ADHD and Executive Function Deficits: Linkage with Dyslexia

21st Annual State Dyslexia Summer Institute
Beyond Dyslexia: Looking at the Whole Child
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Do *you* have Executive Function deficits/skills?

- How did you get here today?
- Did you arrive on time?
- Your family wants to eat dinner at 6 and you are the cook... How do you get the food on the table in time?
- Someone cuts you off in a traffic lane (and of course your child is in the car)... What keeps you from yelling “#!##%$!??”
- The students in the next classroom are playing a loud game while you are writing a lesson, but you don’t hear it. Why?
- You accidentally bump into someone and apologize. Why?
Questions to consider...

• What are executive function deficits (or skills) and how do selected executive function processes affect school successes?
• How can educators begin to understand and informally assess students’ executive function processes?
• How can teachers address the needs of students with executive function weaknesses to both accommodate and teach necessary lacking skills?

What is Executive Functioning?

• Executive functioning is a term psychologists use to describe the many tasks our brains perform that are involved with planning, problem-solving and the very act of thinking itself.
• It is believed that the EF of the brain are primarily carried out in the pre-frontal lobes of the cerebral cortex which is the part of the brain that directs or conducts a number of skills required in daily life, such as planning, decision-making, self-monitoring/regulation, working, memory, motivation, and the entire problem-solving process along with self evaluation of the results.
• Often referred to as the “CEO of the brain”, EF is a set of mental processes that helps connect past experience with present action and as a result can have a major impact on student behavior and performance.
• “Despite the frequency with which it is mentioned in the neuropsychological literature, the concept of executive functions is one that still awaits a formal definition.” (Jurado & Rosselli, 2007, page 213.)
Executive Functioning

• McCloskey notes that it is important to distinguish between Executive Skills and Executive Functions.
• **Executive Skills** involve the use of neural networks routed throughout the brain to perform specific tasks (e.g., attending, inhibiting, modulating, planning, organizing, associating).
• **Executive Functions** involve the part of the executive network that is routed through the frontal lobes and that is used to cue, direct, and coordinate the use of executive skills and other mental capacities.

Executive Function Development

• McCloskey notes the some EF-based clinical syndromes, such as ADHD, demonstrate clear patterns of delayed developmental progression.
• McCloskey also notes that all individuals with ADHD exhibit EF deficits but not all individuals that exhibit EF deficits are ADHD.
Executive Functioning and ADHD

- EF and ADHD are not synonymous terms; rather ADHD is a condition involving EF deficits in:
  - Focus/Select, Sustain, Inhibit, Modulate
- Nearly all people with ADHD also have SELF-REGULATION difficulties; the nature of these additional difficulties is what makes ADHD so variable from one person to the next and what causes confusion in diagnosis. (McCloskey)

Characteristics of AD/HD

A **Chronic** disorder

Characterized by a PERSISTENT pattern of inattention and/or hyperactivity and/or impulsivity that interferes with functioning and development.
Characteristics of ADHD

Several inattentive or hyperactive-impulsive symptoms were present before age 12 and are present in at least 2 areas of life, such as Home, Social Settings, School or Work.

Symptoms have been present for at least 6 months

- To a degree that is inconsistent with developmental level
- Negatively impacts social and academic/occupational activities.

Russell Barkley and Executive Functioning

What we know about the brain and EF...

Four circuits in the brain relate to executive functioning:

- The “What” Circuit – goes from the frontal lobe back to the basal ganglia, particularly a structure called the striatum. The “What” Circuit is linked to working memory, so it’s in this circuit that what we think starts to guide what we do.

- The “When” Circuit – goes from the same prefrontal area back to the cerebellum, located at the very backmost part of your head. The “When” Circuit is the timing circuit of the brain and coordinates not just how smooth behavior will be and the sequence of behavior, but also the timeliness of your actions and when you do certain things.
Russell Barkley and Executive Functioning
What we know about the brain and EF...

• The “Why” Circuit – also originates from the frontal lobe and goes through the central part of the brain – anterior cingulate – to the amygdala – the gateway to the limbic system. This “hot” circuit is linked to our emotions where what we think controls how we feel, and vice versa. It is the final decision maker in all our plans.

