

**Application of Cognitive Hypothesis Testing:
Using PSW Analysis**

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**To “Process” through this “Process” let
these questions be our guide.**

(Otherwise known as an agenda)

- What is learning (or the dysfunction of learning)?
 - As described in law?
 - How complicated can it be?
 - Isn't it just a one to one correspondence?
 - Examples of the complex
- What is an example of PSW?
- How can I apply results from the WISC-V and WIAT-III and/or KTEA-3 to complete PSW?

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**ELIGIBILITY AND NEED
FOR
DIRECT SPECIALIZED
INSTRUCTION**

**DETERMINING THE
EXISTENCE OF A
SPECIFIC LEARNING
DISABILITY**

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IDEA 2004

- ...the criteria adopted by the State: Must not **require** the use of a severe discrepancy between intellectual ability and achievement for determining whether a child has a specific learning disability, as defined in 34 CFR 300.8(c)(10);
 - **Must permit** the use of a process based on the child's response to scientific, research-based intervention; and
 - **May permit** the use of other alternative research-based procedures for determining whether a child has a specific learning disability, as defined in 34 CFR 300.8(c)(10).

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Specific Learning Disability § 300.309 (a) (1)

The child **does not achieve adequately for the child's age** or to meet State-approved grade-level standards in one or more of the following areas, when provided with learning experiences and instruction appropriate for the child's age or State-approved grade-level standards:

1. Oral Expression
2. Listening Comprehension
3. Written Expression
4. Reading Comprehension
5. Basic Reading Skills
6. Reading Fluency Skills
7. Mathematics Calculation
8. Mathematics Problem-Solving

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Ability



Achievement

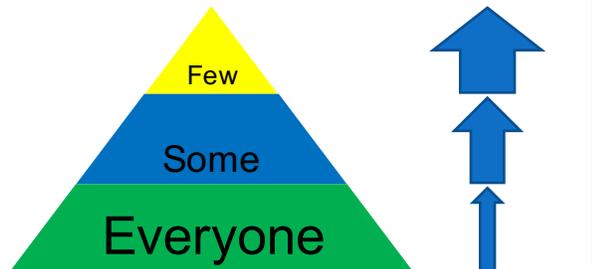
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Specific Learning Disability

The child does not make sufficient progress to meet age or State approved grade-level standards in one or more of the areas identified in paragraph (a)(1) of this section when using a process based on the **child's response to scientific, research-based intervention**; or

§ 300.309 (a) (2) (i)

