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Executive Functions in the Schools: What Do Teachers Know About Executive Functions and How They Impact Student Progress?

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Dissertation Approval

This is to certify that the thesis presented to us by Larissa Morgan-Borkowski on the 5th day of June, 2012, in partial fulfillment of the requirements for the degree of Doctor of Psychology, has been examined and is acceptable in both scholarship and literary quality.

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ABSTRACT

The current study surveyed middle school teachers on their knowledge, attitudes, beliefs, and expectations regarding executive functions in relation to students' academic success.

The results of this study indicated that teachers perceived themselves as knowledgeable of executive functions.

A disconnect was found between teacher responses to an open-ended question regarding abilities and skills required for academic success and their endorsements of specific questions regarding executive functions. Motivation, problem-solving, and basic academic skills were indicated as being most important for success, but two of these are considered capacities students possess intrinsically. When asked about specific executive functions however, they rated them as being important to success, indicated that they could be taught and indicated that that they were actually teaching them to students despite not having received training and not being familiar with executive function resources.

TABLE OF CONTENTS

TABLES

CHAPTER 1

Introduction

Executive functions, such as inhibition and shifting, planning, and organizing (Bull & Scerif, 2001; Clark, Pritchard, & Woodward, 2010), are used to complete various daily tasks. Students also use executive functions in school to complete school assignments, learn concepts, engage appropriately with their peers and staff members, and behave appropriately each day. Executive functions often predict future math achievement in children, and written language and reading comprehension skills also are influenced and impacted by various executive functions (van der Sluis, de Jong, & van der Leij, 2004; Locascio, Mahone, Eason, & Cutting, 2010; Hooper, Swartz, Wakely, de Kruif, & Montgomery, 2002). When students experience delays in the development of one or more executive functions, their understanding of academic material and social interactions may suffer. They may not be able to complete their work, have a hard time grasping concepts, have difficulty attending to instruction, and exhibit several other behaviors representative of deficits in executive function development. They also may be unable to establish new friendships and maintain old ones or may have difficulty interacting socially in general.

Statement of the Problem

Teachers work daily with students who are struggling in one or more academic subject areas. They may not even know the students are having difficulties unless the difficulties are severe and, therefore, more likely to be noticeable. In some cases, teachers may be aware that some students are struggling each day in class but may be

unable to pinpoint the nature of the executive function deficits that underlie the academic problems of these students.

Students are being referred in increasing numbers to pre-referral intervention services teams that are responsible for implementing classroom, small-group, and/or individual interventions. Many of these same students are subsequently referred for testing to a child study team, comprised of a school psychologist, learning disabilities teacher consultant, social worker, teachers, and the parent(s) of the student to determine whether the child has a learning disability or social/emotional difficulties. Often school psychologists ask teachers to complete rating scales such as the Behavior Rating Inventory of Executive Functions (BRIEF) as part of evaluations to further examine students' executive functions. Additionally, more students are being evaluated by outside evaluators, such as neurologists and neuropsychologists, and are told that they exhibit executive dysfunction. They may be diagnosed with Attention Deficit Hyperactivity Disorder or other disorders commonly associated with executive function deficits. Teachers have these students in their classes and often do not understand fully what the term "executive functions" encompasses. They may have heard the terminology for the different skills that fall under the umbrella of executive functions. However, they may not be aware of the actual meanings and may not be able to describe the role that executive functions play in students' perceptions, feelings, thoughts, and actions.

Not only may teachers have little knowledge of what executive functions are, their attitudes and expectations regarding what children should be able to do in the way of self-regulation may be skewed because of a lack of knowledge of how executive functions develop during childhood and adolescence. Furthermore, a limited knowledge

and understanding of executive functions may impact teachers' abilities to know when to seek assistance and/or design and implement interventions to assist students who exhibit executive function difficulties. The use of executive functions by children is important for their success in school. Some students have diagnoses that are characterized by deficits in executive functions. It is imperative, therefore, that classroom teachers know and understand how executive functions impact their students' abilities to learn and produce in the classroom to foster effective learning for all students.

Purpose of the Study

The purpose of this study is to examine teachers' knowledge of executive functions. This study will examine teachers' familiarity with terms most frequently used to refer to executive functions in a general manner as well as terms specific to the executive functions students use to succeed in school. Additionally this study will examine teachers' understanding of self-regulation capacities of children and their attitudes and expectations regarding what children should be able to demonstrate in the way of self-regulation. It is hoped by that by understanding teachers' knowledge of executive functions, we will be better able to help teachers increase their knowledge about executive functions in areas where it may be lacking. Using this information, we can then develop professional development opportunities for teachers to add to their repertoire of knowledge of executive functions in an effort to build their arsenal of interventions to help the students with whom they work who exhibit executive functions deficits. Through examining teachers' existing knowledge and expectations in regards to students' use of executive functions, we also are indirectly considering their desire to increase this knowledge. Understanding teachers' knowledge of executive functions,

their expectations for student self-regulation, and their beliefs about the extent to which self-regulation can be improved through classroom instruction will improve efforts to educate teachers about the role of executive functions in academic success and how they can increase students' self-regulation and increase their likelihood of academic success.

CHAPTER 2

Literature Review

Overview

A Google search of the term "executive function" elicits more than 400,000 hits. A search of scholarly publications elicits thousands of journal articles and books written on the topic. The concept of executive functions is clearly a hot topic in the field of psychology as well as in education. Executive functions often are thought of as the mental capacities that drive behaviors, help each of us complete the daily tasks we tackle, and establish long-term goals for the future. The term "executive functions" is considered to be an overarching construct that encompasses a wide array of directive capacities. But what are executive functions and why are they so important?

Executive functions are typically associated with the frontal lobes or prefrontal cortex of the brain, and definitions tend to be neurologically based and focused on behaviors that are purposeful and goal-directed (Brocki & Bohlin, 2004; Stuss & Alexander, 2000; Anderson, 2002). According to Dawson and Guare (2010), executive functions help us in regulating our behaviors to accomplish goals. More specifically, executive functions are a set of skills used by an individual to cue and direct perceptions, emotions, thoughts, and actions (McCloskey, Perkins, & Van Divner, 2009). We may use executive functions each day, from the moment our alarm rings in the morning to get us up until the moment we go to bed setting that same alarm to wake us up the next morning. Overall, there seems to be a general consensus among researchers that executive functions are involved with higher-level cognitive capacities, such as decision

making, problem solving, and deductive and inductive reasoning, and enable us to do what we do. They are required for intentional, goal-directed behaviors.

Conceptual Frameworks of Executive Functions

Executive functions are multiple and vary in nature. Included in the executive functions research literature are discussions of planning, inhibition, interference control, strategizing, organization, sequencing, maintenance of behavior, self-monitoring, attention, flexibility of thought, utilization of feedback and anticipation (Anderson, 2002; Denckla, 1996; Morris, 1996). A number of conceptual frameworks for the organization of executive functions have been proposed over the years.

Stuss and Alexander (2000) have proposed a model of executive functions incorporating a tiered framework of self-awareness. They consider a hierarchical model with movement among the levels. Their framework consists of four levels of functioning (arousal-attention, perceptual-motor, executive mediation, and self-awareness). There is movement both forward and backward among the levels within the framework. The levels provide for a provisional organization system; however, the allowable movement in either direction provides for adaptations, preferences, or even limitations during operations. It is at the perceptual-motor level in which there is direct contact with the outside environment. The frontal lobes are implicated in the two top levels (executive mediation and self-awareness). The executive mediation level is where planning, inhibition, and problem-solving skills become more engaged. The highest level of self-awareness is an emotional state engaging memory of experiences and knowledge as well as abstract thought for what can be expected in the future. Memory of abstract mental states creates self-awareness from a combination of emotional states and memory.

The framework laid out by McCloskey et al. (2009) describes a holarchical model of executive functions. The model categorizes executive function into five levels. These levels are (1) self-activation, (2) self-regulation, (3) self-realization and self-determination, (4) self-generation, and (5) trans-self-integration. The first level, self-activation, precedes the levels of self-control and describes how executive functions are awakened after a nonconscious state such as sleep. The second level is self-regulation, which is comprised of at least 23 executive functions that are separate from each other. Recently this list of self-regulation executive functions has expanded from 23 to 32 (2010). These executive functions include, but are not limited to, the ability to gauge, inhibit, sustain, shift, manipulate, organize, retrieve, and monitor. They cue and direct our perceptions, cognitions, emotions, and actions both consciously and nonconsciously. The third level includes self-realization and self-determination. Self-realization involves self-awareness and self-analysis through reflection. It is by having a better understanding of self that one also is able to realize the "selves" of others around them. Self-determination involves goal setting and planning for the future. Aspects of self-determination allow an individual to create, monitor, and modify long-term goals. The fourth level, self-generation, enables a person to examine life at a deeper, more philosophical level. At this level, one begins posing questions such as "Why do I exist?' and "Do we have a purpose in life?" The fifth and final level is trans-self-generation. At this level executive functions mediate a state of consciousness in which the individual perceives himself or herself as becoming one with the universe. This stage is not reached easily. McCloskey and colleagues have suggested that one does not have to be fully developed at one level before moving into development at the next levels.

As previously mentioned, self-regulation executive functions direct and cue functioning in the domains of cognition, perception, emotion, and action. The self-regulation executive functions are independent of each other and all develop from birth. A person may effectively use one or more executive functions in an age-appropriate manner but have varying degrees of difficulty with the effective use of other executive functions. It is also possible for executive functions to vary in effectiveness of use across the four domains of perception, emotion, thought, and action. For example, one executive function may be effectively used at an age-appropriate level to cue and direct cognitions but not to cue and direct emotions.

This model also discusses variability of use of executive functions based on four arenas of involvement (intrapersonal, interpersonal, environmental, and symbol system). McCloskey's model of executive function is probably the most comprehensive model in the literature. His model offers descriptions of a large array of executive functions that we use to manage life's tasks.

As research and writing on executive functions continues to expand, additional conceptual frameworks have focused on various subsets of executive functions. These additional sources have targeted teachers and parents as their audience, with the intention of increasing awareness of the role of executive functions in production in both the classroom and the home. In his book, *Executive Functions in the Classroom*, Kaufman (2010) has presented a two-core view of executive functions. The two core aspects are Metacognitive and Social/Emotional Regulation. The Metacognitive core includes goal setting, planning/strategizing, sequencing, organization of materials, time management, executive/goal-directed attention, task persistence, working memory, and set shifting.

The Social/Emotional Regulation core includes response inhibition (impulse control), emotional control, and adaptability. Similarly, Dawson and Guare (2010) have described executive function skills as those processes that assist us in regulating our behaviors. They have broken executive skills into two groupings that are analogous to those described by Kaufman. The first group consists of planning, organization, time management, working memory, and metacognition skills, which help us in creating and achieving our goals and finding solutions to problems. The second group includes response inhibition, emotional control, sustained attention, task initiation, flexibility, and goal-directed persistence, which assists us in directing our behavior toward our goals or problem solutions.

The books currently available to teachers, two of which have been described previously, have a tendency to describe executive functions somewhat vaguely, making it difficult to view them as teachable skills. For example, "time management" often is listed as an executive function, but time management actually describes a state that is achieved through the use of multiple executive functions, including cueing the sensing of time, cueing the estimation of time, and cueing the necessary pacing of performance. Depending on the nature of the task requiring time management skills, there may be additional executive functions needed to be successful.

Development of Executive Functions in Children and Adolescents

When considering and understanding the various individual executive functions, discussion of the development of these skills is imperative. Research on the stages of development of executive functions in children and adolescents presents multiple views, but it appears that most research on development indicates that executive

functions continue to develop well into adulthood and possibly throughout the course of a lifetime. Holler and Greene (2010) have described the development of executive functions as beginning even before birth, with the connections between neurons during processes called *synaptogenesis* and *myelogenesis*. Synaptogenesis is what allows communication to occur among the brain cells. It describes how connections (electrical or chemical) form between neurons. Myelination, which occurs into adulthood, is the process through which a myelin sheath forms around a nerve fiber. This myelin sheath helps speed up communication among neurons.

Levine's neurodevelopmental approach. Another developmental model of executive functions breaks down processes based on what is expected of students in various grade level clusters. Levine (2002) has taken a neurodevelopmental approach focusing on neuromotor, attention, sequencing, and higher-order cognition and how development steers these processes. He has broken down development into four periods: (1) preschool through first grade, (2) grades 1 through 3, (3) grades 4 through 8, and (4) adolescence. Each category is associated with differing neurodevelopmental advances that are key during each stage (grade levels). Levine has not necessarily developed a completely new approach to the development of executive functions skills but, rather, has provided a model for viewing the way in which we combine neurodevelopment and executive function skill acquisition.

A fluid developmental model. McCloskey et al. (2009) have explained the development of executive function as more of a fluid process and one that varies from one individual to another. It is also important to note that development of executive processes may even vary within the individual. The 23 self-regulation processes begin to

develop in infancy and continue through adulthood. McCloskey et al. (2009) suggested that self-determination and self-realization have the potential to begin prior to adolescence but typically do not play a prominent role in executive function development until the adolescent period. Self-generation and trans-self-integration most likely do not begin to develop until early—or even late—adulthood, if at all.

It is important to note that regardless of the theory of development, there is one common thread. Executive functions develop over time, and as one progresses in age, changes are occurring and capacities are becoming more fully developed. There is no charted course that can say at what point in time one will be fully developed in a particular facet of executive functions. There are simply generalizable guides that estimate when full development may occur.

Many researchers have examined how executive functions develop in individuals without necessarily proposing a general model or framework. They instead point out that different skills may develop at different times in an individual's life, which is along the lines of what McCloskey and colleagues (2009) have suggested. There is a growing body of research that suggests executive functions develop substantially during the school years (Romine & Reynolds, 2005) with seeds being planted early in the preschool years (Best, Miller, & Jones, 2009) that will become more fully developed in the later years. For example, cueing, inhibition, and working memory have been suggested to develop at younger ages, whereas shifting and planning are thought to develop in late childhood and adolescence (Jacques & Marcovitch, 2010).

These theories/models of the development of executive functions are primarily based on normal development. They do not take into account any of the many disabilities

with which children are diagnosed. Many children are diagnosed with disorders that impact their development and use of executive functions. It is widely known that children diagnosed with Attention Deficit Hyperactivity Disorder (ADHD) have trouble with inhibition, planning, attention, behavior regulation, and other executive functions (Biederman et al., 2008; Biederman et al., 2004). Other disorders in which executive functions may be impacted significantly include Autism and Asperger's syndrome (Verte, Geurts, Roeyers, Oosterlaan, & Sergeant, 2006), Oppositional Defiant Disorder (Oosterlaan, Scheres, & Sergeant, 2005), Bipolar, Tourette's syndrome, learning disabilities, and traumatic brain injuries (Horton, Soper, & Reynolds, 2010). Many of these disorders are characterized by executive dysfunction resulting from delayed development or damage to areas of the brain responsible for executive functions. Although these disorders all exhibit one or more deficits in executive functions, individuals with these disorders/disabilities do not all experience the same patterns of deficit.

Developmental delays within individuals impact the rate at which they progress in the use of the various executive functions. These developmental delays are not fixed deficits such that an individual is stuck with a deficit and there is no means of improvement; rather, they are simply developing levels of use later than a typically developing individual. For example, when compared to a typically developing 9-year-old, an individual with a developmental delay may be exhibiting a level of executive function use that is more consistent with a typically developing 6-year-old. A delay does not indicate that one will never develop a greater capacity for use of an executive function; it merely suggests that they may take longer to reach that level of capacity.

