Presentation Objectives

• Understand the changes made to the SNP Model and the rationale for those changes from previous versions.
• Understand how the changes to the SNP Model have been integrated into the latest School Neuropsychology Report Shell.
• Appreciate the future directions the SNP Model and Report Shell is heading.

Presentation Overview

• Review of the initial SNP Model development (theoretical influences).
• The SNP Model (2007-2012)
• The Integrated SNP/CHC Model (current)
• A peek at the new SNP Report Shell

Brief History of the School Neuropsychology Conceptual Model

• Dr. Miller's unique doctoral training at The Ohio State University in the late 1980s (blend between school psychology, neuropsychology, and electrophysiology).
• Teaching pediatric/school neuropsychological assessment to Doctoral School Psychology students at Texas Woman's University since 1990.
• School Neuropsychology Post-Graduate Certification Program since 2002.

Purpose of the SNP Model

The school neuropsychological conceptual model ("SNP Model") was created as a way of organizing school-age, cross-battery assessment data based upon the underlying principle neuropsychological constructs being measured.

Purposes of the SNP Model

• Facilitate clinical interpretation by providing an organizational framework for the assessment data:
• Strengthen the linkage between assessment and evidence-based interventions
• Provide a common frame of reference for evaluating the effects of neurodevelopmental disorders on neurocognitive processes

(Miller, 2012)
Evolution of the SNP Model

SNP Model Introduced - Essentials of School Neuropsychological Assessment (Miller, 2007)

SNP Model Refined - Best Practices in School Neuropsychology: Guidelines for Effective Practice, Assessment, and Evidence-Based Intervention (Miller, 2010)


Theoretical Influences on the SNP Model

- Luria Theory
- Neuropsych Theorist
- Process-Oriented Approach
- SNIP Model
- CHC Theory
- Cross Battery Assessment
- CHT Approach

CHC Theory and School Neuropsychology

- Gf – Fluid Reasoning
- Gc – Verbal Ability
- Gv – Visual-Spatial Thinking
- Glr – Long-Term Retrieval
- Ga – Auditory Processing
- Gsm – Short-Term Memory
- Gs – Processing Speed
- Gq – Quantitative Reasoning

Does not adequately address the constructs of:
- Senosimotor Functions
- Attention
- Learning and Memory
- Executive Functions

Initial Development of the SNP Model

- Therefore, the SNP Model integrated additional neuropsychological theories such as Mirsky’s theory of attention (Mirsky, 1996) and Baddeley and Hitch’s (1974) theory of working memory (Baddeley, 2003).
- The SNP Model is also heavily influenced by Kaplan’s process-oriented approach (Milberg et al., 2009), which resulted in the inclusion of qualitative, as well as quantitative assessment data.

Lurian Approach to Assessment

Finally, the SNP Model follows a Lurian approach in which an individual’s neurocognitive strengths and weakness are systematically determined by varying the input, processing, and output demands across a variety of tasks.
CHT Model

- Cognitive Hypothesis Testing (CHT) Model.

Conducting Demand Analyses

- A key component of the CHT Model, particularly the assessment component, is the analysis of the neurocognitive demand/solution strategies required to perform a given task.
- To generate hypotheses about why a particular child performed poorly or well on any given task, the examiner must understand the neurocognitive demands/solution strategies for successful performance on the task.

Demand Analysis of the WISC-IV Block Design Subtest

- Input Demands
  - Models and abstracts visual pictures
  - Understands and follows oral directions (moderate English-language knowledge)
  - Makes use of demonstration/modeling behaviors from the examiner
  - Low cultural knowledge and emotional content

- Processing Demands
  - Visual processing (spatial relations, visualization)
  - Perception of part-whole relationships
  - Discordant/ divergent processing (analysis)
  - Constructional praxis
  - Bimanual coordination (corpus callosum)
  - Concordant/convergent processing (synthesis)
  - Moderate attention and executive demands
  - Planning and strategy use
  - Inhibition of impulsive/wrong responding
  - Low to moderate novel problem solving

Conducting Demand Analyses

- Input Demands
  - e.g., receptive language, visual-motor integration

- Task Processing Demands
  - e.g., focused attention, processing speed, working memory, reasoning, etc.

- Output Demands
  - e.g., fine motor response, visual-motor coordination, visual-spatial processing, expressive language

CHT Model

<table>
<thead>
<tr>
<th>Theory</th>
<th>Hypothesis</th>
<th>Data Collection</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Presenting Problem</td>
<td>2. Intellectual/cognitive problem</td>
<td>3. Administer/score intelligence test</td>
<td>4. Interpret IQ or conduct demand analyses</td>
</tr>
<tr>
<td>5. Cognitive strengths/weaknesses</td>
<td>6. Choose related construct test (s)</td>
<td>7. Administer/score related construct test (s)</td>
<td>8. Interpret related tests/compare results</td>
</tr>
<tr>
<td>13. Continue/terminate/modify intervention</td>
<td></td>
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</tr>
</tbody>
</table>
**Demand Analysis of the WISC-IV Block Design Subtest**

- **Output Demands**
  - Fine motor response, arrangement of manipulatives
  - Timed score with speed bonus; process score without time bonus
  - Visual-motor integration

---

**Presentation Overview**

- Review of the initial SNP Model development (theoretical influences).
  - The SNP Model (2007-2012)
  - The Integrated SNP/CHC Model (current)
  - A peek at the new SNP Report Shell

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**School Neuropsychology Conceptual Model 2007-2012**

- Academic Achievements
- Social-Emotional and Adaptive Behaviors and Cultural and Environmental Factors

---

**Classifying Tests into the SNP Model**

- Major tests of:
  - Cognitive processing
  - Academic functioning
  - Memory and Learning
  - Specific neuropsychological constructs
  - Some behavioral rating scales

---

**Classifying Tests into the SNP Model**

- Published correlational and factorial data were used to group tests together that were shown to measure similar neuropsychological processes or functions.
- When such data were not available, tests were classified into the SNP Model based on what the test authors reported the tests were designed to measure.
- Recent factorial analyses of over 900 clinical cases (see preliminary results in Miller, 2012) further helped refine the SNP Model as it is presented in this chapter.
- The SNP Model will continue to be refined and evolve based on ongoing research.

---

**What is Being Measured by a Test?**

- The goal of an assessment is to maximize the primary ability being measured while minimizing the unique abilities and error variance.
- With the SNP Model, tests were initially classified according to their primary ability being measured.
SNP Model 2007-2012
SNP Model consists of seven broad classifications representing basic neurocognitive functions and processes, including:
• sensorimotor functions
• attentional processes
• visual-spatial processes
• language functions
• learning and memory
• executive functions
• speed and efficiency of cognitive processing.

SNP Model Classifications
• All of these broad classifications except for speed and efficiency of cognitive processing could be further subdivided into what is referred to as second order classifications.
• Many of the second order classifications could be further subdivided into what is referred to as third order classifications.

