

5 Components of Executive Function

and how they impact school performance

PARENTS AND TEACHERS are often baffled when students with AD/HD, including those who are intellectually gifted, teeter on the brink of school failure. Recently, researchers may have solved part of this challenging puzzle: deficits in critical cognitive skills, known as *executive function*, may interfere with a student's ability to succeed in school. Practically speaking, executive function deficits may cause problems for students with AD/HD in several important areas: getting started and finishing work, remembering homework, memorizing facts, writing essays or reports, working math problems, being on time, controlling emotions, completing long-term projects and planning for the future.

Although scientists have not yet agreed on the exact elements of executive function, two AD/HD researchers, Dr. Russell Barkley and Dr. Tom Brown, have given us insightful working descriptions. Dr. Barkley describes executive function as 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." Through use of a metaphor, Dr. Brown gives us a helpful visual image by comparing executive function to the conductor's role in an orchestra. The conductor organizes various instruments to begin playing singularly or in combination, integrates the music by bringing in and fading certain actions, and controls the pace and intensity of the music.



by Chris A. Zeigler Dendy, M.S.

Although the impact of executive function deficits on school success is profound, this fact is often unrecognized by many parents and teachers. I learned the hard way with my own son that a high IQ score alone was not enough to make good grades. Early in my son's academic career, I knew something was interfering with his ability to do well in school. But it wasn't until Dr. Barkley identified the central role executive function plays in school success, that I finally understood why school was so difficult for him.

Components of Executive Function

Based upon material from Barkley and Brown, I have outlined five general components of executive function that impact school performance:

When deficits in executive function and related learning problems are present, students can try their very best and still not succeed in school.

- **Working memory and recall** (holding facts in mind while manipulating information; accessing facts stored in long-term memory).
- **Activation, arousal and effort** (getting started; paying attention; finishing work).
- **Emotion control** (ability to tolerate frustration; thinking before acting or speaking).
- **Internalizing language** (using "self-talk" to control one's behavior and direct future actions).
- **Complex problem solving** (taking an issue apart, analyzing the pieces, reconstituting and organizing it into new ideas).

Let's take a more in-depth look at the first element of executive function—deficits in working memory and recall—and their impact on schoolwork.

Poor Working Memory and Recall

Affects the here and now:

- limited working memory capacity
- weak short-term memory (holding information in mind for roughly 20 seconds; capacity—roughly the equivalent of seven numbers)
- forgetfulness—can't keep several things in mind

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As a result, students:

- have difficulty remembering and following instructions
- have difficulty memorizing math facts, spelling words and dates
- have difficulty performing mental computation such as math in one's head
- forget one part of a problem while working on another segment
- have difficulty paraphrasing or summarizing

Affects their sense of past events:

- difficulty recalling the past

As a result, students:

- do not learn easily from past behavior (limited hindsight)
- repeat misbehavior

Affects their sense of time:

- difficulty holding events in mind
- difficulty using their sense of time to prepare for upcoming events and the future

As a result, students:

- have difficulty judging the passage of time accurately
- do not accurately estimate how much time it will take to finish a task; consequently, they may not allow enough time to complete work

Affects their sense of self-awareness:

- diminished sense of self-awareness

As a result, students:

- do not easily examine or change their own behavior

Affects their sense of the future:

- students live in the present—focus on the here and now
- less likely to talk about time or plan for the future

As a result, students:

- have difficulty projecting lessons learned in the past, forward into the future (limited foresight)
- have difficulty preparing for the future

Common Academic Problems Linked to AD/HD and Executive Function Deficits

Many students with AD/HD have impaired working memory and slow processing speed, which are important elements of executive function. Not surprisingly, these skills are critical for writing essays and working math problems.

A recent research study by *Mayer and Calhoun* has identified written expression as the most common learning problem among students with AD/HD (65 percent). Consequently, writing essays, drafting book reports or answering questions on tests or homework is often very challenging for these students. For example, when writing essays, students often have difficulty holding ideas in mind, acting upon and organizing ideas, quickly retrieving grammar, spelling and punctuation rules from long-term memory, manipulating all this information, remembering ideas to write down, organizing the material in a logical sequence, and then reviewing and correcting errors.

Since learning is relatively easy for most of us, sometimes we forget just how complex seemingly simple tasks such as memorizing multiplication tables or working a math problem really are. For example, when a student works on a math problem, he must fluidly move back and forth between analytical skills and several levels of memory (working, short-term and long-term memory). With word problems, he must hold several numbers and questions in mind while he decides how to work a problem. Next, he must delve into long-term memory to find the correct math rule to use for the problem. Then, he must hold important facts in mind while he applies the rules and shifts information back and forth between working and short-term memory to work the problem and determine the answer.