Delays suggest that continued growth is possible, especially with intervention efforts, albeit at a slower pace. Similarly to this contrast of developmental delays versus fixed deficits is the idea of fixed versus growth mindsets often discussed in work of Dweck (2010). In an article titled "Even geniuses work hard," Dweck (2010) has discussed how those who embrace a growth mindset understand that challenges allow for learning and growth, effort is required to develop abilities no matter their intelligence, and obstacles simply mean a different approach is needed or more resources are required to learn. Those with a fixed mindset believe that they can only work within certain limits, as if they have a certain intelligence level and believe there is no getting beyond that set level. These are important concepts to consider within the discussion of executive functions. There are benefits to having a growth mindset rather than a fixed mindset. From the perspective of a growth mindset, intervention efforts to improve students' use of executive functions is based on the assumption that executive functions can be developed and improved through education, whereas a fixed mindset would be deficit oriented and would suggest that executive function difficulties cannot be changed.

Views of the development of executive functions vary, from fixed views that suggest you are born with a certain amount of potential and you are limited to that potential to growth views that embrace more fluid movement among levels of development. Dweck's growth mindset (2010) and McCloskey and colleagues' (2009) holarchical view of executive functions have suggested that executive functions are more fluid in their development, with each individual progressing at their own rate. The holarchical view also suggests that growth can occur at multiple levels of development at the same time and that individuals may move to a higher level of development before

fully developing the executive functions of a lower level. Levine (2002), however, has taken a more hierarchical approach in his view of executive function development, with it following more of a neurodevelopmental sequence. Whether subscribing to a hierarchical or holarchical view of development, executive functions are integral to success in daily life. Knowing and understanding executive functions is critical to understanding how students learn and produce in an educational setting. How executive functions develop over time and how this development may be delayed is just as crucial as knowing what executive functions are when it comes to working with students with and without disabilities.

Executive Functions in the Educational Setting

Students from preschool through high school are expected to make effective use of self-regulation executive functions within the classroom setting. Executive functions can impact a student's ability to socialize with their friends and converse with their teacher and other staff members. Homework completion and simply getting to and from school also are impacted by a student's use of executive functions. Benefiting from academic instruction and successfully completing assignments both require effective use of executive functions. Several studies have been conducted on the involvement of executive functions in academic achievement. In general, researchers have found that executive functions do affect academic performance (Berninger & Richards, 2002; Bull & Scerif, 2001; Monette, Bigras, & Guay, 2011). Reading, writing, and arithmetic—the three pillars of education—are considered the basic and most important facets of learning in a student's educational career. Therefore, it is important that we examine the research

on the involvement of executive functions in the development of reading, writing, and arithmetic skills in students.

Executive functions in reading. Reading generally requires students to use a variety of cognitive constructs, including phonological and orthographic processing, oral-motor functioning, sight word recognition, decoding, speed and fluency, reading comprehension skills, basic language abilities, reasoning with verbal information, word knowledge, and a fund of general information (McCloskey et al., 2009). Beyond these typical constructs that most people would recognize as important in reading, executive functions greatly impact reading competency. The ability of a child to pay attention, follow directions, and inhibit responses has been found to have a positive relationship with emergent literacy and vocabulary skills in preschoolers (McClelland et al., 2007). Additionally, it is suggested that behavior regulation is important for school readiness. In a study conducted by Locascio, Mahone, Eason, and Cutting (2010), word recognition and reading comprehension skills were found to rely in part on working memory and response inhibition. Those students with known reading comprehension and word recognition deficits were found to have deficits in executive functions as well. They found that students with reading comprehension deficits also exhibited poor planning and organization skills. Other studies have found that reading comprehension skills are impacted by working memory and planning (Sesma, Mahone, Levine, Eason, & Cutting, 2009; Kaufman, 2010), self-monitoring, and shifting (Daniels & Zemelman, 2004; Gaskins, Satlow, & Pressley, 2007).

A study conducted by van der Sluis, de Jong, and van der Leij (2004) focused on inhibition and shifting in children with learning deficits in mathematics and reading and

found shifting and inhibition deficits in children with both mathematics and reading disabilities but not in children with reading disabilities alone.

McCloskey et al. (2009) have discussed the various self-regulation executive functions thought to be involved in cueing, directing, and coordinating the act of reading for meaning. The seemingly simple acts of word recognition and decoding require the ability to focus attention, perceive the orthographic images accurately, inhibit impulsive responses (incorrect word calling), retrieve previously learned information, self-monitor, and self-correct. Added to this is the ability to read fluently, which necessitates the use of the additional executive functions of pace, sustain (attention), and balance. At this point an individual has used a considerable number of executive functions, and they are only reading the words on the page. Reading for understanding elicits the reading skill cues previously described in addition to the use of the executive functions of gauge, modulate, shift, hold, manipulate, generate, sustain, organize, plan, and store.

Berninger and Richards (2002) have referred to the role of executive functions as necessary to develop the skill involved in reading and to orchestrate the working together of what they have referred to as the "reading brain" with other systems within the brain. Executive functions allow for the planning, attending to visual information, retrieval of previously learned information, cueing, controlled processing of information, and so forth. Executive functions are used in the orthographic and oral motor processing of information as well as the comprehension of information. The seemingly simple act of reading text involves a considerable amount of executive function use, as described by Berninger and Richards (2002, p. 160), "during text reading, the executive system manages online links between the reading lexicon and (a) the incoming stimuli and

existing representations of the visual system, (b) the existing representations in the aural/oral language systems, and (c) the cognitive system for reasoning."

Executive functions in writing. Teachers most often cite the importance of organization, planning, monitoring, editing, and being able to generate ideas as skills students need to possess to be able to complete writing assignments in school. Many teachers, however, may not think of the act of writing as a process that involves executive functions. In actuality, many of the basic constructs mentioned by teachers as critical to writing are executive functions.

Several studies have examined the role of various executive functions in the act of writing. Differences in initiation, sustaining effort and set shifting have been found between good and poor writers (Hooper, Swartz, Wakely, de Kruif, & Montgomery, 2002). Self-regulation is considered to be an important capacity for successful writing. A study conducted by Glaser and Brunstein (2007) compared two groups (strategy only and strategy plus self-regulation) of fourth grade students in their writing skills. The strategy only group learned only writing strategies to help them in their writings. The strategy plus self-regulation group learned the same strategies as well as how to self-monitor their planning, self-assess the quality of their writings, self-monitor their revisions, and set goals to achieve the best writing possible. The results of their study showed a dramatic and statistically significant difference between the two groups. The group that was taught strategies and self-regulation procedures (self-monitoring, self-assessing, and planning) produced much better writing samples than the group that was taught only strategies.

Planning, revising, attention, flexibility, inhibition, organization, motivation, and working memory are all needed to write effectively (Graham, Harris, & Olinghouse, 2007). The task of writing is not limited to producing a report or story. Taking notes in class is as much of a writing task as composing a book report. In the case of note taking, inhibition plays an important role. Altemeier, Jones Abbott, and Berninger (2006) have examined executive functions involvement in note taking while reading and subsequent use of the notes to compose a written report. They found that inhibition was most important to note taking, and verbal fluency was most important when writing a report from the notes, whereas working memory did not contribute significantly to this writing process.

Berninger and Richards (2002) have referred to writing as being an "immense juggling act" because it requires more than the act of reading. Writing requires the planning and generating of ideas, putting those ideas down on paper, and then going back over the writing and editing until a final product has been achieved. What may sound like a relatively simple process requires a considerable amount of work and requires the coordination of the attentional, executive, and motor systems. Berninger and Richards (2002) have listed specifically the roles of executive functions when writing as (1) creating goals and plans, (2) updating and monitoring, (3) reviewing and revising, (4) coordinating multiple jobs, (5) coordinating cross-talk with other systems, (6) supervising working memory, and (7) guiding reflections.

Writing requires multiple steps, with each step in the writing process requiring the use of various executive functions. McCloskey et al. (2009) have broken down each step of writing from the beginning of the formation of the text itself to the editing and revising

of the final product. Within each step (text formation and transcription, text production speed and automaticity, spelling, text generation, and text editing/revising) they list the executive functions needed to complete that particular step. Not only are students using those executive functions needed for the writing task itself but also those executive functions needed for reading, as good writing involves reading to oneself what one has written. As aspects of the writing process become more automatic, cognitive processes are freed up that, in turn, lower the executive function load. Writing is arguably the most taxing on executive functions and requires use of a majority of the multiple executive functions they propose.

Executive functions in arithmetic. To complete computations in math problems, one needs to have knowledge of the visual representation of numbers and the quantity associated with each number, knowledge of the operational signs and their meanings, knowledge of how to spatially align numbers, and knowledge of the algorithms used in computation. In addition to these cognitive constructs, executive functions also play a critical role in effective performance of math computations.

Deficits in inhibition, switching, and working memory abilities were found to be predictive of lower math abilities in children (Bull & Scerif, 2001). Further, it was found that the degree of facility with the executive functions of set shifting, inhibitory control, and emotional control and memory in preschool predicted early elementary school math abilities (Clark, Pritchard, & Woodard, 2010). Preschoolers who exhibited deficits in these areas were more likely to struggle in math later in their educational career. In a longitudinal study of executive functions and math skills Mazzocco and Kover (2007) found that inhibition played a role in math skills in early and late

elementary school. Self-regulation skills were found to be integral to early math production (Blair & Razza, 2007). The ability to inhibit impulsive responding and to self-monitor are critical executive functions related to effective completion of math problem solving.

Similarly to how they have discussed executive functioning in reading and writing McCloskey et al. (2009) have broken down the various steps involved in completing mathematic problems and the executive functions used in each step. From basic fact automaticity of retrieval to calculating using computational skills to problem solving using pencil and paper when completing math word problems, executive functions are used with each task. Depending on the specific cognitive processes, abilities, and lexicons being used to complete math problems, varying executive functions are used, including cues for retrieving, for focusing, for pacing, for monitoring, and even for inhibiting. In addition, the executive functions used in reading and writing are all engaged during a student's attempt at completing math word problems. Further, when applying math skills to real-world situations, the use of executive functions greatly increases as they also do when completing mathematical problems that are novel.

Importance of Teacher Knowledge of Executive Functions

We know that students use executive functions on a daily basis to work through challenging assignments, listen to instruction delivered by their teachers, and engage in social activities with their peers. When students have difficulties producing in school, it is possible that their struggles are caused by deficits in, or lack of effective use of, executive functions. Teachers are shown reports stating that children have executive dysfunction, and, more frequently, students are diagnosed with any one of the disorders previously discussed with which executive function deficits typically are associated. Although they have a diagnosis, these students need to be able to demonstrate their knowledge of the information being taught. Teachers must be able to teach these students in the best way possible for them to comprehend and learn the material and to demonstrate their learning. This begins with teachers having an understanding of what executive functions are, how they impact the learning and production of children and adolescents, and what can be expected of students with deficits in executive functions. By responding to a survey regarding knowledge of, beliefs about, and expectations for student use of executive functions, the topic of executive functions is brought to the forefront of teachers' awareness. Having a conscious awareness of the topic of executive functions increases the likelihood that teachers will make a concerted effort to teach or reinforce these skills in their students.

Unfortunately, at this point in time teachers who want to learn about the topic of executive functions have limited resources available to them. Only Dawson and Guare (2010), Kaufman (2010), and Meltzer (2010) have published books on the topic that are intended for use by teachers in their instruction of students. Given the limited availability

of resources, it is very likely that teachers are not receiving much information about executive functions and their role in classroom production. And it is even more likely that teachers are not being provided information or training in ways to help children improve their use of executive functions to increase their effective production in the classroom.

Statement of the Research Questions

Considering that the goal of schooling is to educate students, it can be expected that professional development within most school districts will be focused on curriculum, differentiated instruction, learning tools, and classroom management. For teachers to better serve their ever-changing student body, it is imperative that we understand what teachers know and do not know about executive functions. Using this information, we can better serve our teachers by developing manuals and providing trainings on the role of executive functions in classroom production and academic competence.

Teachers are the sample of interest because they work directly with students, educating them on a daily basis, and they see students in multiple areas within the educational setting. Deficits in executive functioning skills potentially impact a student's ability to learn and socialize with their peers and authority figures, and, therefore, it is imperative for teachers to fully understand executive functions in an effort to teach their students in the most effective and efficient manner. Thus, it is important to examine the extent of their knowledge and attitudes regarding executive functions. Although special education teachers are even more likely to work with many students who have executive functions difficulties, it is not apparent from the professional literature that special education teachers are any more knowledgeable of the construct of executive functions

and the role that executive functions play in academic learning and production.

This study will use a teacher survey to answer the following research questions:

1a. What mental abilities or skills do teachers believe to be essential to students' academic success?

1b. Do general education and special education teachers differ in the mental abilities they believe to be essential for students' academic success?

2a. To what extent do teachers view as essential to success general behaviors that reflect the effective use of executive functions?

2b. To what extent do general education and special education teachers differ in their views regarding the extent to which general behaviors that reflect the effective use of executive functions are essential to success?

3a. To what extent do teachers view specific executive functions as being essential to students' academic success?

3b. To what extent do general education and special education teachers differ in their views regarding the extent to which specific executive functions are essential to students' academic success?

4a. What expectations do teachers have for their students for them to be successful?

4b. Do general education and special education teachers differ in their expectations of their students for them to be successful?

5a. To what extent do teachers expect students to engage in specific executive functions for them to succeed academically?

5b. Do general education and special education teachers differ in their expectations of students to engage in specific executive functions to succeed academically?

6a. How confident are teachers that they can teach students general behaviors that reflect the use of executive functions?

6b. Do general education and special education teachers differ in confidence that they can teach students' general behaviors that reflect the use of executive functions?

7a. To what extent do teachers think specific executive functions can be taught to students who do them poorly?

7b. Do general education and special education teachers differ in their beliefs that students can be taught specific executive functions if they do them poorly?

8a. To what extent do teachers believe they directly teach specific executive functions to students who do them poorly?

8b. Do general education and special education teachers differ in their beliefs that they directly teach specific executive functions to students who do them poorly?

9a. Are teachers in general familiar with terms associated with executive functioning?

9b. Do general education and special education teachers differ in their familiarity with terms associated with executive functioning?

10a. To what extent do teachers think that academic skills, social skills, and behavior are impacted by executive functions?

10b. Do general education and special education teachers differ in their views that various academic skills, social skills, and behavior are impacted by executive functions?

11a. Are teachers being trained on executive functions, either on their own or through their districts?

11b. Do general education and special education teachers differ in their exposure to trainings on executive functions, either on their own or through their districts?

12a. Are teachers familiar with the resources available to them? And, if so, are they reading them and using the information in their classrooms to help their students?

12b. Are special education teachers more familiar with resources than general education teachers?

Hypotheses

It was hypothesized that teachers will have limited knowledge of the concept of executive functions. Additionally it is expected that their exposure to trainings about executive functions will also be limited. It was also hypothesized that teachers would have a limited understanding of self-regulation capacities of children and their attitudes and expectations regarding what children should be able to do in the way of self-regulation will be skewed. We expected teachers to believe that the various executive functions would be essential to academic success. In regards to teaching students how to use executive functions, we expected that a majority of teachers would report that they could be taught with great difficulty and, therefore, would not directly teach the skills. These hypotheses highlight the need for understanding teachers' knowledge, or lack thereof, regarding executive functions. It is important to know what teachers know about executive functions and their perceptions about whether executive functions can be improved through classroom instruction.

