Science text
Houghton Mifflin Math Expressions

Visual Support
- Dot Array
- Ten Frame
- Demonstration Secret Code Cards 1
- Demonstration Secret Code Cards 2
- Secret Code Cards
- Centimeter Rulers
- Pattern Blocks
- Centimeter Dot Paper
- Venn Diagram
- Tangrams
- Centimeter Grid Paper
- Quadrilaterals
- Hundred Chart
- Number Path
- Coin Strips
- Inch Grid Paper
- 10x10 Grid
- Pattern Block Paper
- Hundred Grid
- Class Multiplication Table
- 120 Poster
- Multiplication and Division Strategy Cards 1
- Multiplication and Division Strategy Cards 2
- Paper Clock
- Fraction Circle Model
- Fraction Strips

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<tr>
<td>Processing speed (Gs)</td>
<td>Speed of processing, particularly when required to focus attention for 1-3 minutes.</td>
<td>Difficulties with: Efficient processing of information; Quickly perceiving relationships (similarities and differences between stimuli or information); Working within time parameters; Completing simple,rote tasks quickly.</td>
<td>Reading Difficulties: Slow reading speed, which interferes with comprehension; Needed to re-read for understanding; Math Difficulties: Automatic computations; Computational speed is slow, despite accuracy; Slow speed can result in reduced accuracy due to memory decay.</td>
<td>Repeated practice; Speed drills; Online activities/games (e.g., [link])</td>
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<td></td>
<td>Usually measured by tasks that require the ability to perform simple repetitive cognitive tasks quickly and accurately.</td>
<td></td>
<td>Writing Difficulties: Limited output due to time factors; Shaded process results in reduced motivation to produce.</td>
<td>Extended time.</td>
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<td></td>
<td>Narrow Gs abilities include Perceptual Speed, Rate-of-Test-Taking, Number Facility, Reading Speed, and Writing Speed (note that the latter two abilities are also listed under other broad CHC domains, including Gf).</td>
<td></td>
<td>Language Difficulties: Cannot retrieve information quickly, slow, disrupted speech; cannot get out thoughts quickly enough.</td>
<td>Reducing the quantity of work required (including homework).</td>
</tr>
</tbody>
</table>


Reading and Writing Examples (Gs)

- Writing
- Wordy Qwerty from Talking Fingers

The overall purpose of Wordy Qwerty: Foundations for Reading and Writing Fluency, is to improve phonological and morphological sensitivity, to develop a deeper understanding of how words are constructed in English, and to provide reading and writing activities with helpful feedback, in order to increase fluency and comprehension in reading and writing. Wordy Qwerty has 20 lessons, with six activities per lesson, that present the following foundations for fluency:
Increasing Fluency in Writing

Write Stories: In these cleverly illustrated 8-line rhymes, children hear and see the first line, and have to type out the second line after it is dictated. They can see and hear the dictated line as often as they need, but get more points if they remember the sentence and try to spell the words correctly. These little stories are full of words that require using the spelling rule just presented.

http://www.arcademicskillbuilders.com/games/

<table>
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<tr>
<th>CHC Broad Cognitive Abilities/Neuropsychological Functions</th>
<th>Brief Definition</th>
<th>General Manifestations of Cognitive/Neuropsychological Weaknesses</th>
<th>Specific Manifestations of the Cognitive Neuropsychological Weaknesses</th>
<th>Recommendations/Interventions</th>
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</thead>
</table>
| Processing speed (SA)                                    | Speed of processing, particularly when required to focus attention for 1-2 minutes | Difficulties with:  
- Efficient processing of information  
- Quickly perceiving relationships (similarities and differences between stimuli or information)  
- Working within time parameters  
- Completing simple,rote tasks quickly | Reading Difficulties:  
- Slow reading speed, which interferes with comprehension  
- Need to re-read for understanding  
- Math Difficulties:  
  - Automatic computations  
  - Computational speed is slow despite accuracy  
  - Slow speed can result in reduced accuracy due to memory decay  
  - Writing Difficulties:  
    - Limited output due to time factors  
    - Slurred process results in reduced motivation to produce Language Difficulties:  
      - Cannot retrieve information  
      - Slow, disrupted speech; cannot get out thoughts quickly enough  
      - Is slow to process incoming information, puts demands on memory store which can result in information overload and loss of meaning | Repeated practice  
- Speed drills  
- Online activities/games (e.g., http://www.academicSkillBuilder.com/games)  
- Computer activities that require quick, simple decisions  
- Extended time  
- Reducing the quantity of work required (including homework)  
- Increasing “wait” times; both after questions are asked and after responses are given  
- Choral Repeated Reading  
- Books on tape |
| Short-Term Memory (STM)                                  | Ability to hold information in immediate awareness and use or transform it within a few seconds | Difficulties with:  
- Following multi-step oral and written instructions  
- Remembering information long enough to apply it  
- Remembering the sequence of information  
- Rate memorization  
- Maintaining one’s place in a math problem or train of thought while writing | Reading Difficulties:  
- Reading comprehension (i.e., understanding what is read)  
- Decoding multi-syllabic words  
- Orally retelling or paraphrasing what one has read  
- Math Difficulties:  
  - Rate memorization of facts  
  - Remembering mathematical procedures  
  - Multi-step problems and regrouping  
  - Extracting information to be used in word problems  
  - Writing Difficulties:  
    - Spelling multisyllabic words  
    - Redundancy in writing (word and conceptual levels)  
    - Identifying main idea of a story  
    - Note-taking | (Use meaningful stimuli to assist with encoding and allow for experiential learning (i.e., learning while doing)  
- Provide opportunities for repeated practice and review  
- Provide supports (e.g., lecture notes, guided notes, study guides, written directions) to supplement oral instruction  
- Break down instructional steps for student  
- Provide visual supports (e.g., times tables) to support acquisition of basic math facts  
- Outline math procedures for student and provide procedural guides or flashcards for the student to use when approaching problems  
- Highlight important information within a word problem  
- Have student write all steps and show all work for math computations  
- Use writing programs or techniques that emphasize drafting first (e.g., Draft Builder 6)  
- Teach chunking strategies |