SNP Model (2007-12): Example of Sensorimotor Functions

<table>
<thead>
<tr>
<th>Broad Classification</th>
<th>Second Order Classification</th>
<th>Third Order Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensorimotor functions</td>
<td>Lateral Preference</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sensory Functions</td>
<td>Auditory and visual acuity</td>
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<tr>
<td></td>
<td></td>
<td>Tactile sensation and perception</td>
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<td></td>
<td>Fine Motor Functions</td>
<td>Coordinated hand/finger movements</td>
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<td></td>
<td></td>
<td>Psychomotor speed and accuracy</td>
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<tr>
<td></td>
<td>Gross Motor Functions</td>
<td>Balance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Coordination</td>
</tr>
<tr>
<td></td>
<td>Qualitative Behaviors</td>
<td></td>
</tr>
</tbody>
</table>

Presentation Overview
• Review of the initial SNP Model development (theoretical influences).
• The SNP Model (2007–2012)
• The Integrated SNP/CHC Model (current)
• A peek at the new SNP Report Shell

Evolution of Thought About the SNP Model
• In 2010, Flanagan, Alfonso, Ortiz, and Dynda wrote a groundbreaking chapter in this author’s edited book, Best Practices in School Neuropsychology.
• They presented the major tests of cognitive processing along with several other major pediatric neuropsychological measures and classified each of the subtests from these measures using the Luria Block nomenclature, the SNP Model nomenclature, and the CHC Theory nomenclature.
• They referred to this as an integrated framework based on psychometric, neuropsychological, and Lurian perspectives.
Evolution of Thought About the SNP Model

In 2012, Schneider and McGrew wrote:

The most active CHC ‘spillover’ has been in the area of neuropsychological assessment. It is our opinion that CHC-based neuropsychological assessment holds great potential. Much clinical lore within the field of neuropsychological assessment is tied to specific tests from specific batteries. CHC theory has the potential to help neuropsychologists generalize their interpretations beyond specific test batteries and give them greater theoretical unity (p. 109).

Updating the SNP Model

The constructs or processes that were contained in the 2012 and earlier versions of the SNP Model have not changed in the modified version of the model, but how they are classified in the newly updated Integrated SNP/CHC Model has been updated based on current psychometric and theoretical research.

Integrated SNP/CHC Model

• Further blending of neuropsychological theories with CHC theory
• Reconceptualization of broad classifications
  – Introducing the concept of facilitators/inhibitors.
• Reclassification of some second order classifications.
• Classifying new tests into the model.

Changes to Broad Classifications

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Sensorimotor functions</td>
<td>Basic sensorimotor functions</td>
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<tr>
<td>Attentional processes</td>
<td>Basic cognitive processes</td>
</tr>
<tr>
<td>Visual-spatial processes</td>
<td>Facilitators/Inhibitors</td>
</tr>
<tr>
<td>Language functions</td>
<td>Acquired knowledge</td>
</tr>
<tr>
<td>Learning and memory</td>
<td>Speed and Efficiency of Cognitive Processing</td>
</tr>
<tr>
<td>Executive functions</td>
<td>Visual Motor Integration Skills</td>
</tr>
<tr>
<td>Speed and efficiency of cognitive processing</td>
<td>Visual Scanning</td>
</tr>
</tbody>
</table>

Integrated SNP/CHC Model (Miller, in press, 2012)

- Cognitive Processes:
  - Visual-spatial
  - Attentional
  - Learning and Memory
  - Executive

- Acquired Knowledge:
  - Language Abilities
  - Reading Comprehension
  - Mathematics Achievement

- Basic Sensorimotor Capabilities:
  - Motor Functions
  - Visual Motor Functions
  - Visual Motor Integration Skills
  - Visual Scanning
  - Visual Memory
Sensorimotor Functions

The sensorimotor motor functions are the basic building blocks for higher-order cognitive processes and influence the acquisition of acquired knowledge.

Facilitators/Inhibitors

Cognitive Processes

Essential cognitive processes influenced by both basic sensorimotor functions and facilitators/inhibitors.

Changes to Sensorimotor Functions

Sensory functions added:
- Kinesthetic sensation and perception (Kinesthetic abilities: KA)
- Olfactory sensation and perception (Olfactory memory: OM)

Fine Motor Functions changed:
- Psychomotor speed and accuracy renamed to psychomotor fluency and moved to another area.
- Visual-motor copying skills (3rd order classification) relabeled as visual-motor integration skills and made a 2nd order classification.

Visual Scanning moved from visuospatial processes to this broad classification.

Changes to Sensorimotor Functions

SNP Model (2007-12):
- Lateral Preference
- Sensory functions
- Fine motor functions
- Gross motor functions
- Qualitative behaviors

Integrated SNP Model (current):
- Lateral Preference
- Sensory motor functions
- Fine motor functions
- Visual-motor integration skills
- Visual scanning
- Gross motor functions
- Qualitative behaviors

Assessing Sensorimotor Functions

Lateral Preference:
- Dean-Woodcock Sensory-Motor Battery (DWSMB): Lateral Preference test

Sensory Functions: Auditory and Visual Acuity
- DWSMB: Auditory Acuity, Near Point Visual Acuity, and Visual Confrontation

Sensory Functions: Tactile Sensation and Perception
- DWSMB: Finger Identification, Object Identification, Palm Writing & Simultaneous Localization
- PAL-II RW: Finger Localization & Finger Recognition
- PAL-II M: Fingertip Writing

Just What is a Cognitive Process?

SNP Model (2007-12):
- Attention
- Visual-spatial
- Language
- Learning and memory
- Executive functions
- Speed and efficiency of cognitive processing

Integrated SNP/CHC Model:
- Visual-spatial
- Auditory/phonological
- Learning and memory
- Executive functions
Changes to Visuospatial Processes

SNP Model (2007-12):  Integrated SNP/CHC Model:

Pre-2012:  • Visual perception with motor response  • Visual perception (motor-free)  • Visual scanning/tracking
2012 version:  • Visual-spatial perception  • Visual spatial reasoning  • Visual scanning/tracking

• Visuospatial perception  • Visuospatial reasoning

Classification of Visuospatial Processes

<table>
<thead>
<tr>
<th>Broad Classifications</th>
<th>Second Order Classifications</th>
<th>Third Order Classifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visuospatial Processes</td>
<td>• Visual spatial perception</td>
<td>• Visual discrimination and spatial localization</td>
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<tr>
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<td>• Visual spatial reasoning</td>
<td>• Visual-motor constructions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Qualitative behaviors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Recognizing spatial configurations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Visual gestalt closure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Visuospatial analyses with and without mental rotations</td>
</tr>
</tbody>
</table>

Tests of Visuospatial Processes: Visuospatial Perception

Visual Discrimination and Spatial Localization:  • NEPSY-II: Arrows, Picture Puzzles, & Route Finding  • TVPS-3: Visual Discrimination
Visual-Motor Constructions:  • DAS-II: Pattern Construction  • KABC-II: Triangles  • NEPSY-II: Block Construction  • WISC-IV: Block Design  • WNV: Object Assembly

Tests of Visuospatial Processes: Visuospatial Reasoning

Recognizing Spatial Configurations:  • DAS-II: Matching Letter-Like Forms  • KABC-II: Block Counting  • TVPS-3: Spatial Relations
Visual Gestalt Closure:  • KABC-II: Gestalt Closure  • RIAS: What’s Missing  • TVPS-3: Visual Closure

Visuospatial Analyses with and without Mental Rotations:  • NEPSY-II: Geometric Puzzles Total  • SBS: Nonverbal Visuospatial Processing  • TVPS-3: Form Constancy  • WRAVMA: Matching  • WJIII-COG DS: Block Rotation

Changes to Auditory/Phonological Processes

SNP Model (2007-12):  Integrated SNP/CHC Model:

Language Functions:  • Sound discrimination  • Auditory/phonological processing  • Oral expression  • Receptive language
Auditory Processes:  • Sound discrimination  • Auditory/phonological processing

Classification of Auditory/Phonological Processes

<table>
<thead>
<tr>
<th>Broad Classifications</th>
<th>Second Order Classifications</th>
<th>Third Order Classifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditory/Phonological Processes</td>
<td>• Sound discrimination</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Auditory/Phonological Processing</td>
<td></td>
</tr>
</tbody>
</table>
Tests of Auditory Processing

