Attention and Executive Functioning Deficits

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Session 107

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-Apraxia Kids

Speaker Disclosure

- Paul Beljan, PsyD, ABPdN, ABN
  Financial: Developer of the Motor Cognition Squared® (MC2) program for ADHD/EFD
  Non-financial: No relevant nonfinancial relationships to disclose.

- Lynn Carahaly, M.A., CCC-SLP
  Financial: Developer of The Speech-EZ® Apraxia Program & Gesture
  Non-financial: No relevant nonfinancial relationships to disclose.
HOW THE BRAIN WORKS

Personality and Behavior is Driven by Cognition:

- All Brain Function is Multiply Determined
  - Koziol

How the Brain Works

- **Back**
  - Occipital
  - Temporal
  - Parietal

- **Middle**
  - Limbic System/Basal Ganglia

- **Front**
  - Frontal Lobe
  - Pre Frontal Lobes

YOUR BRAIN
HOW THE BRAIN WORKS

Back = collection of information
- What's out there?
- How many?
- What color?
- Where is it?
- Have I seen it before?
- What's it feel like?

HOW THE BRAIN WORKS

Middle = Regulates - Central Switching - Memory
- Limbic System
- Thalamus
- Amygdala
- Hypothalamus
- Hippocampus
- Basal Ganglia - Caudate Nucleus - Putamen

HOW THE BRAIN WORKS

Front = The Executive - receive, hold, allocate, think, execute
- Collects information
- Holds multiple bits of information
- Simultaneous processing of information in real time
- Decision making
- Execution
HOW THE BRAIN WORKS

Like an effective company that works interactively:

- Sales Force
- Middle Management
- The Executive

Communication via Neuronal Pathways – Nmail

HOW THE BRAIN WORKS

- Sales Force
  - Back of the brain – That which is behind the Frontal Lobes: Temporal/Parietal/Occipital
  - Collects information
    - What’s out there?
    - How many?
    - Where is it?
    - What’s it like?
  - Transmits Nmail to Middle Management

HOW THE BRAIN WORKS

- Middle Management
  - Middle Brain: limbic system, basal ganglia, reticular activating system
  - Receives information from the Sales Force
  - Organizes information
    - Regulate
    - Manage
    - Synthesize
    - Remember
  - Transmits Nmail to the Executive
HOW THE BRAIN WORKS

- Executive
  - Pre-Frontal and Frontal Lobes
  - Receives all of the processed information in a feedback loop (Alexander Circuits-Cingulate Gyrus)
  - Reasons and problem solves
  - Decides what to do
  - Sends out directive Nmails to middle management via the same circuitry

When any part of the system fails or overworks, the system fails to work correctly

An Example: Frontal Mediation

- The poker analogy...
WHERE ARE WE?

- Completed basic brain functioning.

Moving on to:

Executive Functioning and Attention

“Attention is not just one entity, it is multiply determined”
- Mirsky

Executive Function

- Fronto-parietal – Basal Ganglia – Cerebellum:
  - Working Memory
  - Inhibition
  - Planning and Organization
  - Focus Execute
WORKING MEMORY

The ability to hold two or more points of thought in mind and, simultaneously, use that information to generate novel solutions or behaviors.

WHAT IF you cannot hold and use information simultaneously in the here and now?

THEN you cannot 'think ahead'.

WHAT IF you cannot think ahead?

THEN you cannot self-direct behavior and you are stimulus bound.

“I'm stimulus bound.”
WORKING MEMORY

- **WHAT IF:** you are **stimulus bound**?
- **THEN:** how do you anticipate consequences to your behavioral choices?

**Answer:** **YOU DON’T.**

“**My tummy is angry.”**

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**WORKING MEMORY**

- Stimulus Bound behavior is impulsive; i.e., the child is attracted to (distracted by/bound by) extraneous stimulus that is occurring in their environment.

*Hint: Don’t Think Hyperactive – Think Disorganized*

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**WORKING MEMORY**

- **Suggested Tests**
  - WISC V - Digit Span Reverse
  - WISC V - Arithmetic
  - NEPSY II – Auditory Attention & Response Set
  - WCST – failure to maintain set
  - CTOPP-2 – phonological memory (loop)
WORKING MEMORY and SPEECH-LANGUAGE

Phonological Loop
- Nonword repetition
- Learning new vocabulary
- Second language learning
- Apraxia
  - Articulatory Rehearsal Process

Motor Planning

Individuals with apraxia are unable to set up the speech motor codes necessary for articulation, caused by a deficiency of the articulatory rehearsal process.

Dysarthria however...