CHAPTER 3

Methods

Overview

This chapter describes the methods that were used to conduct this study. The objective of the study was to investigate teachers' knowledge of, and attitudes about, executive functions, their expectations for students' use of executive functions in the classroom, and their knowledge of, and attitudes about, teaching strategies intended to help students improve their use of executive functions.

Participants

Teachers from New Jersey, Pennsylvania, South Carolina, New York, Ohio, and California participated in this study. A large portion of the teachers who participated in New Jersey were recruited through mass e-mailing through the use of publically posted e-mail addresses. All participants were general and special education classroom teachers who agreed to complete a survey about their knowledge of executive functions. Teachers were employed in a school district and were teaching students at the time of completion of the survey. No specific identifying information was provided by the teachers who completed surveys. A copy of the survey is included in the appendix.

Instrument

The survey used in the study was designed to elicit teacher knowledge of and attitudes about the concept of executive functions. The survey questions were designed to elicit teachers' judgments about their familiarity with a wide array of executive functions capacities and their opinions about the mental capacities children need to succeed academically and behaviorally in school as well as their expectations for

students' use of executive functions to achieve mastery of content and produce effectively in the classroom.

Procedures

The study was approved by the Institutional Review Board at the Philadelphia College of Osteopathic Medicine. Because the study utilized a survey with no identifiers, informed consent was not required. Two delivery methods were ultilized for the purpose of diseminating the study survey. The paper-and-pencil survey was distributed to teachers during staff meetings in two local New Jersey rural school districts. The majority of participants were reached through mass e-mails sent through the Web-based survey software and questionnaire tool SurveyMonkey.com. Teachers' publically posted e-mail addresses from their respective school district websites were utilized to reach a large participant pool. E-mails contained information regarding the purpose of the study being conducted. Additionally surveys also were distributed from colleague to colleague by e-mailing the survey link on SurveyMonkey.com. The cover letter attached to the survey is presented in the appendix.

Variables for Analysis

Demographic information (length of time teaching, highest degree earned, educational population taught, and setting of school where employed) was collected as part of the survey. Teachers' beliefs about mental abilities or skills believed to be essential to student academic success and behaviors reflecting the use of executive functions were examined. Teacher beliefs about the importance, and teachability, of specific executive functions were examined. Teachers' knowledge of terms associated with executive function also was examined. Additionally, teachers' perceptions about the

impact of executive functions on specific educational subjects, behavior, and social skills were assessed. Exposure to trainings on executive functions as well as familiarity with executive function resources also was examined.

Data Analysis

Data analysis included generating frequency distributions for the demographic information that was collected (i.e., educational degree received, length of time teaching, special education certified, types of students taught, and setting in which the school is located). Frequency distributions of response categories were generated to examine teacher responses to each survey question that utilized a Likert-type rating scale. For the two open-ended questions related to teachers' beliefs about abilities or skills essential to academic success, teacher responses were recorded verbatim into an Excel file. The content of each teacher statement was then analyzed to identify specific abilities and skills included in the statement. Each individual statement about specific abilities and skills was then compared to all other statements to identify common themes and distributions were generated based on the frequency of mentioning of these common themes by teachers.

CHAPTER 4

Results

This chapter presents the data analyses based on the survey responses of participating teachers. Demographic information is presented. Data analyses of the survey of mental abilities or skills essential to students' academic success, teacher knowledge, beliefs, expectations, and practice of executive functions are examined and presented. Additionally, data regarding teacher knowledge of terms associated with executive functioning as well as their exposure to trainings and resources on executive functions are presented.

Demographics

Participants of this study included 307 middle school teachers from New Jersey, Pennsylvania, South Carolina, New York, Ohio, and California. Participants were employed in a teaching position within a public school district during the 2011 to 2012 school year. Participants were general education (n = 201) and special education (n = 106) teachers. The participants reported teaching only general education (n = 56), only special education (n = 40), or both general and special education (n = 211) students. The participants worked in school districts located in rural (n = 50), suburban (n = 200), and urban (n = 57) settings. Table 1 documents the sample demographics.

Table 1

Sample Demographics

	n	%
Highest degree earned		
Bachelors	110	35.8
Masters	180	58.6
Education Specialist	9	2.9
Doctorate	8	2.6
Certified Special Education Teacher		
Yes	106	34.5
No	201	65.5
Types of students taught		
General education only	56	18.2
Special education only	40	13.0
Both general and special education	211	68.7
Years employed as a teacher		
0 to 5 years	47	15.3
6 to 10 years	75	24.4
11 to 15 years	70	22.8
16 to 20 years	47	15.3
21 year or longer	68	22.1
School setting		
Rural	50	16.3
Suburban	200	65.1
Urban	57	18.6

Results of Statistical Analysis by Research Question

Research Question 1a: What mental abilities or skills do teacher believe to be essential to students' academic success?

In an open-ended question, teachers were asked to list the mental abilities of skills they believed to be essential to students' academic success. An analysis of teacher responses identified 42 specific abilities or skills mentioned by one or more teachers.

Table 2 shows the general categories into which responses were sorted and the number of teachers that mentioned an ability or skill that fit into each category.

Table 2

Mental Abilities Teachers Believe To Be Essential to Students' Academic Success

Mental ability/skill	*n* (*N* = 307)	%
Critical thinking/Problem-solving	105	34.2
Motivation	93	30.3
Basic academic skills	85	27.7
Organization	46	15.0
Attention	34	11.1
Perseverance/Determination	33	10.7
Communication skills	28	9.1
Memory	28	9.1
Self-sufficiency	26	8.5
Responsibility/Discipline	21	6.8
Ask for help/Ask questions	20	6.5
Work hard/Effort	19	6.2
Confidence/High self-esteem	18	5.9
Cooperative	12	3.9
Self-control	10	3.3
Home support	10	3.3
Respect	9	2.9
Cognitive ability	9	2.9
Use various strategies/tools	9	2.9
Social skills	9	2.9
Study skills	9	2.9
Time management	7	2.3
Value education	6	2.0
Learn from mistakes	6	2.0
Common sense	6	2.0
Creativity	5	1.6
Maturity	4	1.3
Open to new ideas/experiences	4	1.3
Patience	4	1.3
Flexibility	4	1.3
Goal oriented	3	1.0
Feel safe	3	1.0
Auditory learner	2	0.7
Visual learner	2	0.7
Healthy habits	2	0.7
Executive functions	2	0.7

Mental ability/skill	*n* (*N* = 307)	%
Motor skills	1	0.3
Visual-Perceptual skills	1	0.3
Function in the classroom setting	1	0.3
Capable of multitasking	1	0.3
Tolerance	1	0.3
Humor	1	0.3

Research Question 1b: Do general education and special education teachers differ in the mental abilities they believe to be essential for students' academic success?

Information from the open-ended question regarding mental abilities of skills teachers believed to be essential to students' academic discussed in Table 2 was further broken down to compare the responses of teachers certified only in general education with those of teachers certified in special education. Table 3 shows the comparison of general education and special education teachers' frequency of responses for each category.

Table 3

A Comparison of the Mental Abilities or Skills General Education and Special Education Teachers Believe to be Essential for Academic Success

	General ed. *N* = 201		Special ed. *N* = 106	
Mental ability/skill	*n*	%	*n*	%
Critical thinking/Problem-solving	68	33.8	37	34.9
Motivation	59	29.4	34	32.1
Basic academic skills	53	26.4	32	30.1
Organization	33	16.4	13	12.3
Attention	14	7.0	20	18.9
Perseverance/Determination	26	12.9	7	6.6
Communication skills	17	8.5	11	10.4
Memory	13	6.5	11	10.4
Self-sufficiency	12	6.0	14	13.2
Responsibility/Discipline	15	7.5	6	5.7
Ask for help/Ask questions	16	8.0	4	3.8
Work hard/Effort	14	7.0	5	4.7

	General ed. $N = 201$		Special ed. $N = 106$	
Mental ability/skill	*n*	%	*n*	%
Confidence/High self-esteem	10	5.0	8	7.5
Cooperative	8	4.0	4	3.8
Self-control	6	3.0	4	3.8
Home support	9	4.5	1	0.9
Respect	8	4.0	1	0.9
Cognitive ability	5	2.5	4	3.8
Use various strategies/tools	4	2.0	5	4.7
Social skills	7	3.5	2	1.9
Study skills	7	3.5	2	1.9
Time management	4	2.0	3	2.8
Value education	5	2.5	1	0.9
Learn from mistakes	6	3.0	0	0.0
Common sense	4	2.0	2	1.9
Creativity	4	2.0	1	0.9
Maturity	2	1.0	2	1.9
Open to new ideas/experiences	3	1.5	1	0.9
Patience	3	1.5	1	0.9
Flexibility	3	1.5	1	0.9
Goal oriented	2	1.0	1	0.9
Feel safe	3	1.5	0	0.0
Auditory learner	1	0.5	1	0.9
Visual learner	1	0.5	1	0.9
Healthy habits	2	1.0	0	0.0
Executive functions	1	0.5	1	0.9
Motor skills	0	0.0	1	0.9
Visual-Perceptual skills	0	0.0	1	0.9
Function in the classroom setting	1	0.5	0	0.0
Capable of multitasking	1	0.5	0	0.0
Tolerance	0	0.0	1	0.9
Humor	0	0.0	1	0.9

Research Question 2a: To what extent do teachers view as essential to success general behaviors that reflect the effective use of executive functions?

In a structured, Likert-format question, teachers were asked to endorse 15 general behaviors that reflect the use of executive functions by students based on whether they were essential to student success. Table 4 documents the 15 general behaviors and teacher endorsement of degree of helpfulness.

Table 4

Teacher Levels of Endorsement of the Essential Nature of General Behaviors that Reflect the Effective Use of Executive Functions

	Essential for success		Very helpful but not essential		Somewhat helpful but not essential		Not helpful	
General behavior	*n*	%	*n*	%	*n*	%	*n*	%
Attending to instruction	222	72.3	82	26.7	3	1.0	0	0.0
Quickly taking in new information	32	10.4	193	62.9	80	26.1	2	0.7
Listening and speaking articulately	92	30.0	165	53.7	50	16.3	0	0.0
Comprehending what is read	224	73.0	74	24.1	9	2.9	0	0.0
Solving math problems	128	41.7	144	46.9	34	11.1	1	0.3
Expressing thoughts in writing	157	51.1	126	41.0	23	7.5	1	0.3
Remembering important facts	76	24.8	150	48.9	77	25.1	4	1.3
Large vocabulary	42	13.7	168	54.7	93	30.3	4	1.3
Knowing a lot about many different topics	32	10.4	149	48.5	118	38.4	8	2.6
Holding and working with information in mind	136	44.3	140	45.6	30	9.8	1	0.3
Knowing how to get along with others	165	53.7	98	31.9	39	12.7	5	1.6
Sustaining attention and effort with difficult tasks	204	66.4	88	28.7	15	4.9	0	0.0
Acting responsibly	198	64.5	84	27.4	24	7.8	1	0.3
Exhibiting self-control	200	65.1	88	28.7	19	6.2	0	0.0
Working independently	139	45.3	139	45.3	29	9.4	0	0.0

Research Question 2b: To what extent do general education and special education teachers differ in their views regarding the extent to which general behaviors that reflect the effective use of executive functions are essential to success?

Information from the structured question regarding general behaviors teachers endorsed as essential to student academic success in Table 4 were further analyzed to compare general education and special education teachers' beliefs. Table 5 compares general education and special education teachers' responses for these same general behaviors.

Table 5

General Education versus Special Education Teacher Level of Endorsement of the Essential Nature of General Behaviors that Reflect the Effective Use of Executive Functions

	Essential for success				Very helpful but not essential				Somewhat helpful but not essential				Not helpful			
	Gen. ed.		Spec. ed.		Gen. ed.		Spec. ed.		Gen. ed.		Spec. ed.		Gen. ed.		Spec. ed.	
General behavior	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Attending to instruction	145	72.1	77	72.6	54	26.9	28	26.4	2	1.0	1	0.9	0	0.0	0	0.0
Quickly taking in new information	21	10.4	11	10.4	127	63.2	66	62.3	52	25.9	28	26.4	1	0.5	1	0.9
Listening and speaking articulately	67	33.3	25	23.6	104	51.7	61	57.5	30	14.9	20	18.9	0	0.0	0	0.0
Comprehending what is read	153	76.1	71	67.0	42	20.9	32	30.2	6	3.0	3	2.8	0	0.0	0	0.0
Solving math problems	86	42.8	42	39.6	92	45.8	52	49.1	22	10.9	12	11.3	1	0.5	0	0.0
Expressing thoughts in writing	113	56.2	44	41.5	73	36.3	53	50.0	14	7.0	9	8.5	1	0.5	0	0.0
Remembering important facts	47	23.4	29	27.4	98	48.8	52	49.1	53	26.4	24	22.6	3	1.5	1	0.9
Large vocabulary	28	13.9	14	13.2	112	55.7	56	52.8	58	28.9	35	33.0	3	1.5	1	0.9
Knowing a lot about many different topics	25	12.4	7	6.6	89	44.3	60	56.6.	81	40.3	37	34.9	6	3.0	2	1.9
Holding and working with information in mind	94	46.8	42	39.6	85	42.3	55	51.9	21	10.4	9	8.5	1	0.5	0	0.0
Knowing how to get along with others	108	53.7	57	53.8	63	31.3	35	33.0	26	12.9	13	12.3	4	2.0	1	0.9
Sustaining attention and effort with difficult tasks	136	67.7	68	64.2	55	27.4	33	31.1	10	5.0	5	4.7	0	0.0	0	0.0
Acting responsibly	129	64.2	69	65.1	58	28.9	26	24.5	14	7.0	10	9.4	0	0.0	1	0.9
Exhibiting self-control	132	65.7	68	64.2	58	28.9	30	28.3	11	5.5	8	7.5	0	0.0	0	0.0

Research Question 3a: To what extent do teachers view specific executive functions as being essential to students' academic success?

In a structured, Likert-format question, teachers were asked to endorse 32 specific executive functions based on the extent of their belief that the individual executive function was essential to student academic success. Table 6 documents the 32 specific executive functions and teacher endorsement of their helpfulness. Specific executive functions are listed here by name as they appear in the Holarchical Model of Executive

Functions (McCloskey et al., 2009). Complete listings of the operational descriptions of each executive function as they appeared in the actual teacher survey are provided in the appendix.