Sound Discrimination:
- WJIII-COG DS: Sound Patterns – Music & Voice

Tests of Auditory Processing

Auditory/Phonological Processing:
- CTOPP: Blending Words, Elision, & Sound Matching
- DAS-II: Phonological Processing
- Developmental Test of Auditory Perception (DTAP): Composite Auditory Perception Index
- KTEA-II: Phonological Awareness
- NEPSY-II: Phonological Processing
- PAL-II RW: Phonological Coding
- TAPS-3: Phonological Blending, Phonological Segmentation, & Word Discrimination

Tests of Auditory Processing

Auditory/Phonological Processing – continued:
- TOPA-2+ Kindergarten Edition: Initial Sound Same & Initial Sound Different
- TOPA-2+ Early Elementary Edition: Initial Sound Same & Initial Sound Different
- Test of Phonological Awareness Skills (TOPAS): Incomplete Words, Phoneme Deletion, Rhyming, & Sound Sequencing
- Test of Phonological Awareness in Spanish (TPAS): Composite Score, Initial Sounds, Final Sounds, Rhyming Sounds, & Deletions
- WJIII-ACH NU: Sound Awareness
- WJIII-COG NU: Incomplete Words & Sound Blending

Changes to Learning and Memory Processes

SNP Model (2007-12):
- Rate of new learning
- Immediate verbal memory
- Delayed verbal memory
- Immediate visual memory
- Delayed visual memory
- Verbal-visual associative learning and recall
- Working memory
- Semantic memory

Integrated SNP/CHC Model:
- Rate of new learning
- Immediate verbal memory
- Delayed verbal memory
- Immediate visual memory
- Delayed visual memory
- Verbal-visual associative learning and recall

Stand Alone Tests of Memory and Learning

<table>
<thead>
<tr>
<th>Test</th>
<th>Age Range</th>
<th>Publisher</th>
</tr>
</thead>
<tbody>
<tr>
<td>California Verbal Learning Test - Children's Version (CVLT-C)</td>
<td>5 to 16 years</td>
<td>Pearson</td>
</tr>
<tr>
<td>Children's Auditory Verbal Learning Test - 2 (CAVLT-2)</td>
<td>7 to 11 years</td>
<td>PAR</td>
</tr>
<tr>
<td>Children's Memory Scale (CMS)</td>
<td>5 to 16 years</td>
<td>Pearson</td>
</tr>
<tr>
<td>Test of Memory and Learning - Second Edition (TOMAL-2)</td>
<td>5 to 99 years</td>
<td>PRO-ED</td>
</tr>
<tr>
<td>Wechsler Memory Scale - Fourth Edition (WMS-IV)</td>
<td>6 to 90 years</td>
<td>Pearson</td>
</tr>
<tr>
<td>Wide Range Assessment of Memory and Learning - Second Edition (WRAML2)</td>
<td>5 to 90 years</td>
<td>PAR</td>
</tr>
</tbody>
</table>

Learning and Memory: Rate of New Learning

Verbal Learning Examples:
- NEPSY-II: List Memory Learning Effect
- WRAML2: Verbal Learning

Visual Learning Examples:
- CMS: Dot Locations Learning & Dot Locations Total
Learning and Memory: Immediate Memory

- **Verbal Immediate Memory:**
  - Letter Recall (No Contextual Cues)
  - Number Recall (No Contextual Cues)
  - Word Recall (No Contextual Cues)
  - Sentence Recall (Contextual Cues)
  - Story Recall (Contextual Cues)

- **Visual Immediate Memory:**
  - Abstract Designs with Motor Response (No Contextual Cues)
  - Abstract Designs with Verbal Response (No Contextual Cues)
  - Faces with Verbal or Pointing Response (No Contextual Cues)
  - Objects/Pictures with Motor or Pointing Response (No Contextual Cues)
  - Spatial Locations with Motor Response (No Contextual Cues)
  - Visual Digit Span with Verbal Response (No Contextual Cues)
  - Visual Sequences Imitation with Motor Response (No Contextual Cues)
  - Picture or Symbolic (With Contextual Cues)

Learning and Memory: Immediate Verbal Memory

- **Letter Recall (No Contextual Cues):**
  - TOMAL-2: Letters Forward
  - WISC-IV Integrated: Letter Span - Rhyming & Non-Rhyming

- **Number Recall (No Contextual Cues):**
  - CMS: Numbers Forward
  - DAS-II: Recall of Digits Forward
  - KABC-II: Number Recall
  - TAPS-3: Number Memory Forward
  - TOMAL-2: Digits Forward
  - WISC-IV: Digits Forward

- **Word Recall (No Contextual Cues):**
  - CAS: Word Series
  - CVLT-C: Level of Immediate Recall, Learning Strategies, List A Short-Delay Free Recall, & List A Short-Cued Free Recall
  - CMS: Word Lists Total & Word Pairs Immediate Recall
  - KABC-II: Word Order (with and without color interference)
  - NEPSY-II: Word List Interference Repetition
  - TAPS-3: Word Memory
  - TOMAL-2: Word Selective Reminding
  - WJIII-COG DS: Memory for Words

- **Sentence Recall (Contextual Cues):**
  - NEPSY-II: Sentence Repetition
  - TAPS-3: Sentence Memory
  - WRAML2: Sentence Memory
  - WJIII-COG DS: Memory for Sentences

- **Story Recall (Contextual Cues):**
  - CMS: Stories Immediate & Stories Immediate Thematic
  - NEPSY-II: Narrative Memory Free Recall
  - RIAS: Verbal Memory
  - TOMAL-2: Memory for Stories
  - WMS-IV: Logical Memory I
  - WRAML2: Story Memory
  - WJIII-ACH NU: Story Recall

Learning and Memory: Immediate Visual Memory

- **Abstract Designs with Motor Response (No Contextual Cues):**
  - Bender Visual-Motor Gestalt Test: Recall
  - CAS: Figure Memory
  - DAS-II: Recall of Designs
  - NEPSY-II: Memory for Designs Total
  - WMS-IV: Designs I & Visual Reproduction I
  - WNV: Recognition
  - WRAML2: Design Memory
### Learning and Memory: Immediate Visual Memory

- **Abstract Designs with Verbal Response (No Contextual Cues):**
  - TOMAL-2: Abstract Visual Memory & Visual Sequential Memory
  - TVPS-3: Sequential Memory & Visual Memory
- **Faces with Verbal or Pointing Response (No Contextual Cues):**
  - CMS: Faces Immediate Recall
  - KABC-II: Face Recognition
  - NEPSY-II: Memory for Faces Immediate Recall
  - TOMAL-2: Facial Memory

### Learning and Memory: Delayed Memory: Free-Recall and Recognition

#### Delayed Verbal Memory

- **Delayed Verbal Recall without Contextual Cues:**
  - DAS-II: Recognition of Picture
  - UNIT: Object Memory
  - RIAS: Nonverbal Memory
  - WISC-IV Integrated: Coding Recall
  - WJIII-COG NU: Picture Recognition

#### Delayed Visual Memory

- **Delayed Visual Recall without Contextual Cues:**
  - CVLT-C: List A Long-Delay Free Recall
  - CMS: Word Lists Delayed Recall & Word Pairs Long Delayed Recall
  - NEPSY-II: List Memory Delayed Effect
  - TOMAL-2: Word Selective Reminding Delayed
  - WRAML2: Verbal Learning Delayed Recall

#### Delayed Verbal Recognition without Contextual Cues:

- **CMS: Stories Delayed Recall & Stories Delayed Thematic**
- **TOMAL-2: Memory for Stories Delayed**
- **WMS-IV: Logical Memory II Free Recall**
- **WRAML2: Story Memory Delayed Recall**
- **WJIII-ACH NU: Story Recall Delayed**

### Learning and Memory: Delayed Verbal Memory

#### Delayed Verbal Recall with Contextual Cues:

- **CMS: Stories Delayed Recall & Stories Delayed Thematic**
- **TOMAL-2: Memory for Stories Delayed**
- **WMS-IV: Logical Memory II Free Recall**
- **WRAML2: Story Memory Delayed Recall**
- **WJIII-ACH NU: Story Recall Delayed**

