WISC-V
WISC-V Integrated: Uses from an SNP Perspective
Susan B. Hill, Ph.D. ©2015

Overview
• Psychometric Properties
• Index Scores
• Subtests
• CHC & Miller’s School Neuropsychological Conceptual Model
• Brain-related areas or pathways
• Interpretation
• Process Approach/Qualitative Observations
• Intervention
• WIAT-III & KTEA-3

Psychometric Properties
• Ages 6-0 to 16-11
• Standardization included special group samples (e.g. Gifted, ADHD, SLDs, ASD, etc.)
• Reliability and Validity
• Item Bias
• Equivalency studies with WPPSI-IV AND WAIS-IV
• Co-Normed with WIAT-III and KTEA-3
• Revision goals: update theoretical foundations, increase developmental appropriateness, increase user-friendliness, improve psychometric properties, enhance clinical utility (WISC-V manual)

Wechsler Scales
• “The attributes and factors of intelligence, like the elementary particles in physics, have at once collective and individual properties, that is, they appear to behave differently when alone from what they do when operating in concert.”
  • David Wechsler, 1975, p. 138
• Ecological validity: multiple abilities are needed to complete tasks
• Not all factors can be captured by test scores, but clinical observation and judgment can aid

Index Scores
• Primary
  - Verbal Comprehension (+ Expanded)
  - Visual Spatial
  - Fluid Reasoning (+ Expanded)
  - Working Memory
  - Processing Speed
  - Full Scale – SI, VO, BD, MR, FW, OS, CD
• Ancillary
  - CBI (Quantitative Reasoning) – FW, MR
  - AWMI (Auditory Working Memory) – DS, LNS
  - NVI (Nonverbal) – BD, VP, MR, FW, PIS, CD
  - GAI (General Ability Index) – SI, VO, BD, MR, FW
  - CPI (Cognitive Proficiency Index) – DS, P, CD, SS
• Complementary
  - NSI (Naming Speed)
  - ST (Symbol Translation)
  - VR (Storage and Retrieval) – NS, ST
• WISC-Integrated
  - Multiple Choice Verbal Comprehension
  - Visual Working Memory Index

Giving the entire battery is not required, but rather determining what relevant comparisons are needed for a particular student

Administration
• WISC-V subtests must be given prior to WISC-V Integrated subtests
• WISC-V Integrated subtests are only given in conjunction with the WISC-V subtests
• Typically, select WISC-V subtests to administer for a particular child, then follow with WISC-V Integrated measures
• Coding Recall from WISC-V Integrated must immediately follow Coding from WISC-V rather than waiting until all of the WISC-V is given
• Order of administration for WISC-V Integrated measures is flexible, though it is recommended that types of subtests be alternated; for example, do not give all of the Verbal Multiple Choice subtests in a row, but rather administer a verbal subtest and then a visual subtest and so forth
Comparisons
- Item analysis within a subtest
- Between other subtests within a construct (e.g., Block Design vs. Visual Puzzles; Similarities vs. Vocabulary)
- Between similar subtests on other measures (e.g., Block Design vs. NEPSY-II Block Construction) – differences in test format, administration, scoring, time of day, practice effects
- Between related subtests on other measures to determine patterns (e.g., Block Design, Spatial Memory, geometry concepts, maps)
- Patterns of behavior or strategies across various measures (WISC-V Integrated helps test the limits in a standardized way and systematically determine strategies)

Dynamic Process

Subtests within each Index

Verbal Comprehension
- Measures verbal reasoning, involves abstract thinking, expressive language, semantics (voc/meaning), knowledge
- For children with expressive language or ESL, would not use for obtaining IQ, but using the WISC-V with the WISC-V Integrated can be helpful as a clinical tool for determining if their knowledge through multiple-choice options is stronger than what they are able to express through an open-ended format; compare VCI and MCVC

Verbal Comprehension
- CHC Model: Gc Verbal Ability (Flanagan & Alfonso 2013)
- Miller’s SNP Conceptual Model (Miller & Hale 2008, Miller & Jones tbd):
  – Primary: language
  – Secondary: memory
  – Secondary: executive functioning
Verbal Comprehension: Neurological Correlates