On the other hand, patients with dysarthria, whose speech problems are secondary, show a normal capacity for rehearsal. This suggests that it is the subvocal rehearsing that is crucial.
Many researchers in the field of cognitive skills related to academics believe working memory is the most important predictor of learning, much more so than a student’s overall IQ score. Working memory gives us an isolated measurement of what a student is capable of learning.
## TAPS-4

<table>
<thead>
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<th>Subtest</th>
<th>Scaled Score</th>
<th>Percentile Rank</th>
<th>Normative Classification</th>
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<td>Word Discrimination</td>
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<tr>
<td>Phonological Deletion</td>
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<td>Word Memory</td>
<td>5</td>
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<td>Below Average</td>
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<td>1st</td>
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<tr>
<td>Processing Oral Directions</td>
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<td>Below Average</td>
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<tr>
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### Composite Score

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<td>Listening Comprehension Index</td>
<td>75</td>
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<tr>
<td>Overall Index</td>
<td>83</td>
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## SCAN:C-3

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<td>Auditory Figure Ground +8 dB</td>
<td>10</td>
<td>50</td>
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<td>Typical</td>
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<td>Filtered Words</td>
<td>7</td>
<td>16th</td>
<td>Low Average</td>
<td>Typical</td>
</tr>
<tr>
<td>Competing Words - Directed Ear</td>
<td>2</td>
<td>1st</td>
<td>Poor</td>
<td>Typical</td>
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<tr>
<td>Competing Sentences</td>
<td>4</td>
<td>2nd</td>
<td>Poor</td>
<td>Atypical Right Ear Advantage: Prevalence 15% of population</td>
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## GORT-5

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<td>Fluency Score</td>
<td>9</td>
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<td>Comprehension Score</td>
<td>7</td>
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<tr>
<td>Oral Reading Index</td>
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## PPVT-4

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<td>107</td>
<td>68th</td>
<td>Average</td>
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**Strategies**

Can you increase WM Capacity: YES, to a certain extent

- Gesture
- Visual to Auditory
- Auditory to Visual
- Motor and Movement

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**Visual-Spatial Tic-Tac-Toe**

- Each player calls out the position number of their "X" or "O" move.
- Players must keep track of each other move for a win or a tie.

---

**CELF-5**

<table>
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<th>Subtest</th>
<th>Scaled Score</th>
<th>Percentile Rank</th>
<th>Normative Classification</th>
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<tbody>
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<td>Linguistic Concepts</td>
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<tr>
<td>Word Structure</td>
<td>7</td>
<td>16th</td>
<td>At Risk</td>
</tr>
<tr>
<td>Word Classes</td>
<td>6</td>
<td>9th</td>
<td>At Risk</td>
</tr>
<tr>
<td>Following Directions</td>
<td>8</td>
<td>25th</td>
<td>Average</td>
</tr>
<tr>
<td>Formulated Sentences</td>
<td>8</td>
<td>9th</td>
<td>At Risk</td>
</tr>
<tr>
<td>Recalling Sentences</td>
<td>5</td>
<td>5th</td>
<td>Low Range</td>
</tr>
<tr>
<td>Understanding Spoken Paragraphs</td>
<td>6</td>
<td>9th</td>
<td>At Risk</td>
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Average Scaled Score is 10 with a ±3 point standard deviation.

---

<table>
<thead>
<tr>
<th>Index Scores</th>
<th>Standard Score</th>
<th>Percentile Rank</th>
<th>Normative Classification</th>
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<tbody>
<tr>
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<td>Receptive Language Index</td>
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<td>Language Content Index</td>
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<td>14th</td>
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</tr>
<tr>
<td>Language Structure Index</td>
<td>81</td>
<td>10th</td>
<td>At Risk</td>
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Nonword Target Position

<table>
<thead>
<tr>
<th>Nonwords</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>biapt</td>
<td>1st</td>
</tr>
<tr>
<td>smark</td>
<td>2nd</td>
</tr>
<tr>
<td>shampt</td>
<td>3rd</td>
</tr>
<tr>
<td>waspt</td>
<td>4th</td>
</tr>
<tr>
<td>brench</td>
<td>5th</td>
</tr>
<tr>
<td>flosk</td>
<td>1st</td>
</tr>
<tr>
<td>plekt</td>
<td>2nd</td>
</tr>
<tr>
<td>glisp</td>
<td>3rd</td>
</tr>
<tr>
<td>krosp</td>
<td>4th</td>
</tr>
</tbody>
</table>

- Student LISTENS to nonword stimuli
- Student calls out the phonemes of specified target-position called out by therapist
- Higher-level variation: Student call out target phoneme in specified sequence

Picture This!

- Teaching student how to draw mental pictures linking auditory to visual centers.
- Parallel this concept to following multi-step directions.