#### Delayed Verbal Recognition with Contextual Cues:

- **CMS: Word Lists Delayed Recognition & Word Pairs Long Delayed Recognition**
- **CVLT-C: Short and Long-Delay Cued Recall**
- **WRAML2: Verbal Learning Recognition**
Learning and Memory:
Delayed Verbal Memory

Delayed Verbal Recognition with Contextual Cues:
- CMS: Stories Delayed Recognition
- WMS-IV - Logical Memory II Recognition
- WRAML2 - Story Memory Delayed Recognition

Delayed Visual Recall without Contextual Cues:
- CMS: Dot Locations Long Delayed & Faces Delayed
- NEPSY-II: Memory for Faces Delayed & Memory for Designs Delayed Total (Delayed Content and Spatial Scores)
- WMS-IV: Designs II (Delayed Content and Spatial Scores) & Visual Reproduction II

Learning and Memory:
Delayed Visual Memory

Delayed Visual Recall with Contextual Cues:
- CMS: Family Pictures Delayed Recall
- WMS-IV: Designs II Recognition & Visual Reproduction II Recognition
- WRAML2: Design Memory Recognition

Delayed Visual Recognition with Contextual Cues:
- WRAML2 - Picture Memory Recognition

Learning and Memory:
Verbal-Visual Associative Learning and Recall

Verbal-Visual Associative Learning:
- DAS-II: Recall of Objects Immediate
- KABC-II: Atlantis & Rebus
- NEPSY-II: Memory for Names Total
- TOMAL-2 - Object Recall & Paired Recall
- WMS-IV: Verbal Paired Associates I
- WRAML-2: Sound-Symbol
- WJIII-COG NU: Visual-Auditory Learning
- WJIII-COG DS: Memory for Names

Verbal-Visual Associative Delayed Recall:
- DAS-II: Recall of Objects Delayed
- KABC-II: Atlantis Delayed & Rebus Delayed
- NEPSY-II: Memory for Names Delayed
- WMS-IV: Verbal Paired Associates II Word Recall & Verbal Paired Associates II Recognition
- WRAML-2: Sound-Symbol Delayed Recall
- WJIII-COG NU: Visual-Auditory Learning Delayed
- WJIII-COG DS: Memory for Names - Delayed

What's New in Executive Functions?
Terms/Concepts/Processes Associated with Executive Functions

- Abstract reasoning
- Anticipation
- Attentional control
- Behavioral initiation/productivity
- Behavioral regulation
- Common sense
- Concept formation
- Creativity
- Estimation
- Fluency (verbal and nonverbal)
- Goal setting
- Hypothesis generation
- Inhibition of impulsiveness
- Mental flexibility
- Organization
- Planning problem solving
- Rule learning
- Self-control
- Self-monitoring
- Set formation and maintenance
- Set shifting
- Working memory

Adapted from Baron, 2004

New Resources on Executive Functions

Now available - Executive Functions: What They Are, How They Work, and Why They Evolved by Russell Barkley

Now available - Barkley Deficits in Executive Functioning Scale: Children and Adolescents (BDEFS-CA)

Available November, 2012 - Essentials of Executive Function Assessment by George McCloskey and Lisa Perkins

What Are Executive Functions?

Barkley (2012) defines executive functions as:

the use of self-directed actions so as to choose goals and to select, enact, and sustain actions across time toward those goals usually in the context of others often relying on social and cultural means for the maximization of one’s long-term welfare as the person defines that to be (p. 176).

What Are Executive Functions?

- McCloskey et al. (2009) propose that executive functions are a set of directive capacities that facilitate a person’s ability to engage in purposeful processing of perceptions, emotions, thoughts, and actions.
- Executive functions can be thought of as facilitators that guide other cognitive processing.
- These 32 (and counting) facilitators include attentional control, goal directed behaviors, behavioral regulation, organizational skills, planning, and problem solving strategies.

McCloskey’s 32 Self-Regulation Executive Function Capabilities

Attention Cluster:
- Perceive/Aware
- Focus/Select
- Sustain

Engagement Cluster:
- Initiate
- Energize
- Inhibit
- Stop
- Interrupt
- Flexible
- Shift

Optimization Cluster:
- Modulate
- Monitor
- Correct
- Balance

Memory Cluster:
- Hold
- Manipulate
- Store
- Retrieve
McCluskey’s 32 Self-Regulation Executive Function Capabilities

**Evaluation/Solution Cluster:**
- Gauge
- Anticipate/Foresee
- Estimate Time
- Analyze
- Associate
- Generate
- Plan (Short Term)
- Evaluate/Compare
- Choose/Decide

**Efficiency Cluster:**
- Sense Time
- Pace
- Sequence
- Analyze
- Associate
- Generate
- Plan (Short Term)
- Evaluate/Compare
- Choose/Decide

Comparing Executive Function Constructs

<table>
<thead>
<tr>
<th>BRIEF (Gioia et al.)</th>
<th>MEPS-C (Barkley)</th>
<th>CCSI (Naglieri &amp; Goldsten)</th>
<th>D-REF (Delis)</th>
<th>Integrated SNP/CHC Model (Miller)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delib Self-Restraint</td>
<td>Self-Restraint</td>
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<td>Shift</td>
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<td>Self-Regulate</td>
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<td>Associate</td>
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<td>Self-Restraint</td>
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<td>Activity Level</td>
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<td>Delay Control</td>
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</tbody>
</table>

Measuring Executive Functions

- The conceptualization of executive functions is evolving.
- However, executive functions should ideally be measurable and operationalized for clinical practice.
- More research needs to be done to validate EF models.
- The Integrated SNP/CHC Model takes a neurocognitive approach to EF at this time.

Changes to Executive Functions

**SNP Model (2007-12):**
- **Executive Functions:**
  - Concept generation and recognition
  - Problem solving, fluid reasoning, and planning
  - Response inhibition
  - Retrieval fluency
  - Qualitative behaviors
- **Attentional Processes:**
  - Shifting of Attention

**Integrated SNP/CHC Model:**
- **Executive Functions:**
  - Concept generation and recognition
  - Cognitive flexibility (set shifting)
  - Problem solving, planning, and reasoning
  - Response inhibition
  - Qualitative behaviors
- **Behavioral/Emotional regulation:**

Executive Functions: Cognitive Flexibility (Set Shifting)

**Verbal Cognitive Flexibility:**
- D-KEFS: Color-Word Interference Condition 4 (Inhibition/ Switching) & Verbal Fluency Condition 3 (Category Switching Total Correct Responses)
- NEPSY-II: Inhibition Switching Combined, Switching Total Completion Time, Switching Total Errors, Switching Uncorrected Errors, & Switching Self-Corrected Errors

**Visual Cognitive Flexibility:**
- D-KEFS: Design Fluency Condition 3 (Switching) & Trail Making Condition 4 (Number-Letter Switching)
- TEA-Ch: Creature Counting Total Correct
- WCST: Perseveration Responses
Executive Functions:
Cognitive Flexibility (Set Shifting)

Verbal and Visual Cognitive Flexibility:
- NEPSY-II: Response Set Combined Score, Total Commission Errors, Total Correct, Total Omission Errors, & Total Inhibitory Errors
- PAL-II RW & M: RAS Word and Digit Total Time, RAS Words and Digits Rate Change, & RAS Words and Digits Total Errors
- TEA-Ch: Opposite Worlds Same World Total & Opposite Worlds Opposite World Total
- WJIII-COG NU: Auditory Attention

Executive Functions:
Problem Solving, Planning, & Reasoning

New 3rd Order Classifications:
- Planning
- Deductive and Inductive Reasoning
  - Verbal
  - Visual
- Sequential Reasoning
- Quantitative Reasoning

