Questions about Intelligence

- What is Intelligence?
- Why do you assess intelligence?
- What theoretical model guides your interpretation of intelligence test results?
- What type of mindset do you apply to intelligence testing?

Source Acknowledgements

Contemporary Intellectual Assessment
Edited by Dawn P. Flanagan and Patti L. Harrison

Essentials of Executive Functions Assessment

Consciousness and the Brain
Deciphering How the Brain Codes Our Thoughts
Stanislas Dehaene

Thinking, Fast and Slow
Daniel Kahneman

Source Acknowledgements
Questions about Intelligence

- Do you believe it is possible to raise a child’s FSIQ from 70 to 100 through intervention?
- Can it be done in 6 months? A year? Two years?

Max’s WISC-IV Score Changes

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Ability Deficits

- The conventional wisdom regarding ability deficits represents a fixed mindset.
- What is needed is a new perspective that embraces a growth mindset.
- A growth mindset suggests that abilities are not innate; they can be changed.

From Ability to Skill

The most critical shifts in educational thinking involve:
1) engendering a strong belief in the growth mindset that asserts that ability IS malleable.
2) implementing and refining the techniques needed to change abilities into skills so that they are taught instead of merely measured.

Marzano, Pickering & Pollock provided a blueprint for turning abilities into skills in their book “Classroom Instruction That Works: Research-based Strategies for Increasing Student Achievement.” (2001)

Strategies discussed include:
- Teaching Similarities and Differences
- Teaching Hypothesis Testing
- Teaching Vocabulary

If these research-based strategies have been shown to work, why would it not be commonplace to expect to be able to increase “verbal ability” with good teaching practices?

“What if the different tests were taken to represent generically different entities, one could no more add the values assigned to them in order to obtain an [IQ] than one could add 2 dogs, 3 cats and 4 elephants, and expect the unqualified answer of 9. That, of course, does not mean that their addition is impossible. If instead of being concerned with the characteristics of the dog, the cat and the elephant, which differentiate them from one another, we restrict our interest to those which they all have in common, we can say that 2 dogs, 3 cats and 4 elephants make 9 animals. The reason we can get an answer of 9 here is because dogs, cats and elephants are in fact all animals. The addition would no longer be possible if for cats we were to substitute turnips.”

What do Intelligence Tests Measure?

"Intelligence tests measure more than mere learning ability or reasoning ability or even general intellectual ability; in addition, they inevitably measure a number of other capacities which cannot be defined as either purely cognitive or intellectual,—abilities heavily loaded with factors like "X" and "Z" mentioned above. Hitherto, authors of intelligence scales when recognizing this situation, looked upon these factors as disturbing elements and tried as far as possible to eliminate them. Unfortunately, experience has shown that the more successful one is in excluding these factors, the less effective are the resulting tests as measures of general intelligence." Wechsler, D. (1958). The Measurement and Appraisal of Adult Intelligence, p. 11

Executive Functions and Intelligence

"Wechsler believed that performance on measures of cognitive ability reflected only a portion of what intelligence comprises. He defined intelligence as the “capacity of the individual to act purposefully, to think rationally, and to deal effectively with his environment” (1944, p.3). Wechsler was keenly aware that the results of factor-analytic studies accounted for only a portion of intelligence, and he believed that another group of attributes contributed to intelligent behavior. These attributes included planning and goal awareness, enthusiasm, field dependence and independence, impulsiveness, anxiety, and persistence." WISC-V T&I Manual, page 3.

Executive Functions and Intelligence

- The concept of executive functions is not synonymous with the traditional concepts of intelligence or “IQ”
- Executive functions are not directly assessed with standard intelligence tests

Measuring Executive Functions with a Reasoning Task

Directions for the Wisconsin Card Sorting Test (WCST):
I can’t tell you much about how to do this task. Which of these do you think this one goes with? I’ll tell you if your answer is right or wrong.

Executive Functions and Intelligence

The publishers of the WISC-V emphasize in the Technical and Interpretation Manual the use of intelligence test scores to predict achievement. Other purposes are mentioned only briefly.

