

CHAPTER 1

Executive Functions and Self-Regulation

In this first chapter I introduce readers to executive functions and explain the integral role that self-regulation plays. The relationships between executive function and self-regulation are critically important to understand, considering the dynamic and fluid nature of these skills in the academic, work, and social life of college students. The various aspects of both of these subtypes of cognition not only help us understand the deficits in each, but also inform us about how college students can be coached in order to optimize their own academic and social success. The purpose of this chapter is to provide readers with this foundational knowledge on which the dynamic coaching approach is based. Therefore, the objectives of this chapter are:

- To provide readers with an understanding of what executive functions are and what impairments of executive functions look like in college students.
- To provide readers with an understanding of self-regulation as fluid and ongoing cognitive operations that are central to executive functions.
- To describe for readers the relationships between the beliefs one has about oneself (called self-awareness or self-efficacy) as compared to the ongoing and intentional processes of self-monitoring, self-control, implementing strategies and plans, and comparing and adjusting.
- To describe for readers the importance of self-regulation for college students and why it is the focus of our coaching approach.

WHAT ARE EXECUTIVE FUNCTIONS?

There are several acceptable definitions of executive functions that have emerged from various fields, including neuropsychology and educational, developmental, and cognitive psychology. But to understand what executive functions are and what they do, we must first understand that executive functions exist within a broader framework of cognition. The most common framework is one posited by Stuss and Benson in 1986, over 30 years ago. Based on the work of Luria (1973, 1980) in the mid-20th century, the components of cognition are viewed as a hierarchy that includes both basic and higher-level thinking skills. In this representation, a “sense of self” is the highest level of cognition—this is how we perceive ourselves and is typically operationalized as “self-awareness.” More basic cognitive, language, and motor processes are represented at the bottom of the hierarchy. These include attention, alertness, visuospatial skills, memory, language, perception, emotional processes, and motor skills. Table 1.1 provides brief definitions of each of these processes and how impairments in each might appear in the behavior of a college student. For example, a student with impaired memory ability to store information is capable of understanding a lecture, but will struggle to retain the information at a later time. While most students are challenged to learn all that is required of them, students with memory impairment are particularly disadvantaged. A student who has difficulty paying attention may appear to have difficulty remembering material presented in class; thus, while it may look like a memory impairment, the underlying problem is inattention, making it difficult to get information into one’s memory for later recall.

Thus, cognitive, sensory, language, and motor impairments result in a wide variety of disabilities. The practical effects of these disabilities on students’ academic and social experiences are listed in Table 1.1. Note that these disabilities are examples only; this is not an all-inclusive list of disabilities that result from these impairments.

What can college students do about these disabilities? Besides getting reasonable accommodations for their disabilities, which can help compensate for them (see Chapter 7), students must enlist the help of their own executive functions. Students with memory impairment can recruit the various executive functions (in the middle of the hierarchy) that help them to plan ahead and take good notes, to record lectures, and to use effective study and test-taking strategies. Disabilities tend to create obstacles and barriers, whereas executive functions are the tools that allow us to overcome these obstacles (Ylvisaker, 1998).

In the Stuss and Benson (1986) model, executive functions moderate the ability to compensate for disabilities created by more basic impairments, be they motor, cognitive, language, or emotional, for example. To do this, they operate in the middle, between the sense of self or self-awareness and basic processes. The

TABLE 1.1. Cognitive, Language, Physical, and Sensory Processes and How Impairments in These Domains May Manifest in Students' Ability to Succeed Academically and Socially in College