Planning:
- CAS: Planned Connections
- KABC-II: Rover
- UNIT: Mazes
- WJIII-COG NU: Planning

Executive Functions:
Problem Solving, Planning, & Reasoning

Verbal Deductive and Inductive Reasoning:
- D-KEFS: Proverbs Total Achievement: Free Inquiry, Proverbs Total Achievement: Multiple Choice, & Word Context Total Consecutively Correct
- RIAS: Guess What & Verbal Reasoning
- SB5: Verbal Fluid Reasoning
- TAPS-3: Auditory Reasoning
- WISC-IV: Comprehension
- WISC-IV Integrated: Comprehension Multiple Choice
- WISC-IV: Word Reasoning

Visual Deductive and Inductive Reasoning:
- CAS: Nonverbal Matrices
- CTONI-2: Geometric Analogies & Pictorial Analogies
- D-KEFS: Tower Total Achievement
- DAS-II: Matrices
- NEPSY-II: Clocks
- RIAS: Odd-Item Out
- SB5: Nonverbal Fluid Reasoning
- UNIT: Analogic Reasoning & Cube Design
- WISC-IV: Matrix Reasoning & Picture Concepts
- WJIII-COG NU: Analysis/Synthesis

Sequential Reasoning:
- CTONI-2: Geometric Sequences & Pictorial Sequences
- KABC-II: Pattern Reasoning & Story Completion
- WNV: Picture Arrangement
- WJIII-COG NU: Analysis/Synthesis

Quantitative Reasoning:
- DAS-II: Sequential and Quantitative Reasoning
- WJIII-COG DS: Number Matrices & Number Series
Executive Functions: Response Inhibition

Verbal Response Inhibition:
- CAS: Expressive Attention
- D-KEFS: Color-Word Interference Condition 3 (Inhibition)
- NEPSY-II: Inhibition (Condition 2) Combined

Motoric Response Inhibition:
- NEPSY-II: Statue Total
- TEA-Ch: Walk Don't Walk

Executive Functions: Qualitative Behaviors

So Where Did the Other “Cognitive Processes” of Attention, Working Memory, and Processing Speed Get Classified?

Facilitators/Inhibitors

- In the original SNP Model, attentional processes were designated as a separate broad classification, when in fact, attentional processes permeate almost every other process and function described in the SNP Model.
- This is often the case for the speed and efficiency of processing and to a lesser degree working memory.
Facilitators/Inhibitors

- All three of these: attention, processing speed, and working memory act as **facilitators** to enhance the performance of other cognitive functions. It can be argued that these three processes do not work in isolation per se, but are cognitive facilitators.
- One of the major changes to the SNP Model is the creation of a broad classification called facilitators/inhibitors.

Practical Example of Facilitators/Inhibitors

- Think of a student attempting to solve a story problem.
- Story problems are generally thought of as a mathematical reasoning task, but attempting to solve a story problem also requires a combination of facilitators and inhibitors to accomplish the task.

Practical Example of Facilitators/Inhibitors

- In order for the student to initially encode an auditorially presented story problem, the student must focus attentional resources on the task at hand (a facilitator).
- Depending upon the length of the story problem, the student may have to utilize sustained attention (a facilitator) to maintain focus.
- The student also has to not pay attention to the extraneous details in the story or to any other distractors in the environment or internal distractors (an inhibitor).
- In story problems, the student must figure out what elements to extract and then manipulate to solve the problem, which requires working memory and reasoning skills (a facilitator).
Facilitators/Inhibitors

**WJIII ACH NU Writing Samples**
- Attention
- Working Memory
- Processing Speed
- Task Performance

**WISC-IV Arithmetic**
- Attention
- Working Memory
- Processing Speed
- Task Performance

**Facilitators/Inhibitors**

The facilitators/inhibitors described in the Integrated SNP/CHC Model influence both cognitive processes and acquired knowledge.

**Social-Emotional, Cultural, and Environmental Factors**
- Basic Sensorimotor Capabilities:
  - Functions Integration Skills
  - Functions
- Allocating and Maintaining Visual Attention Facilitators/Inhibitors:
  - Allocating and Maintaining Attentional Processes
    - Selective/focused attention
    - Sustained attention
    - Shifting attention
    - Divided attention
    - Attentional capacity
    - Quantitative behaviors
    - Behavioral ratings of attention

**Changes to Classification of Attentional Processes**

**SNP Model (2007-12):**
- Attentional Processes:
  - Selective/focused attention
  - Sustained attention
  - Shifting attention
  - Divided attention
  - Attentional capacity
  - Quantitative behaviors
  - Behavioral ratings of attention

**Integrated SNP/CHC Model:**
- Allocating and Maintaining Attention Facilitators/Inhibitors:
  - Selective/focused attention
  - Sustained attention
  - Attentional capacity
  - Quantitative behaviors
  - Behavioral ratings of attention

**Allocating and Maintaining Auditory Attention Facilitators/Inhibitors**

<table>
<thead>
<tr>
<th>Test - Subtest</th>
<th>Description</th>
<th>Selective</th>
<th>Age/Grade Range</th>
<th>Publisher</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEPSY-II - Auditory Attention</td>
<td>Selectively responding to auditory target words while ignoring auditory non-target words over time</td>
<td>X</td>
<td>5 to 6 years</td>
<td>Pearson</td>
</tr>
<tr>
<td>TEA-CA - Code Transmission</td>
<td>Listening to a series of numbers and recalling the number heard just prior to two fives being heard together</td>
<td>X</td>
<td>6 to 15-11 years</td>
<td>Pearson</td>
</tr>
<tr>
<td>TEA-CA - Score DT</td>
<td>Keeping count of “scoring sounds”</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEA-CA - Score MT</td>
<td>Keeping count of “scoring sounds” from an audiotape with the presence of an auditory distracter</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Allocating and Maintaining Visual Attention Facilitators/Inhibitors**

<table>
<thead>
<tr>
<th>Test - Subtest</th>
<th>Description</th>
<th>Selective</th>
<th>Age/Grade Range</th>
<th>Publisher</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS - Number Detection</td>
<td>Quickly finding as many target numbers within a visual array</td>
<td>X</td>
<td>5 to 17-11 years</td>
<td>PRO-ED</td>
</tr>
<tr>
<td>TEA-CA - Key Ratings</td>
<td>Quickly finding as many target letters within a visual array</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAS - Searching Mission</td>
<td>Searching a map to find as many target symbols as possible in one minute</td>
<td>X</td>
<td>6 to 15-11 years</td>
<td>Pearson</td>
</tr>
<tr>
<td>TEA-CA - Sky Search Attention</td>
<td>Finding as many “target” spaceships as quickly as possible on paper filled with target and non-target ships</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WJIII-COG NU - Pair Cancellation</td>
<td>Matching target stimuli from a large visual array under time constraints</td>
<td>X</td>
<td>2 to 80+ years</td>
<td>Riverside</td>
</tr>
</tbody>
</table>

**Allocating and Maintaining Attention Facilitators/Inhibitors: Attentional Capacity**

- Attentional Capacity for Numbers or Letters with Verbal Response
- Attentional Capacity for Visual Sequential Patterns with Motor Response
- Attentional Capacity for Words and Sentences (Increased Meaning) with Verbal Response
- Attentional Capacity for Stories (Even more Contextual Meaning) with Verbal Response
Facilitators/Inhibitors

Cognitive Processes:  
- Auditory  
- Visuo-spatial  
- Working Memory  
- Executive

Acquired Knowledge:  
- Language  
- Verbal Memory  
- Visual Memory  
- Executive  
- Conceptual

Social-Emotional, Cultural, and Environmental Factors:  
- Basic Sensorimotor Capabilities:  
  - Sensory Functions  
  - Fine Motor Functions  
  - Visual-Motor Integration Skills  
  - Visual Scanning  
  - Gross Motor Functions

Facilitators/Inhibitors

Cognitive Processes:  
- Verbal working memory  
- Visual working memory  
- Qualitative behaviors

Acquired Knowledge:  
- Verbal working memory  
- Visual working memory  
- Qualitative behaviors

Speed, Fluency, and Efficiency of Processing Facilitators/Inhibitors

- Based on the synthesis of multiple exploratory and confirmatory factor analytic studies, McGrew (2005) and McGrew and Evans (2004) concluded that processing speed (Gs) might be best represented as a set of hierarchically organized speed taxonomy.

