2018

An Analysis of Teachers' Judgements of the Executive Capacities of Students Classified as Emotionally Disturbed/Behaviorally Disordered and a Matched, Non-Clinical Student Group

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Submitted in Partial Fulfillment of the Requirements for the Degree of

Doctor of Psychology

May 2018

PHILADELPHIA COLLEGE OF OSTEOPATHIC MEDICINE
DEPARTMENT OF PSYCHOLOGY

Dissertation Approval

This is to certify that the thesis presented to us by __Catherine Forster__ on the _____ day of ___May 17th____, 2018__, 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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Acknowledgements

A wise person once said, “Not all superheroes wear capes. Some have teaching and psychology degrees.” This not only defines, but truly captures Dr. George McCloskey, whose influence will last with me forever. I thank him for so many things, but most of all, for opening my eyes to many things I never even realized needed awakening. Because of him, I look at things in a new light, I approach things from a new angle, and strive to be the person who can make a change. For teaching me *how* to think, not *what* to think, for making me realize the value of a thought-provoking *question*, as opposed to a solid provided answer, for investing months of efforts and time to ensure that I accomplish my own personal goals, I will forever carry all that I learned from you in my daily work and endeavors. Without your years of expertise and constant calming reassurance and encouragement, none of this would have been possible, and therefore, achieved.

To Dr. Virginia Salzer, I thank you for presenting numbers and statistics in a way that made me less apprehensive, for teaching me in a differentiated modality that made sense, and most of all, for understanding my own individual characteristics and unique needs. My passion and love for PCOM has very much to do with you and the inspiration you ignited within me since 2012. To Dr. Kathryn Robb, to whom I cannot express enough gratitude in words; I am so fortunate to have you take part in my educational process. You are the definition of someone who can do it all. Thank you for walking with me through this journey.

With this committee, how lucky am I to say that I have learned from the best? And then, there is my unwavering, overly supportive, minute-to-minute, always available, 4 siblings and 2 parents that have been my backbone and rugged beating heart this past year, and since I was

young'. I am forever in debt to you for a multitude of factors, but most notably, for being my moral compass, my emotional director, mental sorter in times of uncertainty, and loyal companion and best friends.

Last, and most importantly, Beau, Blake, Bella, and Sienna, this is for you. Every day, when working with children, I see you four. And I instantly smile, and then do even better. For you four.

Abstract

Research has shown that EF difficulties are evident in the symptomatology of numerous psychopathologies and mental health disorders, especially in children. Due to the pervasiveness of EF difficulties related to a majority of the emotional and mental disorders experienced by children, there is a clear need to identify, carefully, the specific nature of the EF difficulties demonstrated by a child so that appropriate interventions can be identified and implemented. Despite this need, currently available individually-administered tests and rating scales are not constructed on the basis of a comprehensive theory of executive capacities, and therefore focus only on one or a handful of executive functions. The current study used archival data from the McCloskey Executive Functions Scale (MEFS; McCloskey, 2016), a norm-referenced rating scale developed in accordance with a multi-tiered, multi-faceted theory of executive control, to examine if teachers' ratings of students' executive capacities differ significantly among a clinical and matched, non-clinical control group. Congruent with the hypothesis of this study, comparison between groups found that a greater proportion of students who were in the Emotionally Disturbed/Behaviorally Disordered sample were consistently judged as having both executive function and executive skill deficits across all seven clusters, for each of the 31 Self-Regulation Executive Capacities, and within both the Academic and Self/Social Arenas. The findings of this study highlight the fact that assessment at this level could lead to better understanding of how and why EF is so broadly impacted across mental health disorders, and thus aid in improved interventions, targeted treatment, and increased positive outcomes for this population.

Keywords: executive functions, mental health, MEFS

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Chapter 1

Introduction

Although the term executive functions (EFs) is exceedingly broad and lacks a consensus definition, most researchers agree that EFs are necessary for goal-directed, purposeful behaviors and critical to effective everyday functioning. Daily tasks that require getting organized, focusing and sustaining attention, using working memory, planning, and decision making depend on intact EFs. Impairment of EFs can have negative effects in various everyday life situations and activities, including the ability to achieve in school, function independently at home, and maintain appropriate social relationships (Chan, Shum, Toulopoulou, & Chen, 2008). Multiple EFs aid in the successful performance of many academic tasks, such as comprehending complex information, analyzing problems, recalling specific facts as needed, drawing inferences, making judgments, and thinking critically (Levine, 1999). EFs also play a central role in the self-regulation of behaviors and emotions. Delayed development of EFs may result in underdeveloped emotional regulation, often leading to difficulties with social relationships, frustration tolerance, stress management, and adaptive functioning. Poor self-regulation of emotions has been associated both with internalizing and with externalizing mental health problems in children. Research has shown that EF difficulties are evident in the symptomatology of numerous psychopathologies and mental health disorders, especially in children (Arnsten, 2009; Arnsten & Robbins, 2002; Rinsky & Hinshaw, 2011; Hosenbocus & Chahal, 2012; Hughes, 2013; Oosterlaan, Logan, & Sergeant, 1998; Kluwe-Schiavon, Viola, Sanvicente-Vieira, Malloy-Diniz, & Grassi-