Cognitive process	Students with these impairments may . . .
<i>Attention:</i> Focusing on a specified activity, behavior, or task. Levels from basic to complex include focused, sustained, alternating, and divided.	<ul style="list-style-type: none"> • Be distractible during class, while studying, or during conversation. • Talk out of turn. • Have a low tolerance for frustration. • Not follow through on assignments or personal commitments.
<i>Visuospatial:</i> Understanding and being able to mentally manipulate visual information, such as understanding spatial relationships, discriminating items or features, or recognizing objects.	<ul style="list-style-type: none"> • Complete reading assignments slowly or with great difficulty. • Fatigue easily when reading. • Struggle to interpret figures or graphs. • Only partially recall graphically displayed information. • Organize notes poorly when taking notes from lectures.
<i>Alertness:</i> Maintaining arousal.	<ul style="list-style-type: none"> • Fall asleep during class or while studying. • Fluctuate alertness during academic activities, resulting in inconsistent comprehension and recall. • Require frequent rest periods, especially after periods of cognitive effort (like class or exams). • Not be able to tolerate infrequent and lengthy classes, such as 3-hour classes that meet once a week. • Require more time to complete work.
<i>Memory:</i> Gathering information so that it can be stored and then recalled at a later time.	<ul style="list-style-type: none"> • Have difficulty recalling facts and new information for tests. • Forget what is read. • Be unable to connect information and draw inferences when reading. • Not know when assignments are due. • Not remember classmates' names. • Get their schedule confused, so that they arrive at the wrong class on the wrong day or at the wrong location. • Rely on poor memory strategies, such as repetition, when studying. • Complete assignments, but forget to turn them in or misplace them. • Confuse information from one class with information they are learning in another class. • Alienate friends by forgetting to go to social engagements.
<i>Autonomic/emotional:</i> Internal mood or feelings, including automatic responses.	<ul style="list-style-type: none"> • Have test anxiety. • Avoid groups, make few personal connections with classmates or professors. • Experience cognitive "side effects" from anxiety or depression, such as increased difficulty recalling information. • Allow academic failures to easily undermine their self-efficacy as a student. • Have low resiliency for challenging situations. • Display negative coping behaviors, such as avoidance, eating too much or too little, drinking alcohol or caffeine excessively.

(continued)

TABLE 1.1. (continued)

Cognitive process	Students with these impairments may . . .
<i>Sensory/perceptual:</i> General sensory input such as the sensation of touch or proprioception (knowing where the body is in space). Specific sensory input such as vision and hearing.	<ul style="list-style-type: none"> • Compulsively check papers or assignments for errors, even if this extra checking results in the assignment being turned in late. • Have difficulty balancing academic and social life. • Struggle to understand speech because of background noise, particularly during group work. • Avoid conversations with peers if unable to hear clearly. • Not be able to see slides or notes on a whiteboard. • Have difficulty reading textbooks. • Have difficulty manipulating writing materials. • Require preferred seating in classes. • Not enjoy many typical college experiences because of sensory overload (e.g., avoid football games, noisy parties, or restaurants).
<i>Language:</i> Expressive language includes thinking of words, sequencing the sounds in the words, then organizing them into grammatically correct sentences; speaking at an appropriate rate and with intonation consistent for the intended meaning. Receptive language includes comprehending speech and decoding meaning—both explicit and implicit—based on factors such as emphasis, facial or body expressions, and intonation. Also being able to read and write fluently.	<ul style="list-style-type: none"> • Be slow to respond to questions. • Become frustrated by group interactions that require listening and responding to multiple speakers. • Learn new vocabulary slowly. • Ramble or use nonspecific speech such as “stuff” or “things” when searching for a word. • Struggle to understand lectures, but be hesitant to ask clarification questions. • Need to sit at the front of the class to hear the instructor clearly and use visual input to maximize listening comprehension. • Use a note taker or swap notes with classmates after class so that they do not have to listen, comprehend, and write simultaneously. • Have difficulty understanding implicit information when reading texts. • Focus on explicit information in texts while missing implicit information. • Require support to write and edit lengthy papers. • Make frequent grammatical and spelling errors when writing.
<i>Motor:</i> Planning and executing motor movements, involving the limbs, hands, face, or tongue.	<ul style="list-style-type: none"> • Be slow to take notes in class. • Need extra time to write papers or emails on a computer because typing is slower than their stream of thought. • Struggle to speak intelligibly with peers in informal settings or during more formal activities, like giving class presentations. • Require extra time to travel between classes or to find a seat in class. • Have to select a seat in class based on motoric needs rather than cognitive needs (e.g., sitting at the back to allow room for a wheelchair, rather than sitting at the front where they could hear more clearly).

