2 Impairments in Executive Functioning

This chapter, rather than focusing on *brain-based disciplines* (Denckla, 2007), will be looking at *executive function* (EF) as it relates to educational and behavioral performance (e.g., how delays in EF impacts planning, organization, study skills, and self-monitoring/checking skills). These terms are familiar to educators and are recognized from literature on learning disabilities.

Why Spend So Much Time on Executive Function?

> *I sometimes forget to turn in my homework. Am I stupid? My science teacher told the class that, I always had an excuse for doing poorly in his class because I had ADHD, but the rest of you don't. My teacher thinks I don't care and I use ADHD as an excuse.*
>
> —Ryan, eighth-grade student

First, the authors of this book feel strongly that teachers often do not understand or recognize the role that EF plays in ADHD behavior. Executive function deficit (EFD) is commonplace in people with ADHD and can play an important role both in academic and behavioral performance in school. Because deficits in EF are often present in children with ADHD, it is very important that educators understand this close association between ADHD and EF.

Second, educators, because of misinformation, can contribute to an atmosphere where children with ADHD are

> in danger of being emotionally traumatized by being called lazy, unmotivated, irresponsible, and other such words implying moral turpitude instead of neurodevelopmental disability or immaturity. Probably the greatest value in recognizing the neurodevelopmental/neurocognitive domain called EF is to protect a sizable minority of children from being traumatized by what amounts to adult name-calling. (Denckla, 2007, p. 15)

What Is Executive Function?

The term *executive function* has been familiar to those who were trained in adult-oriented behavioral neurology for a number of years; however, in the 1980s, writers, such as Russell Barkley, were beginning to write about deficient executive function or its dysfunction as central to the meaning of the syndrome of ADHD (Barkley, 1997). Behavioral neurologists and neuropsychologists were captured by the term EF in the 1990s, and research continues to investigate the role of EF in ADHD and other neurodevelopmental disorders (Denckla, 2007).

Role of Executive Function as Related to ADHD

When reviewing the role of EF as related to ADHD, we have drawn primarily on the EF writings from two distinguished authorities on ADHD: Russell Barkley, PhD, and Thomas Brown, PhD. Barkley and Brown have researched and written extensively on this disorder, and both are internationally recognized experts on ADHD. We recommend that the reader refer to *Executive Function in Education: From Theory to Practice,* edited by Lynn Meltzer (2007), for a more complete introduction to EF as related to learning disabilities and other neurodevelopmental disorders.

Snapshot Overview of Executive Function Processes

Before reviewing Dr. Barkley's and Dr. Brown's ideas on EF, we will present a snapshot look at the primary EF processes (Meltzer & Krishnan, 2007, p. 74).

- Selecting relevant task goals
- Planning and organizing information and ideas

- Prioritizing and focusing on relevant themes rather than irrelevant details
- Initiating and sustaining activities
- Holding information in working memory
- Shifting strategies flexibly
- Inhibiting competing actions
- Self-monitoring, self-checking, and self-regulating behavior

Children with ADHD can exhibit weaknesses in many of these processes.

Deficit in Behavioral Inhibition

Russell Barkley

Barkley (1997) sees behavioral inhibition as the leading function in the chain of events provided by the EFs. Without proper functioning in behavioral inhibition, the EFs cannot occur without interference.

The term *EFs* refers to an individual's self-directed actions that are used to help that person regulate his or her behavior, that is, actions a person performs that help him or her exert more self-control and better reach his or her goals. EFs represent the internalization of behavior that helps us anticipate changes in the environment and events that lie ahead in time. It provides a sense of readiness, the ability to inhibit habitual responses, delaying gratification, and adjusting ones actions to changing conditions. It is, in some ways, a cognitive process that serves as a kind of supervisor or scheduler that helps one select a strategy to integrate information from different sources.

Affected children often do not exert self-control in reaching important goals, for example, putting off watching their favorite TV program so they can study and pass an important test the next day. Typical children will put off watching their favorite TV program to study if they know they have an exam the next day. On the other hand, children with ADHD are often driven by immediate gratification and will watch the TV program, test or no test; they do not take time to measure the consequences of their choices. Many children with ADHD show an aversion to delay, showing preferences for small and more immediate rewards compared to larger, delayed rewards (Doyle, 2006). For this reason, many classroom reward systems that include a long span of time before earning a reinforcer are not effective for children with ADHD. An unaffected child understands the need to reach the long-term goal of getting a good grade, which becomes more important than the immediate gratification of watching a favorite TV program.

Components of Executive Function

Barkley's (1997) model suggests six components of EF. He considers four of the EFs to be covert, self-directed forms of behavior that yield information that is *internally* represented and exerts a controlling influence over the sixth component of the model—the *motor control and execution* system. Barkley suggests that in the ADHD population, these functions are impaired.