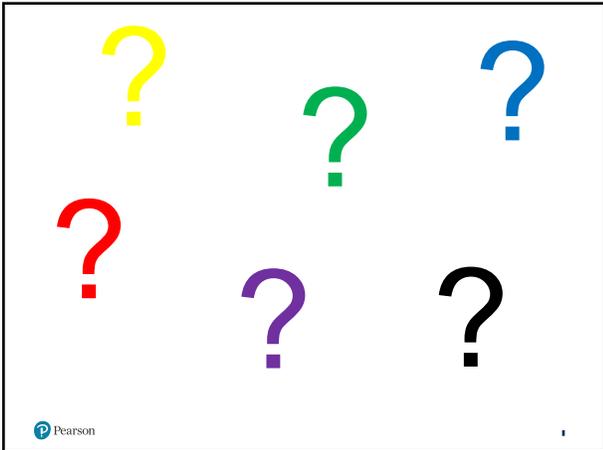


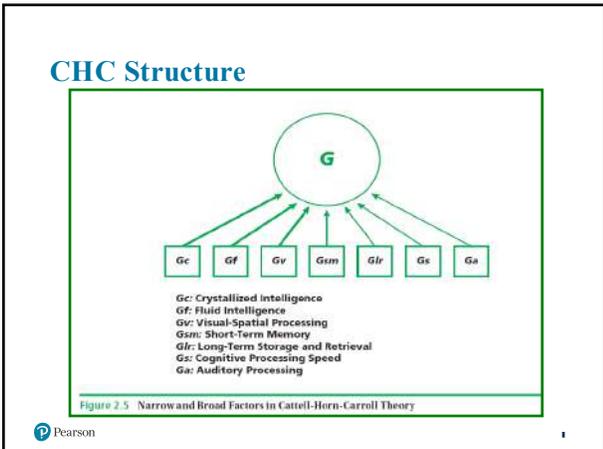


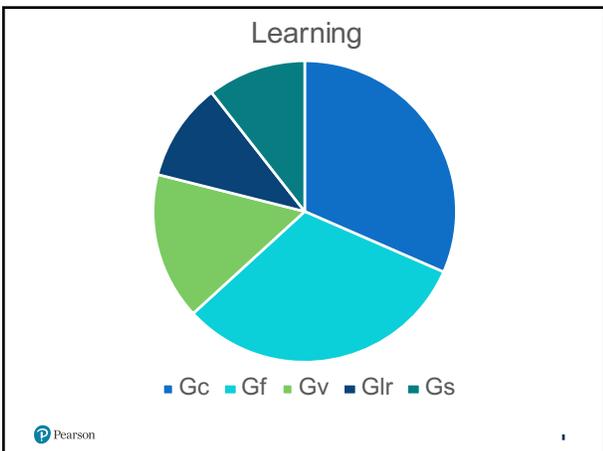
Specific Learning Disability

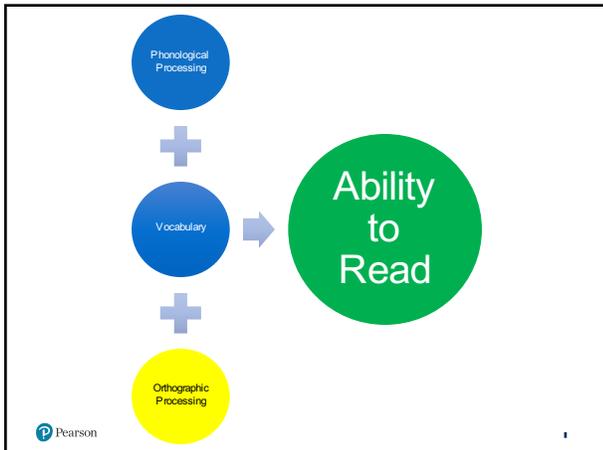
the child exhibits a **pattern of strengths and weaknesses** in performance, achievement, or both, relative to age, State-approved grade level standards or intellectual development . . . ”
(§300.309 (a) (2) (ii)).









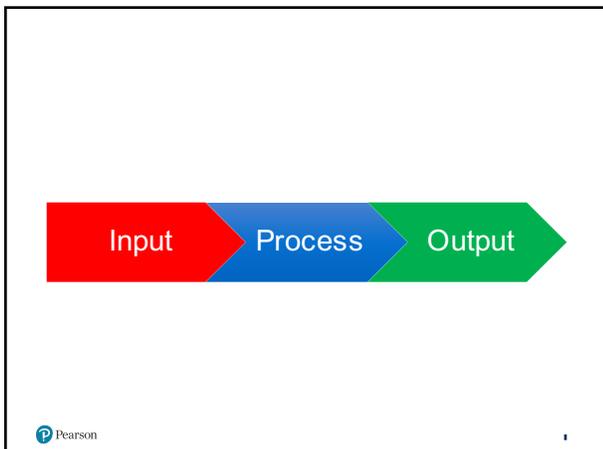


The Process of Learning



- Learning is the process of acquiring information.
- What are the cognitive factors that enable students to **show** what they know and can do?
 - How do they collect, sort, store, and retrieve information?
 - How do they receive, perceive, process, and remember information?
- Other factors?
 - How do they take in information?
 - How do they "put out" information?

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Learning Disability NOT because of Input or Output? (Sec. 300.309)

- (3) The group determines that its findings under paragraphs (a)(1) and (2) of this section are not primarily the result of--
 - (i) A visual, hearing, or motor disability;
 - (ii) Mental retardation;
 - (iii) Emotional disturbance;
 - (iv) Cultural factors;
 - (v) Environmental or economic disadvantage; or
 - (vi) Limited English proficiency.



Sensory/Motor Functions and Learning

To respond effectively to the demands of the typical classroom, children must be able to encode information, and show what they know.

- Is the child able to see the information? Is visual acuity within normal limits?
- Is the child able to hear the information? Is hearing acuity within normal limits?
- Is the child able to respond in writing? Are fine motor abilities within normal limits?
- Is the child able to respond orally? Are language production abilities within normal limits?