terminology used to refer to skills encapsulated by executive functions varies, but includes such abilities as anticipating, goal setting, planning, and monitoring. Executive functions are the controllers of the basic skills, and as such direct, assess, and make decisions about what to attend to, how to subtly respond to a sensitive question, which goals are more important than others, how to initiate use of strategies, how to compare results with goals, and so on. However, executive functions are also dependent on the more basic processes. For example, a typical student needs to be able to maintain attention to read a text, but executive functions direct attention toward the text while also working to make decisions about what pieces of information might be most important. In contrast, if a student has a severe memory impairment for which he is unable to retain new information, his ability to set goals and make strategic decisions will suffer, since these kinds of decisions depend to an extent on an accurate recall of what has happened recently. This also means that students may manifest difficulty at the basic systems level and at the executive functions middle level. These students have *dual disabilities*: an impairment of basic cognitive processes and an impairment of executive functions, the very processes that help them figure out how to compensate or maneuver around their disability.

Neuropsychology and rehabilitation disciplines (e.g., speech–language pathology and occupational therapy) have emphasized the integrative nature of executive functions that allows one to “determine goal-directed and purposeful behavior in everyday life.” These processes include inhibition, working memory, shifting thoughts and/or actions, generating goals, planning, reasoning, self-control, and “monitoring and adaptive behavior to fit a particular task or context” (Cicerone et al., 2000, p. 1605).

Regardless of how executive functions are defined, there is no doubt that many of these processes are interrelated. An analysis of a wide range of executive function tasks by young and old adults in 2000 revealed that these functions are fundamentally related to three categories of behavior: shifting, updating and monitoring information, and inhibiting (Miyake, Friedman, Emerson, Witzki, & Howarter, 2000). More recently, Hofmann, Schmeichel, and Baddeley (2012) reviewed the factors included in various models of executive functions and concluded that three common features account for the variability across models:

1. *Working memory*, defined as the ability to hold, manipulate, and update information internally.
2. *Inhibition*, defined as the ability to withhold or to disengage from behaving or thinking based on impulses or routines.
3. *Mental set shifting*, defined as the ability to switch back and forth from one kind of behavior or thought pattern to another.

Others have found that executive functions can be grouped into two broad categories: behavioral regulation and metacognition both in children (Gioia, Isquith, Guy, & Kenworthy, 2002) and in adults (Roth, Lance, Isquith, Fischer, & Giancola, 2013). Using a questionnaire called the Behavior Rating Inventory of Executive Function (BRIEF), researchers found that all of the items were interrelated to each other in one of two ways: *regulating behavior* and *regulating thinking (metacognition)*.

For the purposes of this book, the executive functions and examples of what impairments may look like in the behavior of college students are listed in Table 1.2. This list comes from our knowledge of the research and are commonly identified as contributing to daily life experiences in young adults and in our work with college students with executive function problems. For example, a student who has memory impairment with poor cognitive self-regulation may underestimate the amount of time and effort it will take to study for an exam and will fare worse than a student with memory impairment with strong cognitive self-regulation who plans ahead, adjusts her study schedule, and knows that more effort will be needed. Thus, students with cognitive, motor, sensory, language, and emotional disabilities, who nevertheless have the capability to succeed in college, need strong executive function skills so that they can anticipate problems and create solutions around the barriers created by their disability. As pointed out earlier, students who have executive function problems in addition to their other disabilities have dual disabilities. The manifestations of executive function problems that are listed in Table 1.2 are examples of the kinds of problems college students may have.

Why are there so many different lists of executive functions? There are three primary reasons for this. First and foremost, the definitions reflect the efforts of researchers from various disciplines to modify the original framework of Luria (1980) and Stuss and Benson (1986) based on advances in science and education. Although the lists have been modified, the notion that executive functions oversee more basic systems to manage daily problems, while at the same time receive input from these same systems, has been a challenging concept to test. On the other end of the hierarchy, the integration and influence of one's sense of self or self-awareness has face validity but is hard to prove. We are indeed closer to understanding the contributions to executive functions made by more basic cognitive processes on the one end, and self-awareness on the other end, given that the scientific and educational communities are more accepting (and even embracing) of using a mix of test results, interviews, and questionnaires to find out what individuals think about their thinking and why.