- Gc, specifically measures from Wechsler scales, associated with cortical gray matter thickness, particularly in left temporal cortex in functional and anatomical MRI (Choi, Shamosh, Cho, et al. (2008)*
- Temporal and frontal areas, primarily left hemisphere
- Frontal regions associated with more abstract semantic relations (e.g. Similarities, reading comprehension, listening comprehension)
- Children from low SES show reduced left lateralization, may put them at-risk for less efficient lang devel (Raizada, Richards, Meltzoff, & Kuhl, 2008)*

Multiple Choice Format

- Recognition (m.ch.) vs. recall (open-ended format) – same items, different format
- Reduces the demand on expressive language and memory retrieval/free recall
- May increase demands on receptive language, reading, decision-making (e.g. which item is most relevant), and working memory

Verbal Comprehension

Primary (VCI)
- Similarities
- Vocabulary
Secondary (VECI)
- Information
- Comprehension

WISC-V Integrated (MCI)
- Similarities: Multiple Choice
- Vocabulary: Multiple Choice
- Picture Vocabulary: Multiple Choice
- Information: Multiple Choice
- Comprehension: Multiple Choice

Multiple Choice vs. Open-Ended

If Multiple Choice is Stronger:
- Has knowledge and able to recognize
- Can select most relevant
- May be hindered by recall
- May be hindered by oral expression

If Open-Ended is Stronger:
- Has enough verbal ability to convey idea
- Adequate recall
- May get confused by choices
- May have difficulty identifying main concept

Verbal Comprehension: Similarities

- Conceptualization for semantic categories
- Concept generation (in report shell)
- Knowledge base and associative thinking
- Concrete to abstract reasoning
- Mult Choice:
  - Concept recognition
  - Auditory comprehension/memory and/or
  - Reading skills/comprehension

Similarities: Qualitative Observations

- 1-point vs. 2-point responses
- Frequency of querying
- Knowledge of the terms
- Shift from knowledge to reasoning as items become more abstract
- Use of strategy: “they both...” vs. defining each word
Similarities: Other test measures

To delve deeper into conceptualization:
- WISC-V Picture Concepts
- DKEFS Sorting
- NEPSY-II Animal Sorting
- DAS-II Verbal Similarities
- DAS-II Picture Similarities

Conceptualization: Strategies

- Teach how to group words into categories
- Explicitly teach broad, overarching concepts
- Provide options (e.g. Are they animals, foods, or feelings?)
- Increase vocabulary
- Games: Categories, Apple to Apples, Scattergories (verbal fluency)

Verbal Comprehension: Vocabulary

- Ability to explain the meaning of words (expressive understanding)
- Oral expression: vocabulary knowledge (report shell)
- Knowledge and conceptualization; sometimes can give an example to illustrate understanding
- Long-term memory

Mult Choice:
- Ability to recognize the broadest conceptual definition
- Receptive language/reading

Picture Vocabulary Mult Choice (receptive understanding)
- Understanding of the concept through visual images rather than words; reduces demand on language; may increase demand on visual perception, visual comprehension, visual-verbal associations
- May show difficulty recognizing overall concept in pictures

Vocabulary: Qualitative Observations

- Detailed vs. broad responses
- Frequency of querying
- Similar-sounding words (audit discrim vs. conceptual)
- Ease of providing a description (concise, wordy, filler pauses, hard to describe)
- Increasing difficulty of the test:
  - basic naming (at early age, 6 & 7 year old)
  - defining common words
  - defining uncommon words

Vocabulary: Other test measures

To delve deeper into defining meaning
(conceptual understanding and oral expression):
- DAS-II Word Definitions
- CREVT2 Expressive Vocabulary

To delve deeper into providing a vocabulary term (can be affected by word retrieval):
- WJ-IV OL Picture Vocabulary
- DAS-II Naming Vocabulary

Impact on reading:
- KTEA-3 Reading Vocabulary
- SRI-2 Reading Comprehension: Vocabulary questions

