

Strategy 4: Minimize Demands on Working Memory (Limit Simultaneous Processing Load)

As discussed in Chapter 1, it is difficult to overestimate or overstate the role of working memory in the learning and production process. In addition to being essential for concrete classroom activities such as following directions and simultaneously “holding onto” the steps of tasks while following them, working memory capacity is also heavily involved in the ability to comprehend and store information, then retrieve it into consciousness as needed (Dehn, 2008). Children whose working memories are limited relative to peer norms may show clear signs of the limitation across a range of academic tasks, with particular vulnerability displayed in the areas of reading comprehension, applied math, and (above all else) written language. Without question, a child’s ability to hold information in working memory can have profound influence on the ability to understand and produce in real-world learning settings.

Given the dramatic impact that comparatively weak working memory can have on academic functioning, it is important that instruction be delivered in ways that minimize the amount of information (e.g., directions, content) students with working memory problems must hold at any one time on their smallish “cognitive desktops.” The essence, then, of this core principle is that efforts must be made to lower the simultaneous processing load placed on students if they show signs of significant working memory impairment. To accomplish this, instruction must become more sequential in form, such that students can process information to a larger degree in a step-by-step, bit-by-bit manner (Reid & Ortiz Lienemann, 2006). How is a teacher to know when the simultaneous processing load of curriculum elements is too much for children with executive function difficulties? Although students’ cognitive overload presentations can vary (e.g., some tune out, some walk out, some freak out), many students will tell you when their cognitive workspaces have been maxed out through comments such as the following:

- I can’t keep all that in my head at one time.
- Everything you’re saying is too much and it’s making my head hurt.

- I read it, but I didn't really understand it because I keep forgetting it.
- I know what I want to write, but when I try to write it down it keeps flying out of my head and I can't remember it.

Even if students' executive function profiles are not reflective of obvious working memory deficits, they may still benefit from instructional adjustments that reduce simultaneous processing load (Paas, Renkl, & Sweller, 2003). For example, children with task organization and sequencing difficulties are also likely to benefit from teaching that is highly stepwise in nature because the concrete sequence of the instruction and tasks lessens the amount of ordering/organization they must do on their own. Children with goal-directed attention deficits are also likely to do better on activities with a step-by-step design because they only require focus on one element at a time.

Strategy Examples

- Clearly separating the stages of the writing process, with students only being required to complete one portion of the process each day (e.g., on the first day, they analyze the prompt and choose a topic; on the second day, they brainstorm ideas and jot them down in abbreviated form in any order; on the third day, they sequence the ideas and arrange them into paragraph groupings; on the fourth and fifth days, they write; on the sixth day, they edit; on the seventh day, they "publish")
- Supplementing oral directions for assignments with clearly worded written instructions that divide tasks into a series of discrete steps
- Separating the note-taking and listening comprehension elements of classroom discussions by pausing at regular intervals to allow students to take notes and providing clear indications of what they should be writing during these periods (e.g., using an overhead projector to model the note-taking for the class)
- Minimizing the amount of factual information students must hold in working memory as they write by "downloading" this information into their immediate instructional environments in the form of word walls, punctuation bulletin boards, and sequential graphic organizers that clearly reflect the sequence of ideas
- Minimizing the arithmetic facts that students must hold in working memory while they solve applied problems by "downloading" addition, subtraction, multiplication, and division facts into their immediate instructional environments in the form of "math fact walls"

Case Example

Situation: Robert, a tenth grader with a long history of ADHD diagnosis and related written language disorders, presents as bright and articulate to his teachers in class discussions, but produces very little on paper. His writing samples also include numerous spelling and punctuation errors, even though he always did well on spelling and punctuation tests as a younger student. Although Robert's scores on intelligence

tests consistently reflect above-average cognitive ability, he often fails classes because of missing assignments and writing pieces that do not meet even minimal standards. Despite the wealth of ideas he shows in class discussions, Robert often complains about not being able to think of things to say when writing and generally abandons written language assignments after a few sentences (if he does them at all).

Recommendation: Robert's patterns of written language struggle are fairly typical for students with working memory deficits. Although he has little difficulty sequencing and recalling his thoughts in conversations and class discussions, his rather limited working memory makes it difficult for him to hold onto and organize his ideas (and the language he wants to use to express them) in narrative writing contexts. He therefore is likely to benefit from strategies that substantially lessen the amount of information he must simultaneously process across the stages of the writing process. It may be helpful to modify the curriculum so that the student is required to complete fewer narrative writing assignments across all classes and is given more time to complete those that remain. It would also be helpful to clearly separate the creative/organizational elements of the process from mechanical (actual writing) elements, and use highly structured prewriting approaches such as Stop and List (Graham & Harris, 2005) or BOTE (Brainstorm, Organization, Topic Sentence, Evidence, Conclusions; Meltzer, Sales Pollica, & Barzillai, 2007) that ease brainstorming and thought sequencing. See Chapter 7 for a detailed description of these strategies.