• The “Who” Circuit – goes from the frontal lobe to the very back of the hemisphere. It is where self-awareness takes place – where we are aware of what we do, how we feel (both internally and externally), and what is happening to us.
Russell Barkley and Executive Functioning

- Knowing what parts of the brain control executive functions, Barkley defines Executive Functioning this way...

  "Broadly speaking, executive function refers to the cognitive or mental abilities that people need to actively pursue goals. In other words, it's about how we behave toward our future goals and what mental abilities we need to accomplish them. The term is very closely related to self-regulation. Executive functions are things you do to yourself, in order to change your behavior. By employing your executive functions effectively, you’re hoping to change your future for the better.”

7 Executive Function Deficits Tied to ADHD

1. **Self-awareness**: self-directed attention
2. **Inhibition**: also known as self-restraint
3. **Non-Verbal Working Memory**: self-directed sensing; the ability to hold thing in your mind. Essentially, visual imagery – how well you can picture things mentally.
4. **Verbal Working Memory**: self-speech, or internal speech. Most people think of this as their “inner monologue.”
5. **Emotional Self-Regulation**: the ability to take the previous 4 EFs and use them to manipulate your own emotional state. This means learning to use words, images, and your own self-awareness to process and alter how we feel about things.
6. **Self-Motivation**: how well you can motivate yourself to complete a task when there is no immediate external consequence.
7. **Planning and Problem-Solving**: also referred to as “self-directed play.” How we play with information in our minds to come up with new ways of doing something. By taking things apart and recombining them in different ways, we’re planning solutions to our problems.
Executive Functioning and ADHD

“Executive Functions are those actions we perform to ourselves and direct at ourselves so as to accomplish self-control, goal-directed behavior, and the maximization of future outcomes.”

Russell Barkley

Brown’s Model of Executive Functions
Impaired in AD/HD

Executive Functions
(work together in various combinations)

1. Activation
2. Focus
3. Effort
4. Emotion
5. Memory
6. Action

Self Talk – Self Action

For chronic problems with:
• Regulating actions
• Jumping into conversations
• Jumping to conclusions too quickly
• Failure to notice others reactions as a stop mechanism for behavior or action

It may be necessary to develop strategies to:

1. **STOP** → **Listen** → **Think** → **Respond**
2. **STOP** → **Observe** → **Think** → **Act**

Or

Dendy’s Components of Executive Function based on the work of Barkley, Brown, and Gioia

1. **Working memory and recall** – holding facts in mind while manipulating information; accessing facts stored in long-term memory; includes an impaired sense of time
2. **Activation, arousal, and effort** – getting started; paying attention; finishing work
3. **Controlling emotions** – ability to tolerate frustration; thinking before acting or speaking
4. **Internalizing language** – using “self-talk” to control one’s behavior and direct future actions
5. **Taking an issue apart, analyzing the pieces, reconstituting and organizing it into new ideas** – complex problem solving
6. **Shifting, inhibiting** – changing activities, stopping, existing activity, stopping and thinking before acting or speaking
7. **Organizing/planning ahead** – organizing time, projects, materials, and possessions
8. **Monitoring** – self-monitoring and prompting
Common Academic Problems Linked to ADHD and Executive Function Deficits

- Many students with ADHD have **impaired working memory** and some also have **slow processing speed** both of which are critical elements of EF
- **Written expression** is the most common learning problem among students with ADHD (65% - study by Mayes and Calhoun)
- **Memorizing multiplication tables** or **working math problems**
- Two-thirds of children with ADHD have at least one other **co-existing problems** such as learning disorders, depression, or anxiety

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Co-Existing Disorders

- **AD/HD alone** 30%
- **Learning & Language Disorders** Up to 50%
- **Tourette Syndrome** 7%
- **Oppositional Defiant Disorder** 40%
- **Depression** 10% - 30% Children 47% Adults
- **Conduct Disorder** 25% Children 45% - 50% Adol.
- **Anxiety Disorder** 30% Children 25% - 40% Adults
- **Bipolar Disorder** Up to 20%

NIMH, MTA Study
What EF Deficits Can Look Like in Students
Adapted from Table 4.2, “Executive Function in the Classroom” - Christopher Kaufman