Component 1

Behavioral inhibition is the foundation of executive function—the reference point on which the next four components (numbers two through five) are dependent.

Component 2

Nonverbal working memory helps us guide behavior across time toward a goal—ability to maintain internal representations of sensory-motor information (holding events in mind, sense of time and imagination, hindsight and forethought).

These children will have a difficult time in a classroom without structural classroom support, such as an agenda and a regular classroom routine, because of their struggle with the sense of time. These children will often repeatedly ask when reading or recess will occur. Without a clear sense of time and what happens next, students cannot particularly guide their behavior toward a goal because their hindsight, what occurred yesterday at this time, and forethought, what might happen next, may be affected. These children seem to spin their wheels in the classroom but not get anything done because of this lack of clear structure. They are often touching things and moving about in an attempt to overcome their lack of ability to maintain internal representation of sensory motor information.

Component 3

Internalization of speech (verbal working memory) means for an individual to describe or reflect on an event before responding to it, central to development of rule-governed behavior.

These children often blurt out the answer without thinking or waiting for a prompt to answer. Part of this "rude" behavior comes from the children's own recognition that in a moment the thought will no longer be in their memory. They also do not maintain an internal dialogue that helps them reflect and think about consequences before acting on a thought. Their behaviors seem erratic, and they do not seem to learn from

their mistakes. Regular classroom punishment is not very effective for children who struggle to develop these rule-governed behaviors because they do not use the process that most go through in thinking out, through internal conversation, the consequences and then developing alternate more appropriate behaviors. This cause-and-effect kind of thinking that is developed through the internalization of speech will have a significant effective on reading comprehension and the development of moral reasoning.

Component 4

Self-regulation of affect, motivation, and arousal means not reacting on emotion but evaluating events rationally, then reacting.

These children are a bundle of emotion and struggle significantly with emotional competence. According to Hooper and Umansky (2004), emotional competence has three parts including (1) emotional expression, (2) emotional understanding, and (3) emotional regulation. Affected children can struggle with emotional regulation and/or choosing an emotion that is appropriate for a particular situation. Asking them to project and determine how the other child might feel after an altercation may seem an impossible task—often leading caretakers to express that these children seldom say they are sorry. These children will struggle with the process steps necessary prior to reacting emotionally to a situation (Denham, 1998). Typically, developing children will first take notice of an emotion; second, they will consider what the emotion means to them; and finally, they'll choose an appropriate response. For ADHD-affected children who struggle with this area of EF, the process can fall apart at any of these three stages.

Component 5

Reconstitution is analysis, goal-directed behavior, flexibility, and promotion of problem solving and creativity.

These children, because of delays in EF, will often struggle with viewing new situations or new learning from a variety of perspectives. Analytical thinking, when not supported by graphic organizers to manage and organize thoughts and concepts, can be very difficult for children with ADHD. Without support to see how concepts, actions, and content are related and then internalized, goal-directed behavior becomes a struggle. These students seem to exhibit haphazard behaviors that do not seem to have any rhyme or reason because of their difficulties with structured problem-solving processes, often leading teachers and parents to comment that they "don't seem to learn from their mistakes."

Component 6

Behavioral inhibition, along with components two through five, exerts a controlling influence over the sixth component of Barkley's model, the *motor control and execution system.*

Studies measuring fine motor coordination, such as balance, pencil-and-paper mazes, and fine motor gestures, often find children with ADHD to be less coordinated in these areas (Mariani & Barkley, 1997). Handwriting is an example where flexibility and fluency of fine motor movement are built on complex arrangements of letters, words, and sentences. Speech is another example where assembly of complex fine motor sequences is important to articulate language. Children affected by ADHD are more likely than unaffected children to have speech problems (Barkley, 1997).

Executive Functions Work Together in Various Combinations

Thomas Brown

Like Barkley, Thomas Brown (2008) views attention as an "incredibly complex and multifaceted function of the mind," and "it plays a critical role in what we perceive, remember, think, feel, and do. And it is not just one isolated activity of the brain" (p. 12). Brown sees attention as "essentially a name for the integrated operation of the executive functions of the brain" (p. 12).

Brown (2008) views EFs as operating in an integrated way, and most people diagnosed with ADHD show impairment in some aspects of the six clusters he describes under the heading "Executive Functions Impaired in ADD Syndrome" in his article for *Attention* magazine (pp. 12–17).

