

Executive Function and the Provenance of Patience

Claire King

Stella and Charles Guttman Community College at CUNY

You're so patient with Mom!" my sisters said after I spent the weekend at my aging mother's house, getting ready to move her to assisted living. At the time, I shrugged off the comment. Later, though, after the third time my mother had asked me the same question within the hour and the fourth time I had redirected her to the task at hand, it dawned on me: I am, in fact, quite patient with her.

How did that happen? "Patience" has never been a word used to describe me personally or professionally. I characterize myself as an impetuous, task-oriented, "git 'er done" type of person. But I've taught adolescents and emerging adults for most of my 35 years as an educator and, thanks to the knowledge and experience I've acquired helping my mother in recent years, I think I may now have it. Patience.

In 2012, I joined the inaugural team of faculty at an innovative start-up, open admissions, liberal arts community college in the nation's largest public urban university system. Targeting low-income, first generation, multilingual students coming directly from

under-served communities with the ambitious goal of on-time graduation with little to no student loan debt, we offer a rigorous curriculum with remedial coursework embedded in credit-bearing courses. The combination of structure, commitment to student success, and multi-faceted supports has attracted a growing number of students with developmental and learning disabilities. Consequently, our student demographics represent the largest proportion of learner variability and neurodiversity of any student body among the other colleges and universities in our metropolitan higher educational system.

I'm a K-16 educator, a developmentalist with a great deal of interest in the translational neuroscience research that is making its way into education. Impelled by my desire to design strategies effective for the wide range of learners I now was charged with teaching, I began exploring the topic of executive function—an inquiry which I credit as the source of my growing ability to exercise patience with both my students and my mother.

Before studying the learning sciences, I responded in righteous indignation when students would ask me the same question I had just answered, would fail to annotate readings, or would miss a project deadline. To me, their actions communicated that they didn't care, weren't trying, and obviously weren't as invested in their success as I was. My story typically went like this: First anger: "They didn't study and weren't engaged in the work—work I had spent hours creatively designing, facilitating and offering feedback." Then, self-recrimination: "I'm a lousy teacher! I don't know how to teach the concept the right way! If they liked me they would have handed in the paper!"

Once I began to understand the development of the brain's prefrontal cortex and the impacts of environmental, physiological, and developmental factors on executive function, however, patience began to replace my tendency to assign such judgments.

The three main executive functions involve the interrelation of working memory, shifting, and inhibition. Our working memory represents information we can "place on hold" and allows us to retrieve and manipulate that information when needed (Booth, Boyle & Kelly, 2010). We use working memory to plan, organize and decide. These complex moves require both focused attention and a future orientation that assumes an understanding of cause/effect and natural consequence (Diamond, 2013). Think of the burden on working memory that reading imposes, or notetaking while listening to a presentation, or computation of mathematical equations. In each instance, we have to foreground some information while holding other information in mind to attend to in the next steps.

Shifting, or adaptive and flexible thinking, involves the metacognitive ability to monitor and change activity, perspective, or approach. It allows us to move between mental states, beliefs, rules, tasks or priorities in response to new, incoming information (Diamond, 2013; Miyake et al., 2000). Evaluating an argument's claims based on evidence, rejecting a theory, forming an opinion and managing one's time wisely all reflect the capacity to shift in executive functioning.

Inhibition, the third characteristic of executive function, allows us to judge appropriate responses in various settings. Inhibitory behavior includes impulse control, self-regulation and attentional, self-limiting choices. These self-initiated or self-imposed forms of control or discipline make possible the use of working memory and the act of shifting (Best & Miller, 2010). Much time in classroom management involves teachers at every level helping students code-switch in their use of informal language or profanity, understand why "one mic!" facilitates focused attention, and how persevering through difficult assignments instead of giving up yields progress.

For all of us, during the first few years of life, executive function emerges concurrently with the 700 to 1,000 new neural connections that form every second. Executive function strengthens significantly throughout childhood between the ages of three and five and it continues to develop into our early adult years. Notably increasing in the completion of more complex tasks, rapid executive function proficiencies occur between the ages of 15 and 23, after which they are generally either maintained or decline with age. (Best & Miller, 2010; Center, 2016; Craik & Bialystok, 2006; Moran & Gardner, 2007).

As educators, it's important to know that executive function is not synonymous with intellectual ability. Neuropsychological tests reveal that individuals with immature frontal lobes or prefrontal cortex damage can display executive function deficits while possessing average to above-average IQs. For example, it is not uncommon for learners to recall a strategy but forget to apply it. In fact, it is "the very curious dissociation between knowing and doing" (Bridge Denckla, 2007, p. 11) which lies at the core of executive dysfunction. For example, I've found that despite what I know as a professional practitioner, I have made the snap judgment of attributing laziness and irresponsibility to students who are neurodevelopmentally immature, impugning an moral deficit when the incomplete development of the brain is the real issue.