Second, executive functions are developmental by nature, and the labels given to the executive functions seem to change across the lifespan. Emerging executive functions in children are solidified in early adulthood. Neurobiologically, the structural architecture of cortical gray matter and the connections in white matter reach maturation in the frontal lobes of the brain in young adults (Barnea-Goraly

TABLE 1.2. Executive Functions and How Impairments in These Domains May Be Manifest in Students' Abilities in College

Executive functions	Students may . . .
<i>Attention control:</i> Deciding what to pay attention to, what to ignore, how long to attend, and when to switch attention.	<ul style="list-style-type: none"> • Get too focused on one part of an assignment. • Be easily distracted in class, during exams, and while studying. • Become distracted when completing long assignments. • Not recall or learn material.
<i>Memory control:</i> Holding information in one's mind in order to manipulate it; retrieving details when needed; or remembering to do something at a later time (i.e., prospective memory).	<ul style="list-style-type: none"> • Not be able to follow a threaded discussion or lengthy instructions or texts. • Have trouble multitasking (e.g., listening and taking notes). • Make decisions based on limited information. • Forget to do assignments and to plan. • Forget important details. • Miss punch lines or story conclusions because they do not recall previous important information. • Have difficulty weighing options.
<i>Initiation:</i> Acting and following through in response to a reminder or recollection.	<ul style="list-style-type: none"> • Appear lazy or unmotivated. • Have trouble starting or restarting assignments. • Not seek for help from others. • Appear to procrastinate.
<i>Inhibition and impulse control:</i> Withholding the urge to say or do something that does not fit the circumstance or seems out of place.	<ul style="list-style-type: none"> • Make snap decisions, jump to conclusions. • Complete assignments quickly without checking them. • Say what comes to mind without considering the situation. • Respond quickly, "in the moment" instead of "wait and see."
<i>Problem identification and goal setting:</i> Knowing when there is a problem, deciding on goals, and creating smaller goals/tasks in order to meet the goal.	<ul style="list-style-type: none"> • Not recognize when a problem exists. • Identify general problems (e.g., having trouble with writing), but cannot identify why or the steps to solve it. • Generate lots of goals, but cannot sequence them into logical steps, especially for large assignments. • Not be able to break down a goal into the smaller steps needed to achieve it.
<i>Flexibility in thinking and behavior:</i> Being able to switch one's former or routine viewpoint, behavior, and way of thinking.	<ul style="list-style-type: none"> • May not perceive that a different way of thinking or behaving could help remedy a problem situation. • Get stuck in a routine, especially when studying and socializing. • Start but not be able to maintain a new routine. • Appear self-centered. • Have difficulty returning to a routine if it is interrupted.
<i>Emotion self-regulation:</i> Managing and bouncing back from everyday ups and downs without overreacting.	<ul style="list-style-type: none"> • React emotionally in ways that are out of proportion to the situation. • Get upset or overly discouraged when given feedback. • Have fluctuating emotions or "mood swings" over a short period of time. • Get easily irritated if someone disagrees with them.
<i>Cognitive self-regulation:</i> Monitoring the need for strategies; selecting and implementing strategies.	<ul style="list-style-type: none"> • Underestimate the need to study and to use strategies for learning. • Underestimate the amount of time and effort it takes to complete assignments and to study for exams. • Not adjust or change study strategies even when current ones are ineffective. • Know about a number of study strategies that could be useful, but do not use them.

et al., 2005). And even though the brain changes throughout adulthood through what we now understand as neuroplasticity, the underlying structural foundation is fairly complete by the mid-20s (Lebel & Beaulieu, 2011). The demands of the environment (at school, work, and play) change: Children who were dependent on their family to assist them in executive functioning are suddenly expected to take over these executive functions as they exert their independence, rely more on peer feedback, and navigate more challenging contexts. We also know that the experiences we have also change how our brain will respond at a future point in time. Conversely, as one becomes an older adult, some aspects of cognition decline (Salthouse, Atkinson, & Berish, 2003). So definitions of executive functions may also reflect the age group from which that definition was derived.