Oliveira, 2017; Siddiqui et al., 2008; McCloskey, Hewitt, Henzel, & Eusebio, 2009b). Many studies have discussed the specific EF difficulties that are exhibited by adults and children diagnosed with internalizing and externalizing disorders, including ADHD, Autism, Oppositional Defiant Disorder (ODD), Conduct Disorder (CD), Obsessive Compulsive Disorder (OCD), Anxiety, Depression, and Bipolar Disorder (Snyder, Miyake, & Hankin, 2015; Schmeichel, Volokhov, & Demaree, 2008; Chiang & Gau, 2014; Halperin, 2016; Barkley, 1997a; Barkley, 1997b; Barkley, 2001; Barkley, 2016; Brown, 2006; McCloskey, Perkins, & Van Divner, 2009a; McCloskey, 2017; Pennington & Ozonoff, 1996; Crosbie, Pérusse, Barr, & Schachar, 2008; Kerns, McInerney, & Wilde, 2001; Nigg, 2001; Oosterlaan et al., 1998; Geurts et al., 2004; Goldberg et al., 2005; Chang, McCracken, & John, 2007; Watkins et al., 2005; Hobson, Scott, & Rubia, 2011; Moffitt, 1993; Thorell & Wahlstedt, 2006; McBurnett et al., 1993; Oosterlaan, Scheres, & Sergeant, 2005; Schoemaker et al., 2012; Waschbusch, 2002; Castaneda et al., 2011; Martens, 1969; Horwitiz & McCaffrey, 2008; Berggren, Richards, Taylor, & Derakshan, 2013; Kalanthroff, Henik, Derakshan, & Usher, 2016; Pacheo-Unguetti et al., 2010; Mayberg et al., 1999; Fossati, Ergis, & Allilaire, 2002; Dunlop & Nemeroff, 2007; Watkins & Brown, 2002; Wang, Ongur, Auerbach, & Yao, 2016; Mur, Portella, Martinez-Aran, Pfifarre, & Vieta, 2007; Goldberg & Chengappa, 2009; Kenworthy, Yerys, Anthony, & Wallace, 2008; Ozonoff & Jensen, 1999; Ozonoff, Strayer, McMahon, & Filloux, 1994; Hovik et al., 2017; Bishop, 1993; Hughes, Russell, & Robbins, 1994; Joseph, 1999; Ozonoff & Strayer, 1997; Robins, 1997; Ozonoff, 1997; Kana, Keller, Minshew, & Just, 2007; Buhler, Bachmann, Goyert, Heinzel-Gutenbrunner, & Kamp-Becker, 2011; Rasmussen, 2005; Rasmussen & Bisanz, 2009; Mattson,

Goodman, Caine, Delis, & Riley, 1999, Noland et al., 2003; Green et al., 2009; Gruner & Pittenger, 2017; Morein-Zamir et al., 2014; Shin, Lee, Kim, & Kwon, 2013).

Due to the pervasiveness of EF difficulties related to a majority of the emotional and mental disorders experienced by children, there is a clear need to identify carefully the specific nature of the EF difficulties demonstrated by a child so that appropriate interventions can be identified and implemented. Thorough assessment and intervention efforts related to the EF difficulties associated with diagnosed emotional disorders can lead to better outcomes in regard to overall life quality (McCloskey et al., 2009b; McCloskey et al., 2014; Klumpp et al., 2017; Goodkind et al., 2015; Siegal, 2007; Segal, Williams, & Teasdale, 2002; Greenland, 2010; Diamond & Lee, 2011; Riggs, Jahromi, Razza, Dillworth-Bart & Mueller, 2006; Dawson & Guare, 2010; Hosenbocus & Chahal, 2012).

Statement of the Problem

When assessing a student who is thought to be emotionally disturbed (ED), a thorough assessment of the student's EF strengths and weaknesses can help to identify the degree of impairment and help guide selection of appropriate interventions. Although norm-referenced, individually administered tests and rating scales are available to assess EFs, these instruments have many limitations.

Most importantly, individually-administered tests formally assess the use of executive functions only to cue and direct perceptions, thoughts and actions within the Symbol System (Academic) arena of involvement. Individually administered tests do not formally assess the cueing and directing of emotions within the Academic arena, nor do they assess the cueing and directing of perceptions, feelings, thoughts and actions within

the Intrapersonal, Interpersonal or Environment arenas. Although most of the currently available rating scales assess some aspects of executive control of perceptions, feelings, thoughts and actions across multiple arenas, they do not do so in a systematic, comprehensive manner.