Vocabulary: Strategies

- Index cards: Word on one side with definition on the other side / pair with pictures
- Word Bank / matching
- Teach format: broad idea to specific details
- Terminology within a context
- Ask yes/no questions in class; allow time to formulate
- Apps: Words with Friends, Word of the Week
- Games: Taboo, Name 5, Outburst, Zingo, Crosswords
- Vocabulary Building Games & Activities book
- https://www.therapyshoppe.com/category/P3145-vocabulary-building-games-activities-special-needs-kids
**Verbal Comprehension: Information**
- Secondary subtest
- Incidental learning (items for younger children)
- Measures general knowledge of fact-based information, such as names of historical figures, geographical places, science
- Long-term memory for facts
- Acquired knowledge, semantic memory (report shell)
- Multi Choice: recognition rather than recall

**Information: Qualitative Observations**
- Word retrieval vs. knowledge
- Recalling names
- Certain types of facts (science vs. history vs. geography); do item analysis
- Literal vs. global thinking

**Information: Other test measures**
- WJ-IV Cog General Information
- WJ-IV Ach Academic Knowledge
- NEPSY-II Memory for Names
- NEPSY-II List Memory
- Reading Comprehension for factual information

**Information: Strategies**
- Link to meaningful experiences
- Create charts or timelines for linking facts
- Bring the information to life through plays or movies
- Use cued recall or multiple-choice
- Games: Trivial Pursuit

**Verbal Comprehension: Comprehension**
- Secondary subtest
- Ability to verbally express common sense reasoning and social judgment
- Apply practical knowledge
- Understanding of conventional expectations
- Problem solving using verbal deductive and inductive reasoning (report shell)
- Multi Choice: best representation of a general principle or social situation

**Comprehension: Qualitative Observations**
- Clinical item analysis between social items and conventional items
- Generating more than one idea
- Answering “why” questions
- Does the child logically understand, but does not apply in social situations?
- Do emotional factors override logic in real-life?
Comprehension: Other test measures

- DKEFS Word Context
- DKEFS Proverbs (ages 16 and up)
- TAPS Auditory Reasoning
- Reading Comprehension for Inferences
- Math Word Problems
- NEPSY-II Theory of Mind
- Social Language Development Test (www.linguisystems.com)

Common Sense/Social: Strategies

- Teach child to connect experiences
- Practice “why” questions; model ways to reason
- May be inclined to make literal interpretations and need explanations of figurative language
- Social stories
- Role-playing and practice in real-life
- Social Skills DVD’s or games: http://www.moddekids.com/, http://www.incrediblehorizone.com/social-skills-thera.htm
  Teen Sense, What Do You Stand For?, (available at www.creativetherapystore.com)
  Buddy and Teen Talk Conversation Cards
  https://www.therapyshoppe.com/category/P2658-buddy-teen-talk-conversation-cards-social-skills

Comparing Subtests within VCI

Vocabulary & Information
- Factual, literal, long-term retrieval, crystallized knowledge
- Impacted by formal schooling experiences (e.g., truancy, minimal reading) more than verbal tasks that emphasize reasoning; can contribute to decline in scores over time; can also improve with experience

Similarities & Comprehension
- Abstract, verbal reasoning
- Extrapolate to novel situations

Real-Life Presentations

- Strong Verbal: preference for verbally explaining (though introverted children may not do so in a large group), discussion, precision in words, present as bright, may not necessarily be organized in thought process
- Weak Verbal: hard to provide a description (though may know the concept), may prefer doing rather than explaining, may think in images rather than words, may struggle with verbal conceptualization (terminology, complex wording in text)
- Verbal comprehension does not necessarily equate to language disorder, often linked, but sometimes able to conceptualize and have knowledge even though expressive language deficits and sometimes expressive language is intact, but struggle with conceptualization

10-Minute Break

Visual Spatial Index

- Measures visual-spatial abilities
- Visual detail, spatial orientation, part-whole relations
- Simultaneous processing
Visual Spatial Index

- CHC Model: Gv Visual (Flanagan
- Miller’s SNP Conceptual Model (Miller & Hale 2008):
  - Primary: Visual Spatial
  - Secondary: Sensory Motor
  - Secondary: Executive Functioning