We know from studies of executive function in older adults that the disorganization,

distraction, and maddeningly intransigent opinions of our adolescent students originate in physiology. Sometimes the diminishment of executive function capacities are the result of lesions to the prefrontal cortex (Holmes Bernstein & Waber, 2007), as happens with stroke or traumatic brain injury. Even without age-related diminishment, disease, or damage, the prefrontal cortex is highly sensitive to chronic stress, lack of sleep, depression, poor nutrition and lack of exercise (Diamond, 2013). When our students experience repeated exposure to environmental toxins, alcohol, drugs, neglect or abuse, it is no surprise that their brains are negatively impacted. For young people living in chronic poverty, fear or chaos can increase these conditions and can overload stresses associated with trying to survive. Their energy and attention is habitually directed towards crisis and uncertainty which, in turn, weaken the neural circuitry that supports the development of executive function.

For students with executive function challenges, educators at all levels can do two things within any existing curriculum: 1) reduce or eliminate the barriers to executive function in the classroom; and 2) provide regular, embedded instructional supports to practice executive function skills (Rose & Rose, 2007).

When I employ instructional strategies which strengthen executive function for all learners, I use the instructional content as a springboard for increasingly student-regulated learning, with all of the organization, attention, goal-setting and flexibility that this requires of them. I now make executive function processes explicit in whatever class I am teaching through systematic strategy instruction, a component of universal design for learning (UDL) (Rose & Rose, 2007). This means that I am intentional about sustained mentoring and modeling of executive function in my own teacher behaviors, often narrating my actions with metacognitive talk as innocuously as I can.

For example, after giving a deadline for an assignment, I might say, “This is where it helps me if I get out my phone and put the assignment due date right on my calendar” or “Wow—I need to think about what I just heard you say so I don’t react and say something I may regret later...” I provide students with incremental practice in trial and error, along with specific feedback and coaching that acknowledges their progress. I have learned to slow down my pace and use fewer words in my directives. This frees up space in the class period in which I use pauses to elicit students’ reflections and voice my own.

What do these systematic instructional strategies look like when reflective educators embed them into our curricula? Most of us already do many of these practices without intention or

awareness of their potency in assisting students in strengthening executive function or compensating for executive dysfunction:

- making an outline visible for each days' objective or lesson
- providing “starter sentences” to initiate writing
- using linear graphic organizers instead of randomized web or bubble outlines
- offering think-alouds, self-talk and question-asking while reading, viewing or listening
- teaching a note-taking technique with guided notes or templates
- distributing rubrics ahead of an assignment, and inviting students to co-construct rubrics
- acknowledging that a task is hard and will take focused effort
- valorizing observed effort at least as much as results
- providing a schema or framework to connect to when introducing new knowledge by applying facts and skills to contemporary and historical events
- creating metaphors and analogies for new information
- progressing from whole/part/whole
- expecting students to take part in discussions by elaborating on, relating to, and putting in their own words key concepts that have just been presented
- revealing test-taking strategies before a test, during, and before handing it in
- setting and sticking to clear deadlines and boundaries, allowing students to experience the natural consequences of meeting and missing them

With the exception of creating guided notes and rubrics, most of these teacher and teacher/student moves do not require additional labor. All of them, however, take in-class time that is already at a premium. I've found, though, that my commitment to modeling, repeating and routinizing these strategies yields real results in students' memory retention, organizational skills, and ability to attend to complex academic demands.

Employing executive function is challenging. It is easier to “go with the flow” rather than to plan; easier to react than to control; easier to cling to the familiar rather than to change. Each of these choices imply conscious decisions indicative of neural integrations that allow such cognitive processes. Adolescence and emerging adulthood is a prime time for systematic instruction that strengthens executive function for the long haul. In explicitly using these compensatory strategies with students, I see for myself what the research claims: that executive function positively contributes to academic achievement (Miller & Hinshaw, 2010;

Taylor et al., 2015).

Teaching for executive function requires some cognitive shifting of my own as well. If my goal is for students to become self-directed, self-authoring, metacognitively reflective learners, as much as I routinize organizational frameworks and hold firm on deadlines, I need to minimize my direct instruction, control my own need to intervene and re-commit myself to my important facilitative role in the learning process. I can't take on the position of becoming the class' "surrogate prefrontal cortex" (Walsh, 2011, p. 157) but I can help students operate within guidelines and anticipate consequences.

And that takes patience—with myself, as both a teacher and as a learner, even as one with several decades of experience with students at all levels. What I'm learning from my students' executive function challenges and growth is helping me learn new cognitive strategies. It is also teaching me new ways of being with my aging mother, who is and will remain my first and most amazing teacher.

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