Table 6

Teacher Levels of Endorsement of Specific Executive Functions Essential for Student Success

	Essential for success		Very helpful but not essential		Somewhat helpful but not essential		Not helpful	
Executive function	*n*	%	*n*	%	*n*	%	*n*	%
Becoming aware	61	19.9	154	50.2	89	29.0	3	1.0
Focusing	221	72.0	82	26.7	4	1.3	0	0.0
Sustaining	228	74.3	71	23.1	7	2.3	1	0.3
Gauging	202	65.8	92	30.0	12	3.9	1	0.3
Putting forth Effort	255	83.1	50	16.3	1	0.3	1	0.3
Initiating	88	28.7	174	56.7	44	56.7	1	0.3
Inhibiting	125	40.7	144	46.9	36	11.7	2	0.7
Stopping	135	44.0	127	41.4	42	13.7	3	1.0
Interrupting	83	27.0	151	49.2	60	19.5	13	4.2
Being flexible	109	35.5.	158	51.5	38	12.4	2	0.7
Shifting	110	35.8	156	50.8	41	13.4	0	0.0
Modulating	154	50.2	132	43.0	20	6.5	1	0.3
Balancing	122	39.7	149	48.5	34	11.1	2	0.7
Monitoring	135	44.0	140	45.6	31	10.1	1	0.3
Correcting	174	56.7	113	36.8	19	6.2	1	0.3
Anticipating	34	11.1	156	50.8	102	33.2	15	4.9
Estimating time	60	19.5	177	57.7	65	21.2	5	1.6
Analyzing	158	51.5	124	40.4	24	7.8	1	0.3
Comparing/ Evaluating	94	30.6	154	50.2	54	17.6	5	1.6
Associating	189	61.6	98	31.9	19	6.2	1	0.3
Generating	105	34.2	151	49.2	44	14.3	7	2.3
Planning	158	51.5	121	39.4	25	8.1	3	1.0
Organizing	181	59.0	104	33.9	20	6.5	2	0.7
Deciding	210	68.4	84	27.4	12	3.9	1	0.3
Sensing time	86	28.0	181	59.0	36	11.7	4	1.3
Pacing	75	24.4	187	60.9	44	14.3	1	0.3
Executing routines	128	41.7	152	49.5	27	8.8	0	0.0
Sequencing	131	42.7	135	44.0	41	13.4	0	0.0
Holding	125	40.7	145	47.2	37	12.1	0	0.0
Manipulating	32	10.4	150	48.9	112	36.5	13	4.2
Storing	101	32.9	150	48.9	56	18.2	0	0.0
Retrieving	116	37.8	150	48.9	38	12.4	3	1.0

Research Question 3b: To what extent do general education and special education teachers differ in their views regarding the extent to which specific executive functions are essential to students' academic success?

Information from the structured question regarding levels of endorsement of specific executive functions considered essential to student academic success were further analyzed to compare general education and special education teachers beliefs. Table 7 compares general education and special education teachers' levels of endorsement of specific executive functions considered essential to student academic success.

Table 7

General Education versus Special Education Teacher Level of Endorsement of the Essential Use of Specific Executive Functions

	Essential for success				Very helpful but not essential				Somewhat helpful but not essential				Not helpful			
	Gen. ed.		Spec. ed.		Gen. ed.		Spec. ed.		Gen. ed.		Spec. ed.		Gen. ed.		Spec. ed.	
Executive function	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Becoming aware	42	20.9	19	17.9	95	47.3	59	55.7	61	30.3	28	26.4	3	1.5	0	0.0
Focusing	144	71.6	77	72.6	55	27.4	27	25.5	2	1.0	2	1.9	0	0.0	0	0.0
Sustaining	148	73.6	80	75.5	47	23.4	24	22.6	5	2.5	2	1.9	1	0.5	0	0.0
Gauging	130	64.7	72	67.9	63	31.3	29	27.4	8	4.0	4	3.8	0	0.0	1	0.9
Putting forth Effort	168	83.6	87	82.1	32	15.9	18	17.0	1	0.5	0	0.0	0	0.0	1	0.9
Initiating	65	32.3	23	21.7	110	54.7	64	60.4	26	12.9	18	17.0	0	0.0	1	0.9
Inhibiting	78	38.8	47	44.3	93	46.3	51	48.1	28	13.9	8	7.5	2	1.0	0	0.0
Stopping	84	41.8	51	48.1	85	42.3	42	39.6	30	14.9	12	11.3	2	1.0	1	0.9
Interrupting	56	27.9	27	25.5	99	49.3	52	49.1	36	17.9	24	22.6	10	5.0	3	2.8
Being flexible	78	38.8	31	29.2	99	49.3	59	55.7	22	10.9	16	15.1	2	1.0	0	0.0
Shifting	76	37.8	34	32.1	100	49.8	56	52.8	25	12.4	16	15.1	0	0.0	0	0.0
Modulating	100	49.8	54	50.9	87	43.3	45	42.5	13	6.5	7	6.6	1	0.5	0	0.0
Balancing	84	41.8	38	35.8	98	48.8	51	48.1	18	9.0	16	15.1	1	0.5	1	0.9
Monitoring	98	48.8	37	34.9	87	43.3	53	50.0	16	8.0	15	14.2	0	0.0	1	0.9
Correcting	124	61.7	50	47.2	68	33.8	45	42.5	9	4.5	10	9.4	0	0.0	1	0.9
Anticipating	23	11.4	11	10.4	102	50.7	54	50.9	66	32.8	36	34.0	10	5.0	5	4.7
Estimating time	42	20.9	18	17.0	120	59.7	57	53.8	37	18.4	28	26.4	2	1.0	3	2.8
Analyzing	118	58.7	40	37.7	71	35.3	53	50.0	12	6.0	12	11.3	0	0.0	1	0.9
Comparing/ Evaluating	72	35.8	22	20.8	94	46.8	60	56.6	33	16.4	21	19.8	2	1.0	3	2.8
Associating	129	64.2	60	56.6	59	29.4	39	36.8	12	6.0	7	6.6	1	0.5	0	0.0
Generating	74	36.8	31	29.2	100	49.8	51	48.1	23	11.4	21	19.8	4	2.0	3	2.8
Planning	108	53.7	50	47.2	75	37.3	46	43.4	17	8.5	8	7.5	1	0.5	2	1.9

Executive function	Essential for success				Very helpful but not essential				Somewhat helpful but not essential				Not helpful			
	Gen. ed.		Spec. ed.		Gen. ed.		Spec. ed.		Gen. ed.		Spec. ed.		Gen. ed.		Spec. ed.	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Organizing	121	60.2	60	56.6	68	33.8	36	34.0	11	5.5	9	8.5	1	0.5	1	0.9
Deciding	136	67.7	74	69.8	58	28.9	26	24.5	6	3.0	6	5.7	1	0.5	0	0.0
Sensing time	61	30.3	25	23.6	119	59.2	62	58.5	20	10.0	16	15.1	1	0.5	3	2.8
Pacing	52	25.9	23	21.7	125	62.2	62	58.5	23	11.4	21	19.8	1	0.5	0	0.0
Executing routines	89	44.3	39	36.8	94	46.8	58	54.7	18	9.0	9	8.5	0	0.0	0	0.0
Sequencing	88	43.8	43	40.6	90	44.8	45	42.5	23	11.4	18	17.0	0	0.0	0	0.0
Holding	89	44.3	36	34.0	90	44.8	55	51.9	22	10.9	15	14.2	0	0.0	0	0.0
Manipulating	20	10.0	12	11.3	104	51.7	46	43.4	69	34.3	43	40.6	8	4.0	5	4.7
Storing	73	36.3	28	26.4	98	48.8	52	49.1	30	14.9	26	24.5	0	0.0	0	0.0
Retrieving	81	40.3	35	33.0	97	48.3	53	50.0	21	10.4	17	16.0	2	1.0	1	0.9

Research Question 4a: What expectations do teachers have for their students for them to be successful?

In an open-ended question, teachers were asked to list their expectations of students of what they believe to be essential to students' academic success. Based on teacher responses, 29 separate categories of expectations were identified. Table 8 documents the categories into which responses were sorted and the number of teachers that mentioned a specific expectation that fit into the category.

Table 8

Teachers' Reported Expectations of Students

Expectations	*n* (*N* = 307)	%
Effort	130	42.3
Active learner	73	23.8
Attention	69	22.5
Complete work in school & at home	62	20.2
Self-discipline	62	20.2
Ask for help/ask questions	48	15.6
Self-sufficiency	48	15.6
Critical thinking	46	15.0
Character education skills	38	12.4
Cooperative	24	7.8
Mastery of basic academic skills	23	7.5
Motivated to learn	22	7.2
Self-control	19	6.2
Organized	19	6.2
Self-advocacy	18	5.9
Use various strategies	12	3.9
Time management	12	3.9
Self-esteem	12	3.9
Positive attitude/belief about learning	10	3.3
Learn from mistakes	9	2.9
Memory	9	2.9
Goal-oriented	6	2.0
Open-minded	6	2.0
Parental involvement	3	1.0
Flexibility	3	1.0
Initiate task	1	0.3
Common sense	1	0.3
Creativity	1	0.3
Coping skills	1	0.3

Research Question 4b: Do general education and special education teachers differ in their expectations of their students for them to be successful?

Information from the open-ended question regarding expectations teachers had for their students that they believed to be essential to students' academic success was further broken down to compare general education teachers to special education teachers

responses. Table 9 compares general education and special education teachers responses on these same categories.

Table 9

General Education versus Special Education Teachers' Reported Expectations of Students

	General ed. (*N* = 201)		Special ed. (*N* = 106)	
Expectations	*n*	%	*n*	%
Effort	78	38.8	52	49.1
Active learner	51	25.4	22	20.8
Attention	46	22.9	23	21.7
Complete work in school & at home	43	21.4	19	17.9
Self-discipline	41	20.4	21	19.8
Ask for help/ask questions	34	16.9	14	13.2
Self-sufficiency	30	14.9	18	17.0
Critical thinking	28	13.9	18	17.0
Character education skills	26	12.9	12	11.3
Cooperative	20	10.0	4	3.8
Mastery of basic academic skills	18	9.0	5	4.7
Motivated to learn	17	8.5	5	4.7
Self-control	10	5.0	9	8.5
Organized	13	6.5	6	5.7
Self-advocacy	13	6.5	5	4.7
Use various strategies	10	5.0	2	1.9
Time management	8	4.0	4	3.8
Self-esteem	11	5.5	1	0.9
Positive attitude/belief about learning	8	4.0	2	1.9
Learn from mistakes	9	4.5	0	0.0
Memory	3	1.5	6	5.7
Goal-oriented	5	2.5	1	0.9
Open-minded	5	2.5	1	0.9
Parental involvement	2	1.0	1	0.9
Flexibility	2	1.0	1	0.9
Initiate task	0	0.0	1	0.9
Common sense	1	0.5	0	0.0
Creativity	1	0.5	0	0.0
Coping skills	0	0.0	1	0.9

Research Question 5a: To what extent do teachers expect students to engage in specific executive functions for them to succeed academically?

In a structured, Likert-format question, teachers were asked to endorse 32 specific executive functions based on their expectations of students to demonstrate use of the individual executive function. Table 10 documents the 32 specific executive functions and teacher endorsement of their level of expectation of student use of each. Specific executive functions are listed here by name as they appear in the Holarchical Model of Executive Functions (McCloskey et al., 2009). Complete listings of the operational descriptions of each executive function as they appeared in the actual teacher survey are provided in the appendix.

Table 10

Teacher Levels of Endorsement of Expected Student Engagement in Specific Executive Functions

	Do without any prompting or assistance		Do with some prompting or assistance		Do with a lot of prompting or assistance		Not do at all	
Executive function	*n*	%	*n*	%	*n*	%	*n*	%
Becoming aware	86	28.0	193	62.9	27	8.8	1	0.3
Focusing	145	47.2	148	48.2	14	4.6	0	0.0
Sustaining	120	39.1	167	54.4.	20	6.5	0	0.0
Gauging	53	17.3	205	66.8	47	15.3	2	0.7
Putting forth Effort	192	62.5	105	34.2	10	3.3	0	0.0
Initiating	107	34.9	172	56.0	26	8.5	2	0.7
Inhibiting	126	41.0	154	50.2	24	7.8	3	1.0
Stopping	165	53.7	125	40.7	17	5.5	0	0.0
Interrupting	99	32.2	180	58.6	27	8.8	1	0.3
Being flexible	99	32.2.	182	59.3	26	8.5	0	0.0
Shifting	110	35.8	169	55.0	27	8.8	1	0.3
Modulating	169	55.0	126	41.0	12	3.9	0	0.0
Balancing	92	30.0	186	60.6	27	8.8	2	0.7
Monitoring	86	28.0	172	56.0	43	14.0	6	2.0
Correcting	132	43.0	135	44.0	34	11.1	6	2.0
Anticipating	47	15.3	182	59.3	69	22.5	9	2.9
Estimating time	46	15.0	193	62.9	56	18.2	12	3.9
Analyzing	96	31.3	163	53.1	44	14.3	4	1.3
Comparing/ evaluating	60	19.5	180	58.6	57	18.6	10	3.3
Associating	89	29.0	167	54.4	49	16.0	2	0.7

Executive function	Do without any prompting or assistance		Do with some prompting or assistance		Do with a lot of prompting or assistance		Not do at all	
	n	%	*n*	%	*n*	%	*n*	%
Generating	50	16.3	175	57.0	69	22.5	13	4.2
Planning	78	25.4	166	54.1	56	18.2	7	2.3
Organizing	97	31.6	152	49.5	53	17.3	5	1.6
Deciding	177	57.7	114	37.1	15	4.9	1	0.3
Sensing time	81	26.4	170	55.4	47	15.3	9	2.9
Pacing	90	29.3	168	54.7	45	14.7	4	1.3
Executing routines	149	48.5	141	45.9	17	5.5	0	0.0
Sequencing	87	28.3	184	59.9	35	11.4	1	0.3
Holding	95	30.9	164	53.4	43	14.0	5	1.6
Manipulating	37	12.1	174	56.7	75	24.4	21	6.8
Storing	57	18.6	176	57.3	65	21.2	9	2.9
Retrieving	94	30.6	165	53.7	44	14.3	4	1.3

Research Question 5b: Do general education and special education teachers differ in their expectations of students to engage in specific executive functions to succeed academically?

Information from teachers' endorsements of their expectations of their students use of specific executive functions was further broken down to compare general education teachers responses to special education teachers' responses. Table 11 compares general education and special education teachers' responses.