- Schneider and McGrew (2012) modified the aforementioned hierarchically model of processing speed to include a hypothesized general g factor of speed and composed of broad factors of cognitive speed, decision speed, and psychomotor speed.

- These broad factors included constructs of perceptual speed, rate of test taking, reaction time, movement time, and retrieval fluency.
**Speed, Fluency, and Efficiency of Processing Facilitators/Inhibitors**

- Speed, Fluency, and Efficiency of Processing Facilitators/Inhibitors (Broad Classification)
- Second Order Classifications:
  - Performance Fluency
  - Retrieval Fluency
  - Acquired Knowledge Fluency
  - Fluency and Accuracy

**Performance Fluency**: Third Order Classifications

- Psychomotor fluency
- Perceptual fluency & rate of test taking
- Figural fluency
- Naming fluency
- Oral motor fluency

**Speed and Efficiency: Performance Fluency: Psychomotor Fluency**

- Psychomotor fluency tasks require rapid motor output.
- In CHC nomenclature, psychomotor fluency is a measure of psychomotor speed (Gps) and movement time (MT).
- An example of this kind of task would be keeping a pencil line moving through a maze as quickly as possible.

**Speed and Efficiency: Performance Fluency: Psychomotor Fluency**

- D-KEFS: Trail Making Condition 5 - Motor Speed
- NEPSY-II: Visuomotor Precision
- WISC-IV Integrated - Coding Copy
**Performance Fluency: Third Order Classifications**

- Psychomotor fluency
- Perceptual fluency & rate of test taking
- Figural fluency
- Naming fluency
- Oral motor fluency

**Speed and Efficiency: Performance Fluency: Perceptual Fluency**

- Perceptual speed or fluency ($P$) is defined as the ability to quickly distinguish similar but different visual patterns and maintain attention under timed conditions (Horn & Blankson, 2012).
- Rate of Test Taking ($R_9$) is a narrow ability within the CHC nomenclature and relates to the perform of tests that are relatively easy or those that require very simple decisions (Horn & Blankson, 2012).

### Test - Subtest: Description

<table>
<thead>
<tr>
<th>Test - Subtest: Description</th>
<th>Rate of Test Taking</th>
<th>Age/Grade Range</th>
<th>Publisher</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS - Matching Numbers: Underlining the two numbers in each row that are the same.</td>
<td>X</td>
<td>2-0 to 90+ years</td>
<td>PRO-ED</td>
</tr>
<tr>
<td>CAS - Planned Codes: Quickly filling in the appropriate codes in empty boxes beneath each letter from a corresponding legend.</td>
<td>X</td>
<td>5-0 to 17-11 years</td>
<td></td>
</tr>
</tbody>
</table>

### Performance Fluency: Third Order Classifications

- Psychomotor fluency
- Perceptual fluency & rate of test taking
- Figural fluency
- Naming fluency
- Oral motor fluency

### Speed and Efficiency: Performance Fluency: Perceptual Fluency

<table>
<thead>
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<tbody>
<tr>
<td>DAS-II - Speed of Informational Processing: Marking a target figure or number contained within a row of similar objects or numbers.</td>
<td>X</td>
<td>6-0 to 18-11 years</td>
<td>Pearson</td>
</tr>
<tr>
<td>WISC-IV - Cancellation: Marking target pictures within a visual set of pictures in a specified time period.</td>
<td>X</td>
<td>6 to 16 years</td>
<td>Pearson</td>
</tr>
<tr>
<td>WISC-IV - Coding: Copying symbols paired with geometric shapes or numbers within a time limit.</td>
<td>X</td>
<td>4 to 16 years</td>
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</table>

### Test - Subtest: Description

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</thead>
<tbody>
<tr>
<td>WISC-IV - Symbol Search: Scanning a search group and marking the presence or absence of a target symbol or symbols within a time limit.</td>
<td>X</td>
<td>4 to 89 years</td>
<td>Pearson</td>
</tr>
<tr>
<td>WISC-IV - Copying: Copying symbols paired with geometric shapes or numbers within a time limit.</td>
<td>X</td>
<td>4 to 21 years</td>
<td></td>
</tr>
<tr>
<td>WJIII-COG DS - Cross Out: Rapidly scanning a row of 19 drawings and marking the 5 that match a target drawing.</td>
<td>X</td>
<td>4-0 to 90- years</td>
<td>Riverside</td>
</tr>
<tr>
<td>WJIII-COG NU - Visual Matching: Rapidly matching two numbers on a row.</td>
<td>X</td>
<td>2-0 to 90- years</td>
<td></td>
</tr>
</tbody>
</table>
**Speed and Efficiency: Performance**

**Fluency: Figural Fluency**

Figural fluency refers to the ability to connect dots with unique line patterns while following discrete rules.

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<tr>
<th>Test / Subtest Description</th>
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</tr>
</thead>
<tbody>
<tr>
<td>D-KEFS - Design Fluency Total Correct Condition 1 + 2: The total number correct across Conditions 1 &amp; 2</td>
<td>8-0 to 89-11 years</td>
<td>Pearson</td>
</tr>
<tr>
<td>NEPSY-II - Design Fluency Total: Connecting dots with unique line patterns</td>
<td>3 to 16 years</td>
<td></td>
</tr>
</tbody>
</table>

**Performance Fluency: Third Order Classifications**

- Psychomotor fluency
- Perceptual fluency & rate of test taking
- Figural fluency
- Naming fluency
- Oral motor fluency

**Speed and Efficiency: Performance**

**Fluency: Naming Fluency**

- Naming fluency = rapid automatized naming (RAN)
- Naming fluency tasks require the student to rapidly name common objects, colors, words, or letters as quickly as possible.
- Naming fluency or RAN tests are frequently used for diagnosing reading disabilities in children.

**Speed and Efficiency: Performance**

**Fluency: Oral Motor Fluency**

- Many of the tests that measure oral motor fluency require the student to repeat words that are not real words but require the application of phonological rules.
- Students with deficits in this area should be referred to a speech and language therapist for a thorough evaluation.
Speed and Efficiency: Performance

Fluency: Oral Motor Fluency

- CAS: Sentence Repetition & Speech Rate/Sentence Question
- CTOPP: Segmenting Words & Segmenting Non-Words
- DWSMB: Expressive Speech
- KTEA-II: Oral Expression
- NEPSY-II: Oral Motor Sequences Total & Repetition of Nonsense Words Total
- OWLS-II: Oral Expression
- PAL-II RW: Oral Motor Planning Total Time & Oral Motor Planning Errors Total
- WIAT-III: Oral Expression

Retrieval fluency tasks require a student to recall as quickly as possible words that start with a particular letter or words that can be categorized within a particular semantic category (e.g., examples of furniture). The performance fluency measures previously discussed do not require memory skills to complete those fairly automatic tasks; whereas, the retrieval fluency tasks combine speed of retrieval and memory recall.