	Input	Process	Output
Written Expression	<ul style="list-style-type: none"> ▪ Spoken directions ▪ Pictures ▪ Words and sentences on a page ▪ Spoken stimuli ▪ Time limit for essay 	<ul style="list-style-type: none"> ▪ Acquired knowledge and achievement: writing ability, English usage, grammar/syntactic knowledge ▪ Verbal working memory ▪ Executive functions: planning, strategy use 	<ul style="list-style-type: none"> ▪ Written response ▪ Open ended ▪ Constrained
Phonological Processing	<ul style="list-style-type: none"> ▪ Brief spoken directions ▪ Spoken stimuli ▪ Sample and teaching items ▪ Pictures 	<ul style="list-style-type: none"> ▪ Acquired knowledge and achievement: phonological awareness ▪ Lower-level processing: auditory perception and discrimination ▪ Higher-level processing: phonetic analysis and synthesis (sequencing, assembly, and segmentation) ▪ Verbal working memory 	<ul style="list-style-type: none"> ▪ Pointing response ▪ Spoken formulation/retrieval ▪ Open ended ▪ Multiple choice
Nonsense Word Decoding	<ul style="list-style-type: none"> ▪ Brief spoken directions ▪ Teaching items ▪ Nonwords on a page 	<ul style="list-style-type: none"> ▪ Acquired knowledge and achievement: decoding ▪ Higher-level processing: phonetic analysis ▪ Verbal working memory 	<ul style="list-style-type: none"> ▪ Spoken response ▪ Oral formulation ▪ Open ended

Attention and Learning

To receive, perceive, process, and remember information, children must

- selectively attend to certain stimuli while ignoring competing, irrelevant stimuli.
- sustain attentional focus for a prolonged period.
- shift attentional resources from one activity to another.
- respond to more than one task simultaneously – divided attention.



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Visual-Spatial Processes and Learning

- Much of what is presented in school has either a visual-spatial or language basis.
- Visual-perceptual skills play a major role in the development of a child's handwriting skills, and fluency in math and reading.
- For example, a student may be able to name individual letters in a word (visual analysis, b-e-d). She may be unable to integrate the letters to say the word (visual synthesis, bed).



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Language and Learning

Language is the basis for much of the learning that occurs in schools.

- Children must understand words and sentences to perceive and process information - receptive.
- They must use words to show they can retrieve information from memory - expressive.
- Early development of reading depends critically on whether the receptive phonological component of the aural system and the expressive phonological component of the oral system are developing in an age-appropriate manner (Berninger, V., 2007).

Language  Literacy



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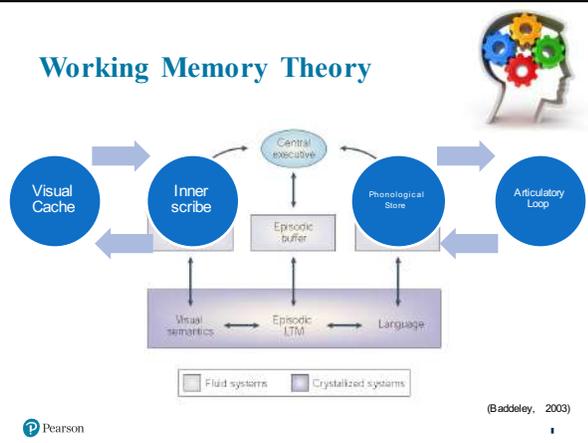
Speed of Processing and Learning

- Efficient cognitive processing frees-up cognitive resources for more complex or higher-level tasks.
- A weakness in the speed of processing routine information may make the task of comprehending novel and/or non-routine information more time-consuming and difficult.
- For example,
 - If a child names words effortlessly, s/he can focus cognitive energy on higher-order comprehension.
 - If a child computes fluently, s/he can focus on application.