Third, executive functions are affected by differences in or disorders of neurobiology. Individuals with neurodevelopmental disorders, such as ADHD, have certain kinds of executive function challenges that are different from those individuals who have intellectual disabilities. Individuals with acquired brain injury, including TBI, stroke, tumors, encephalitis, or progressive neurological diseases (e.g., multiple sclerosis), have unique executive function deficits based on the age of the individuals when the injury occurred, the type and severity of the injury, the location of the injury in the brain, and the recovery pattern or progression of the disease. Thus, definitions of executive functions reflect the population sample on which the research was based.

As we noted previously, we know that these processes work in concert to self-assess, make strategy decisions, distribute attention, initiate action, block out distractions, shift attention, exert effort, create goals, follow through with an action plan, make adjustments in response to feedback (self or external), and hold information in working memory to allow for reasoning and decision making—all done with seemingly little effort so as to maximize performance in a given activity. There is wide agreement that these are critically important ways of thinking and behaving that can have positive or negative effects on how we function in the world. This is especially true for the college student who has a disability. For the purposes of this book, executive function domains are described in Table 1.2, including examples of possible student behaviors associated with difficulties in each of these domains.

However, executive functions are not involved in all kinds of behavior. Automatic behaviors and routines, wherein one does not consider or think about what should be done, are based on long-term memory that has been solidified through years of repeating the same behavior or as a conditioned response (Squire, 1992). These responses and behaviors are fast, seemingly automatic, and under little cognitive or conscious control. Examples of these kinds of behaviors include brushing your teeth as a part of your morning routine, driving a car, or even having memories about a past Thanksgiving dinner as soon as you smell the aroma of the turkey

in the oven. College students can have many routines in place, such as taking notes during class, drilling with flashcards to study, or packing books and computers for class each morning. Maladaptive routines can also be established, such as cramming before exams or writing papers the night before rather than using executive functions to plan and study over a more appropriate period of time. College students with or without disabilities may rely on old routines that worked well for them in high school, but have become ineffective when met with the demands of college. Students without executive function disabilities can figure out what is or is not working and make adjustments, whereas students with executive function problems lack the skills to figure this out on their own.

WHAT IS SELF-REGULATION AND HOW IS IT RELATED TO EXECUTIVE FUNCTIONS?

Self-regulation is the ability to assess one's own (hence the "self") cognitive and emotional states and to make decisions about what to do in light of that assessment. Self-regulation is a group of cognitive considerations and are the "meta" manipulations that allow us to monitor and control our own emotions, thoughts, and actions. Rather than viewing self-regulation as one of many executive functions, as Cicerone and colleagues (2000) described above, we view self-regulation as integrally related to the executive function processes required to carry out everything from simple to complex intentional actions. Self-regulation occurs within a context and is a limited resource, wherein students must make both quick learning decisions and slow, more planful ones. Readers who wish to explore this aspect of self-regulation further are referred to a special issue of *Metacognition Learning* that is dedicated to the complexities of self-regulated learning (Ben-Eliyahu & Bernacki, 2015).

Self-regulation is sometimes used synonymously with *metacognition*, or thinking about your thinking when referring to cognition, and *metamemory*, or thinking about your memory and learning. Sometimes self-regulation is interpreted as only including "self-control," or withholding or not engaging in a routinized or impulsive behavior, like overeating, or not blurting out what we really think. Self-regulation is viewed by cognitive, developmental, and educational psychologists as including both self-monitoring and self-control.

Flavell (1979) was a developmental psychologist who conceptualized self-regulation as having two parts. He described ongoing "metacognitive experiences" as those that occur during our daily lives at school, home, and work and in the community during activities in which we engage. These experiences can be divided into two parts: self-monitoring, or self-assessment, and self-control, or the ability to decide to act in a particular way. In the Stuss and Benson (1986)

framework, these processes are implicitly inherent in the executive functions in the middle of their model, but with an emphasis on self-monitoring and self-control. The second part of Flavell's conceptualization is metacognitive or autobiographical "beliefs." These are the stored memories of those daily experiences that become integrated into what we believe about ourselves. These include ideas about what we are good at and not good at doing and what strategies have been successful or not. Neuropsychologists might call this the "sense of self" and operationalize it as "self-awareness." Flavell also stressed the interaction between these two; that metacognitive experiences serve to update our metacognitive beliefs or sense of self.