### Manifestations of CHC Ability Weaknesses and Empirically-based Recommendations and Interventions (Flanagan & Mascolo, 2012)

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<td>Attention</td>
<td>- Attention is a complex and multifaceted construct used when an individual must focus on certain stimuli for information processing. In order to regulate thinking and to complete tasks of daily living such as schoolwork, it is necessary to be able to attend to both auditory and visual stimuli in the environment. Attention can be divided into five subareas: selective focused attention, shifting attention, divided attention, sustained attention, and attentional capacity (Miller)</td>
<td>- Easily distracted; - Loses attention to detail; - Makes careless mistakes; - Difficultly disorganizing demands of a task (e.g., where to begin or how to get started); - May only be able to attend to task in short intervals; - Difficultly changing activities; - Difficultly applying a different strategy when task demands change; - Difficultly attending to more than one thing or task at a time; - Cannot perform well with faced with multiple stimuli or an abundance of detail;</td>
<td>- Reading Difficulties: - Loses one's place easily; - Easily distracted while reading; - Does not pick up important details in text;</td>
<td>- Provide a quiet place to work in the classroom during seatwork; - Provide reinforcement for timely completion of work; - Make sure student understands oral directions and has the same directions in written form for reference; - Provide a cue when transitioning; - Work with student to develop a time line for longer assignments; - Allow student to use a computer or dictate longer assignments; - Assist student in proofreading and writing assignments; - Reduce amount of repetitive seatwork; - Build in breaks during longer assignments; - Provide structure and highlight critical information in all academic tasks; - Provide student with a monitor with whom he or she can check in with once or twice a day (e.g., keeping track of assignments, books, schedule)</td>
</tr>
</tbody>
</table>
| Executive Functioning                                     | - Executive functioning is often understood as two broadly conceptualized areas that are related to the brain's frontal lobes: cognitive control and behavioral/ emotional control. The cognitive aspects of executive functioning include concept generation (Go/No-Go); problem solving (Go, attentional shifting; attention; Go); planning/organizing; working memory (Gan); and retrieval fluency (Gf). The behavioral/emotional aspects of executive functioning relate to the inhibitory controls of behavior (e.g., impulsivity, regulation of emotional tone, etc.) (see Miller, 2010; KDS, Inc.) | - Difficulty with: - Planning new activities; - Generating concepts, and solving problems; - Identifying goals and setting goals; - Initiating (e.g., begins project without necessary materials; does not allocate sufficient time to complete task); - Engaging (e.g., may skip steps in anti-step problems); - Managing (e.g., has trouble staying on task); - Sequencing (e.g., leaves important papers, fails to turn in completed work, misses assignments, schedule); - Persistence (e.g., has difficulty getting started on tasks, assignments, etc.); - Time (e.g., often runs out of time on seatwork and tests; has difficulty completing homework due to extended timeframes); - Shifting between activities flexibility, coping with circumstances events; - Self-monitoring (e.g., doesn’t check to ensure that each step was completed; doesn’t check work before submitting it); - Emotional control (e.g., may exhibit inappropriate or over-reactive responses to situations). Examples were adapted from Leslie E. Porter: PNC (2001) see also Porter & Porter Sample Program: Executive Functioning Kit, Challenged Teacher’s Workbench Press, 2010 | - Reading difficulties: - Inaccurate; - Story chronologically; - Inapparent: Extracting main ideas and other important information; - Problem solving; drawing inferences from text; - Math difficulties: - Inaccurate; remembering order of operations; - Inapparent: - Figuring out what is important when solving word problems; - Shifting: - Reading signs on a page; - Writing difficulties: - Inapparent: generating ideas to write about; - Sequencing a story; - Prioritizing main events in a story | - Assist student in organizing work by explaining verbally and in writing or through visuals/the steps necessary to complete a task; - Use visual schedules and build in time throughout the day to review; - Use graphic organizers; - Set alarms (on watch or computer) to regulate timing of projects and tasks; - Plan and structure transition times and shifts in activities; - Break long assignments into smaller, manageable assignments and provide time frames for completing each; - Organize work space and minimize clutter; do this on a daily or weekly basis; - Make a checklist for getting through assignments. For example, a student’s checklist could include such items as: get out pencil and paper, put name on paper, put due date on paper, read directions, etc. Examples adapted from LD Online: Copyright 2008 by the National Center for Learning Disabilities, Inc. All rights reserved.