Executive Functions and Intelligence

Research suggests that measures of self-control in preschool are better predictors of later school achievement than Full Scale IQ scores.
If measures of self-control in preschool are better predictors of later school achievement than Full Scale IQ scores, then why are we still endorsing the use of intelligence tests if their primary purpose is to predict achievement?

The ultimate purpose of psychoeducational assessment is to enable a clinician to characterize an individual’s cognitive and adaptive capacities and academic skill proficiencies in the most accurate and effective manner possible.

• Replacing the concept of Intelligence with Cognition
• Recognizing that Cognition is an amalgam of multiple mental constructs including:
  - Attention, Initial Registration/Encoding, Working Memory
  - Long-Term Storage and Retrieval, Executive Functions,
  - Language, Visuospatial, Reasoning, Motor Production
• Understanding the role of cognition in social/emotional functioning and academic skill development

The CHC Model of Intelligence is based on a Narrow Definition of Intelligence; Intelligence is represented by the scores from multiple broad ability factors.
Neuropsychological Models Emphasize Multiple Cognitive Components within Broad Functional Categories of Cognition

**Reasoning**
- (V, NV, Q)

**Visual**
- (Ortho, NV)

**Visual/Spatial**

**Language**
- (R, E, F, S, PA)

**Memory**
- (I, WM, LTR)

**Processing Speed**

**Executive Functions**

**Motor Functioning**

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**Process-oriented Interpretation**

The Process Approach requires a clear understanding of what a task measures so that performance can be effectively task analyzed to characterize a person’s cognitive capacities as accurately as possible.

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**Cognitive Task Performed During PET Scan**

- For each noun that appeared on a monitor, subjects were instructed to say a verb that would go with the noun.
- 40 words were shown, one at a time, one word per second.
- Study completed by Raichle, et. al. (1994), *Cerebral Cortex*.

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What’s the difference between a WISC-IV Similarities Scaled Score of 12 and a WISC-IV Similarities Scaled Score of 12?

Retrieval of verbal information form long-term storage vs Reasoning with verbal information

What Does Block Design Measure?

Consider the following quote from John Carroll (Human Cognitive Abilities, 1993, page 309):

From Carroll’s description, Block Design can be measuring at least 5 distinct cognitive processes:
- Visual perception and discrimination
- Reasoning with visual stimuli
- Visualization (optional)
- Motor dexterity
- Speed of motor response
**What Does Block Design Measure?**

From Carroll’s description of Block Design, which of the 5 distinct cognitive processes do you think Subject 3 lacked?

- Visual perception and discrimination
- Reasoning with visual stimuli
- Visualization (optional)
- Motor dexterity
- Speed of motor response

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**The Process Approach to Analysis of Block Design**

Consider the following quote from Carroll (1993, p. 309):

> …considerable confusion exists about the identification of factors in the domain of visual perception… Some sources of confusion are very real, and difficult to deal with. This is particularly true of confusion arising from the fact that test takers apparently can arrive at answers and solutions – either correct or incorrect ones – by a variety of different strategies. French (1960) demonstrated that different “cognitive styles” can cause wide variation in factor loadings; some of his most dramatic cases had to do with spatial tests, as where a sample of subjects who reported “systematizing” their approach to the Cubes test yielded a large decrease of the loading of this test on a Visualization factor (that is, decreased correlations of Cubes with other spatial tests), as compared to a sample where subjects did not report systematizing. It has been shown (Kyllonen, Lohman, & Woltz, 1984), that subjects can employ different strategies even for different items within the same test. Lohman et al. (1987) have discussed this problem of solution strategies, even rendering the judgment that factor-analytic methodology is hardly up to the task of dealing with it because a basic assumption of factor analysis is that factorial equations are consistent over subjects.

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**Identifying Task Component Processes**

- An Information Processing Model provides a theoretical framework for understanding cognition and its role in learning.
- An information processing model represents a dynamic model of cognition rather than a taxonomy of cognitive abilities.
Subtests/tasks involve more than one Cognitive Process.
The format of the task can greatly affect performance levels.
Processing preferences and strategy selection can greatly affect performance levels.
The cognitive processes involved in performing a task often vary based on the age, cognitive capacity, and strategy selection of the examinee.
To truly understand a person’s performance, you must know not just the score obtained, but how the person performed the task to obtain the score.
What Are Executive Functions?