INHIBITION

- The behavioral outcome of an intact working memory system.
  - As working memory allows an individual to self-direct their behavior, a lack of working memory will result in poorly self-directed (impulsive) behavior (again, stimulus bound).
INHIBITION

- **Inhibition** is not being able to stop when you should.
  - Poor inhibition undermines working memory.

However, an individual can have a large working memory capacity and still be impulsive.

- Intact skill-set for working memory that is undermined by impulsivity.

Inhibition at the level of the Anterior Cingulate Gyrus
**INHIBITION**

- **Inhibition** is being able to stop when you should.
  - Behavioral brakes
  - A full working memory can cause dysinhibition, behavioral overflow
  - Intact inhibition, does not mean working memory is intact
  - Working memory can be intact, but attention span can undermine the skill set.

---

**INHIBITION**

- **CAN’T vs WON’T**
  - Inhibition is a have/have not ability.
  - This changes our view of intent: i.e., willful behavior.
  - This changes our view of goal directed behavior vs. planning and organization.
  - This changes our view of generalizing treatment gains in the office.

---

**INHIBITION**

- This is disorganized, nonself-directed behavior.
- “It’s as if that kid is run by a motor.”
- **Rigid Behavior**
  - The child does not have extra energy (ADHD), they are disorganized in the direction of their behavior.
INHIBITION

**Suggested Tests**
- NEPSY II – Statue
- TOL – 1st move
- GDS – Delay Task
- Observation on anything multiple choice

INHIBITION and LANGUAGE

Individuals with Attention Deficits and Spectrum Disorders struggle in social conversations

- Maintain and update information as conversation progresses
- INHIBIT distracting stimuli (external/internal) to stay on topic
- Formulate relevant ideas to respond appropriately to interlocutors

Games that require and develop Inhibition in young children

- Simon Says
- Mother May I?
- Slap Jack
- Red Light; Green Light
- Freeze Tag
- Musical Chairs
Chess can also be helpful to improve concentration and patience because the game requires constantly thinking about the next move.

- Draw analogies to chess and conversational skills
  - Being tuned-in to the other players move
- Responding to actions of other player; changing own plans

Other Games

- **Uno**: card-playing decisions, maintaining card depletion strategy, shifting to changes in the deck
- **Monopoly**: Purchasing decision; resisting impulsive buying
- **Ant Smasher app**: Don’t smash the bee!

Think or Say?: Developing the concept of a “Filter”
Commercial Games with Inhibition/Impulse Control in Mind

World of Ryuu. A must have if you work with HFA/AS
PLANNING and ORGANIZATION

- The direct result of a functioning working memory and inhibition system-future memory.

1. You have to keep things in mind to think.
2. You have to be able to think to plan.
3. You have to be able to plan to organize.
4. You have to inhibit extraneous behavior to think ahead.

Planning and Organization

- If you do not think ahead: how do you factor in consequences to behavior?
- If you don’t think ahead: how do you inhibit or direct your own behavior?
- If you don’t think ahead: how do you change behavior?
- If you don’t think ahead: how do you clean your room and do your homework?

Suggested Tests

- NEPSY II: Verbal Fluency (phoneme vs. semantic)
- TOL
- WISC V – Matrix Reasoning
Concept of Time: Time Management

- Predicting how long a task is really going to take. Evaluating how long it actually took.
  - Reference points that are meaningful: As long as my favorite TV show.
  - What does five more minutes REALLY mean?

Model and Structure a System

- Go clean your room!
  - vs.
  - First, pick up you stuffed animals and dolls
  - Second, pick up your dress-up clothes
  - Last, pick up your grocery and kitchen play toys
Providing as System: Visual, Consistent and Predictable

Developing early language organization skills as they relate to EF

- Verbal and Visual routines.
  - First, go potty
  - Second, brush your teeth
  - Third eat breakfast
  - Last, get dressed (may to expand order of operations)
    - What happens second?

- Novel plan of events for the day
  - First, we are going to baseball
  - Second, to McDonalds
  - Last, we are meeting friends at the park

Continued...

- Sorting/Categories
  - Silverware, cups, plates, etc.
    - Function of object: what are a spoon and fork for? A spoon and a fork are for __________?
    - Tell me something you can eat with a spoon: What might happen if you eat soup with a fork? (predicting outcomes and consequences)

- Categories
  - Shapes (tell me three things that are round)
  - Textures (tell me three things that are soft...what is the opposite of soft)
  - Rapid naming of items in a category

- Zones and Activity Set Up
  - Well defined areas for specific tasks
  - Painting project; craft project
    - Omitting a necessary object
Tools for Written and Verbal Expression

Descriptive Cue Cards  
Language Webs

CELF-5 Sentence Assembly commands
organization of language and flexibility
There are four possible constructions here. How quickly can you assemble four options? Or even two?