Table 11

General Education versus Special Education Teachers' Level of Endorsement of Expectations of Student Engagement in Specific Executive Functions

	Do without any assistance or prompting				Do with some assistance or prompting				Do with a lot of assistance or prompting				Not do this			
	Gen. ed.		Spec. ed.		Gen. ed.		Spec. ed.		Gen. ed.		Spec. ed.		Gen. ed.		Spec. ed.	
Executive function	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Becoming aware	57	28.4	29	27.4	129	64.2	64	60.4	14	7.0	13	12.3	1	0.5	0	0.0
Focusing	107	53.2	38	35.8	89	44.3	59	55.7	5	2.5	9	8.5	0	0.0	0	0.0
Sustaining	89	44.3	31	29.2	107	53.2	60	56.6	5	2.5	15	14.2	0	0.0	0	0.0
Gauging	37	18.4	16	15.1	140	69.7	65	61.3	24	11.9	23	21.7	0	0.0	2	1.9
Putting forth effort	129	64.2	63	59.4	69	34.3	36	34.0	3	1.5	7	6.6	0	0.0	0	0.0
Initiating	77	38.3	30	28.3	113	56.2	59	55.7	10	5.0	16	15.1	1	0.5	1	0.9
Inhibiting	87	43.3	39	36.8	98	48.8	56	52.8	15	7.5	9	8.5	1	0.5	2	1.9
Stopping	105	52.2	60	56.6	83	41.3	42	39.6	13	6.5	4	3.8	0	0.0	0	0.0
Interrupting	66	32.8	33	31.1	117	58.2	63	59.4	18	9.0	9	8.5	1	0.9	0	0.0
Being flexible	68	33.8	31	29.2	113	56.2	69	65.1	20	10.0	6	5.7	0	0.0	0	0.0
Shifting	70	34.8	40	37.7	111	55.2	58	54.7	19	9.5	8	7.5	1	0.5	0	0.0
Modulating	114	56.7	55	51.9	83	41.3	43	40.6	4	2.0	8	7.5	0	0.0	0	0.0
Balancing	59	29.4	33	31.1	126	62.7	60	56.6	16	8.0	11	10.4	0	0.0	2	1.9
Monitoring	65	32.3	21	19.8	114	56.7	58	54.7	19	9.5	24	22.6	3	1.5	3	2.8
Correcting	99	49.3	33	31.1	82	40.8	53	50.0	17	8.5	17	16.0	3	1.5	3	2.8
Anticipating	30	14.9	17	16.0	118	58.7	64	60.4	47	23.4	22	20.8	6	3.0	3	2.8
Estimating time	31	15.4	15	14.2	129	64.2	64	60.4	32	15.9	24	22.6	9	4.5	3	2.8
Analyzing	67	33.3	29	27.4	110	54.7	53	50.0	24	11.9	20	18.9	0	0.0	4	3.8
Comparing/ evaluating	43	21.4	17	16.0	120	59.7	60	56.6	34	16.9	23	21.7	4	2.0	6	5.7
Associating	62	30.8	27	25.5	108	53.7	59	55.7	30	14.9	19	17.9	1	0.5	1	0.9
Generating	31	15.4	19	17.9	123	61.2	52	49.1	39	19.4	30	28.3	8	4.0	5	4.7
Planning	50	24.9	28	26.4	114	56.7	52	49.1	33	16.4	23	21.7	4	2.0	3	2.8
Organizing	70	34.8	27	25.5	97	48.3	55	51.9	31	15.4	22	20.8	3	1.5	2	1.9
Deciding	116	57.7	61	57.5	78	38.8	36	34.0	7	3.5	8	7.5	0	0.0	1	0.9
Sensing time	52	25.9	29	27.4	119	59.2	51	48.1	25	12.4	22	20.8	5	2.5	4	3.8
Pacing	60	29.9	30	28.3	114	56.7	54	50.9	25	12.4	20	18.9	2	1.0	2	1.9
Executing routines	99	49.3	50	47.2	91	45.3	50	47.2	11	5.5	6	5.7	0	0.0	0	0.0
Sequencing	60	29.9	27	25.5	121	60.2	63	59.4	19	9.5	16	15.1	1	0.5	0	0.0
Holding	66	32.8	29	27.4	105	52.2	59	55.7	28	13.9	15	14.2	2	1.0	3	2.8
Manipulating	30	14.9	7	6.6	112	55.7	62	58.5	49	24.4	26	24.5	10	5.0	11	10.4
Storing	36	17.9	21	19.8	123	61.2	53	50.0	38	18.9	27	25.5	4	2.0	5	4.7
Retrieving	70	34.8	24	22.6	102	50.7	63	59.4	27	13.4	17	16.0	2	1.0	2	1.9

Research Questions 6a: How confident are teachers that they can teach students general behaviors that reflect the use of executive functions?

In a structured, Likert-format question, teachers were asked to endorse the extent to which they believed that general behaviors related to executive functions could be taught. Table 12 shows these general behaviors and teacher endorsement of their level of belief that they could be taught to students.

Table 12

Teachers' Level of Confidence in Their Ability to Teach General Behaviors that Reflect Executive Functions

	Can be taught without difficulty		Can be taught with some difficulty		Can be taught with great difficulty		Cannot be taught	
General behaviors	*n*	%	*n*	%	*n*	%	*n*	%
Improve time management	64	20.8	215	70.0	28	9.1	0	0.0
Increase adaptability	52	16.9	199	64.8	52	16.9	4	1.3
Increase memory capacity	37	12.1	157	51.1	92	30.0	21	6.8
Improve time on task performance	92	30.0	189	61.6	26	8.5	0	0.0
Improve organization	122	39.7	159	51.8	25	8.1	1	0.3
Plan out long-term projects	116	37.8	151	49.2	40	13.0	0	0.0
Set goals	163	53.1	122	39.7	22	7.2	0	0.0
Improve attentiveness	51	16.6	163	53.1	81	26.4	12	3.9
Self-monitor work	67	21.8	173	56.4	66	21.5	1	0.3
Shift from one task to another easily	78	25.4	181	59.0	43	14.0	5	1.6
Improve task persistence	56	25.4	179	58.3	65	21.2	7	2.3
Prioritize tasks	118	38.4	154	50.2	33	10.7	2	0.7
Attend tasks until the end	79	25.7	166	54.1	58	18.9	4	1.3
Improve task initiation	60	19.5	188	61.2	55	17.9	4	1.3

Research Question 6b: Do general education and special education teachers differ in confidence that they can teach students general behaviors that reflect the use of executive functions?

Information from the structured question regarding teachers' belief about the extent to which general behaviors teachers related to executive functions could be taught was further analyzed to compare general education and special education teachers' beliefs. Table 13 compares general education and special education teachers' responses.

Table 13

General Education versus Special Education Teachers' Level of Confidence in Teaching Students General Behaviors that Reflect Executive Functions

	Can be taught without difficulty				Can be taught with some difficulty				Can be taught with great difficulty				Cannot be taught			
	Gen. ed.		Spec. ed.		Gen. ed.		Spec. ed.		Gen. ed.		Spec. ed.		Gen. ed.		Spec. ed.	
General behavior	*n*	%	*n*	%	*n*	%	*N*	%	*n*	%	*n*	%	*n*	%	*n*	%
Improve time management	45	22.4	19	17.9	141	70.1	74	69.8	15	7.5	13	12.3	0	0.0	0	0.0
Increase adaptability	33	16.4	19	17.9	129	64.2	70	66.0	36	17.9	6	15.1	3	1.5	1	0.9
Increase memory capacity	32	15.9	5	4.7	100	49.8	57	53.8	56	27.9	36	34.0	13	6.5	8	7.5
Improve on task performance	62	30.8	30	28.3	124	61.7	65	61.3	15	7.5	11	10.4	0	0.0	0	0.0
Improve organization	80	39.8	42	39.6	104	51.7	55	51.9	16	8.0	9	8.5	1	0.5	0	0.0
Plan out long-term projects	78	38.8	38	35.8	92	45.8	59	55.7	31	15.4	9	8.5	0	0.0	0	0.0
Set goals	106	52.7	57	53.8	79	39.3	43	40.6	16	8.0	6	5.7	0	0.0	0	0.0
Improve attentiveness	34	16.9	17	16.0	107	53.2	56	52.8	51	25.4	30	28.3	9	4.5	3	2.8
Self-monitor work	46	22.9	21	19.8	114	56.7	59	55.7	40	19.9	26	24.5	1	0.5	0	0.0
Shift from one task to another easily	51	25.4	27	25.5	117	58.2	64	60.4	29	14.4	14	13.2	4	2.0	1	0.9
Improve task persistence	40	19.9	16	15.1	112	55.7	67	63.2	43	21.4	22	20.8	6	3.0	1	0.9
Prioritize tasks	83	41.3	35	33.0	96	47.8	58	54.7	22	10.9	11	10.4	0	0.0	2	1.9
Attend to tasks until the end	58	28.9	21	19.8	99	49.3	67	63.2	41	20.4	17	16.0	3	1.5	1	0.9
Improve task initiation	41	20.4	19	17.9	121	60.2	67	63.2	36	17.9	19	17.9	3	1.5	1	0.9

Research Question 7a: To what extent do teachers think specific executive functions can be taught to students who do them poorly?

In a structured, Likert-format question, teachers were asked to endorse 32 specific executive functions based on their belief of the extent that students could be taught the executive function if done poorly. Table 14 shows the 32 specific executive functions and teacher endorsements of their belief of the extent that these executive functions can be taught. Specific executive functions are listed here by name as they appear in the Holarchical Model of Executive Functions (McCloskey et al., 2009). Complete listings of the operational descriptions of each executive function as they appeared in the actual teacher survey are provided in the appendix.

Table 14

Teachers' Levels of Endorsement of Specific Executive Functions They Believe can be Taught to Students Who do Them Poorly

	Can be taught without difficulty		Can be taught with some difficulty		Can be taught with great difficulty		Cannot be taught	
Executive function	*n*	%	*n*	%	*n*	%	*n*	%
Becoming aware	47	15.3	187	60.9	63	20.5	10	3.3
Focusing	36	11.7	189	61.6	75	24.4	7	2.3
Sustaining	28	9.1	168	54.7	102	33.2	9	2.9
Gauging	40	13.0	183	59.6	79	25.7	5	1.6
Putting forth effort	34	11.1	165	53.7	96	31.3	12	3.9
Initiating	49	16.0	174	56.7	81	26.4	3	1.0
Inhibiting	16	5.2	144	46.9	131	42.7	16	5.2
Stopping	71	23.1	156	50.8	79	25.7	1	0.3
Interrupting	57	18.6	180	58.6	69	22.5	1	0.3
Being flexible	41	13.4	173	56.4	81	26.4	12	3.9
Shifting	47	15.3	185	60.3	73	23.8	2	0.7
Modulating	45	14.7	181	59.0	81	26.4	0	0.0
Balancing	24	7.8	176	57.3	98	31.9	9	2.9
Monitoring	59	19.2	172	56.0	75	24.4	1	0.3
Correcting	72	23.5	161	52.4	72	23.5	2	0.7
Anticipating	43	14.0	160	52.1	89	29.0	15	4.9
Estimating time	34	11.1	175	57.0	89	29.0	9	2.9
Analyzing	25	8.1	162	52.8	116	37.8	4	1.3

	Can be taught without difficulty		Can be taught with some difficulty		Can be taught with great difficulty		Cannot be taught	
Executive function	*n*	%	*n*	%	*n*	%	*n*	%
Comparing/ evaluating	28	9.1	167	54.4	108	35.2	4	1.3
Associating	40	13.0	175	57.0	92	30.0	0	0.0
Generating	21	6.8	143	46.6	133	43.3	10	3.3
Planning	86	28.0	154	50.2	66	21.5	1	0.3
Organizing	79	25.7	159	51.8	68	22.1	1	0.3
Deciding	53	17.3	143	46.6	108	35.2	3	1.0
Sensing time	31	10.1	159	51.8	94	30.6	23	7.6
Pacing	42	13.7	174	56.7	83	27.0	8	2.6
Executing routines	78	25.4	169	55.0	58	18.9	2	0.7
Sequencing	66	21.5	175	57.0	65	21.2	1	0.3
Holding	22	7.2	144	46.9	118	38.4	23	7.5
Manipulating	16	5.2	130	42.3	128	41.7	33	10.7
Storing	20	6.5	142	46.3	121	39.4	24	7.8
Retrieving	21	6.8	147	47.9	115	37.5	24	7.8

Research Question 7b: Do general education and special education teachers differ in their beliefs that students can be taught specific executive functions if they do them poorly?

Information regarding teachers' beliefs of the extent that students could be taught the executive functions if done poorly was further broken down to compare general education and special education teachers' endorsements. Table 15 compares general education and special education teachers' beliefs of the extent that students can be taught specific executive functions if they do them poorly.

Table 15

General Education versus Special Education Teachers' Endorsement of Specific Executive Functions They Believe can be Taught to Students Who do Them Poorly

Executive function	Can be taught without difficulty				Can be taught with some difficulty				Can be taught wit great difficulty				Cannot be taught			
	Gen. ed.		Spec. ed.		Gen. ed.		Spec. ed.		Gen. ed.		Spec. ed.		Gen. ed.		Spec. ed.	
	N	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Becoming aware	34	16.9	13	12.3	121	60.2	66	62.3	40	19.9	23	21.7	6	3.0	4	3.8
Focusing	24	11.9	12	11.3	124	61.7	65	61.3	51	25.4	24	22.6	2	1.0	5	4.7
Sustaining	20	10.9	8	7.5	109	54.2	59	5.57	66	32.8	36	34.0	6	3.0	3	2.8
Gauging	30	14.9	10	9.4	117	58.2	66	62.3	51	25.4	28	26.4	3	1.5	2	1.9
Putting forth effort	22	10.9	12	11.3	105	52.2	60	56.6	65	32.3	31	29.2	9	4.5	3	2.8
Initiating	35	17.4	14	13.2	112	55.7	62	58.5	53	26.4	28	26.4	1	0.5	2	1.9
Inhibiting	11	5.5	5	4.7	91	45.3	53	50.0	90	44.8	41	38.7	9	4.5	7	6.6
Stopping	49	24.4	22	20.8	102	50.7	54	50.9	50	24.9	29	27.4	0	0.0	1	0.9
Interrupting	38	18.9	19	17.9	115	57.2	65	61.3	48	23.9	21	19.8	0	0.0	1	0.9
Being flexible	28	13.9	13	12.3	108	53.7	65	61.3	58	28.9	23	21.7	7	3.5	5	4.7
Shifting	30	14.9	17	16.0	117	58.2	68	64.2	53	26.4	20	18.9	1	0.5	1	0.9
Modulating	32	15.9	13	12.3	112	55.7	69	65.1	57	28.4	24	22.6	0	0.0	0	0.0
Balancing	18	9.0	6	5.7	108	53.7	68	64.2	71	35.3	27	25.5	4	2.0	5	4.7
Monitoring	41	20.4	18	17.0	105	52.2	67	63.2	55	27.4	20	18.9	0	0.0	1	0.9
Correcting	53	26.4	19	17.9	98	48.8	63	59.4	50	24.9	22	20.8	0	0.0	2	1.9
Anticipating	25	12.4	18	17.0	101	50.2	59	55.7	63	31.3	26	24.5	12	6.0	3	2.8
Estimating time	25	12.4	9	8.5	110	54.7	65	61.3	59	29.4	30	28.3	7	3.5	2	1.9
Analyzing	17	8.5	8	7.5	101	50.2	61	57.5	81	40.3	35	33.0	2	1.0	1	1.9
Comparing/ Evaluating	19	9.5	9	8.5	108	53.7	59	55.7	71	35.3	37	34.9	3	1.5	1	0.9
Associating	28	13.9	12	11.3	112	55.7	63	59.4	61	30.3	31	29.2	0	0.0	0	0.0
Generating	13	6.5	8	7.5	91	45.3	52	49.1	89	44.3	44	41.5	8	4.0	2	1.9
Planning	58	28.9	28	26.4	96	47.8	58	54.7	47	23.4	19	17.9	0	0.0	1	0.9
Organizing	58	28.9	21	19.8	96	47.8	63	59.4	47	23.4	21	19.8	0	0.0	1	0.9
Deciding	33	16.4	20	18.9	87	43.3	56	52.8	79	39.3	29	27.4	2	1.0	1	0.9
Sensing time	24	11.9	7	6.6	98	48.8	61	57.5	62	30.8	32	30.2	17	8.5	6	5.7
Pacing	28	13.9	14	13.2	112	55.7	62	58.5	55	27.4	28	26.4	6	3.0	2	1.9
Executing routines	48	23.9	30	28.3	109	54.2	60	56.6	42	20.9	16	15.1	2	1.0	0	0.0
Sequencing	45	22.4	21	19.8	111	55.2	64	60.4	45	22.4	20	18.9	0	0.0	1	0.9
Holding	15	7.5	7	6.6	92	45.8	52	49.1	78	38.8	40	37.7	16	7.5	7	6.6
Manipulating	13	6.5	3	2.8	75	37.3	55	51.9	91	45.3	37	34.9	22	10.9	11	10.4
Storing	17	8.5	3	2.8	87	43.3	55	51.9	82	40.8	39	36.8	15	7.5	9	8.5
Retrieving	16	8.0	5	4.7	87	43.3	60	56.6	81	40.3	34	32.1	17	8.5	7	6.6

Research Question 8a: To what extent do teachers believe they directly teach specific executive functions to students who do them poorly?