Cluster 1: Organizing, Prioritizing, and Activating for Tasks

- Have difficulty getting started on tasks (completing homework assignments, doing chores or classroom assignments)
- Procrastinate, particularly with tasks not intrinsically interesting
- Have difficulty attending to what is most important to attend to (working on the history paper due the next day rather than playing Sudoku on the computer)
- Often fail to notice critical details (putting name at top of paper, noticing + versus – in a math quiz)
- Have difficulty figuring out how long a project will take or prioritizing and putting some items ahead of others

These children's problems with organization and prioritization are often the first to spark awareness that they may have ADHD. These are the children who have a backpack that can be referred to as "the black hole." This mess is because of the children's difficulty with identifying what is most important. The backpack contains important papers along with trash because the children are unable to determine which does and does not have importance. These children are not self-starters and will be seen sharpening their pencils, taking trips to the Kleenex box, trips to the restroom, and any number of other delay tactics to keep from beginning the task at hand. This procrastination accounts for many incomplete assignments and an inordinate amount of homework. These children cannot realistically determine how long a new task will take, usually underestimating the time needed, and they do not have the ability to prioritize tasks. Feeling overwhelmed and not having strategies to break the tasks into "doable parts," children will often give up before they even start. This, in addition to frequent negative feedback because of the failure to notice critical details, makes this area of weakness one that often makes children with ADHD failures in school.

Cluster 2: Focusing, Sustaining, and Shifting Attention to Tasks

- Have difficulty sustaining attention on a task long enough to complete it
- Have difficulty with selective attention (listening on the telephone or the words printed on a page)
- Have difficulty not being drawn away from a project by distractions (both internal and external)
- Have difficulty ignoring a myriad of thoughts, background noises, or room distractions (child walking down the aisle, pencil dropping on the floor)
- Are unable to stop focusing on one thing so they can redirect their attention to what is important ("locking on" to a sound on the radio when driving and not looking ahead or paying attention to the traffic)

These children pay attention to everything. Their lack of ability to attend to the important information leads them to become distracted by the noises in the hallway, the clothes the teacher is wearing, the seam of their socks on their toes, the conversation of students in the next row, the buzz of the lights, and the hum of the overhead projector fan, just to name a few. They are also bombarded by racing thoughts that compete with the important information that the teacher is sharing. These children have a very difficult time keeping their thoughts on a task long enough to complete it when there are so many other things vying for their attention.

Cluster 3: Regulating Alertness, Sustaining Effort, and Processing Speed

- Have difficulty keeping their eyes open when they have to sit still and be quiet, especially pronounced when the classroom teacher uses a lecture format to present information (Fatigue is suggested to be caused by chronic difficulties in sustaining attention.)
- Have difficulty getting a good night sleep (Affected children have difficulty settling into sleep even when they are tired and want to go to sleep.)
- Have difficulty completing certain school tasks because of slow processing speed (They will complain it takes them a particularly long time to read and write.)
- Have difficulty using a processing speed that is not too slow or too fast (When too fast, they often perform poorly because of carelessness and not attending to details.)

These children are often seen as the lazy and unmotivated students who have difficulty paying attention in class. They are often perceived as sleepy and bored. Although their fatigue may be organic, the lack of engaging instruction and the requirement to sit silently exacerbates the problem. These same students, even when alert and engaged, struggle with completing tasks because of much slower processing speeds, making assignment completion more difficult.

Cluster 4: Managing Frustration and Modulating Emotion

- Have "very low thresholds for frustration and chronic difficulty in regulating subjective emotional experiences and expression" (Brown, 1998, p. 15)
- Have disproportionate emotional reaction to frustration, short fuse, and low threshold for irritability
- Have emotions flooding their minds, leaving little room for any other thought
- Displace thoughts or feelings when in a high emotional state
- Are overly sensitive and react strongly to even minor slights or criticism
- Have chronic problems managing frustration and other emotions

These children are an emotional wreck. They are often perceived as having anger issues by their teacher and parents. They do not have the internal speech to regulate their behaviors or to determine appropriate

emotional responses. They cannot identify the emotions of others while they are in a high emotional state. Because of the difficulties with emotional regulation, they do seem overly sensitive and very reactive. With this said, they do know what to do; they just have great difficulty doing it. These children often get labeled as "bad kids," when it really is a problem centered on developmental delays in self-regulation.

Cluster 5: Utilizing Working Memory and Accessing Recall

- Have difficulty with memory—impairments in working-memory, holding one bit of information active while working with another (remembering a telephone number you just heard so you can call the number)
- Have difficulty with communication (expressive and receptive aspects) because of working memory impairments
- Have difficulty retrieving information from long-term memory
- Have difficulty with proper functioning of working memory (important component in mastering many school academic core areas like reading, math, and written expression)

These children are significantly impacted by problems related to working memory. They frequently *forget* what they are supposed to do next, they *forget* to turn in their homework, and they *forget* important information while taking notes and taking tests. The difficulties with holding onto information in short-term memory keeps them from being able to affectively take notes and answer questions in class when they have to wait to respond or hold some of the information in working memory while they finish writing their notes. The difficulty with retrieving information from long-term memory has catastrophic impact when students are required to pass high-stakes tests to earn a high school diploma or graduate. The performance inconsistency that comes from not being able to retrieve what they know on command is extremely debilitating and causes many of the academic failures that these students experience. In addition to the academic effects of weaknesses in this area, the struggles with communication affecting their ability to express themselves appropriately and to understand the communication of others has serious implications on social skills development and competency.