Visual Spatial: Neurological Correlates

- Emphasis in right hemisphere
- Particular region varies based on the type of visual task
- Regions may include: right parietal, temporal, fusiform, basal ganglia, thalamus
- Visual Puzzles linked with right frontoparietal network (visual working memory) and left temporoparietal junction (temporal ordering, details integrated into a whole) McCree & Robinson 2011

Visual Spatial

Primary
- Block Design
- Visual Puzzles

WISC-V Integrated
- Block Design
- Multiple Choice

Visual Spatial: Block Design

- Analyze and synthesize abstract visual info (perceive the gestalt; integrate parts into a whole)
- Visual perception and organization
- Visual-motor integration
- Fine motor coordination
- Figure-ground separation
- Nonverbal concept formation
- Problem-solving
- Visual spatial perception with visual-motor construction (report shell)
- Complex, primarily right hemisphere, but involves both hemispheres and executive/frontal demands (Hale & Fiorello)

Block Design: Process Scores

- BDN – No time bonus (still an overall time limit)
  - Can still be affected by poor visual perception, speed of problem-solving, motor issues
  - Discrepancies are rare; if BDN > BD, then speed issue
- Partial Credit – correct blocks within time
- Mult. Choice: removes motor manipulation and relies only on mental rotation, spatial orientation, integration, visual discrimination

Block Design

If Block Design w/ actual blocks is stronger:
- Hands-on task, using physical manipulatives may help
- May persevere through trial and error strategy
- May struggle to perceive subtle visual differences

If Block Design Multiple choice is stronger:
- Motor planning and execution may be stronger; mental math may be stronger than on paper
### Block Design: Qualitative Observations

- Did they notice small details (e.g., a diagonal block rotated the opposite direction)?
- Did they carefully consider all multiple-choice options (impulsivity)?
- Configuration (global, size/proportion, rotation, 3x3)
- Grid lines
- Persistence
- Slow, but accurate (degree of slowness: BDN vs. outside time limit)

### Block Design: Other test measures

- NEPSY-II Block Construction
- K-ABC Triangles
- VMI-6 - all 3 parts
- NEPSY-II Design Copy (local vs. global)
- NEPSY-II Geometric Puzzles
- Visual Memory for Designs or Location
- Item analysis of reading and spelling errors (Vidyasagar 2013)
- Math: geometry, fractions, algebra

### Block Design: Strategies

- Use of manipulatives or not
- Hands-on vs. mentally (e.g., geometry, physics, do you need to move the furniture in the room to see a new layout or can you visualize it)?
- Help detect subtle differences in visual details
- Diagrams, charts, graphic organizers for relating big picture to details
- Translate analytical into verbal explanation
- Provide a structure to follow (e.g., template for writing)
- Games: Puzzles, Legos, Trac 4, Tic-Tac-Toe

### Case Example

- Diagnosed with surface dyslexia and seems to fit a pattern related to dorsal stream challenge
- Had ample phonetic skills for reading but sight-word recognition skills are considered a deficit
- Can read/sound out phonetically regular words (in one to one correspondence), she has extreme difficulty recognizing phonetically irregular words
- Often substitute a word that looks relatively similar in a guessing fashion. For example, she read: “Important” for “Impatient,” “Advance” for Audience, and for “Post” for Process, “Thought” for Enough, “Unite” for Knowledge
- THESE TYPES OF ERRORS MAY BE RELATED TO CHALLENGES IN THE VISUAL PROCESSING SYSTEM FOR PERCEIVING THE WHOLE FROM WHAT CAN APPEAR AS CLUTTER. LOOK AT HIGHLIGHTED LETTERS IN THE WORDS TO SEE HOW SHE’S PICKING OUT PIECES, BUT IT’S NOT GETTING PROCESSED TOGETHER LIKE IT SHOULD BE. SIMILAR OBSERVATIONS WERE SEEN ON SOME OF THE MEASURES FOR VISUAL MEMORY OF PARTICULAR CONFIGURATIONS OR LOCATIONS, AS WELL AS ON BLOCK CONSTRUCTION.