In a structured, Likert-format question, teachers were asked to endorse 32 specific executive functions based on their perceptions of the extent to which they teach each executive function to students who do them poorly. Table 16 shows the 32 specific executive functions and teachers' endorsement of the extent to which they directly teach these executive functions. Specific executive functions are listed here by name as they appear in the Holarchical Model of Executive Functions (McCloskey et al., 2009). Complete listings of the operational descriptions of each executive function as they appeared in the actual teacher survey are provided in the appendix.

Table 16

Teachers' Levels of Endorsement of Specific Executive Functions They Believe They Directly Teach Students

	I teach this very often		I teach this sometimes		I teach this rarely		I do not teach this	
Executive function	*n*	%	*N*	%	*n*	%	*n*	%
Becoming aware	91	29.6	131	42.7	51	16.6	34	11.1
Focusing	248	80.8	46	15.0	6	2.0	7	2.3
Sustaining	189	61.6	92	30.0	18	5.9	8	2.6
Gauging	125	40.7	135	44.0	42	13.4	6	2.0
Putting forth effort	232	75.6	55	17.9	15	4.9	5	1.6
Initiating	170	55.4	103	33.6	26	8.5	8	2.6
Inhibiting	148	48.2	111	36.2	36	11.7	12	3.9
Stopping	163	53.1	95	30.9	38	12.4	11	3.6
Interrupting	135	44.0	101	32.9	54	17.6	17	5.5
Being flexible	101	32.9	128	41.7	56	18.2	22	7.2
Shifting	143	46.6	11	38.8	32	10.4	13	4.2
Modulating	188	61.2	84	27.4	17	5.5	18	5.9
Balancing	132	43.0	117	38.1	50	16.3	8	2.6
Monitoring	202	65.8	89	29.0	14	4.6	2	0.7
Correcting	215	70.0	81	26.4	8	2.6	3	1.0
Anticipating	91	29.6	117	38.1	74	24.1	25	8.1
Estimating time	94	30.6	143	46.6.	54	17.6	16	5.2
Analyzing	164	53.4	118	38.4	21	6.8	4	1.3
Comparing/ Evaluating	123	40.1	121	39.4	51	16.6	12	3.9
Associating	212	69.1	71	23.1	19	6.2	5	1.6

	I teach this very often		I teach this sometimes		I teach this rarely		I do not teach this	
Executive function	*n*	%	*N*	%	*n*	%	*n*	%
Generating	131	42.7	124	40.4	45	14.7	7	2.3
Planning	144	46.9	116	37.8	42	13.7	5	1.6
Organizing	163	53.1	92	30.0	43	14.0	9	2.9
Deciding	200	65.1	75	24.4	19	6.2	13	4.2
Sensing time	116	37.8	121	39.4	50	16.3	20	6.5
Pacing	132	43.0	126	41.0	38	12.4	11	3.6
Executing routines	171	55.7	97	31.6	25	8.1	14	4.6
Sequencing	152	49.2	111	36.2	33	10.7	11	3.6
Holding	120	39.1	108	35.2	47	15.3	32	10.4
Manipulating	82	26.7	100	32.6	75	24.4	50	16.3
Storing	123	40.1	107	34.9	58	18.9	19	6.2
Retrieving	121	39.4	114	37.1	45	14.7	27	8.8

Research Question 8b: Do general education and special education teachers differ in their beliefs that they directly teach specific executive functions to students who do them poorly?

Information regarding teachers' beliefs of the extent that they directly teach executive functions to students who do them poorly was further broken down to compare general education and special education teachers' endorsements. Table 17 compares general education and special education teachers' beliefs of the extent to which they directly teach specific executive functions if students do them poorly.

Table 17

General Education versus Special Education Teachers' Levels of Endorsement of Specific Executive Functions They Believe They Directly Teach Students

Executive function	I teach this very often				I teach this sometimes				I teach this rarely				I do not teach this			
	Gen. ed.		Spec. ed.		Gen. ed.		Spec. ed.		Gen. ed.		Spec. ed.		Gen. ed.		Spec. ed.	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Becoming aware	53	26.4	38	35.8	91	45.3	40	37.7	34	16.9	17	16.0	23	11.4	11	10.4
Focusing	158	78.6	90	84.9	34	16.9	12	11.3	3	1.5	3	2.8	6	3.0	1	0.9
Sustaining	111	55.2	78	73.6	71	35.3	21	19.8	13	6.5	5	4.7	6	3.0	2	1.9
Gauging	73	36.3	52	49.1	94	46.8	41	38.7	28	13.9	13	12.3	6	3.0	0	0.0
Putting forth effort	144	71.6	88	83.0	44	21.9	11	10.4	9	4.5	6	5.7	4	2.0	1	0.9
Initiating	108	53.7	62	58.5	70	34.8	33	31.1	16	8.0	10	9.4	7	3.5	1	0.9
Inhibiting	84	41.8	64	60.4	79	39.3	32	30.2	27	13.4	9	8.5	11	5.5	1	0.9
Stopping	101	50.2	62	58.5	67	33.3	28	26.4	26	12.9	12	11.3	7	3.5	4	3.8
Interrupting	82	40.8	53	50.0	66	32.8	35	33.0	40	19.9	14	13.2	13	6.5	4	3.8
Being flexible	62	30.8	39	36.8	83	41.3	45	42.5	39	19.4	17	16.0	17	8.5	5	4.7
Shifting	94	46.8	49	46.2	74	36.8	45	42.5	24	11.9	8	7.5	9	4.5	4	3.8
Modulating	118	58.7	70	66.0	56	27.9	28	26.4	12	6.0	5	4.7	15	7.5	3	2.8
Balancing	86	42.8	46	43.4	81	40.3	36	34.0	28	13.9	22	20.8	6	3.0	2	1.9
Monitoring	130	64.7	72	67.9	60	29.9	29	27.4	9	4.5	5	4.7	2	1.0	0	0.0
Correcting	142	70.6	73	68.9	53	26.4	28	26.4	4	2.0	4	3.8	2	1.0	1	0.9
Anticipating	57	28.4	34	32.1	75	37.3	42	39.6	49	24.4	25	23.6	20	10.0	5	4.7
Estimating time	58	28.9	36	34.0	97	48.3	46	43.4	35	17.4	19	17.9	11	5.5	5	4.7
Analyzing	110	54.7	54	50.9	77	38.3	41	38.7	10	5.0	11	10.4	4	2.0	0	0.0
Comparing/ Evaluating	83	41.3	40	37.7	77	38.3	44	41.5	33	16.4	18	17.0	8	4.0	4	3.8
Associating	148	73.6	64	60.4	39	19.4	32	30.2	10	5.0	9	8.5	4	2.0	1	0.9
Generating	86	42.8	45	42.5	82	40.8	42	39.6	29	14.4	16	15.1	4	2.0	3	2.8
Planning	89	44.3	55	51.9	77	38.3	39	36.8	30	14.9	12	11.3	5	2.5	0	0.0
Organizing	96	47.8	67	63.2	69	34.3	23	21.7	28	13.9	15	14.2	8	4.0	1	0.9
Deciding	124	61.7	76	71.7	51	25.4	24	22.6	15	7.5	4	3.8	11	5.5	2	1.9
Sensing time	75	37.3	41	38.7	78	38.8	43	40.6	33	16.4	17	16.0	15	7.5	5	4.7
Pacing	86	42.8	46	43.4	80	39.8	46	43.4	28	13.9	10	9.4	7	3.5	4	3.8
Executing routines	104	51.7	67	63.2	71	35.3	26	24.5	17	8.5	8	7.5	9	4.5	5	4.7
Sequencing	95	47.3	57	53.8	75	37.3	36	34.0	22	10.9	11	10.4	9	4.5	2	1.9
Holding	79	39.3	41	38.7	72	35.8	36	34.0	26	12.9	21	19.8	24	11.9	8	7.5
Manipulating	53	26.4	29	27.4	66	32.8	34	32.1	46	22.9	29	27.4	36	17.9	14	13.2
Storing	82	40.8	41	38.7	68	33.8	39	36.8	37	18.4	21	19.8	14	7.0	5	4.7
Retrieving	78	38.8	43	40.6	74	36.8	40	37.7	27	13.4	18	17.0	22	10.9	5	4.7

Research Question 9a: Are teachers in general familiar with terms associated with executive functioning?

In a structured, Likert-format question, teachers were asked to endorse their level of familiarity with terms associated with executive functions. Table 18 shows the terms and teacher endorsement of their degree of familiarity with the terms.

Table 18

Teachers' Level of Endorsement of Familiarity with Terms Associated with Executive Functioning

	Know this term and a lot about what it means in relation to academic success		Know this term and something about what it means in relation to academic success		I have heard this term but not sure what it means in relation to academic success		I have not heard this term in relation to academic success	
Terms	*n*	%	*n*	%	*n*	%	*n*	%
Self-responsibility	259	84.4	44	14.3	2	0.7	2	0.7
Self-discipline	269	87.6	34	11.1	4	1.3	0	0.0
Meta-cognition	146	47.6	90	29.3	52	16.9	19	6.2
Self-regulation	188	61.2	77	25.1	33	10.7	9	2.9
Executive function	78	25.4	70	22.8	76	24.8	83	27.0

Research Question 9b: Do general education and special education teachers differ in their familiarity with terms associated with executive functioning?

Information from the structured, Likert-format question regarding teachers' level of familiarity with terms associated with executive functions was further analyzed to compare general education and special education teachers' reported degree of familiarity with the terms. Table 19 compares general education and special education teachers' responses.

Table 19

General Education versus Special Education Teachers' Levels of Endorsement of Familiarity with Terms Associated with Executive Functioning

Terms	Know this term and a lot about what it means in relation to academic success				Know this term and something about what it means in relation to academic success				Have heard this term but not sure hat it means in relation to academic success				Have not heard this term in relation to academic success			
	Gen. ed.		Spec. ed.		Gen. ed.		Spec. ed.		Gen. ed.		Spec. ed.		Gen. ed.		Spec. ed.	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Self-responsibility	166	82.6	93	87.7	31	15.4	13	12.3	2	1.0	0	0.0	2	1.0	0	0.0
Self-discipline	175	87.1	94	88.7	22	10.9	12	11.3	4	2.0	0	0.0	0	0.0	0	0.0
Meta-cognition	89	44.3	57	53.8	59	29.4	31	29.2	36	17.9	16	15.1	17	8.5	2	1.9
Self-regulation	112	55.7	76	71.7	55	27.4	22	20.8	25	12.4	8	7.5	9	4.5	0	0.0
Executive function	45	22.4	33	31.1	49	24.4	21	19.8	47	23.4	29	27.4	60	29.9	23	21.7

Research Question 10a: To what extent do teachers think that academic skills, social skills, and behavior are influenced by executive functions?

In a structured, Likert-format question, teachers were asked to endorse the extent to which they believed different areas of education to be influenced by executive functions. Table 20 shows these areas and teachers' endorsement of their belief in the level of influence executive functions have on those various areas.

Table 20

Teachers' Levels of Endorsement of Skills Believed to be Influenced by Executive Functions

Area	Significantly influenced by executive functions		Greatly influenced by executive functions		Somewhat influenced by executive functions		Not influenced by executive functions	
	n	%	*n*	%	*n*	%	*n*	%
Mathematics	98	31.9	95	30.9	92	30.0	22	7.2
Reading	105	34.2	93	30.3	87	28.3	22	7.2
Written Language	109	35.5	91	29.6	85	27.7	22	7.2
Social skills	104	33.9	65	21.2	90	29.3	48	15.6
Behavior	104	33.9	67	21.8	92	30.0	44	14.3

Research Question10b: Do general education and special education teachers differ in their views that various academic skills, social skills, and behavior are influenced by executive functions?

Information from the structured, Likert-format question regarding teachers' belief that executive functions influence various areas was further analyzed to compare general education and special education teachers' beliefs. Table 21 compares general education and special education teachers' responses.

Table 21

General Education versus Special Education Teachers' Levels of Endorsement of Skills Believed to be Influenced by Executive Functions

Area	Significantly influenced by executive function				Greatly influenced by executive function				Somewhat influenced by executive function				Not influenced by executive function			
	Gen. ed.		Spec. ed.		Gen. ed.		Spec. ed.		Gen. ed.		Spec. ed.		Gen. ed.		Spec. ed.	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Mathematics	65	32.3	33	31.3	59	29.4	36	34.0	62	30.8	30	28.3	15	7.5	7	6.6
Reading	68	33.8	37	34.9	58	28.9	35	33.0	60	29.9	27	25.5	15	7.5	7	6.6
Written Language	71	35.3	38	35.8	56	27.9	35	33.0	59	29.4	26	24.5	15	7.5	7	6.6
Social skills	69	34.3	35	33.0	40	19.9	25	23.6	62	30.8	28	26.4	30	14.9	18	17.0
Behavior	67	33.3	37	34.9	44	21.9	23	21.7	65	32.3	27	25.5	25	12.4	19	17.9

Research Question 11a: Are teachers being trained about executive functions, either on their own or through their districts? If so, how much training have teachers received?

Information was collected on teachers' exposure to trainings about executive function, reasons for attending training, the number of trainings they had received, and whether their specific districts provided trainings. Table 22 documents teachers' training experiences.

Table 22

Teacher Exposure to Trainings Regarding Executive Functions

	n	%
Attended training(s)		
Yes	24	7.8
No	283	92.2
Number of trainings attended		
1 to 2	14	4.6
3 to 5	4	1.3
6 to 7	3	1.0
8 to 10	2	0.7
Reason for attending		
District required	6	2.0
Sought on own	17	7.5
When training was attended		
Within last 2 years	4	1.3
3 to 4 years ago	8	2.6
5 to 6 years ago	5	1.6
7 to 8 years ago	6	2.0
District provided trainings		
Yes	9	2.9
No	297	96.7

Research Question 11b: To what extent do general education and special education teachers differ on their exposure to trainings on executive functions?

Information from teachers' exposure to trainings was further analyzed to compare general education and special education teachers' training exposure. Table 23 compares general education and special education teachers' responses about training experiences.

Table 23

General Education versus Special Education Teachers' Exposure to Trainings on Executive Functions

	General education (*N* = 201)		Special education (*N* = 106)	
	n	%	*n*	%
Attended training(s)				
Yes	12	6.0	12	11.3
No	189	94.0	94	88.7
Number of trainings attended				
1 to 2	7	63.6	7	58.3
3 to 5	2	18.2	2	16.7
6 to 7	1	9.1	2	16.7
8 to 10	1	9.1	1	8.3
Reason for attending				
District required	3	27.3	3	25.0
Sought on own	8	72.7	9	75.0
When training was attended				
Within last 2 years	2	18.2	2	16.7
3 to 4 years ago	3	27.3	5	41.7
5 to 6 years ago	3	27.3	2	16.7
7 to 8 years ago	3	27.3	3	25.0
District provided trainings				
Yes	5	2.5	4	3.8
No	195	97.5	102	96.2

Research Question 12a: Are teachers familiar with the resources available to them? And, if so, are they reading them and using the information in their classrooms to help their students?

In a structured, Likert-format question information was collected on teachers' degree of familiarity with selected resources on executive functions. Table 24 shows teachers' endorsements of their degree of familiarity with specific executive function resources.