The student  the manager  an application  send  did

- Did the student send the manager an application?
- Did the manager send the student an application?
- The student did send the manager an application.
- The manager did sent the student an application.
TOLD-4: Relational Vocabulary

- Measures the ability to organize incoming language into categories

  Igloo and Teepee

  One point: homes, shelter, place to live, dwellings, houses, residence
  Query: Indians use them

Oral Vocabulary: using language to describe language

Sugar

What is sugar?
Tell me everything you know about sugar.

How are sugar and salt different? (hearing salt requires a shift in thought)

Language, subvocalizing specifically, can be effective in problem solving, logic, and reasoning tasks even if "nonverbal".
More Executive Functions & Attention

- Perception-Action Coupling
- Shift
- Sustain
- Encode

Perception-Action Coupling

- the ability to add a novel trait or behavior to a mastered or habituated behavior (i.e., the brain modifies what it knows).

Perception-Action Coupling

- Consolidation of procedural memory.
- Adaptability.
- Using old skills in new ways.
- Frees working memory/nimble thinking.
Perception-Action Coupling

- Requires flexibility in:
  - Allocation of attentional resources on a specific task
  - Reasoning
  - Speed of adjustment (Cognitive processing speed)
  - Fluency of thought
  - Skill integration

Suggested Tests

- Symbol Search
- WISC-V: Coding
- Trails A & B x5
- NEPSY-II: Visual Attention
- Rapid Naming (RAN) tasks: CTOPP-2; ELLA; WRMT-3

From the Emerging Literacy & Language Assessment® (ELLA)
SHIFT

- Using cues from the environment to direct one’s concept formation-problem solving appropriately.

SUGGESTS:
- Allocation of attentional resources.
- Concept formation.
- Inhibition.
- Cognitive flexibility.

ONLY TEST FOR SHIFT

WISCONSIN CARD SORTING TASK
SUSTAIN

- **Sustaining attention** is the ability to allocate attentional abilities as mediated by the frontal executive functioning system.
SUSTAIN

- Requires vigilance and inhibition from distractibility.
- Has a lot to do with arousal (reticular system).

SUSTAIN (allocation)

- Attention must be *sustained* internally. COGNITION

SUSTAIN (allocation)

- Suggested Tests
  - Gordon Diagnostic System
    - Vigilance
    - Distractibility

* Be careful of the stats.
Too many mental tabs are open. Must close several or minimize.

Student LISTENS to therapist call out digits and must add them and give verbal response.
- T: 1,3 S:4; T:2 S:5; T:2 S:4; T:5 S:7; etc....
- Student’s own voice becomes the distracter.
- Taps into WM, Attention, and Inhibition

ENCODE

- is the means by which one places information into memory for later recall.
  - Requires planning and organization.
  - Must be distinguished from storage or recall deficits.
ENCODE

- Requires
  - working memory
  - divided attention
  - language comp. (ex. Semantics)
  - planning
- Semantic Associations
  - increased retention

ENCODE

- Suggested Tests
  - WISC-V - Digit Span Forward
  - NEPSY-II - Faces
  - CVLT-C
    - SDFR vs. SDCR
    - LDFR vs. LDCR
  - NEPSY-II - Sentences
  - NEPSY-II - Narrative
  - WISC-V - Arithmetic
  - NEPSY-II - Comprehension of Instructions

EXECUTIVE FUNCTION and ATTENTION

- This system works immediately and simultaneously.
- A breakdown in any part of this system undermines optimal functioning.
- Becomes increasingly mediated by the frontal lobes with age.
- The importance of planning and language are often overlooked in memory recall tasks.
- You will recall more if you encoded Semantically.
Clinical Implications for the SLP

- Do not assume intact EF skills are “available” to compensate for weak language skills.

Successful use of compensatory strategies is largely dependent on the presence of intact EFs.

Clinical Implications for the SLP

- Expressive communication skills engage semantics and syntax, as well as EFs.
- Expressive Language skills particularly related to:
  - Planning and Organizing
  - Shifting
  - Monitoring
  - Initiating

EFs and Metalinguistic Awareness

Metalinguistic skills are also essential in the writing process for both initial production (composition) and later revision (editing), as writers choose words, analyze their communicative intent, and assess syntax for both functions.
Clinical Implications for the SLP

- Children with reduced expressive language skills may also have weak EF skills.
- Thus, SLPs should be involved in the assessment process and review of data process in regards to Executive Functions in addition to language to optimize therapeutic planning and outcomes.

Thank You for “Attending”

QUESTIONS?

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