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Working Memory Theory



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(Baddeley, 2003)

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WISC-IV (2003)

- Compared 4 factors of WISC-IV to 11 domains of functioning explained by Cattell, Horn, and Carroll (1993).
- Found the following domains are measured by the WISC-IV:
 - G_f (Fluid Reasoning, Novel Problem Solving)
 - G_c (Crystallized Knowledge)
 - G_s (Processing Speed, Automatic Thinking)
 - G_v (Visual Spatial Abilities)
 - G_{sm} (Short-term Memory, Conscious Awareness)
 - G_q (Store of Acquired Quantitative Knowledge)

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**Phelps, McGrew, Knopik,
& Ford (2005)**

- A cross battery confirmatory factor analytic (CFA) approach was applied to major intelligence assessments for classification of abilities (WISC-III and WJ-III)
- Confirmed G_f - G_c broad domains and narrow abilities.
- The WISC-III and WJ-III load heavily on five stratum II domains (G_c , G_q , G_s , G_{sm} , G_v).
- WISC-IV represents the addition of G_f , G_a , and G_{lr} domains.



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**Keith, Goldenring Fine, Taub,
Reynolds, & Kranzler (2006)**

- Extended WISC-IV (2003)
- Confirmatory Factor Analysis of WISC-IV
- Identified the following factors:
 - G_c
 - G_v
 - G_f
 - G_{sm}
 - G_s
 - Not G_q



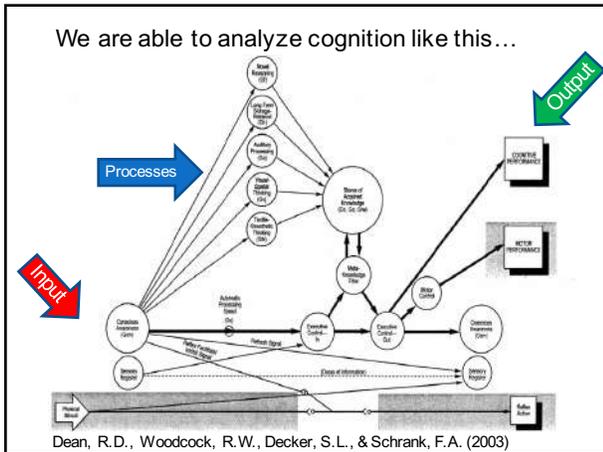
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If we think of WISC-V factors like this...

Index Score	CHC Broad Ability (Narrow)
VCI	G_c
VSI	G_v
FRI	G_f
WMI	G_{sm} (MW, MS)
PSI	G_s
QRI	G_f (RQ), G_q
AWMI	G_{sm} (MW, MS)
NSI	G_{lr} (NA)
STI	G_{lr} (MA)
SRI	G_{lr}



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KTEA-3 and CHC

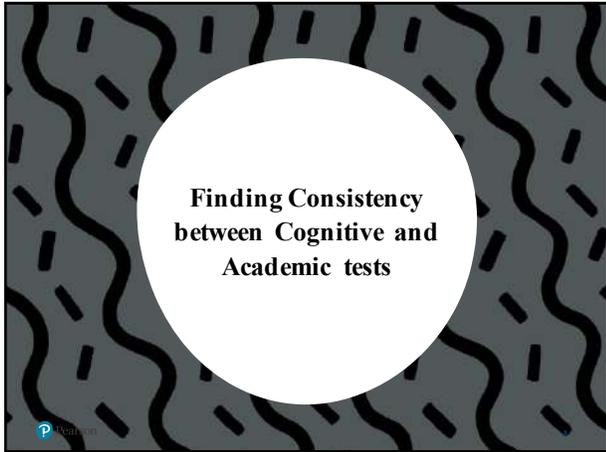
Reading	Broad Ability	Narrow Ability
Letter & Word Recognition	Grw	Reading Decoding (RD)
Nonsense Word Decoding	Grw Ga	Reading Decoding (RD) Phonetic Coding (PC)
Reading Comprehension	Grw	Reading Comprehension (RC)
Reading Vocabulary	Gc Grw	Language Development (LD) Reading Comprehension (RC)
Reading Fluency	Broad Ability	Narrow Ability
Word Recognition Fluency	Grw	Reading Speed (RS)
Decoding Fluency	Grw Grw Ga	Reading Speed (RS) Reading Decoding (RD) Phonetic Coding (PC)
Silent Reading Fluency	Grw	Reading Speed (RS)