### Visual Spatial: Visual Puzzles

- Visual spatial (report shell)
- Mental rotation
- Part-whole relations (integration & synthesis)
- Has a time limit
- No alternate formats; not on WISC-V

### Visual Puzzles: Qualitative Observations

- Shift from obvious to more subtle and complex (e.g., 2 pieces vs. the required 3 pieces)
- Complete a few seconds after time limit
- Scanning all options or responding impulsively
Visual Puzzles: Other test measures

- WJ-IV Cog Visualization
- TVPS-3 Spatial Relationships
- NEPSY-II Geometric Puzzles
- NEPSY-II Picture Puzzles
- Visual Working Memory

Visual Puzzles: Strategies

- Use words instead of maps
- Verbal strategies in math
- Assist with breaking down into components
- Explain alternate viewpoints
- Games: Unblock Me, Tetris, Tanagrams

Comparing Subtests within VSI

Given an overall picture:
- Block Design – physically integrate pieces, concrete feedback, allows for trial-and-error problem-solving, procedural learning
- BD Mult Choice – mentally integrate; eliminates motor component
- Visual Puzzles – determine parts to configure the whole, eliminates motor component

Real-Life Presentation

- Strong Visual-Spatial: enjoy building or designing things, architecture, engineering, visualization
- Weak Visual-Spatial: may get lost easily, weak sense of direction, overwhelmed by visual information on a page (reduce clutter)

Fluid Reasoning

- Measures problem-solving, abstract thinking, application of rules, conceptual relations
- Simultaneous processing
- Inductive reasoning
- Quantitative reasoning

Fluid Reasoning

- CHC Model: Gf (Flanagan, et al 2013)
- Miller’s SNP Conceptual Model (Miller & Hale 2008):
  - Primary: Executive
  - Secondary: Visual Spatial
**Fluid Reasoning: Neurological Correlates**
- Dorsolateral prefrontal cortex
- Middle frontal gyrus thickness
- Activation in multiple areas: all lobes in left hemisphere and right frontal/prefrontal cortex
- Frontal-parietal
- Figure Weights: right frontoparietal and right temporoparietal junction (numerical magnitude estimation)
- “The brain does not solve problems without the frontal associative networks directing and recruiting other associative areas in the brain. Without the frontal networks behavior is disconnected from context, disinhibited, disorganized, and reactive.”
  
  Elaine Fletcher-Janzen, WISC-V Technical Manual

**Fluid Reasoning Subtests**

**Primary**
- Matrix Reasoning
- Figure Weights

**Secondary (EFI)**
- Picture Concepts
- Arithmetic

**WISC-V Integrated**
- Figure Weights Process Approach
- Arithmetic Process Approach
- Written Arithmetic

**Fluid Reasoning: Matrix Reasoning**
- Solve visual analogies
- Perceive details and overall patterns/relations
- Identify a conceptual rule to link all visual elements
- Problem-solving with visual deductive and inductive reasoning (report shell)
- No alternate formats; not on WISC-V Integrated

**Matrix Reasoning: Qualitative Observations**
- Do they just match to a single aspect rather than the perceiving the overall relation? (e.g. match color, but not spatial direction)
- Do they perceive differences in visual detail? (e.g. shadow above vs. shadow below design)
- Do they study items carefully or respond impulsively?
- Do they enjoy novelty of tasks or prefer familiar tasks?

**Matrix Reasoning: Other test measures**
- WJ-IV Cog Concept Formation
- WCST
- TONI-4

**Matrix Reasoning: Strategies**
- Patterning
- Building Thinking Skills by The Critical Thinking Co. (www.criticalthinking.com)
- Sudoku
Fluid Reasoning: Figure Weights

- Problem solving; quantitative reasoning (report shell)
- Relations between objects
- Logic
- Matching, addition, multiplication patterns

Process Approach on WISC-V Integrated
- Provides an extended time limit for the items that were incorrect on WISC-V (re-administer only items scored 0)
- If using Q-Interactive, need to set up a new client file with only the Figure Weights subtest, but record responses by hand on the paper protocol OR call Pearson for the Stimulus book with Figure Weights