Cluster 6: Monitoring and Self-Regulating Action

- Have difficulty slowing down and controlling their actions (act without much forethought, can be restless and hyperactive)

- Have difficulty "holding back" and getting started—"Most behaviors require the ability to act, to 'do it,' as well as the ability to inhibit, to refrain from acting" (Brown, 2008, p. 17).
- Have difficulty measuring or assessing the expectations to behave appropriately in social situations
- Have difficulty making thought-out responses rather than random decisions (series of guesses)
- Are excessively "focused on how others are reacting and are excessively self-conscious" (Brown, 1998, p. 17) (These children can be very shy, too inhibited, and resistant to group activities.)

These children can be the ones that teachers very quickly identify as having ADHD. Their constant restlessness and purposeless activity quickly catches the teacher's attention. These children may struggle with social situations because their lack of control keeps other children from wanting to play with them. They are emotionally volatile and struggle with empathetic thinking. They do not have a plan when dealing with others or their emotions making them a "loose cannon" on the playground. Academically, they lack a plan of action and rely on guesses and luck to do well in school. Without a specific plan or sequence of activities established, they struggle with getting started or completing work. Some students are so keenly aware of how they struggle with social skills that they are resistant to social situations and suffer from extreme social isolation.

Source: Attention Magazine, February 2008: Article by Thomas Brown, Executive Functions: Describing Six Aspects of a Complex Syndrome, pp. 12–17.

Summary

Barkley and Brown both seem to suggest that EF is an "umbrella term," as suggested by one writer, that incorporates a collection of interrelated processes responsible for goal-directed and purposeful behavior (Meltzer, 2007, p. 79).

Barkley and Brown propose that in affected children, those self-monitoring and self-regulating tasks important for educational and social adjustment are often delayed or impaired because of neurodevelopmental delays in EF. Educational and positive peer relationships both depend to a large degree on proper functioning of EF. Table 2.1, Executive Function and Areas Affected (page 28), shows the areas of learning and social development associated with each cluster.

It should be noted, however, that when assessing EFs in preschool children, there is general debate about whether preschoolers do in fact display specific deficits in EF. One reason for the debate is that in very young

children EFs may be inadequately developed. However, differences in EFs become more apparent with increasing age. Even though it is apparent that very young children can have substantial ADHD symptoms, it's possible that the executive model may not be applicable to this young age group (*Current ADHD Insights*, 2004). Also, there have been minimal studies looking at EF in the preschool population (Doyle, 2006).

An important contribution to academic and social-emotional adjustment in affected children depends to a large degree on providing academic accommodations and behavioral interventions to minimize core ADHD symptoms. As much as parents and teachers wish that the affected child be more self-directed, be a self-stopper, or be a self-starter, children with ADHD are challenged in all three behavior areas largely because of developmental delays in EFs. The school counselor can play a very important role by helping teachers and parents better understand this important contributor to the child's performance. Equally important, for the school counselor, is to advocate educational and behavioral accommodations in the school setting.

In conclusion, even though the authors recognize the very important role EF plays in affected children's school performance, we also recognize that many other factors can have impact on children's motivation and focusing. There is little debate that EF plays an important role in affected children's learning and behavior; however, we suggest that *important* is not *exclusive,* and we encourage the reader to be open to other factors that may be impacting affected children's educational performance. As we emphasize throughout the book, academic and behavioral interventions need to be tailored to each child, and a cookbook approach to student interventions often falls short in meeting a child's needs.

Table 2.1 Executive Function and Areas Affected

Cognitive Cluster	Executive Function	Areas Affected
Activation	Organizing Prioritizing Initiating Planning Strategizing Sequencing	Writing long-term projects Math word problems
Focus	Focusing Sustaining attention Shifting attention	Shifting between tasks Transitions Math word problems
Effort	Regulating alterness Sustaining speed Processing speed Pacing Managing time Resisting distraction	Reading comprehension Long-term projects
Emotion	Managing frustration Regulating emotions	Shifting between tasks Playing games Social skills Impulsivity
Memory	Utilizing working memory Accessing recall	Reading comprehension Math word problems
Action	Monitoring action Self-regulating action Inhibiting	Long-term projects Playing games Social skills Impulsivity