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KTEA-3 and CHC

Writing	Broad Ability	Narrow Ability
Written Expression	Grw Grw Gc	Writing Ability (WA) English Usage (EU) Grammatical Sensitivity (MY)
Spelling	Grw	Spelling Ability (SG)
Writing Fluency	Gv/Gps	Writing Speed (WS)
Oral Language	Broad Ability	Narrow Ability
Listening Comprehension	Gc Glr	Listening Ability (LS) Meaningful Memory (MM)
Oral Expression	Gc Gc	Communication Ability (CM) Grammatical Sensitivity (MY)
Associational Fluency	Glr	Ideational Fluency (FI)
Language Processing	Broad Ability	Narrow Ability
Phonological Processing	Ga	Phonetic Coding (PC)
Object Naming Facility	Glr	Naming Facility (NA) Rate-of-Test-Taking (RT)
Letter Naming Facility	Glr Gs	Naming Facility (NA) Rate-of-Test-Taking (RT)

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Possible Areas of Cognitive Processing Weaknesses Suggested by Qualitative Observations on KTEA-3

Language or Achievement Area	Graphomotor	Visual Processing	Attention & Exec. Functions	Phonological Processing	Orthographic Processing	Language Processing	Processing Speed	Automaticity/ RAN	Working Memory	Fluid Reasoning
Oral Expression						X				
Listening Comprehension									X	
Basic Reading								X		
Reading Comprehension									X	
Reading Fluency										
Spelling									X	
Written Expression										
Math Calculation								X		
Math Problem Solving										

Real Word and Non-Word Reading

- Word Reading
 - Indexes: VCI and AWMI
 - Subtest DS VC (IN, CO)
 - Complementary Measures
 - Delayed Symbol Translation
 - Naming Speed Literacy
- Pseudoword Decoding
 - Indexes: VCI, WMI, NSI
 - Subtest DS VC (IN, CO)
 - Complementary Measures
 - Delayed Symbol Translation
 - Naming Speed Literacy

Reading Comprehension and Fluency

- Reading Comprehension
 - Indexes: VCI, FRI and AWWI
 - Subtest SI, VC (CO), MR (AR)
 - Complementary Measures
 - Delayed Symbol Translation
- Oral Reading Fluency
 - Indexes: VCI, NSI, AWM
 - Subtest VC, CD, DS (LNS), SI
 - Complementary Measures
 - Naming Speed Literacy
 - Delayed Symbol Translation



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Reading Indexes

- Basic Reading
 - Indexes: VCI, AWWI, WMI, NSI
 - Subtest VC (IN), DS, AR
 - Complementary Measures
 - Naming Speed Literacy
- Total Reading
 - Indexes: VCI, AWWI, SRI
 - Subtest DS, SI, VC (CO, IN), AR
 - Complementary Measures
 - Naming Speed Literacy
 - Delayed Symbol Translation



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Math Calculation and Problem Solving

- Math Problem Solving
 - Indexes: QRI, AWWI, VSI
 - Subtest DS, FW, CD (AR), BD, VC (AR)
 - Complementary Measures
 - Delayed Symbol Translation
- Numerical Operations
 - Indexes: QRI, PSI, AWWI, VCI
 - Subtest SI, CD, DS (AR), FW (AR)
 - Complementary Measures
 - Naming Speed Quantity (CD)



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Math Fluency and Total

- Math Fluency
 - Indexes: QRI, PSI, AWWMI, NSI
 - Subtests: CD, DS (AR), FW (AR)
 - Complimentary
 - Naming Speed Literacy
 - Naming Speed Quantity
- Total Math
 - Indexes: VCI, FRI, and AWWMI
 - Subtests: DS, CD, FW, SI, AR
 - Complimentary
 - Delayed Symbol Translation



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Spelling and Writing

- Essay Composition
 - Indexes: PSI, VCI, QRI
 - Subtest CD, SI (CO), FW
- Spelling
 - Indexes: AWWMI, VCI, and FRI
 - subtest DS VC (IN), MR, AR
 - Complimentary Measures
 - Delayed Symbol Translation
 - Naming Speed Literacy