Since then, psychologists, educators, and rehabilitation professionals have considered how ongoing self-regulation interacts with one's goals and one's motivation to figure out a problem or engage in complex activities (Carver & Scheier, 2001; Evans, Kirby, & Fabrigar, 2003). Carver and Scheier (1991) summarized two connotations of self-regulation that fit here: one is "the sense of self-corrective adjustments being made as the person [actively] interacts with the world," and the other is a sense of purpose as in goal-directed behavior (p. 168). Kennedy and Coelho (2005) used these conceptualizations of self-regulation to describe its underlying processes and the potential points of breakdown involved in intentional, complex activities for individuals with executive function problems from an acquired brain injury (e.g., TBI, stroke). Seen here as a cycle or sequence of behaviors, this is the self-regulation model used throughout this book. Figure 1.1 is a modification of the 2005 conceptualization. It shows the ongoing relationships between self-monitoring, self-control, taking action, comparing performance with the goal, and making adjustments. For a discussion of theories that have informed our approach,

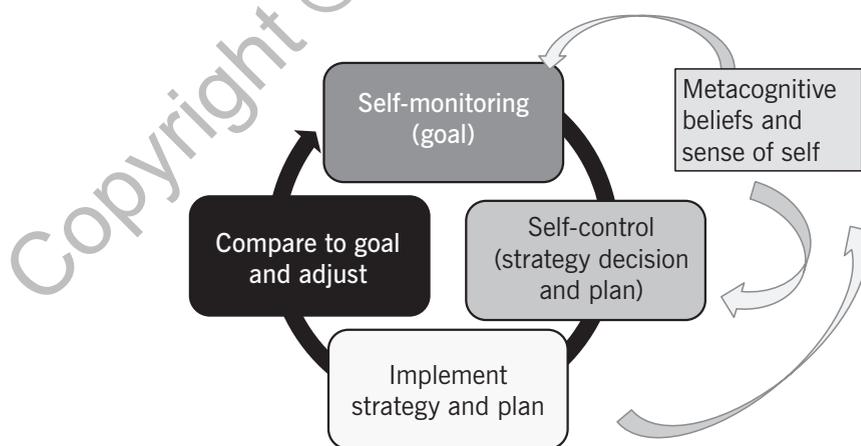


FIGURE 1.1. Model of self-regulation. Based on Kennedy and Coelho (2005).

readers are also referred to Hart and Evans (2006). Each part of this model is operationalized in the following manner:

- Self-monitoring, or self-assessing, is done by considering or predicting how one will do based on past experiences and the demands of the task. If one thinks that he or she will not perform as well as wanted, then a goal is established. If one thinks that he or she will perform well, then there is no reason for a goal. Creating a goal actually triggers the sequence of thinking “events” or steps in the rest of the sequence (e.g., Locke & Latham, 2002).
- Self-control, or making strategy decisions, is linked to self-monitoring. When one self-assesses the need for a goal, then one needs to make a strategic decision (i.e., use the same strategy as used before, or use a different strategy).
- Acting, or implementing the strategy plan.
- Comparing the results with the goal occurs when getting feedback. Feedback can be self-generated (using self-monitoring) or externally generated (e.g., instructor or employer feedback). Regardless of the type of feedback, willingness to self-monitor is again a key component in this step. If the goal was reached, then there is no need to adjust the goal or the strategy. However, if the goal was not reached, then either the goal or the strategy needs adjustment (i.e., change the goal or select and implement a different strategy).

Take, as an example, a common metacognitive experience of the college student who is studying. She assesses the situation (self-monitors) and realizes that she is going to need to put forth effort into studying for an upcoming exam, so she decides to use a strategy (self-control) (e.g., reviewing class notes) and selects one that has worked well for her in the past. However, when the exam grade is lower than she expected (compares outcome with her goal), she decides that she will need to use a different strategy (self-control) the next time if she wants to achieve her goal. The discrepancy between her goal and her performance, that is, a lower grade than expected, forces her to consider a different study approach if her goal remains the same. However, she could also reduce her performance expectations for the next exam and stick with the same study strategy. In both of these scenarios, she has made adjustments and thereby reduced the discrepancy between her goal and her performance (Carver & Scheier, 1991).