<table>
<thead>
<tr>
<th>EF Domain</th>
<th>What Teachers Might See...</th>
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<tbody>
<tr>
<td>Goal-directed Attention</td>
<td>• Trouble sustaining attention doing something does not like</td>
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<td></td>
<td>• Distracted easily by other things going on in class</td>
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<td></td>
<td>• Distracted easily by daydreams or stray thoughts</td>
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<td></td>
<td>• Needs lots of reminders to stay on task and focused</td>
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<td></td>
<td>• Complains of difficulty staying on task</td>
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<td>• Trouble reading connected text, with oral reading fluency impacted by leaving out words or making changes, even though single-word decoding not an issue*</td>
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<td>• May skip whole line of text when reading aloud, without noticing*</td>
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<td></td>
<td>• Math errors seem to be “careless” ones done often</td>
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<tr>
<td></td>
<td>• Mechanical errors in written work also seem frequent and “careless”</td>
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<td>*May also show trouble with working memory or self-monitoring</td>
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<tr>
<td>Goal Setting</td>
<td>• Trouble setting long-range goals</td>
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<td>Decision Making</td>
<td>• Seems to live moment to moment</td>
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<td>Prioritizing</td>
<td>• Responds to what is happening in the immediate environment, not to inner direction</td>
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<td></td>
<td>• Needs major support and direction with long-term projects, such as a research paper</td>
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<td>• Requires lots of support when making decisions in the classroom</td>
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<td>• In more unstructured academic settings, such as at the library or in art class, not well-focused about decisions to make and directions to take</td>
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<td></td>
<td>• Finds it difficult to know where to start with assignments</td>
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<td></td>
<td>• Runs out of time when completing work because has trouble prioritizing what should be done first and then next, and with how much time to devote to each section</td>
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| Planning                         | • Obvious and consistent lack of planning with class work and homework  
| Organization                     | • Written work in need of flow and organization, as opposed to random unconnected thoughts  
| Sequencing                       | • Considerable problems when assignments require planning  
|                                  | • Loses track of assignment sequencing and details  
|                                  | • Finds it hard to chunk large assignments, breaking them down into more doable blocks  
|                                  | • Becomes overwhelmed by assignments or jobs that others would find easy to do if organized  
|                                  | • Struggles to solve math problems because has trouble following sequenced steps of operation  
|                                  | • Reading comprehension problems because has trouble with holding on to important details in the correct sequence of events, and so struggles to comprehend the main points                                                                                                                                 |
| Task Initiation                  | • Trouble starting tasks, seen in different academic settings - Ask “if worse in some settings than others, what aspects of the settings in which the child particularly struggles seem poorly aligned to his/her needs?”  
|                                  | • Seems paralyzed about starting a task – may say he knows what to do, but can’t take the first step toward doing it  
|                                  | • If given help starting, often does fine with completing task successfully                                                                                                                                                                                                                               |
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<td>Task Persistence</td>
<td>• Starts OK but runs out of steam before finishing and stops working; can’t sustain effort</td>
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<td>• Even when written work is planned and sequenced OK, there is not much of it</td>
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<tr>
<td>Problem Solving</td>
<td>• Even though seems to get enough sleep at home, gets drowsy in class, especially in the afternoons</td>
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<td>• Requires lots of teacher prompting to continue working</td>
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<td></td>
<td>• Cannot apply problem-solving skills independently, even when faced with minor difficulties</td>
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<td>• Stops working without individualized or consistent help</td>
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<th>Time Management</th>
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<td></td>
<td>• Usually struggles with figuring out how much time will be needed to complete a task - “I didn’t realize it would take so long”</td>
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<td>• Needs more time than peers to complete the same assignment/task</td>
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<td>• Often surprised or upset to learn something is due – “You mean the test is today?!”</td>
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<td></td>
<td>• Can tell time but loses track of it</td>
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<td>Self-Monitoring</td>
<td>• Written work has many mechanical errors, including misspellings</td>
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<td>• Leaves out small function words in writing [such as “the” or “an”]</td>
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<td>• Unwilling to edit own writing</td>
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<td></td>
<td>• When reading out loud, often inserts words or deletes them</td>
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<td></td>
<td>• When reading out loud, tends to skip entire lines of text and doesn’t notice</td>
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<td></td>
<td>• In math work, will make “careless” errors [such as misreading operation signs]</td>
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<td>• Does not appear to “see” errors in work and is surprised when they are pointed out</td>
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<td>Working Memory</td>
<td>• Cannot remember or follow multi-step directions</td>
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<td>• Loses train of thought when talking</td>
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<td></td>
<td>• Forgets details of what was read son after</td>
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<td>• After reading something can answer literal questions but has difficulty remembering more complex details and with making predictions/inferences</td>
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<tr>
<td></td>
<td>• Loses track of what was looking for</td>
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<td></td>
<td>• Will start writing but forget what wanted to say</td>
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<td></td>
<td>• May spell words OK in isolation but cannot transfer that to written work</td>
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<tr>
<td></td>
<td>• Math errors show pattern of forgetting wholly or partly the steps needed to solve problems</td>
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## EF Domains