Speed and Efficiency: Retrieval Fluency:

Word Fluency:
- D-KEFS: Verbal Fluency – Condition 1 (Letter Fluency)
- NEPSY-II: Word Generation Initial Letter Total

Semantic Fluency:
- D-KEFS: Verbal Fluency – Condition 2 (Category Fluency)
- KTEA-II: Associational Fluency
- NEPSY-II: Word Generation Semantic Total
- WJIII-COG NU - Decision Speed

Acquired knowledge fluency measures represent the automaticity of processing for rapid reading, writing, and solving math problems.

Acquired Knowledge Fluency

- These academic fluency measures are classified as facilitators/inhibitors because that is how they function.
- For example, reading fluency is important because it allows the reader to maintain an even flow of comprehension. Therefore, good reading fluency facilitates reading comprehension and poor reading fluency inhibits reading comprehension.
- The same logic applies to writing and math fluency.
Speed and Efficiency: Acquired Knowledge Fluency: Reading Fluency

- With the revision of IDEA in 2004 (United States Department of Education, 2004), reading fluency was added as a type of specific learning disability. The major academic test publishers have included a variety of reading fluency measures.

  - Reading fluency measures:
    - Rapid phonological decoding (most common)
    - Rapid morphological decoding

- Reading fluency measures:
  - GORT-5: Rate & Fluency
  - KTEA-II: Decoding Fluency & Word Recognition Fluency
  - PAL-II RW: Pseudoword Decoding Fluency Total Correct at 60 seconds
  - TOSWRF: Silent Word Reading Fluency
  - WIAT-III: Oral Reading Fluency
  - WJIII COG NU: Reading Fluency

Speed and Efficiency: Acquired Knowledge Fluency: Writing Fluency

- While writing fluency is not yet recognized as a specific learning disability in IDEA, it is an important skill to be assessed.

  - Writing fluency represents the automaticity of writing, which can be adversely affected by a variety of deficiencies such as poor graphomotor output or poor language abilities.

  - PAL-II RW: Narrative Compositional Fluency (Narrative Compositional Fluency Total Number of Words & Narrative Compositional Fluency Total Correctly Spelled Words)
  - WIAT-III: Alphabet Writing Fluency
  - WJII ACH NU: Writing Fluency

Speed and Efficiency: Acquired Knowledge Fluency: Math Fluency

- Mathematics fluency is also not yet recognized as a specific learning disability in IDEA, yet it is also an important skill to be assessed.

  - Mathematics fluency represents the automaticity of completing math problems quickly and efficiently. There are many reasons why mathematics fluency can be disrupted.
Speed and Efficiency: Acquired Knowledge

- PAL-II M: Numerical Writing (Automatic Legible Numerical Writing at 15 seconds, Legible Numerical Writing, Total Time)
- WIAT-III: Math Fluency - Addition, Subtraction, & Multiplication
- WJII ACH NU: Math Fluency

Assessing Fluency with Accuracy

- An important measure to consider in a school neuropsychological evaluation is the interaction between fluency and accuracy.
- Anytime a test requires the examiner to record completion time, processing speed is indirectly being measured.
- Typically, tests that measure completion time also provide a measure of performance accuracy.

Interpretation of the Completion Time - Accuracy Interaction

<table>
<thead>
<tr>
<th>Low # of Errors</th>
<th>High # of Errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fast Completion Time: Indicates that the child had excellent processing speed and accuracy.</td>
<td>Reflective of impulsive behaviors.</td>
</tr>
<tr>
<td>Average Completion Time: Indicates a child with good inhibitory skills.</td>
<td>The child is attempting to balance speed with control but lacks the inhibitory skills to keep his or her error rate within normal limits.</td>
</tr>
<tr>
<td>Slow Completion Time: Indicates that the child may have chosen to slow down to increase accuracy or may have slow processing speed.</td>
<td>Indicates that despite the child slowing down accuracy did not improve; usually indicative of low ability in the tested area.</td>
</tr>
</tbody>
</table>

Acquired Knowledge

Acquired knowledge is just what the name implies and includes encyclopedic knowledge, language abilities and academic achievement.

Comprehension-Knowledge (Gc), Domain-Specific Knowledge (Gdk), Reading and Writing (Grw), and Quantitative Knowledge (Gq) are all classified as acquired knowledge within CHC theory since "they all involve the acquisition of useful knowledge and understanding of important domains of human functioning" and all of "these factors represent information stored in long-term memory" (Schneider & McGrew, 2012, p. 122).
Acquired Knowledge

Broad Classifications for Acquired Knowledge:

- Acculturation Knowledge
- Language Abilities
- Reading Achievement
- Written Language Achievement
- Mathematics Achievement

Acquired Knowledge (Acculturation Knowledge):

- The term "acculturation knowledge" was used by Horn and Blankson (2012) to describe Gc and is synonymous with the label comprehension knowledge.
- In the Integrated SNP/CHC Model, the label acculturation knowledge was used as a broad classification.
- The term semantic memory, first used by Miller (2007) in the original SNP Model, is a second order classification within acculturation knowledge.

<table>
<thead>
<tr>
<th>Broad Classification</th>
<th>Second Order Classification</th>
<th>Third Order Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acculturation Knowledge</td>
<td>Semantic memory</td>
<td>Verbal comprehension, General information, Domain-specific knowledge</td>
</tr>
</tbody>
</table>

Acquired Knowledge (Acculturation Knowledge): Semantic Memory: General Information

<table>
<thead>
<tr>
<th>Test - Subtest Description</th>
<th>Age/Grade Range</th>
<th>Publisher</th>
</tr>
</thead>
<tbody>
<tr>
<td>KABC-II - Verbal Knowledge</td>
<td>3 to 18 years</td>
<td>Pearson</td>
</tr>
<tr>
<td>WJIII-COG NU - Verbal Comprehension</td>
<td>2-0 to 90+ years</td>
<td>Riverside</td>
</tr>
<tr>
<td>WJIII-COG DS - Bilingual Verbal Comprehension</td>
<td>2-0 to 90+ years</td>
<td>Riverside</td>
</tr>
<tr>
<td>WISC-IV - Information</td>
<td>6-0 to 16-11 years</td>
<td>Pearson</td>
</tr>
<tr>
<td>WJIII-COG NU - General Information</td>
<td>2-0 to 90+ years</td>
<td>Riverside</td>
</tr>
</tbody>
</table>

Acquired Knowledge (Acculturation Knowledge): Semantic Memory: Domain-Specific Knowledge

<table>
<thead>
<tr>
<th>Test - Subtest Description</th>
<th>Age/Grade Range</th>
<th>Publisher</th>
</tr>
</thead>
<tbody>
<tr>
<td>WJIII-ACH NU - Academic Knowledge</td>
<td>2-0 to 90+ years</td>
<td>Riverside</td>
</tr>
</tbody>
</table>
Acquired Knowledge

Broad Classifications for Acquired Knowledge:

- Acculturation Knowledge
- Language Abilities
- Reading Achievement
- Written Language Achievement
- Mathematics Achievement

Acquired Knowledge (Language Abilities):

SNP Model (2007-12):

Language Functions:
- Sound Discrimination
- Auditory/Phonological Processing
- Oral Expression
- Receptive Language

Auditory Processes:
- Sound Discrimination
- Auditory/Phonological Processing
- Speed, Fluency, and Efficiency of Processing: Performance Fluency
- Oral Motor Fluency

Acquired Knowledge: Language Abilities:
- Oral Expression (vocabulary knowledge)
- Receptive Language

Integrated SNP/CHC Model:

Language Functions:
- Sound Discrimination
- Auditory/Phonological Processing
- Oral Expression
- Receptive Language

Auditory Processes:
- Sound Discrimination
- Auditory/Phonological Processing
- Speed, Fluency, and Efficiency of Processing: Performance Fluency
- Oral Motor Fluency