Figure Weights: Qualitative Observations

- Can they shift from one-to-one correspondence to more abstract analogous relations?
- Time limit – does extended time help

Figure Weights: Other test measures

- WJ-IV Cog Number Series
- WJ-IV Ach Number Matrices
- WISC-V Arithmetic
- Math

Figure Weights: Strategies

- Assist with Algebra
- Real-life examples of equivalent concepts

Fluid Reasoning: Picture Concepts

- Secondary subtest
- Group concepts portrayed in pictures
- Semantic categorization/relations
- Conceptual thinking
- Does not require external verbalization
- Problem-solving visual deductive and inductive reasoning (report shell)
- Compare to Similarities

Fluid Reasoning: Arithmetic

- Mentally solve math problems presented through an oral format
- Problem-solving
- Listening
- Attention
- Working memory (report shell)
- Manipulation of numbers
- Applied math
- Time limit; pause timer when repeat question
Arithmetic: Process Measures

Process Approach:
• Re-administer items scored 0 on the WISC-V
• Items are presented in multiple modalities:
  Part A – questions are in a written format; presented visually and read aloud
  Part B – items presented orally, but provided with paper and pencil
• Reduces demands on attention, memory, and listening comprehension

Written format:
• Presented through paper-and-pencil equations rather than word problems
• Measures numerical ability, while reducing demands on attention and mental efficiency, as well as mathematical problem-solving to convert words into calculations

Comparing Subtests within FRI

Matrix Reasoning & Picture Concepts
• Inductive reasoning
• Abstract vs. concrete

Figure Weights & Arithmetic
• Quantitative reasoning
• Visual vs. verbal

Real-Life Presentation

• Strong Fluid Reasoning: logical, good at solving problems in novel situations, can extrapolate and apply rules in different situations
• Weak Fluid Reasoning: may study hard and do poorly on test; do well on math homework and then poor on the test because cannot apply, may remember all the facts when reading, but struggle to apply the knowledge

10-Minute Break

Working Memory

• Hold information in mind while using it to complete a task
• Measures registration of information, immediate memory, manipulation, sequencing
• Auditory rehearsal
• Visual imaging
• Attention

Working Memory

• CHC Model: Gsm (Flanagan
• Miller’s SNP Conceptual Model (Miller & Hale 2008):
  – Primary: Memory
  – Secondary: Attention
Working Memory: Neurological Correlates

- Frontal regions, parietal, premotor, cingulate cortical regions
- Frontal-Parietal regions - gray matter volume
- Ventral prefrontal (a less efficient pathway) – late childhood through adolescence
- Right dlpfc becomes more involved with adolescents and young adults – linked with greater capacity for mental manipulation
- Pfc- attention and cognitive control

Working Memory

Primary
- Digit Span: Forward, Backward, Sequencing
- Picture Span

Secondary
- Letter Number Sequencing

WISC-V Integrated
- Spatial Span
- Sentence Recall

Digit Span

- Forward: rote, immediate verbal memory, number recall (no context); attentional capacity (report shell)
- Backward – verbal working memory; maintain location of the number within a series
- Sequencing – verbal working memory; maintain quantitative value and compare to numbers before and after

Picture Span

- Remember pictures in order with distracters
- Visual working memory
- Sequencing
- Semantically meaningful
- Interference – recurring objects, sometimes in target series and sometimes not

Letter Number Sequencing

- Verbal working memory
- Sequencing
- Visualization

Spatial Span

- Visual equivalent to Digit Span
- Visual, spatial location, attentional capacity
- Involves motor and self-regulation
- Forward – immediate visual memory, may have primacy effects
- Backward – visual working memory; may have recency effects
Sentence Recall

- Complex verbal working memory; increases cognitive processing demands (vs. simple verbal working memory, such as DS)
- Question task: presented with a question and required to respond Yes or No (similar to Reading Fluency measures, but in an oral format)
- Recall task: required to recall the last word of each sentence in the order presented within a set
EX: Is ice hot?, Can you eat with a spoon? Hot Spoon

Working Memory: Other test measures

- TOMAL-2
- TAPS-3
- WJ-IV Cog
- WRAML-2
- PAL-II Math (Spatial Working Memory)