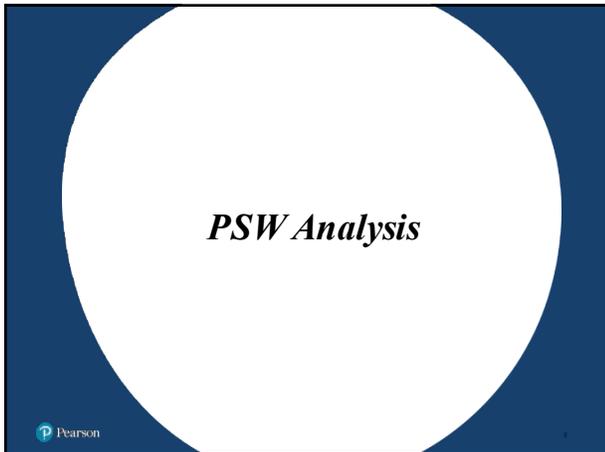
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Total Writing

- Total Writing
 - Indexes: VCI, AWWMI, PSI, QRI
 - subtest DS (LN), SI, CD, VC (IN), AR
 - Complimentary Measures
 - None



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Approaches to Pattern of Strengths and Weaknesses Analysis
(Hale, Flanagan, & Naglieri, 2008)

- Most prominent research-based:
 1. Concordance-discordance method (C-DM; Hale & Fiorello, 2004)
 2. Discrepancy/consistency method (Naglieri & Das, 1997),
 3. Cross battery assessment approach (Flanagan, Ortiz, & Alfonso, 2013)

PSW Approaches

- Commonalities:
 - Rule out exclusionary factors as part of the definition of a learning disability
 - Identify a cognitive processing weakness that is related to the achievement weakness
 - Identify one or more areas of strength that are unrelated to the achievement weakness
- However, they also do differ in several key areas, including the criteria for defining strength and weakness.

What is PSW

- Requires the identification of a processing weakness,
 - Differentiates between SLD and underachievement (for other reasons).
 - SLD requires individualized instruction responsive to processing strengths and weaknesses .
- Is important given current thinking that only using RTI is not sufficient for diagnosing SLD (Flanagan, Fiorello, & Ortiz, 2010; Hale et al., 2010; Hale, Kaufman, Naglieri, & Kavale, 2006) .

Methodological and Statistical Requirements for PSW

- The scores comparisons must be significantly different (discrepant) meet criteria for SLD identification:
 - processing strength vs . achievement weakness
 - processing strength vs . processing weakness
- Is there a consistency between the achievement weakness and the processing weakness
 - Rationale for SLD

Methodological and Statistical Requirements for PSW

- Score comparisons are evaluated using the simple-difference method rather than the predicted-score (regression) method .
 - Not an implicit causal relationship,
 - As with AAD
- If comparisons are *not* statistically significant, the child does *not* demonstrate a pattern consistent with an SLD
 - However, USE CLINICAL JUDGMENT AND MULTIPLE DATA POINTS!

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PSW and the WISC-V

- The PSW model in the WISC-V
 - Most closely resembles the C-DM model.
 - Legally acceptable and clinically sound approach (Hale & Fiorello, 2004; Hale et al., 2010).
- Use it within research-supported cognitive and neuropsychological approaches to assessment
 - Cognitive hypothesis-testing model (e.g., Hale & Fiorello, 2004),
 - Cross-battery assessment approach (e.g., Flanagan et al., 2013)
 - Cattell-Horn-Carroll (CHC) theory (e.g., Flanagan, Alfonso, Mascolo, & Sotelo-Dynega, 2012)
 - Lurian approaches (e.g., Luria, 1973)
 - PASS theory as operationalized by the Das-Naglieri Cognitive Assessment System (CAS; Naglieri & Das, 1997; Naglieri, 1999) and the NEPSY-II (as discussed in Kemp & Korkman, 2010).

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PSW and the WISC-V

- Naming Speed Literacy and Symbol Translation subtests give standard scores (as opposed to scaled scores).
- Directly comparable to other frequently used score in PSW
 - Such as WISC-V index scores, subtest and composite standard scores on achievement measures linked to the WISC-V.

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Conducting a **PSW** with WISC-V

STEP 3
Select the WISC-V standard score that represents the processing strength

STEP 2
Select the WISC-V standard score that represents the processing weakness

STEP 1
Select the subtest or composite score corresponding to the primary achievement weakness.