In the model shown in Figure 1.1, metacognitive beliefs, or self-awareness, have both influenced the metacognitive experiences and have also been affected by them. How might this work? The student in the above example viewed herself as academically strong (metacognitive beliefs) and as one who could rely on a simple strategy like reviewing class notes. This is what had worked well in the past, and she saw no reason to change that strategy now. In this way, her sense of self and

past experiences influenced her choice of strategies. However, when the results fell short of what she expected, she could either adjust the goal (e.g., I'm fine with getting a lower grade) or she could select a different strategy, one that would improve the chances of her getting a more acceptable grade. If her perception of herself (also called self-efficacy) is strong, meaning she believes she has the capability of getting a better grade, then she is likely to choose a different study strategy, perhaps one that she has used before when material is difficult, such as creating note cards and using them to self-quiz. To prepare for the next exam, she uses note cards and her exam grade improves. These experiences will not likely change her sense of self as a strong student, but it may show her that in some situations where the demands are greater, she simply has to use a different strategy, one that takes more time and effort. And while underlying her belief that she is a strong student may not change, this experience has enriched and deepened her awareness that she *is capable of figuring this out and being successful*.

Self-efficacy, or self-determination, is a critical aspect of self-awareness and is used to operationalize the belief that "I will be successful" or "I will figure this out." The broader-based construct of "self-determination," however, captures both the ongoing self-assessment and adjustment of self-regulation as well as the self-efficacy or beliefs that one holds about oneself. Self-determination is

a combination of skills, knowledge and beliefs that enable a person to engage in goal-directed, self-regulated, autonomous behavior. An understanding of one's strengths and limitations together with a belief in oneself as capable and effective are essential to self-determination. When acting on the basis of these skills and attitudes, individuals have better ability to take control of their lives and assume the role of successful adults. (Field, Martin, Miller, Ward, & Wehmeyer, 1998, p. 115)

Indeed, individuals with strong self-determination are more likely to put more effort into and be more persistent in accomplishing their goals than those with low self-determination (Bandura, 1997). Yet, students also need to be able to create doable goals and have the knowledge, plans, and skills to accomplish their goals (Schunk, 1991).

Self-regulating emotions are an important factor that can have positive or negative consequences for the ability to engage in cognitive self-regulation, which has been the center of our discussion so far. Emotion regulation is the ability to self-monitor and self-control one's emotional states. When an emotion such as anxiety occurs, it can have a negative effect on an individual's self-control. Wyble, Sharma, and Bowman (2008) described a neural network of emotional self-regulation that can interfere with the ability to make self-control decisions in the cognitive domains. They showed that negative emotional interference during a taxing

cognitive-control task (i.e., the Stroop task) can slow down, suppress, or even withdraw their attention from the challenging task. In college, students may get a lot of negative feedback if they are struggling academically or socially. This negativity can then result in the likelihood that they will disengage or withdraw from those situations or activities, explained by Wyble and colleagues as a protective or defense mechanism. Thus, having the support of a coach and a team of individuals to whom these students can turn is even more important for these students than for students who are doing well in college and receive positive feedback. Furthermore, preventing negative experiences from occurring in the first place can be a key element of supporting college students with executive function problems.

Why Emphasize Self-Regulation?

Self-regulation is the ability to assess, select, act, adapt, and understand how “the self” has input into these processes. Self-regulation is a set of processes that are at the core of executive functions. Consider the current college and work environments. The successful student or employee is one who follows the rules but can quickly assess, look for options, and adapt on demand. This fluid form of intelligence actually predicts learning in both settings. A meta-analysis conducted by Sitzman and Ely (2011) found that four aspects of self-regulation had the strongest effect or impact on learning and work:

1. Identifying and setting attainable goals.
2. Being persistent in the steps taken toward those goals.
3. Appropriating and maintaining good effort or motivation.
4. Having the self-efficacy that they have the knowledge and skills to be successful.

In this sense, self-regulation “reflects goal-oriented behavior and includes a multitude of processes operating in concert . . . within a learning context” (Sitzman & Ely, 2011, p. 421). Here, the context is college.