Strategy 5: Provide Many Opportunities for Guided, Extended Practice

While practice may not actually make perfect, it does build fluency. When students are able to use skills with fluency and automatically recall facts and other elements of content, the load on the prefrontal cortex drops considerably. As discussed in Chapter 3, the brain regions associated with executive function work hardest in task situations that are both unfamiliar and challenging (Goldberg, 2001). As students develop some level of mastery over a given content area or skill, the self-directed cognition that had been directed toward it can be devoted to other problems. Take math fact acquisition, for example. Third- and fourth-grade elementary students trying to master the algorithm for triple-digit subtraction with regrouping will find the learning process far easier if they have already mastered all single-digit subtraction facts (Bedard, Martinussen, Ickowicz, & Tannock, 2004; Dehn, 2008). Students who still have to rediscover these basic facts by counting on their fingers each time will have less working memory space to devote to the more complex regrouping task. They will also have to frequently "shift sets" between higher order algorithm work and more mechanical finger subtraction, which can lead to confusion, missed steps, and other problems. The same principle applies to narrative writing. Students with large expressive vocabularies who have also learned such elements of mechanics as spelling and punctuation to the point of fluency will have this factual information at their fingertips as they write (freeing up their self-directed cognition to the more creative, synthetic aspects of writing), whereas children with smaller vocabularies and less mastery of basic rules will need to devote far more cognitive energy to the mechanical aspects of the writing process (McCutchen, Covill, Hoynes, & Mildes, 1994).

Given the clear impact of fluency and automaticity on available executive skill resources, it seems logical to improve the academic function of students with executive function weaknesses by providing them with plenty of time to practice new skills and integrate new content into what they already know. Unfortunately for students whose executive function falls below developmental norms, teachers are often unable to provide the amount of practice and exposure time needed to turn the unfamiliar into the routine. Local and national assessment demands, increasingly complex curriculums, and a host of other things compete for precious instructional and seatwork time. Some research suggests that teachers' assumptions about the amount of time needed to grasp new skills are contributing factors to the lack of practice available to students. Shrager and Siegler (1998), for example, found that teachers tend to underestimate the time it takes students to consistently use newly learned mathematical strategies, and may therefore move onto other topics/skills before many students are ready to do so. Such a hurried instructional pace only compounds the stress levels of children with executive skill weaknesses, leaving them feeling overwhelmed and disinclined to continue to try to keep up.

Strategy Examples

- Using guided oral reading practice (known as “repeated reading” in its more systematic forms). Because many students with executive struggles find reading boring and/or arduous, they tend to avoid it in favor of high-stimulus activities such as TV and video games, which feed directly into their field dependence. By not practicing reading as much as their peers, these students often fail to develop the fluent reading skills necessary for comprehension and later enjoyment of literacy activities. Among the most helpful interventions with this population—particularly in the elementary grades—is to provide them with daily opportunities to read aloud to an adult trained to constructively correct errors over the course of several months, which can build fluency and increase levels of reading enjoyment and stamina
- Explicitly modeling the use of specific writing templates, and then requiring students to use the templates on numerous occasions over the course of the school year in forming and sequencing ideas associated with a range of writing assignments
- Employing math worksheets and workbooks that present new skills/concepts in a spiraling manner, such that material introduced earlier in the year continues to be practiced on a frequent basis
- Explicitly teaching classroom rules/expectations at the start of the school year, and continuing to practice (via role playing and demonstrations) a rule each week through the end of the year to make sure they stay fresh in students' minds

Case Example

Situation: Marilyn, a third grader of average intelligence, exhibits rote-learning struggles and a range of executive skills weaknesses centered on goal-directed

attention and working memory weaknesses. Although her counting and number identification skills were fine in preschool, Marilyn has struggled with number concept and has had marked difficulties acquiring basic addition and subtraction facts. Her mother said, “If she didn’t have her fingers, forget it. There would be no way she could do math.” A variety of flash-card and manipulative techniques have been tried with little success by Marilyn’s parents, teachers, and tutors.

Recommendation: Given Marilyn’s difficulties with both number concept (i.e., a sense of what numbers mean) and math fact recall, she would likely benefit from an instructional strategy that explicitly presents the real value of numerals as she works with them and also scaffolds the fact recall process so that she is not held back from learning grade-level math concepts. The TouchMath (Innovative Learning Concepts Inc., n.d.) system can be quite helpful for both of these purposes. The program uses a mental manipulative strategy that teaches children to perform basic arithmetic by counting the TouchPoints on each numeral (e.g., 1 has one TouchPoint, 2 has two TouchPoints). Advocates of the approach contend that it helps children associate abstract numerals in long-term memory with real values. Given the power of this remedial approach, it seems likely that with lots of guided exposure and practice with TouchMath over the course of the third-grade year, Marilyn will move beyond her inefficient finger-counting strategies and will also be able to internalize all single-digit addition and subtraction facts.