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Conduct PSW Analysis with WISC-V and WIAT-III and/or KTEA-3:
Step 1

1. Select the achievement weakness

- a. Subtest or composite score that corresponds to primary achievement weakness
 - a. Consider below average (i.e., standard score less than 85)
 - b. Consider selecting a subtest or composite score that corresponds to IDEA-specified areas of achievement for identifying an SLD
- b. Examine subtest variability within a composite score before selecting the composite as the achievement weakness.
 - a. Use subtests

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Step 2

2. Select the WISC-V standard score that represents the processing weakness.

- a. Generally associated with the achievement weakness
- b. Examine subtest variability within the WISC-V standard scores before selecting a processing weakness.
 - a. Preferable (not always necessary) to use a different standard score

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Step 3

3. Select the WISC–V standard score that represents the processing strength.
 - a. Processing strength not typically related to the achievement weakness
 - b. Examine subtest variability within the WISC–V standard scores before selecting the processing strength (see 2b).
 - c. Avoid using WMI, PSI, AWMI, any of Naming Speed process or subtest scores, or SRI as the strength in PSW.

Comparing the PSW and AAD Analyses - Differences

1. WISC–V primary index scores, some of the ancillary and complementary index scores, and some of the subtest and process standard scores are used in the PSW analysis as measures of processing strengths and weaknesses; the FSIQ, NVI, and GAI scores are not used.
2. Two score comparisons are required to meet the criteria of the PSW model, rather than the single comparison used in the AAD analysis.
3. Statistical evidence of a processing weakness is an essential requirement of only the PSW analysis. A processing weakness (i.e., a disorder in one or more of the basic psychological processes) is specified as a defining characteristic of a learning disability, according to the federal definition (IDEIA Sec. 300.8(c)(10)). Proper use of the AAD model may also include a supplementary evaluation of processing weaknesses; however, this analysis is not essential to the model.

Pattern of Strengths and Weaknesses

Pattern of Strengths and Weaknesses Analysis

Comparison	Relative Strength Score	Relative Weakness Score	Diff.	Critical Value .05	Sign. Diff. Y / N	Supports SLD hypothesis? Yes / No
A Processing Strength / Achievement Weakness	114 (VCI)	79 (NO)	35	8.82	Y	Yes
B Processing Strength / Processing Weakness	114 (VCI)	80 (WMI)	34	10.18	Y	Yes

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

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Pattern of Strengths and Weaknesses Concordance/Discordance Model (Hale & Fiorello, 2004)

Processing Strength
WISC-IV Verbal Comprehension Index
SS = 114

A. Discrepant?
Yes

B. Discrepant?
Yes

Achievement Weakness
WIAT-III Numerical Operations
SS = 79

Processing Weakness
WISC-IV Working Memory Index
SS = 80

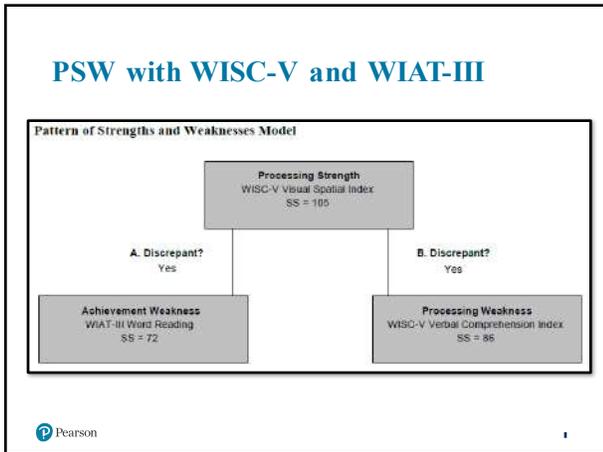
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PSW with WISC-V and WIAT-III

PATTERN OF STRENGTHS AND WEAKNESSES ANALYSIS						
Area of Achievement Weakness	WIAT-III	Word Reading: 72				
Area of Processing Weakness	WISC-V	VCI: 86				
Area of Processing Strength	WISC-V	VSI: 105				
Comparison	Relative Strength Score	Relative Weakness Score	Difference	Critical Value .05	Significant Difference Y/N	Supports SLD hypothesis? Yes/No
A Processing Strength/ Achievement Weakness	105	72	33	10.00	Y	Yes
B Processing Strength/ Processing Weakness	105	86	19	12.00	Y	Yes

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