Acquired Knowledge: Language Abilities:
- Oral Expression (vocabulary knowledge)
- Receptive Language

Acquired Knowledge (Language Abilities): Oral Expression: Vocabulary Knowledge

- CREVT-2: Expressive Vocabulary
- DAS-II: Naming Vocabulary & Word Definitions
- DWSMB: Naming Pictures of Objects
- EOWPVVT-4
- EOWPVVT-SBE: English or Spanish Expressive Language
- EVT-2: Total
- KABC-II: Expressive Vocabulary
- NEPSY-II: Body Part Naming Total
- SPELT-P 2: Total
- SPELT-3: Total
- WIAT-III: Oral Expression (Expressive Vocabulary)
- WISC-IV: Vocabulary
- WISC-IV Integrated - Vocabulary Multiple Choice & Picture Vocabulary Multiple Choice
- WJIII-ACH NU: Picture Vocabulary

Acquired Knowledge (Language Abilities): Receptive Language with Verbal Response

- CAS: Sentence Questions
- KTEA-II: Listening Comprehension
- ROWPVT-4: Total
- ROWPVT-SBE: English & Spanish Receptive Language
- TAPS-3: Auditory Comprehension
- WIAT-III: Listening Comprehension
- WJIII-ACH NU: Oral Comprehension & Understanding Directions

Acquired Knowledge (Language Abilities): Receptive Language with Motoric Response

- CAS: Verbal-Spatial Relations
- CREVT-2: Receptive Vocabulary
- DAS-II: Verbal Comprehension
- NEPSY-II: Body Part Identification Total
- NEPSY-II: Comprehension of Instructions Total
- OWLS-II: Listening Comprehension
- PPVT-IV: Total Score
- WJIII-ACH NU: Understanding Directions
Classification of Reading Achievement

<table>
<thead>
<tr>
<th>Broad Classifications</th>
<th>Second Order Classifications</th>
<th>Third Order Classifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acquired Knowledge: Reading Achievement</td>
<td>• Basic reading skills</td>
<td>• Phonological decoding</td>
</tr>
<tr>
<td></td>
<td>• Orthographic coding</td>
<td>• Reading comprehension skills</td>
</tr>
<tr>
<td></td>
<td>• Morphological/syntactic coding</td>
<td></td>
</tr>
</tbody>
</table>

Acquired Knowledge: Reading Achievement: Basic Reading Skills – Phonological Decoding:
- GORT-5: Accuracy
- KTEA-II: Letter & Word Recognition & Nonsense Word Decoding
- PAL-II RW: Pseudoword Decoding Accuracy
- TOWRE-2: Reading Efficiency Index
- WIAT-III: Early Reading Skills, Pseudoword Decoding, & Word Reading
- WJIII ACH NU: Letter-Word Identification & Word Attack
- WIST: Sound-Symbol Knowledge & Word Identification

Acquired Knowledge: Reading Achievement: Basic Reading Skills – Orthographic Decoding:
- PAL-II RW: Orthographic Coding
  - Expressive Coding
  - Receptive Coding

Basic Reading Skills: Morphological/Syntactic Coding:
- PAL-II RW - Morphological/Syntactical Coding Composite
  - Are They Related?
  - Does it Fit?
  - Sentence Structure

Acquired Knowledge: Reading Achievement: Reading Comprehension
- GORT-5: Comprehension
- KTEA-II: Reading Comprehension
- WIAT-III: Reading Comprehension
- WJIII ACH NU: Passage Comprehension
- WJIII ACH NU: Reading Vocabulary
- PAL-II RW: Sentence Sense Accuracy

Classification of Written Language Achievement

<table>
<thead>
<tr>
<th>Broad Classifications</th>
<th>Second Order Classifications</th>
<th>Third Order Classifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acquired Knowledge: Written Language Achievement</td>
<td>• Written expression</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Expository composition</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Orthographic spelling</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Handwriting skills</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Qualitative behaviors</td>
<td></td>
</tr>
</tbody>
</table>

Acquired Knowledge: Written Language Achievement: Written Expression
- KTEA-II: Written Expression
- OWLS-II: Written Expression
- WIAT-III: Written Expression
- WJIII ACH NU: Written Expression
Acquired Knowledge: Written Language
Achievement: Expository Composition

- PAL-II RW: Expository Note Taking and Report Writing
- PAL-II: Cross-Genre Compositional and Expository Writing
- WIAT-III: Sentence Composition
- WIAT-III: Essay Composition
- WJIII ACH NU: Writing Samples

Acquired Knowledge: Written Language
Achievement: Orthographic Spelling

- KTEA-II: Spelling
- PAL-II RW: Orthographic Spelling
- Test of Orthographic Competence (TOC): Orthographic Ability
- WIAT-III: Spelling
- WIST: Spelling

Acquired Knowledge: Written Language
Achievement: Handwriting Skills

- PAL-II RW:
  - Alphabet Writing
  - Copying a Sentence (Task A)
  - Copying a Paragraph (Task B)
  - Handwriting Errors

Classification of Mathematics Achievement

<table>
<thead>
<tr>
<th>Broad Classifications</th>
<th>Second Order Classifications</th>
<th>Third Order Classifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acquired Knowledge: Mathematics Achievement</td>
<td>Oral counting</td>
<td>Mathematical calculations</td>
</tr>
<tr>
<td></td>
<td>Fact retrieval</td>
<td>Mathematical reasoning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Qualitative behaviors</td>
</tr>
</tbody>
</table>

Acquired Knowledge: Mathematics
Achievement: Mathematical Calculations

- KTEA-II: Math Computation
- KeyMath3: Operations
- PAL-II M: Computation Operations Composite, Place Value Composite, & Part-Whole Relationship Composite
- WIAT-III: Numerical Operations
- WJIII ACH NU: Calculations

Oral Counting:
- PAL-II M: Oral Counting

Fact Retrieval:
- PAL-II M: Fact Retrieval
Acquired Knowledge: Mathematics
Achievement: Mathematical Reasoning

- KeyMath3:
  - Applications
  - Basic Concepts
  - Math Concepts and Applications
- PAL-II M:
  - Finding the Bug
  - Multi-Step Problem Solving
- SBS:
  - Numerical Quantitative Reasoning
  - Verbal Quantitative Reasoning
- WJAT-III: Math Problem Solving
- WJIII ACH NU:
  - Applied Problems
  - Quantitative Concepts

Presentation Overview

- Review of the initial SNP Model development (theoretical influences).
- The SNP Model (2007-2012)
- The Integrated SNP/CHC Model (current)
  - A peek at the new SNP Report Shell

Report Shell Version 19.0

- Utilizes the new Integrated SNP/CHC Model
- Available to members of the School Neuropsychology Alumni Website
- Used in the School Neuropsychology Post-Graduate Certification Program
- Included on the Supplemental CD of the forthcoming Essentials of School Neuropsychological Assessment - Second Edition

Summary

- The School Neuropsychology Conceptual Model has evolved over the past 5 years and will continue to evolve.
- Continual validation studies are underway.
- The latest version of the SNP Model attempts to further synthesize CHC theory with neuropsychological theory.
- The Integrated SNP/CHC Model serves as the foundation for the School Neuropsychology Report Shell.

Integrated SNP/CHC Model

- Verbal/Spatial
- Auditory and Maintaining Attention
- Working Memory
- Speed and Efficiency of Cognitive Processing

Facilitators:
- Attention

Inhibitors:
- Distractions

Cognitive Processes:
- Visual-Spatial
- Learning and Memory
- Executive

Basic Neuro-Aognitive Capabilities:
- Initial Functions
- Basic Functions
- Integration Skills
- Scanning
- Quantitative Functions

Acquired Knowledge:
- Attention
- Language Attainments
- Reading Attainments
- Mathematics Attainment
- Quantitative Concepts

References