- Directive capacities of the mind
- Multiple in nature, not a single capacity
- Cue the use of other mental capacities
- Direct and control perceptions, thoughts, actions, and to some degree emotions
- Part of neural circuits that are routed through the frontal lobes

Executive Functions and Reading

1. Cueing immediate and sustained attention to orthography for accurate letter/word perception and discrimination
2. Cueing and coordinating the use of phonological and orthographic processes for accurate word pronunciation
3. Directing efficient oral motor production, prosody, and rate for reading words and connected text
4. Cueing and coordinating the use of attention and immediate memory resources for reading words and connected text
5. Cueing retrieval of information from various Lexicons to read words and connected text
6. Cueing and coordinating the use of word recognition, word decoding, and reading comprehension skills
7. Cueing and coordinating the use of abilities and the retrieval of knowledge from Lexicons to create meaning for text comprehension
8. Cueing and sustaining the use of working memory resources while reading words and constructing meaning from text
9. Cueing and directing the oral expression of meaning derived from text comprehension
10. Cueing and directing the use of strategies for reading words and deriving meaning from text
Executive Functions and Reading

Alana, an 11 year-old child displays adequate word reading skills when reading word lists and adequate RAN performance with letters and words. However, when asked to read a short two sentence text orally, she experiences extreme difficulties with applying both word reading and rapid naming skills; words are skipped, misread, and reread; highly familiar words are decoded instead of sight read, less familiar words are decoded at an extremely slow pace; word misreadings are left uncorrected despite the disconnect between the orally read word and the meaning of the text (e.g., reading “bornes” for “bones”). Despite superior ability to reason with verbal material, Amanda is unable to offer adequate responses to questions about what she just read.

Executive Functions and Writing

- What Evan wrote for me:
  
  My favorite game is ... “mabul roling it is fun. I like making the box to role in to. lam prety gode as well. It is rell inters ing. It is so fun

Executive Functions and Writing

- What Evan told me:
  
  “My favorite game is rolling marbles. I think it is fun. I just learned it yesterday. It can be pretty hard at times. It can be fun and it’s interesting if you make it challenging. I like making the boxes to roll the marbles into. You probably need to be pretty skilled with eye hand coordination to do it. To get up the ramp you need to roll it really fast.”

Assessing Executive Functions Related to Reading

Amanda’s case description serves to illustrate an important point:

Executive function processing deficits often manifest as inconsistencies in the use of adequately developed processes, abilities, lexicons, skills and/or strategies resulting in achievement and production below what would be expected.

Interventions for Executive Functions Difficulties Related to Reading

Many executive functions difficulties related to reading are the result of a lack of adequate maturation of the neural networks involved in the use of these executive functions for reading.

An Integrative Model Specifying Processes, Abilities, Knowledge Bases, Skills, Memory and Achievement in Writing

- indicate Executive Function processing at work
- Initial Registration (Immediate Memory)
- Working Memory
- Retrieval from Long Term Storage
- Language
- Idea Generation
- Reasoning
- Spelling
- Text Editing & Revising
- Text Generation
- Text Transcription & Spelling
- Text Production
- Automaticity
- General & Specific Lexicons
- Semantic Lexicon
- Word & Phrase Knowledge
- Orthographic Processing
- Phonological Processing
- Visuospatial Processing
- Motor Processes
- GraphoMotor Processing
- Executive Function processing at work
- Executive Function processing at work
Learning vs Producing

- Producing difficulties are different from learning difficulties;
- Producing difficulties are more likely to reflect poor use or disuse of executive functions.