Strategy 6: Keep Things as Predictable and Consistent as Possible

To ease the burden of students with executive skills weaknesses, schools and teachers should adhere to the principle that consistency is good. When schedules play out in the same way every day and when teachers’ procedures for such things as introducing new concepts, assigning work, and collecting work remain unchanged, all students (even those with comparative executive function weaknesses) become habituated to the routines and need to allocate little self-directed cognition to them. Do consistent routines and procedures guarantee that students with executive skills difficulties will always adhere to them? Of course not, but consistency and predictability of process may enhance the chances that students with prefrontal lobe weakness will remember to do what needs to be done. Across the grade span, educators should start the year by explicitly teaching their students the behavioral expectations and organizational routines to be followed, then strive to remain consistent with these expectations and routines. By doing so, teachers create less stress for students with executive function challenges than teachers whose procedures vary to a greater extent. Students with ADHD and related diagnoses often like to know what to expect in their classes and what to do if they have a problem (e.g., “Mrs. Ryan is really strict, but I do okay in her class most of the time because she always does stuff in the same way every day and I can deal with that. Like, I know we’ll always have a quiz on Friday and that she’ll give us the study materials on Wednesday and a pre-quiz on Thursday”).

Strategy Examples

- See the quote associated with Mrs. Ryan in the previous paragraph. Although teachers who always do things the same way from week to week

might be perceived by their colleagues and some students as a tad rigid, using a predictable routine lessens the prefrontal cortical strain on everyone in the room because students know exactly when to expect study materials, tests, and assignments and then can develop weekly study schedules that align to the never-varying schedule.

- Develop clear classroomwide organizational systems and adhere to them religiously over the course of the school year. Students with executive function difficulties may require additional supports to stick with the systems (see Chapter 9 for several examples), but they are still likely to benefit from using procedures that are required of all students (as opposed to having to use their own, distinct system). As noted earlier in this chapter, classroomwide organizational procedures tend to work best when the teacher not only explicitly demonstrates them at the start of the year and adheres to them consistently over the course of the year, but also when the systems are “re-taught” at regular intervals to help prevent the natural forgetting that can occur among all students as the school year proceeds.
- Requiring students to use the same or similar graphic organizers and templates to complete the prewriting elements of essays/reports across the school year, as the repeated practice of carefully sequenced prewriting activities will benefit children with executive function weaknesses (and by the end of the school year, all students will likely approach writing tasks in more structured ways than they might have previously, including those whose neuropsychological profiles lead them naturally toward “sit down and wing it” writing efforts)

Case Example

Situation: Katie is a sixth grader with a major homework completion problem. She struggled some in elementary school with getting homework done and handed in on time. Now that she is in middle school and the variety and amount of after school assignments has increased, she has really been floundering. When asked when and where she does her homework, Katie replies, “My parents don’t care when I do it or where I do it, as long as I get it done, and so I do it at different times every day and in whatever places in the house has what I need — like sometimes I do it in my Dad’s study because that’s where the paper, stapler, and printer are.” Her parents, who are very busy professionals, admit that although they are committed to their daughter’s scholastic progress, they tend to leave the homework responsibility to her: “She’s in middle school now and really needs to start taking more responsibility for her own work.” A review of Katie’s assignment book indicates that although she makes entries in it more days than not, her notation system is very inconsistent and varied.

Recommendation: Some sixth graders can consistently complete homework with inconsistent assignment book use, or by doing the work at different times and places in the home. Katie, however, is not one of them. Although reasonably motivated, she lacks the self-regulation, organization, and time-management skills to get assignments done at home in the absence of very consistent structure and support.

Given this executive function profile, the intervention strategy in this case should involve at least the following: 1) structuring of Katie's daily assignment book use around a particular template that requires specific types of entries across all core classes (with daily parent and teacher checking to ensure compliance); and 2) creation of a consistent after-school homework starting time (e.g., right after dinner) and homework completion space (i.e., a space in which Katie keeps all home-based school supplies—including whatever computer equipment she might possess—and at which she always does her homework). In this case, Katie's parents should take a significantly more active role in monitoring her homework organization and completion ("surrogate frontal lobe"). Although it is true that Katie needs to learn to take more responsibility for her own work, her executive profile is such that she is going to require much more explicit task initiation/organization completion teaching from the authority figures in her life and guided practice before she can be expected to show even reasonable ability to do so on her own.