To further complicate matters, other serious conditions may co-occur with AD/HD. According to the recent landmark National Institute of Mental Health multi-modal study on AD/HD (1999), two-thirds of children with AD/HD have at least one other co-existing problem, such as depression or anxiety.

Accommodating students with complex cases of AD/HD is critical! These children are at greater risk than their peers for a multitude of school problems, for example, failing a grade, skipping school, suspension, expulsion and sometimes dropping out of school and not going to college.

Favorite School Success Strategies

Over the years, I have collected several favorite teaching strategies and accommodations that work well for students with AD/HD. Here are just a few of those tips:

General teaching strategies

- Make the learning process as concrete and visual as possible.

Written expression

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

Math

- Use paired learning (teacher explains problem, students make up their own examples, swap problems and discuss answers).
- Use a peer tutor.

(After barely passing high school and college algebra, my son made an A in calculus plus had a 100 average on tests when the professor used this strategy. At the same time, he also tutored a friend.)

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.

Modify teaching methods

- Use an overhead projector to demonstrate how to write an essay. (Parents may simply write on paper or a computer to model this skill.)
- Use color to highlight important information.
- Use graphic organizers to help students organize their thoughts.

Modify assignments—reduce written work

- Shorten assignments.
- Check time spent on homework, and reduce it if appropriate (when total homework takes longer than

roughly 10 minutes per grade as recommended in a PTA/NEA Policy, e.g. 7th grader = 70 minutes).

- Write answers only, not the questions (photocopy questions).

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 a “row captain” to check that homework assignments are written down and later turned into 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.

Unfortunately students with AD/HD are often punished for executive function deficits such as lack of organizational and memory skills that interfere with their ability to bring home the correct homework assignments and books. Hopefully, after reading this article, teachers and parents will develop more innovative intervention strategies. For example, one effective



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So what should parents and teachers do? Identify the student's specific learning problems and their executive function deficits and provide accommodations in both areas.

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alternative would be to have someone (a friend or teacher aide), meet the student at his locker to get the necessary homework materials together. Ultimately, this process of "modeling" and "shaping" behavior at the critical "point of performance" will help the student master skills or at a minimum, teach him to compensate for deficits.

Clearly school is often very difficult for students with AD/HD. However, when executive function deficits are also present, the accompanying problems are often overwhelming to the student and family. Unfortunately, some parents and teachers have had little awareness or sympathy for the challenges presented by these combined deficits. Hopefully, teachers and parents now realize that AD/HD is often a very complex condition. It is much more than just a simple case of hyperactivity. When deficits in executive function and related learning problems are present, students can try their very best and still not succeed in school.

So what should parents and teachers do with this new information? Identify the student's specific learn-

ing problems (e.g., written expression or math) and their executive function deficits (e.g., working memory, disorganization, forgetfulness, or impaired sense of time) and provide accommodations in both areas.

I leave you with this food for thought, "Succeeding in school is one of the most therapeutic things that can happen to a child! So do whatever it takes to help the child succeed in school."

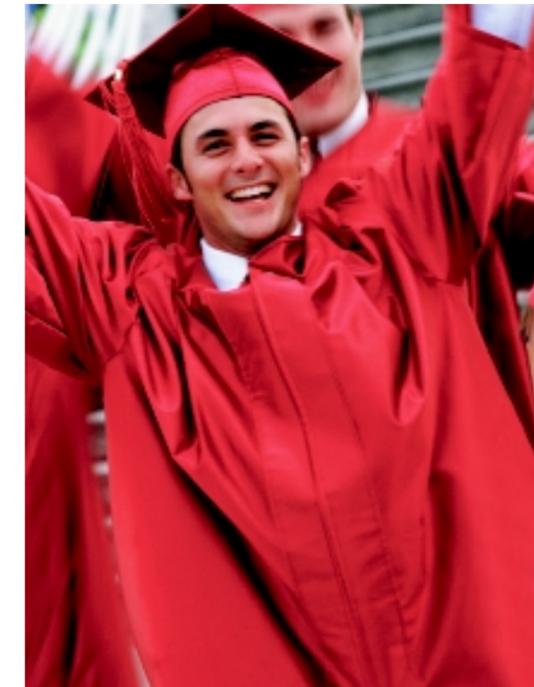
On a personal note, our youngest son struggled terribly throughout his school years with AD/HD and executive function issues. Although college was very difficult, he is a senior and will graduate this year. So, if your child is struggling in school, do not give up. My family offers living proof that there is hope and help for AD/HD and coexisting conditions. ■

Chris Dendy has over 30 years experience as a teacher, school psychologist, mental health counselor and administrator. More importantly, she is the mother of two grown sons with AD/HD. Ms. Dendy is the author of two popular books on AD/HD and producer of two videotapes, *Teen to Teen: the ADD Experience* and *Father to Father*. She is also cofounder of Gwinnett County CHADD (GA) and a member of the national CHADD Board of Directors.

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