A General Model for Conceptualizing Learning and Producing Difficulties

- Often NOT recognized as a Learning Disability, even when severe, unless an evaluation involving process assessment is done
- Recognized fairly quickly as a Learning Disability
- When severe, typically attributed to lack of motivation, character flaws, or behavior/personality problems

Intervention for Difficulties with Directing Attention to Orthography

Interventions for executive functions difficulties with word reading miscues:
1) Increase awareness of and use of all of the steps in the word recognition process.

Intervention for Difficulties with Directing Attention to Orthography

- For a student who appears to be having a lot of difficulty with substituting visually similar highly familiar words, talk with the student about how words can be illusions in that they can fool us into believing that they look like other words we know.

Intervention for Difficulties with Directing Attention to Orthography

- Script for increasing awareness and use:
  - “Look” (Perceive cue)
  - “at each word” (Focus cue)
  - “carefully.” (Monitor cue)

Intervention for Difficulties with Directing Attention to Orthography

- “See the letters and words that are on the page, not the letters and words you believe to be on the page.” (Inhibit cue)
- “Quickly” (Pace cue)
- “figure out if you know the word or don’t know the word.” (Gauge cue)
Intervention for Difficulties with Directing Attention to Orthography

• “Quickly” (Pace cue)
• “say the word if you know it.” (Retrieve cue)
• “Pause if you don’t know it.” (Interrupt cue)
• “Shift to decoding mode.” (Shift cue)

Intervention for Difficulties with Directing Attention to Orthography

• “and quickly” (Pace cue)
• “use your decoding skills to sound out the word.” (Retrieve cue)
• “Ask yourself if what you sounded out matches a word you’ve heard before.” (Monitor & Retrieve cues)

Intervention for Difficulties with Directing Attention to Orthography

• “Use your decoding skills again if you don’t recognize what you sounded out or if the word doesn’t make sense in the sentence.” (Correct cue)

Intervention for Difficulties with Directing Attention to Orthography

• Follow the discussion with word recognition drills and oral reading of passages that emphasize the use of the first four cues in the sequence (“Look / at each word / carefully./ See the letters and words that are on the page, not the letters and words you believe to be on the page.”)

Intervention for Difficulties with Directing Attention to Orthography

• Attention to orthography difficulties also should be addressed in conjunction with fluency instruction.
• The following strategy can be used:
• Note the words that are mispronounced during a “cold” read of a fluency practice passage.
• Identify those words that have been read correctly in word decoding lessons but that were mispronounced during the cold read.

• On a copy of the practice passage, underline every mispronounced word that had been pronounced correctly during decoding instruction.

• Instruct the student as follows: “When you see an underlined word, that means that this is a word that you don’t always read correctly but that you know how to decode. The underline is there to remind you to use your decoding skills to sound out that word so that you will be sure to read it correctly.”

• Computer-based interventions that emphasize attention to orthographic regularity have demonstrated improvements in students’ decoding skill application and overall reading achievement levels.

• Many programs available today, such as Read 180 and Lexia, have the reading with orthographic and speech support components that have been shown to improve decoding skills.

Many executive functions difficulties related to reading are the result of a lack of adequate maturation of the neural networks involved in the use of these executive functions for reading.
**Interventions for Executive Functions Difficulties Related to Reading**

The most effective form of intervention for maturational difficulties with executive functions cues is increased practice of the complete act of reading, i.e., applying the integration of all processes, skills, abilities and lexicons while reading connected text while receiving feedback from an external source.

**Interventions for Executive Functions Difficulties Related to Reading**

Interventions for executive functions difficulties with reading rate:

- Increased oral reading practice with words and passages composed of words that can be recognized by sight.

**Interventions for Executive Functions Difficulties Related to Reading**

- The goal of fluency instruction is to reduce the executive function demands by making word reading automatic.
- Fluency instruction also helps to improve use of the Pace cue; through repetition, pacing is gradually transferred from being externally guided to internally directed.

**Interventions for Executive Functions Difficulties Related to Reading**

Interventions for executive functions difficulties with cues involved in reading comprehension:

- Strategy instruction that models and teaches the student how to approach the tasks of vocabulary building and reading comprehension.