Strategy 7: Anticipate the Aspects of Tasks and Situations Students Might Find Threatening or Frustrating, and Model Strategies to Manage These Challenges When They Occur

If you have ever been late for work in the morning because of difficulties finding an object essential for daily functioning such as glasses, car keys, or your wallet, you know firsthand the impact that anxiety and frustration can have on executive skills. With time running short and the missing object still maddeningly out of sight, negative emotions start to spike and the quality of the search declines precipitously as one dashes with increasing desperation from pillar to post. Even individuals who are capable in calmer moments of a logical and well-regulated search will find themselves casting about in a more random—and therefore less effective—manner when the pressure is really on. Your ability to engage the executive skills you possess is highly dependent upon the amount of fear and frustration you experience from moment to moment.

Children with limited executive skill capacity relative to peer norms will have less self-directed learning and behavior regulation skills at their command in classroom settings when stressed (Barkley, 1997). Children with executive function profiles that make them vulnerable to being swamped by anxiety and anger (recall the amygdala hijack phenomena discussed in Chapter 3) will have a particularly hard time reigning in their emotions once they are triggered, and are likely to engage in a range of maladaptive coping strategies (e.g., shutting down, disrupting, leaving the classroom).

If teachers want to increase all students' abilities to engage the executive skills they possess, it is essential that efforts be made to keep anxiety, frustration, and stress levels as low as possible (Swick, 1987). Consistency and routines help a lot with this, as do explicit teaching and extended practice. Another key strategy to keep negative emotion levels down in the classroom is for instructors to explicitly show students the parts of tasks that might be frustrating and then model ways to manage the difficulty. By doing this, teachers both normalize the negative emotions students might feel in a given academic context (e.g., "The teacher said we might find this part hard to understand, and so I know it's not just me") and provide students with clear directions regarding ways to handle the dicey spots when they occur.

Strategy Examples

- Before asking students to begin working at their seats on a series of workbook pages, read through all the pages with the class and point out the section(s) that students might find confusing, which both clarifies the directions for this section and demonstrates the best way of managing any additional confusion children might have with it (e.g., “If, when you get to this part, you forget what to do or are still confused, do the first problem just like I showed you up here on the board. I’ll leave it up here as an example to you. You can also just raise your hand and I’ll come over to your desk and help you. This part is pretty new and tricky, so I won’t be surprised if a lot of you need some extra help with it.”)
- Before asking her fourth grade students to read a *National Geographic* article on global warming, the teacher does an “article walk” with the class to show them its different headings and to clearly define some key words/concepts with which several of the children may be unfamiliar (e.g., “It will be hard to fully understand this first part unless you know the meaning of the words *looming* and *imminent*”)
- Tell the class that if they become confused at any point while reading the article, they should place a question mark in the margin next to the sentences they find difficult; then after everyone has finished reading, the article discussion will begin an opportunity for students to ask questions about their “question mark” sentences

Case Example

Situation: Mr. Smith is the lead teacher in a self-contained special education class program for middle school students with severe emotional difficulties. After completing a unit on Dr. Martin Luther King and the American civil rights movement, Mr. Smith decides to assign all students the task of writing a three-page essay on the civil rights figure of their choice and then presenting their reports to the class. Although he feels this assignment is generally matched to his students’ literacy levels, Mr. Smith recalls the behavioral escalations that he and the classroom assistants have had to confront whenever narrative writing has been assigned. He wants to present this project in such a way as to minimize the likelihood of disruptive behavior.

Recommendations: Given his students’ writing-related anxieties and marked difficulties managing negative emotions, Mr. Smith decides to present the assignment to the class in a way that recognizes their emotional vulnerabilities. He first notes, for example, that some students may be worried about the topic selection process: “Picking a topic for a report like this can be hard.” So, Mr. Smith tells the class that he will meet later that day with each student individually to help them choose a civil rights figure: “I will give each of you a choice of three people, and then help you select the one that’s best for you.” He also tells the students that they will have 3 weeks to complete the project, that portions of each school day will be devoted to it (“So you won’t have to do much at home on your own”), and that in the first several days all they will need to do is answer questions about their individual on a sequential graphic organizer (see Chapter 7 for examples of these and similar “frontal lobe–friendly” prewriting devices).

Because Mr. Smith expects that several of his students may feel overwhelmed with the assignment, even with the scaffolds he has put in place, he also elects to have a candid conversation with the class about the strategies they should use if feeling overly anxious or frustrated as they work on their project. As part of this discussion, he role-plays the negative thoughts that might go through students' minds related to the project (e.g., "This stinks! I'm terrible at writing and there's no way I can write three whole pages on anything. I'm going to end up looking stupid") and also demonstrates the more adaptive things they can think and try to keep themselves going (e.g., "This is hard, but we've got lots of time and I only have to do a little bit each day and, besides, the teachers will help me with each part. If I'm stuck, all I need to do is raise my hand for help").

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