In general, self-regulation in high school and college students appears to be related to general academic success and adjustment. Those students with self-regulation abilities are more likely to graduate and have higher GPAs compared to students without these kinds of abilities (Getzel & Thoma, 2008; Kitsanta, Winsler, & Huie, 2008). In a review of what contributes to university students’ GPA, Richardson, Abraham, and Bond (2012) found that self-efficacy predicted GPA the best, followed by students’ high school GPA. Additionally, all three aspects of self-regulation (self-efficacy, having goals, and effort regulation) positively correlated with GPA.

Furthermore, several studies point out the relationship between self-regulation and academic stress in older high school students and in college students. For example, Kadzikowska-Wrzosek (2012) found that of 18- to 19-year-olds who experienced test-taking stress but had used self-regulation strategies had fewer mental health problems when compared to stressed students who did not use self-regulation skills. Others have found that in the first year of college, students who improved in their self-regulation abilities (constructive thinking or problem solving, emotion regulation, and sense of mastery) were better adjusted psychologically at the end of the first year compared to students who did not improve in self-regulation (Park, Edmundson, & Lee, 2011).

Unfortunately, individuals appear to have a limited capacity for self-regulation. Over 600 studies in the social and behavior sciences have shown that self-control, the ability to suppress thoughts or behaviors in favor of those that are needed to meet a goal, can be depleted. In other words, we have a set amount of self-regulation resources, and when we run out, we are less likely to be able to inhibit or use self-control (Muraven & Baumeister, 2000). For college students, the need for self-control can be very demanding. Students have to exert discipline to study, to get to class on time, to meet deadlines, to engage in healthy living behaviors, to say no, at times, to friends, and so forth. However, stress, which is a part of college life, impairs or depletes self-control. Students who experience high levels of exam stress, for example, tend to smoke more (West & Lennox, 1992) and exercise less (Stephoe, Wardle, Pollard, Canaan, & Davies, 1996) before exams. These two behaviors require self-control: for the latter, students were unable to exert self-control over smoking, and for the former, students did not exert self-control by continuing to exercise. Oaten and Cheng (2005) found that students who were stressed during exams were more likely to engage in more unhealthy eating, smoking, and drinking of caffeine, and had less emotional control, a lack of follow-through to commitments, and poor study habits, for example. When professionals working with college students have a better understanding of detrimental effects that stress has on self-regulation, they can help students to develop a stress management plan to prevent self-regulation fatigue during critical times in the semester.

For college students without disabilities, self-regulation usually predicts academic success. For individuals with disabilities, having strong executive functions, specifically self-regulation skills, is even more critical to their success. For students with disabilities such as hearing, visual, and mobility impairments, those who have strong executive function abilities can compensate for and work around their disabilities and overcome many of the barriers to learning, socializing, and working. However, students *with executive function disabilities* lack the very self-regulation skills that would improve the likelihood of their success; they lack these critical *ways of thinking and problem solving*. Highlighting the need to emphasize these self-skills, Ylvisaker (1998) stated, "What you do with what you have is more important

than what you have.” In other words, for students who have the basic cognitive, language, and memory abilities to learn college-level material, *how they use their strengths and compensate for their weaknesses is more critical to college success than what their strengths and weaknesses are.*

In summary, executive functions are viewed as higher-order cognitive processes that oversee more basic cognitive abilities. And while there are many definitions and lists of executive function skills, self-regulation is a group of processes that are inherent to executive functions. Self-regulation includes both ongoing regulating processes (self-monitoring, self-control, self-acting, and self-comparing/adjusting) and the sense of oneself, or what one believes about oneself. In complex and intentional activities, self-regulation is necessary in order to create goals, select strategies, plan and sequence the necessary steps, carry out the steps using strategies, evaluate performance using strategies, and make adjustments when necessary. As a part of self-regulation, strong self-efficacy and self-determination are predictors of success not only in college but also at work. The ability to self-regulate is important for all college students, but for those with disabilities, it is critical. However, students with executive function disabilities are at a unique disadvantage since the nature of their disability lies in the very cognitive processes that would allow them to problem-solve, compensate, and adjust to the academic, work, and social demands of college life.

Let us now turn to the groups of college students who are likely to have executive function problems as the result of an acquired condition (e.g., brain injury) or as the result of a developmental condition (e.g., ADHD) in Chapter 2.