**Comprehension Instruction**

The NRP's conclusions about CI:

- Strategies for active comprehension are normally acquired informally
- Explicit or formal instruction of strategies leads to improvement of comprehension
- When the strategies have been acquired, students can apply the strategies independently
- Students who are not explicitly taught these strategies are unlikely to learn, develop, or use them spontaneously

“*The idea behind explicit instruction of text comprehension was that comprehension could be improved by teaching students to use specific cognitive strategies or to reason strategically when they encountered barriers to comprehension in reading.”* NRP 2000, page 4-5
The NRP identified 8 kinds of CI that “appear to be most effective and most promising for classroom instruction”:

Comprehension Monitoring - teaching students how to be aware or conscious of the attempt to understand what is being read; procedures for dealing with problems in understanding are learned and applied as needed.

The NRP’s cited two major approaches to comprehension strategy instruction:

Direct Explanation (DE) - teachers help students view reading as a problem-solving task that requires the use of strategic thinking and help them learn to think strategically about solving reading problems. DE focuses on developing teachers’ capacities for explaining the reasoning and mental processes involved in successful reading comprehension in an explicit manner.

Typically, Comprehension Strategy Instruction involves:

- Developing of an awareness and understanding of one’s own cognitive processes that are amenable to instruction and learning
- Guiding and modeling the actions that a reader can take to enhance the comprehension processes used during reading
- Practicing strategies with teacher assistance until students internalize them and use them independently.

Many executive functions difficulties related to writing are the result of a lack of adequate maturation of the neural networks involved in the use of these executive functions for writing.
George McCloskey, Ph.D.

Later Composition Instruction: General Rationale

“...it is unlikely that brain maturation alone without explicit instruction in self-regulation strategies will help middle school and high school students develop and apply executive functions productively to writing. The major pedagogical goal at this stage of development is to guide the Writing Brain in becoming more self-regulated. A major research-supported technique for accomplishing this goal is teaching explicit strategies for regulating the writing process, some of which are genre specific, and all of which should be coordinated with curriculum.”


Interventions for Executive Functions Difficulties Related to Writing

The most effective form of intervention for maturational difficulties with the use of executive functions is increased practice of all the stages of the writing process increasingly guided by the use of self-regulation strategies that can be taught to the student.

Early Composition Instruction

Modeling Strategies for Writing During Writing Sessions:

  – Teacher thinks out loud and discusses the ideas she plans to say.
  – Teacher models how different ways that she could state her ideas.
• “The sounds in what I say are related to letters in the words I write.”
  – Teacher models how she could say each word sound by sound, and change those sounds into letters using a sound-letter correspondence clue sheet.
• Teacher circulates and assists individual children as they apply the strategies to generate ideas, spoken text, phonologically segmented words, and written spellings with the aid of their clue sheets.

Five Stages of Strategy Instruction

1. Explain the purpose of self-regulation strategies in general and describe and discuss the specific steps of the strategy that will be taught.

2. Model the use of the strategy using language and examples that connect with the students.

3. Students memorize the steps in the strategy as well as any mnemonics that are used as part of the strategy.
Five Stages of Strategy Instruction

4. Teacher supports the implementation of the strategy by the students, scaffolding as necessary to help the students to master the use of the strategy.

5. Students independently apply the self-regulated strategy covertly (in their own minds). Students and teacher collaboratively evaluate the effectiveness of student self-directed strategy application.

The Report Writing Strategy

1. Select a topic.
2. Brainstorm what you know and what you want to learn.
3. Organize your information using a visual web.
4. Review your visual web and identify any holes or disconnects.
5. Gather new information and revise your visual web.
6. Use the visual web to help construct an outline for the report or to begin writing.
7. Review, plan and revise as you write.
8. Check the visual web; did you write what you wanted to write?
9. Add information that is missing; fix sentences that don’t say what you want them to say.
A. Read the sentence silently and/or aloud.
B. Does the sentence make sense to you? What does it mean?
C. Is that what you meant to say?

D. What’s missing? What doesn’t make sense?
E. Restate what you want to write. Repeat it to yourself.
F. Write what you just said.
G. Read what you wrote; go through steps A-G again if needed.