### What Teachers Might See

#### Shifting Adaptability
- Low tolerance for changes in routine
- Gets stuck on one topic or activity and resists stopping until done with it
- Has patterns of actions or behaviors in social settings and does not want to change them, even with encouragement
- Cannot come up with more than one way to solve a problem

#### Impulse Control (Response Inhibition)
- Blurs out in class
- Impetuously says or does things, then expresses regret or remorse
- Often says or does things that embarrass others
- Repeatedly acts as though does not have any thought filters
- Will frequently deny responsibility for behavior, even when caught in the act ["It wasn’t me, I swear!"]
- Cannot explain behavior ["I don’t know why I tripped him, I just did it."]
- When reading out loud, will guess at words based on the first letter or two, rather than reading through the word
- When reading out loud, often will insert words not in the text
- In math, will frequently give an answer without thinking through the required process or applying problem-solving skills
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<td>Emotional Control</td>
<td>• Overreacts to small problems that would not bother peers</td>
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<td>• Shows excessive response to situations, often crying or whining or acting out of control</td>
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<td>• Becomes easily upset or angered by what others are doing</td>
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<td>• When angry, can become verbally and physically aggressive</td>
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<td></td>
<td>• Can appear swamped by both positive and negative emotions</td>
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<td></td>
<td>• Usually expresses remorse after showing anger and/or aggression</td>
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Helping Students with EF Issues

• McCloskey states that cognitive strategies, such as planning and organizing, can be taught – “Executive awareness is awareness of awareness.”

• Student should be aware that he/she has EF difficulties and should be taught strategies to cope and compensate for any deficits – if student is not aware of this he does not know how to modulate himself and keeps getting into trouble.
Make the learning process as concrete and visual as possible!

**Written Expression:**
- Dictate information to a “scribe” or parents
- Use graphic organizers to provide visual prompts
- Use “post-it” notes to brainstorm essay ideas

**Math:**
- Use a peer tutor
- Use paired learning – teacher explains problem, students make up their own examples, swap problems, and discuss answers

**Memory:**
- Use mnemonics (memory tricks), such as acronyms or acrostics, e.g., HOMES to remember names of the Great Lakes
- Use “visual posting” of key information on strips of poster board
- Consider “Times Alive” to assist with memorizing multiplication tables

**Modify teaching methods**
- Use an overhead projector to demonstrate how to write an essay
- Use color to highlight important information
- Use graphic organizers to help students organize their thoughts
Collection of Favorite School Success Strategies for Working with EF Issues

Memory – cont’d.:

• Modify testing and grading
  • Give extended time on tests
  • Divide long-term projects into segments with separate due dates and grades
  • Average two grades on essays – one for content and one for grammar

• Modify level of support and supervision
  • Appoint “row captains” to check to see that homework assignments are written down and later turned in to the teacher
  • Increase the amount of supervision and monitoring for these students, if they are struggling

• Use technology
  • Use a computer as often as possible
  • Use software to help teach skills

In closing...

“By closely watching a child’s behavior and studying work samples, you may gain important insights into the scope and severity of the struggles, which may have clear implications for possible interventions strategies.”

Kaufman, 2010
Resources

- Assessment and Intervention for Executive Function Difficulties by George McCloskey, Lisa A. Perkins, Bob Van Diviner. 2009
- Promoting Executive Function in the Classroom by Lynn Meltzer, 2010.
- Executive Function in the Classroom by Christopher Kaufman,