Working Memory: Strategies

- Milt Dehn’s books & lecture
- CogMed
- Rehearsal
- Group information into meaningful clusters to reduce the load on memory capacity
- Engage in active studying (e.g. do something with the material, such as make comparisons, create notecards, re-group the information, etc.) rather than only passive studying (e.g. glancing over notes)
- Prepare for math tests by presenting a mixture of the various procedures to assist with determining when to apply each method
- Books on mnemonics include Every Good Boy Deserves Fudge by Rod Evans and Thirty Days Has September: Cool Ways to Remember Stuff by Chris Stevens (available through amazon.com)

Comparing Subtests within WMI

- Forward vs. backward (engagement in passive task vs. wk mem)
- Visual vs. verbal
- Simple vs. complex

Real-Life Application

- Strong Working Memory: mental math, reading comprehension, able to keep things organized in their mind
- Weak Working Memory: may get lost in the procedure in math, may confuse details when reading, following directions and sequencing may be hard

Processing Speed

- Measures speed and accuracy for visual information
- Visual scanning/tracking
- Visual discrimination
- Basic clerical tasks (not complex thinking)
- Concentration
- Cautious/perfectionistic tendencies
Processing Speed

- CHC Model: Gs (Flanagan
- Miller’s SNP Conceptual Model (Miller & Hale 2008):
  - Primary: Processing Speed
  - Secondary: Visual Spatial
  - Secondary: Attention
  - Secondary: Sensory Motor

Processing Speed: Neurological Correlates

- White matter (supports communication across brain regions)
- Size of corpus callosum & thalamus
- Neurotransmitters (e.g. acetylcholine, dopamine)
- Greater activation in dlpcfc to other regions of brain linked with slower efficiency/automatization (Waber 2010)
- Greater efficiency linked with more activation in parietal cortex and ventromedial pfc

Processing Speed

<table>
<thead>
<tr>
<th>Primary</th>
<th>Secondary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coding</td>
<td>Cancellation</td>
</tr>
<tr>
<td>Symbol Search</td>
<td>Naming Speed Literacy</td>
</tr>
<tr>
<td>Naming Speed Quantity</td>
<td></td>
</tr>
</tbody>
</table>

WISC-V Integrated

- Coding Recall
- Coding Copy
- Cancellation Abstract

Processing Speed: Coding

- Visual tracking (vertical and horizontal), perceptual fluency (report shell)
- Visual-motor coordination and speed
- Attention

Process Measures:
- Coding Recall: administer immediately after Coding
  immediate visual memory, incidental learning
  Cued symbol recall: recall the mark that went in each shape/#
  Cued digit recall: write the number that went with each mark
  Shape-symbol/Digit symbol pairing: match the mark to the shape/#

- Coding Copy: psychomotor fluency

Coding: Qualitative Observations

- Do they memorize
- Do they look back and forth
- Do they lose set
- Reversal errors

Coding: Other test measures

- NEPSY-II Visual Motor Precision
- DKEFS TMT Motor Speed
- PAL-II Copying A and B
- DASH
Coding: Strategies
- Copy of notes
- Use of computer
- Extra time for copying
- Break assignments into shorter segments

Processing Speed: Symbol Search
- Visual scanning and tracking, perceptual fluency (report shell)
- Visual discrimination
- Set-loss errors
- Rotation errors
- Skip a row/answer on wrong row

Symbol Search: Other test measures
- WJ-IV Cog Number Pattern Matching
- WJ-IV Cog Letter Pattern Matching
- Reading Fluency

Symbol Search: Strategies
- Answer on test booklet
- Circle details (e.g., operational signs)
- Workbooks to improve visual scanning and discrimination (e.g., www.academictherapy.com)
- Visual Discrimination activity sheets by Jean Edwards available through amazon.com
- Tools to assist with maintaining place when reading or copying: https://www.therapyshoppe.com/category/1529-resources-reading-eye-tracking
- uHealth/uMoove app for eye tracking games to assist with focus