Table 24

Teachers' Levels of Endorsement of Familiarity with Select Executive Functions Resources

	I have heard of this resource		I have heard of this resource and have read it		I have never heard of this resource	
Resources	*n*	%	*n*	%	*n*	%
Executive Function in the Classroom By: Christopher Kaufman	7	2.3	24	7.8	273	88.9
Executive Function in Education By: Lynn Meltzer	6	2.0	19	6.2	279	90.9
Executive Skills in Children and Adolescents By: Peg Dawson and Richard Guare	6	2.0	17	5.5	281	91.5
Promoting Executive Function in the Classroom By: Lynn Meltzer	6	2.0	20	6.5	278	90.6
Assessment and Intervention for Executive Function Difficulties By: George McCloskey, Lynn Perkins, and Bob Van Divner	5	1.6	19	6.2	280	91.2
Teaching Teens with ADD, ADHD, and Executive Function Deficits By. Chris Zeigler Dendy	14	4.6	43	14.0	247	80.5
Smart but Scattered By Peg Dawson and Richard Guare	9	2.9	37	12.1	258	84.0
Rush Neurobehavioral Center website	3	1.0	15	4.9	286	93.2
Intervention Central website	14	4.6	33	10.7	257	83.7
CHADD website	33	10.7	62	20.2	209	68.1

Research Question12b: Are special education teachers more familiar with resources than general education teachers?

Information collected and presented on teachers' degree of familiarity with executive functions resources was further analyzed to compare the degree of familiarity between general education and special education teachers. Table 25 compares general

education and special education teachers' endorsements of their level of familiarity with specific executive function resources.

Table 25

General Education versus Special Education Teachers' Level of Endorsement of Familiarity With and Use of Select Executive Functions Resources

	I have heard of this resource				I have heard of this resource and have read it				I have never heard of this resource			
	Gen. ed.		Spec. ed.		Gen. ed.		Spec. ed.		Gen. ed.		Spec. ed.	
Resources	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Executive Function in the Classroom By: Christopher Kaufman	3	1.5	4	3.8	15	7.6	9	8.5	180	90.9	93	87.7
Executive Function in Education By: Lynn Meltzer	3	1.5	3	2.8	10	5.1	9	8.5	185	93.4	94	88.7
Executive Skills in Children and Adolescents By: Peg Dawson and Richard Guare	3	1.5	3	2.8	9	4.5	8	7.5	186	93.9	95	89.6
Promoting Executive Function in the Classroom By: Lynn Meltzer	4	2.0	2	1.9	11	5.6	9	8.5	183	92.4	95	89.6
Assessment and Intervention for Executive Function Difficulties By: George McCloskey, Lynn Perkins, and Bob Van Divner	1	0.5	4	3.8	11	5.6	8	7.5	186	93.9	94	88.7
Teaching Teens with ADD, ADHD, and Executive Function Deficits By: Chris Zeigler Dendy	6	3.0	8	7.5	29	14.6	14	13.2	163	82.3	84	79.2
Smart but Scattered By: Peg Dawson and Richard Guare	7	3.5	2	1.9	27	13.6	10	9.4	164	82.8	94	88.7
Rush Neurobehavioral Center website	1	0.5	2	1.9	13	6.6	2	1.9	184	92.1	102	96.2
Intervention Central website	5	2.5	9	8.5	20	10.1	13	12.3	173	87.4	84	79.2
CHADD website	15	7.6	18	17.0	41	20.7	21	19.8	142	71.7	67	63.2

CHAPTER 5

Discussion

Overview

As stated previously, executive functions is a topic receiving increasing attention in education. Students who have difficulties producing in school likely experience these difficulties because of deficits in executive functions. Teachers responsible for educating these students need to have an understanding of what executive functions are, how they impact the learning and production of children and adolescents, and what can be expected of students with deficits in executive functions.

This study aimed to examine teachers' general beliefs about abilities and skills needed for academic success; their specific knowledge of, and beliefs about, executive functions; and their beliefs and expectations regarding what executive functions students should be using and the extent to which these executive functions can be taught to students. In addition, this study examined what executive functions teachers believe they already directly teach. Familiarity with terms associated with executive functions, degree of exposure to trainings on executive functions, and familiarity with executive functions resources also were examined.

Summary of the Results

The first research question examined teachers' beliefs about what general mental abilities or skills are essential to students' academic success. This open-ended question provided for many opinions from the teachers completing the survey. Critical thinking was the most frequently mentioned skill, cited by 34.2% of the teachers surveyed. When comparing general education and special education teachers' responses, critical thinking

was at the top of both lists. Motivation was listed as the second most frequently mentioned mental ability or skill. Teachers surveyed believe that students need to be capable of problem-solving, analyzing, and applying skills learned to be successful academically. This was followed by student motivation and basic academic skills. The second part of the question examined the differences between general education and special education teachers' beliefs. There was little difference between the proportions of teachers mentioning of the specific abilities or skills believed to be essential for students' academic success. It appears that regardless of the type of teacher training received, teachers share similar beliefs about abilities and skills essential for academic success in similar proportions.

The second research question examined general behaviors reflective of the use of executive functions and teachers' beliefs regarding the extent to which these behaviors are essential to academic success. Teachers' endorsements indicated that most teachers believed that the various behaviors were either essential or at least very helpful for academic success. Very few teachers expressed the belief that these behaviors were not helpful at all. When a comparison between general education and special education teachers was made, it was again found that they hold similar beliefs in similar proportions.

The third research question focused on the specific executive functions listed in the Holarchical Model of Executive Functions by McCloskey et al. (2009). A majority of the teachers surveyed indicated that each of the 32 executive functions either are essential or very helpful to students' academic success. A comparison between general and special education teachers did not show much variation in the proportions of endorsements for

specific executive functions. The only substantially large differences in percentages between general education and special education teachers was in their views on Stopping (i.e., stopping when told to do so) and Analyzing (i.e., analyzing problems when necessary). A large proportion of special education teachers believe that stopping is essential to academic success, whereas a large proportion of general education teachers believe that it is helpful although not essential. Conversely, a large proportion of general education teachers believe that analyzing is essential for academic success, whereas a large proportion of special education teachers believe that analyzing is very helpful although not essential.

The fourth research question examined what expectations teachers have for their students for them to be academically successful. This open-ended question resulted in a large number of well-thought-out responses from teachers who completed the survey. A large percentage of teacher responses focused on student effort. This information is not necessarily new. Teachers typically desire to have their students put forth effort with their studies and to try to do their best, whatever that may be. Other expectations teachers reported were for students to be active learners, attend to instruction, and to complete work both in and outside of school. Interestingly, when looking at this information in comparison to what teachers believed to be essential, critical thinking was at the top of the list when asked about skills essential to learning. However, it was lower on the list in regards to what teachers expect of students. In a comparison of general education and special education teachers, there was little difference in their proportions of responses regarding what they expected from their students for them to be academically successful.

The fifth research question again focused on the specific executive functions listed in the Holarchical Model of Executive Functions by McCloskey et al. (2009). The study examined what specific executive functions teachers expected their student to use to be academically successful. A majority of teachers expected students to engage in a majority of the executive functions with at least some prompting or assistance. There were a limited number of skills that a majority of the teachers expected to be engaged independently. The executive functions of focusing, effort, stopping, modulating (i.e., keeping behavior within the limits set for an activity), and deciding (i.e., making good choices and decisions) were all skills in which a majority of teachers expected students to engage without prompting or assistance. A comparison of general education and special education teachers' proportions of endorsements revealed few differences. Differences between the two groups of teachers were mainly reflected in larger proportions of general education teachers expecting students to engage in executive functions more independently than special education teachers.

The sixth research question examined teachers' levels of confidence in their ability to teach students general behaviors that reflect the use of executive functions. In general, a majority of teachers believed that behaviors reflecting the use of executive functions could be taught, although with some difficulty. The only behavior that a majority of teachers believed could be taught without difficulty was that of setting goals. A comparison of general education and special education teachers' levels of confidence in teaching general behaviors revealed no differences in proportions for the categories resulting in the highest frequencies of responses.

The seventh research question examined teachers' beliefs that specific executive functions could be taught to students who did them poorly. The specific executive functions were used. A majority of the teachers believed that most executive functions could be taught with some difficulty. Some of the executive functions were judged to be more difficult to teach by a majority of teachers. These included inhibiting, generating, and manipulating. A comparison of general education and special education teachers showed little difference in their proportions of endorsements of each category for each executive function. Teachers with general education and special education training both believed in similar proportions that most self-regulation executive functions could be taught with some difficulty.

The eighth research question examined what specific executive functions, listed in the Holarchical Model of Executive Functions by McCloskey et al. (2009), teachers believe they directly teach to students who do them poorly. A large majority of teachers indicated a belief that they directly teach these skills either very often or sometimes. In a comparison between general education and special education teachers, little difference was found in the two groups' endorsement patterns. The few noticeable differences found involved special education teachers indicating that they directly teach an executive function more frequently than general education teachers. For example, in regards to gauging (i.e., figuring out what it will take to complete a task), special education teachers reported teaching this skill more often than general education teachers.

The ninth research question assessed teachers' familiarity with terms associated with executive functioning. Teachers' responses indicated a high degree of familiarity with the terms "self-regulation" and "self-discipline" as well as "self-regulation" and

"meta-cognition." In regards to the actual term "executive functions," the percentages were relatively equal across the four response options. The largest percentage, however, had not heard the term. In a comparison between general education and special education teachers' responses, percentages of degrees of familiarity with terms were highly similar for all terms, with the exception of "executive functions." In reference to the term "executive functions," a larger percentage of special education teachers indicated a high degree of familiarity with the term "executive functions" and its relation to academic success. In contrast, general education teachers' responses were highest for having not heard the term in relation to academic success.

The tenth research question considered teachers' beliefs about the extent that academic skills, social skills, and behavior are influenced by executive functions. The data revealed that a large majority of teachers believed that executive functions influence mathematics, reading, written language, social skills, and behavior at least to some extent. In a comparison between general education and special education teachers, proportions were similar for each response category. Most notably, most teachers, whether trained in general education or special education, believed that executive functions influence academics, social skills, and behavior.

The eleventh research question examined teachers' exposure to trainings about executive functions. A majority of teachers surveyed (92.2%) had not attended any training on executive functions. Of those who had attended trainings, most had only attended one to two trainings. A majority of the teachers had sought training on their own, which would lead one to believe that the information regarding executive functions is reaching some teachers. A small percentage (2.9%) of teachers reported that their

districts had provided trainings on executive functions. A comparison of general education and special education teachers revealed little difference in proportions relative to their exposure to executive functions trainings.

The twelfth and final research question examined teachers' familiarity with select resources on executive functions. The majority of teachers reported that they had never heard of the various resources, especially the published books. Comparatively, general education and special education teachers were similar in their lack of familiarity with the resources listed. Therefore, teachers either are not seeking out this information, or the resources are not making their way into the catalogs or onto websites that teachers access for information to help them with classroom instruction and management. Another consideration is that teachers may not be looking for books for various reasons, one being that they may not have the time to read through a book. Often, teachers are pressed for time to learn about topics not directly related to the curriculum they teach. Greater familiarity was reported for websites over books, but of the websites inquired about in this study, a majority of the teachers indicated that they had not heard of them.

Overall, some aspects of the original hypotheses were supported and some were unsupported. It was hypothesized that teachers would have limited knowledge of executive functions. The teachers we surveyed indicated that they were familiar with executive functions. However, familiarity with the actual term "executive function" responses was varied, with the largest percentage having not heard the term. Although they varied in their responses on the amount of influence executive functions had on academics, social skills, and behaviors, their responses suggested awareness that executive functions in fact influenced those areas. The hypothesis that teachers would

endorse the belief that the various executive functions are essential to academic success was supported. It was hypothesized that teachers would expect their students to engage in specific executive functions independently. Survey responses did not fully support this hypothesis, as they indicated that a majority of teachers expected students to engage specific executive functions with some prompting or assistance rather than independently. Only 3 of the 32 specific executive functions were endorsed by teachers as being expected to be performed by their students without prompting or assistance. In regards to teaching executive functions, it was hypothesized that teachers would report that executive functions could be taught with great difficulty or possibly not at all and that they would therefore indicate that they were not directly teaching these skills to their students who did them poorly. The survey data did not support these hypotheses. Survey responses indicated that teachers believed that students who have executive functions deficits could be taught to improve them. The data also showed that a majority of teachers believed that they were directly teaching students how to improve executive functions at least some of the time.

It is encouraging to see that teachers indicate that they are aware of executive functions and indicate that they believe that executive functions are important to success in education. Interestingly, however, when asked in the first open-ended question (research question one) regarding what mental abilities teachers felt were important for academic success, the most frequently reported mental abilities (effort, basic academic skills, etc.) were not executive functions. Basic academic skills are what students are learning with the assistance/use of their executive functions. The most frequently reported mental ability, critical thinking, is directed by executive functions, but it is not

an executive function. Motivation typically is considered a characteristic that is intrinsic to an individual and not something that is taught. In the second open-ended question (research question four) regarding what expectations teachers have for their students for them to be successful, teachers again reported many behaviors that were not considered executive functions. One of the most reported expectations was being an active learner, which again is not an executive function, although it requires students to use executive functions. Based on teachers' input in these open-ended questions and their endorsements on the prompted questions, there appeared to be a disconnect in teacher response patterns.

The data did not support the hypotheses that teachers have high expectations of their students to self-regulate the use of executive functions and, therefore, directly teach them. This leads to the question of where teachers obtained their training regarding how to teach executive functions, as they indicated that they have been teaching them as necessary. One of the hypotheses was that teachers have had limited exposure to training about executive functions. Our hypothesis was supported in that more than 90% of the teachers surveyed had not received any training about executive functions. Therefore, there appears to be a need for training.

The initial impetus behind conducting this study was the frequent occurrence of teacher comments during many child study team meetings attended by this researcher and many colleagues. It was during these meetings that, when executive functions were brought into the discussion, teachers often asked what executive functions were and what they could do in their classrooms to assist students with executive functions difficulties. These experiences are counter to the results of the survey reported here. Although

teachers in this study reported that they have been directly teaching executive functions, no data were gathered regarding exactly what teachers meant by these endorsements—that is, how teachers are operationally defining "teach." It is unclear, therefore, as to what teachers may consider to be "direct teaching" of executive functions. It is possible that some teachers believe that teaching involves prompting for the use of the executive function rather than teaching the student how to perform the executive function.

Difficulties related to teacher definitions of what constitutes the teaching of executive functions is further supported by the fact that academic curricular materials reviewed by this researcher and colleagues do not provide specific lesson plans for the teaching of the general behaviors associated with the use of executive functions nor the teaching of the specific executive functions specified in the model proposed by McCloskey et al. (2009). Given the lack of teaching resources available through standard curricular materials and the majority of teachers indicating that they are not familiar with the executive functions resources listed in the survey, the source of teachers' knowledge about how to teach executive functions is unclear. As a result, there may be a large gap between what teachers believe they know and believe they do and what they actually know and actually do in relation to the teaching of executive functions.

A disconnect between survey results and professional experiences with teachers also may have arisen from the way in which teachers were recruited for participation in the study. With the exception of a small group of teachers who completed the survey during a school faculty meeting, and some teachers who were contacted by acquaintances familiar with the researcher and the study, participation primarily was based on teachers' willingness to open, read, and respond to e-mails sent by the researcher. As there was no

incentive provided for responding to the survey, teachers' who did choose to respond likely were interested in sharing their knowledge, beliefs, and expectations regarding students skills, thereby potentially producing a biased sample of respondents for the survey.

Limitations of the Study

The current study was impacted by several limitations. Perhaps the most critical of these is the participant recruitment method. As mentioned in the discussion above, relying primarily on e-mail solicitation to recruit participants may have produced a biased sample of teachers who had interest in sharing their knowledge, beliefs, and expectations of student skills, although neither the survey title nor the cover/introduction letter mentioned executive functions.

A second limitation of this study is the data collection method. The survey method employed here only permitted the expression of specific perceptions and beliefs of individual teachers. The study employed no specific means for checking the veracity of teacher statements about their levels of knowledge of executive functions and the extent to which they are teaching executive functions in their classroom. Although the study solicited teachers' opinions about abilities and skills essential for academic success and opinions about their expectations of students in terms of self-regulation capacities, the study provided no means for examining the extent to which these stated opinions were consistent with teachers' actual expectations in their classrooms or with the skills and abilities that are actually needed to ensure academic success in their classrooms.

Further, the comparison between general education and special education teachers was based on their educational background rather than the types of students they taught.

The majority of teachers reported teaching both general and special education students. This may have impacted the comparison between the two teacher groups. It is possible that those general education teachers who regularly work alongside a special education teacher may be influenced by the special education teacher and draw on their specialized training and teaching techniques.

Additionally, this study focused on middle school students and the teachers who educate them. By limiting the study to middle school teachers, no information was gathered regarding elementary and high school teachers' knowledge of and beliefs about executive functions, thereby limiting the interpretability of results to this specific teacher group.

Implications for Practice

The intent of this study was to examine teacher knowledge, beliefs, and practice related to the area of executive functions. It was hypothesized that teachers would have limited knowledge of executive functions, have high expectations that students should be engaging in these skills independently more frequently, and, therefore, that they would be less likely to be directly teaching executive functions to their students. This study revealed that teachers expected students to engage in executive functions with relative independence; however, they reported that they directly teach executive functions on a regular basis. The study results suggest that teachers believe that they are knowledgeable in the area of executive functions and how they relate to academic success. These results, however, were inconsistent with the experience of the primary investigator and colleagues. When executive functions are mentioned in their place of employment, a public school district, teachers frequently ask what executive functions are and how to

work with students with deficits in executive functions when presented with psychological and neuropsychological reports during meetings. The difference between teacher-reported knowledge on this survey and teacher behavior during team meetings is difficult to reconcile.

Another major implication of the study is that teachers report they are unaware of executive function resources. A large percentage of teachers, more than 80%, had never heard of the executive function resources written by leading individuals on the subject. This is an important finding, as it suggests that teachers are not being exposed to the literature needed to expand their knowledge of executive functions. Resources on executive functions need to be more readily available to the teachers who work directly with the students lacking these skills. This information is important for book publishers, authors, school psychologists, and learning consultants to know, as they are the ones either directly associated with, or having the greatest knowledge of, the books and/or Internet resources teachers need to effectively teach their students.

The most notable aspect of the study was that most teachers said they are unfamiliar with executive functions as a specific area and have not had training on the topic of executive functions. This suggests that training is needed to reach the teachers who work directly with students. It is possible that through effective training, teachers may come to realize that they are not really teaching executive functions, as they believe. Training would provide a knowledge base of executive functions and expose teachers to ways to teach executive functions effectively and efficiently to their students.

Future Research

Future research could be done by expanding the analysis of the open-ended questions regarding what mental abilities teachers believe are essential to students' academic success and what expectations they have for their students for them to be successful. Teacher responses to these questions were overwhelmingly positive in the amount of thought applied to the questions and the quantity and quality of the responses provided. Teachers' responses also provided great insight into their ideas about education and the students they educate.

Additionally, the current study could be expanded by collecting data on teacher knowledge of and beliefs about executive functions using a different method. Providing case examples of students with and without executive function deficits and having teachers determine whether any executive dysfunction exists would likely produce more accurate results of their knowledge of executive functions. Further, a survey including examples of methods used to directly teach executive functions to students where teachers had to determine what executive functions were being taught might help in determining teachers' level of knowledge of executive functions as well as their use of that knowledge.

Another research method that may be considered would be to have videos of students both with and without executive function deficits as well as videos of teachers teaching students. After watching the videos, teachers would then identify any examples of executive function deficits in students. They would also identify examples of teachers directly teaching executive function skills to students. Use of a video makes the situation

more real and relatable to study participants and likely would produce more reliable data of teacher knowledge and beliefs using virtual real-life situations.

Further, future research also could consider teacher knowledge of executive function interventions. This study did not address their knowledge of interventions or strategies, and this is an area that would provide more detailed information about how teachers view their ability to teach the skills to students exhibiting executive dysfunction.

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APPENDIX A

Invitation to Participate

Dear Teacher:

You are invited to participate in a research study examining teacher knowledge, beliefs and expectations about students' skills and learning. If you choose to participate you will be asked to complete the following survey. The length of time estimated to complete the survey is approximately 15 minutes.

The study is being conducted as part of my dissertation, under the supervision of George McCloskey, Ph.D., Professor, and Director of School Psychology Research at the Philadelphia College of Osteopathic Medicine (PCOM). Completion of the survey will be considered an indication of your willingness to participate in the research, as well as your permission to allow me to use and interpret the data you provide. All responses will be completely anonymous.

To participate in this study, please proceed to the survey by clicking on the following link to complete the survey online or fill out the attached survey.

I appreciate your participation in this survey. If you have any questions, comments, or concerns, please do not hesitate to contact me via phone at 609-758-6800 x 3408 or at larissamo@pcom.edu. If you are interested in receiving the results of this study at a later date please email me.

Your time and effort is greatly appreciated!

Sincerely,

Larissa Morgan-Borkowsky, Ed.S
Certified School Psychologist
Doctoral Candidate
Philadelphia College of Osteopathic Medicine

APPENDIX B

Survey

Survey of Student Skills and Teacher Knowledge and Expectations

Background Information

What is your highest level of education?

_____ Bachelor's Degree
_____Master's Degree
_____Education Specialist Degree
_____Doctorate
_____Other _____

In what year did you obtain your highest degree? _____

How many years have you been employed as a teacher?

_____ 0 to 5
_____ 6 to 10
_____ 11 to 15
_____ 16 to 20
_____ 21 or more

What students do you teach?

_____ Special Education students
_____ General Education students
_____ Both

With which grade level(s) do you work? _____

Which of the following best describes the setting in which you are employed?

_____Rural
_____Suburban
_____ Urban

In what town and state are you employed? _____

Based on your experience as a teacher, what mental abilities or skills do you believe to be essential to students' academic success?

How essential do you think each of the following mental abilities or skills are for students' academic success?

	Essential for success	Very helpful but not essential	Somewhat helpful but not essential	Not helpful
Attending to instruction				
Quickly taking in new information				
Listening and Speaking articulately				
Comprehending what is read				
Solving math problems				
Expressing thoughts in writing				
Remembering important facts				
Having a large vocabulary				
Knowing a lot about many different topics				
Holding and working with information in mind				
Knowing how to get along with others				
Sustaining attention and effort with difficult tasks				
Acting responsibly				
Exhibiting self-control				
Working independently				

To what extent do you think each of the following affect the academic success of the children you teach?

	Essential to success	Very helpful but not essential	Somewhat helpful but not essential	Not helpful
Being aware of surroundings				
Paying attention to instruction				
Sustaining attention long enough to complete tasks				
Figuring out what it will take to complete a task				
Putting effort into completing tasks				
Getting started on tasks without prompting				
Resisting acting on impulse				
Stopping when told to do so				
Interrupting ongoing activity when asked to do so				
Being open to changes in routines				
Shifting from one activity to another without problems				
Keeping behavior within the limits set for an activity				
Having a good sense of balance about things (balancing speed and accuracy in work, balancing humorousness and seriousness)				
Checking work for errors				
Correcting errors when they are found				
Anticipating what is going to happen next in class				
Accurately estimating amount of time needed to complete tasks				
Analyzing problems when necessary				
Making comparisons and evaluating the adequacy of task performance				
Making associations between what was learned and what is now being taught				
Generating new solutions to problems that have not been seen before				
Making a plan for accomplishing a project or assignment				
Organizing work on projects and other assignments				
Making good choices and decisions				
Having a good sense of time				
Maintaining a good work pace				
Using learned routines effectively				
Getting the steps right in tasks, putting things in the right order				
Holding onto information (not require a lot of repetition of directions)				
Working with information in mind without needing to write things down				
Knowing what information to store for later use				
Recalling important information without being asked to do so				

As a teacher, what expectations do you have for your students for them to be successful academically?

To what extent do you expect students in your class to do the following to succeed academically?

	Do this without any assistance or prompts	Do this with some assistance or prompting	Do this with a lot of assistance or prompting	Not do this
Being aware of surroundings				
Paying attention to instruction				
Sustaining attention long enough to complete tasks				
Figuring out what it will take to complete a task				
Putting effort into completing tasks				
Getting started on tasks without prompting				
Resisting acting on impulse				
Stopping when told to do so				
Interrupting ongoing activity when asked to do so				
Being open to changes in routines				
Shifting from one activity to another without problems				
Keeping behavior within the limits set for an activity				
Having a good sense of balance about things (balancing speed and accuracy in work, balancing humorousness and seriousness)				
Checking work for errors				
Correcting errors when they are found				
Anticipating what is going to happen next in class				
Accurately estimating amount of time needed to complete tasks				
Analyzing problems when necessary				
Making comparisons and evaluating the adequacy of task performance				
Making associations between what was learned and what is now being taught				
Generating new solutions to problems that have not been seen before				
Making a plan for accomplishing a project or assignment				
Organizing work on projects and other assignments				
Making good choices and decisions				
Having a good sense of time				
Maintaining a good work pace				
Using learned routines effectively				
Getting the steps right in tasks, put things in the right order				
Holding onto information (not require a lot of repetition of directions)				
Working with information in mind without needing to write things down				
Knowing what information to store for later use				
Recalling important information without being asked to do so				

How confident are you that you could teach students to do the following:

	Can be taught without difficulty	Can be taught with some difficulty	Can be taught with great difficulty	Cannot be taught
Improve Time Management				
Increase Adaptability				
Increase memory capacity				
Improve on task performance				
Improve organization of materials				
Plan out long-term projects				
Set goals				
Improve attentiveness				
Self-monitor work				
Shift from one task to another easily				
Improve task persistence				
Prioritize tasks				
Attend to tasks until the end				
Improve task initiation				
Better organize ideas				

To what extent do you think each of the following could be taught if a student does it poorly?

	Can be taught without difficulty	Can be taught with some difficulty	Can be taught with great difficulty	Cannot be taught
Being aware of surroundings				
Paying attention to instruction				
Sustaining attention long enough to complete tasks				
Putting effort into completing tasks				
Getting started on tasks without prompting				
Resisting acting on impulse				
Stopping when told to do so				
Interrupting ongoing activity when asked to do so				
Being open to changes in routines				
Shifting from one activity to another without problems				
Keeping behavior within the limits set for an activity				
Having a good sense of balance about things (balance speed and accuracy in work, humorousness and seriousness)				
Checking work for errors				
Correcting errors when they are found				
Anticipating what is going to happen next in class				
Accurately estimating amount of time needed to complete tasks				
Analyzing problems or situations when necessary				
Making comparisons and evaluate the adequacy of task performance				
Making associations between what was learned and what is now being taught				
Generating new solutions to problems that have not been seen before				
Making a plan for accomplishing a project or assignment				
Organizing work on projects and other assignments				
Making good choices and decisions				
Having a good sense of time				
Maintaining a good work pace				
Using learned routines effectively				
Getting the steps right in tasks, put things in the right order				
Holding onto information (not require a lot of repetition of directions)				
Working with information in mind without needing to write things down				
Knowing what information to store for later use				
Recalling important information without being asked to do so				

To what extent do you think you directly teach each of the following to students who do them poorly?

	I teach this very often	I teach this sometimes	I teach this rarely	I do not teach this
Being aware of surroundings				
Paying attention to instruction				
Sustaining attention long enough to complete tasks				
Putting effort into completing tasks				
Getting started on tasks without prompting				
Resisting acting on impulse				
Stopping when told to do so				
Interrupting ongoing activity when asked to do so				
Being open to changes in routines				
Shifting from one activity to another without problems				
Keeping behavior within the limits set for an activity				
Having a good sense of balance about things (balance speed and accuracy in work, humorousness and seriousness)				
Checking work for errors				
Correcting errors when they are found				
Anticipating what is going to happen next in class				
Accurately estimating amount of time needed to complete tasks				
Analyzing problems or situations when necessary				
Making comparisons and evaluate the adequacy of task performance				
Making associations between what was learned and what is now being taught				
Generating new solutions to problems that have not been seen before				
Making a plan for accomplishing a project or assignment				
Organizing work on projects and other assignments				
Making good choices and decisions				
Having a good sense of time				
Maintaining a good work pace				
Using learned routines effectively				
Getting the steps right in tasks, put things in the right order				
Holding onto information (not require a lot of repetition of directions)				
Working with information in mind without needing to write things down				
Knowing what information to store for later use				
Recalling important information without being asked to do so				

How familiar are you with the following terms in relation to students' academic success?

	I know this term and know a lot about what it means in relation to academic success	I know this term and know something about what it means in relation to academic success	I have heard this term but I am not sure what it means in relation to academic success	I have not heard this term I relation to academic success
Self-responsibility				
Self-discipline				
Meta-cognition				
Self-regulation				
Executive functions				

To what extent do you think the following areas are impacted/influenced by executive functions skills?

	Significantly impacted/influenced by	Greatly impacted/Influenced by	Somewhat impacted/influenced by	Not impacted/influenced by
Mathematics				
Reading				
Written language				
Social skills				
Behavior				

Have you attended any training on Executive Function skills in students?

_____ Yes
_____ No

If "yes"…

how many have you attended?

_____ 1 to 2
_____ 3 to 5
_____ 6 to 7
_____ 8 to 10

Reason for attending training?

_____ District required
_____ Sought training on own

When did you attend the training(s)?

_____ During the 2011–2012 school year
_____ During the 2009–2011 school years
_____ During the 2007–2009 school years
_____ During the 2005–2007 school years

Has your district provided any training on Executive Function skills in students? Yes No

If "yes," please describe the training:

Are you aware of any resources (books or websites) on the topic of Executive Functions?

_____ Yes
_____ No

If "yes," please list the resources you are aware of:

How familiar are you with the following resources?

	I have heard of this resource	I have heard of this resource and have read it	I have never heard of this resource
BOOKS			
Executive Function in the Classroom: Practical Strategies for Improving Performance and Enhancing Skills for all Students By: Christopher Kaufman			
Executive Function in Education By: Lynn Meltzer			
Executive Skills in Children and Adolescents: A Practical Guide to Assessment and Intervention By: Peg Dawson and Richard Guare			
Promoting Executive Function in the Classroom By: Lynn Meltzer			
Assessment and Intervention for Executive Function Difficulties By: George McCloskey, Lisa Perkins, and Bob Van Divner			
Teaching Teens With ADD, ADHD & Executive Function Deficits: A Quick Reference Guide for Teachers and Parents By: Chris A. Zeigler Dendy			
Smart but Scattered By: Peg Dawson and Richard Guare			
WEBSITES			
Rush Neurobehavioral Center http://www.rnbc.org/education/a-focus-on-executive-function/			
Intervention Central www.interventioncentral.com			
CHADD www.chadd.org			