Processing Speed: Cancellation
- Visual scanning, perceptual fluency (report shell)
- Visual discrimination
- Selective attention
- Structured vs. random
- Semantic/categorical content (animals/clothing) vs. abstract (yellow squares/red triangles)
- Decision-making
- Visual neglect
- Response inhibition

Comparing Subtests within PSI
- Motor vs. visual
- Visual structure of the task
- Size of font
- Vertical vs. horizontal
- Compare to verbal speed
- Compare to speed in daily life
### Processing Speed: Strategies

If supported by other areas, such as rate of completion for academic tasks:

- Omega-3
- Reduced assignments
- Extended time
- Test over multiple days
- Practice a skill 5 to 10 minutes/daily to increase automaticity

- [http://www.braincufsls.com](http://www.braincufsls.com) (e.g. BrainFlex, React), [http://cognitivelabs.com/test4.htm](http://cognitivelabs.com/test4.htm)

### Real-Life Applications

- **Strong Processing Speed:** efficient at getting through basic tasks (e.g. math worksheets, copying information)
- **Weak Processing Speed:** may be slow to process symbols on paper (e.g. impacts reading rate), may be slow to process in general
- **Processing Speed does not necessarily equate with rate of completion when complex thinking is involved**

### Complementary Subtests

**Naming Speed Index**
- Naming Speed Literacy
- Naming Speed Quantity

**Symbol Translation Index**
- Immediate
- Delayed
- Recognition

### Naming Speed

- Naming fluency (report shell)
- Literacy – moderate to high correlation w/Obj Naming and Letter Naming; sensitive to reading, spelling, attention, language
- Quantity – correlation w/ math related subtests, particularly in younger children (6-9)
- Not measures of intelligence, but processes related to learning difficulties
- Compare to visual speed

### Symbol Translation

- Measures the ability to recall a word related to a visual cue
- Related to reading fluency, sight-word recognition, reading text, math

### Symbol Translation

- CHC Model: Glr (Flanagan)
- Miller’s SNP Conceptual Model (Miller & Hale 2008):
  - Primary: Verbal-Visual Associative Learning
Symbol Translation: Neurological Correlates

- Complex and unclear
- Hippocampus
- Inferior temporal cortex (ITC), a high level stage of visual processing
- Middle temporal or MT area, an early way station along the dorsal pathway. It's also nicknamed the "motion area"
- Left pfc
- Lateral occipital/fusiform cortex

Symbol Translation

- Immediate Symbol Translation
- Delayed Symbol Translation (20-30 min. later)
- Recognition Symbol Translation: administer immediately after DST; reduces effects of retrieval problems
- Avoid Naming Speed tasks in between IST and DST (6-8 year olds)

Symbol Translation: Other test measures

- WJ-IV Cog Visual Auditory Learning
- TOMAL-2 Paired Recall
- NEPSY-II Memory for Names
- K-ABC Atlantis / Rebus
- Sight word recognition / rate
- Spelling (e.g. unpredictable patterns)
- Math fact fluency

Storage and Retrieval Index

- Naming Speed Index and Symbol Translation Index combined

Comparing Indices

- Give VCI cluster to help determine impact of language issues on ability to convey knowledge and thinking
- Give NVI cluster (VSI & FRI) if suspect NLD and compare to VCI
- Calculate GAI & CPI to separate reasoning from cognitive efficiency
- Auditory Working Memory (phonological loop) vs. Visual Working Memory (visual-spatial sketchpad); may be overlap due to strategy

Statistical Significance and Base Rate

- Statistical difference – likelihood that the difference between scores is not due to chance (e.g. .05 = 95% chance that it's a real difference)
- Base Rate – how often the difference occurs; differences that occur less than 15% of the time are considered clinically significant (Sattler 2008)
- Scatter is common among subtests, so important to check the Base Rate
### Correlations with KTEA-3

- **VCI**: Reading, reading comprehension
- **VIQ**: moderate with math
- **RMI**: moderately with math, highly with math concepts/applications
- **WMI**: orthographic processing, sound-symbol, reading
- **PSI**: academic fluency and oral fluency
- **STI**: sound-symbol, decoding, reading fluency
- **SRI**: orthographic processing, reading fluency

### References


### References