Highlighted by the problems with assessment of all domains of functioning within all arenas of involvement, is the fact that currently available, individually-administered tests and rating scales are not constructed on the basis of a comprehensive theory of executive capacities. As a result, they focus on only one or on a handful of executive functions rather than offering coverage of the broad array of executive capacities that could be identified and assessed.

The McCloskey Executive Functions Scale (MEFS; McCloskey, 2016) is a norm-referenced rating scale that attempt to rectify many of the shortcomings found in previously developed rating scales. The MEFS is based on the Holarchical Model of Executive Functions (HMEF) developed by McCloskey (McCloskey et al., 2009a, McCloskey & Perkins, 2016; McCloskey, 2016). The HMEF is a multi-tiered, multi-faceted theory of executive control. The model specifies four tiers of executive control: 1) Self-Regulation, 2) Self-realization and Self-Determination, 3) Self-Generation, and 4) Trans-self-Integration. At the self-regulation level, the model specifies 31 distinct executive capacities that can be used to cue and direct various combinations of perceptions, feelings, thoughts and actions. The effective use of these 31 executive capacities can vary greatly between and within individuals, resulting in inter individual profiles of executive capacity strengths and weaknesses and allowing for the possibility of inter individual profiles of executive capacity strengths and weaknesses. Unique to

this theory of executive control is the distinction between executive functions (EFs) and executive skills (ESs). In the HMEF, EFs are responsible only for creating awareness of what to do and when to do it. Executive skills are responsible for knowing how to activate perceptions, feelings, thoughts and actions in a manner consistent with the EF awareness. EFs and ESs ideally work together in a highly coordinated manner, but it is possible for them to dissociate to the degree that a person can be aware of when he or she should be perceiving, feeling, thinking or acting in a certain manner, but not know how to get him or herself to do so, thereby reflecting an ES deficit. Conversely, a person may know how to cue and direct perceiving, feeling, thinking or acting, but be unaware of the need to do so, thereby reflecting an EF deficit.

Equally important within this theoretical model is the idea that an individual's effective use of executive capacities can vary greatly, depending on the specific arena of involvement. The model specifies four arenas of involvement: the Intrapersonal, the Interpersonal, the Environment, and the Symbol System (Academic).

The MEFS represents an attempt to develop a rating scale that embodies the multiple tiers and facets of executive control within the HMEF. The MEFS assesses executive capacities (functions and skills) at the first two tiers: Self-regulation and Self-realization/Self-determination. At the Self-regulation tier, the MEFS assesses 31 specific self-regulation executive capacities (SRECs) and provides 7 cluster scores that represent theoretically-based groupings of the 31 SRECs. Normative scores or comparisons also are provided for the 7 Clusters and each individual SRECs based on two arenas of involvement. Due to measurement limitations, the MEFS collapsed items representing executive control within the Intrapersonal and Interpersonal arenas into a single arena

referred to as the Self/Social arena. Items addressing the Symbol System arena remained separate, but this arena is referred to as the Academic arena because all of the items make reference to using ECs in relation to school work.

Although the MEFS appears to have great potential for providing a more comprehensive, theoretically-based assessment of teachers' perceptions of students' uses of executive capacities, more research is needed to increase the understanding of how the MEFS ratings characterize students that are exhibiting symptoms of a mental disorder and how this characterization may differ from how the MEFS ratings characterize students that are not exhibiting symptoms of a mental disorder.

Purpose of the Study

Because executive function difficulties related to emotional disturbance can vary by the specific executive functions affected, the developmental tiers of self-control affected, the domains of functioning affected, and the arenas of involvement affected, there is need for a greater understanding of how the MEFS characterizes students exhibiting symptoms of emotional disturbance and how this characterization might differ from how the MEFS characterizes students that are not exhibiting symptoms of a mental disorder.. The purpose of this study was to utilize such a comprehensive, multidimensional, holarchical model of EFs approach to assessment in order to examine differences in teachers' perceptions of the EF capacities of groups of students between the ages of 5 and 18 years. During standardization of the MEFS, teacher ratings were obtained for a group of students that were identified as ED in the school setting, according to IDEA. After standardization, these students were matched by demographic variables to a sample of students that were not identified with any clinical condition. The

current study will examine the cluster, SREC, and item scores resulting from the teacher ratings of the ED students and their matched non-clinical counterparts, in order to determine in what ways, if any, teacher ratings of students classified as ED differ from the teacher ratings of students not classified with any clinical condition.

Furthermore, an analysis of teacher ratings of specific items may lead to the identification of specific EC deficits that characterize many, or all, students classified as ED. This is crucial because with this deeper understanding of the specific executive dysfunctions that are exhibited by those with emotional disorders may come enhanced knowledge of the types of interventions that would be appropriate for these individuals (Duijkers, Vissers, & Egger, 2016). This research also may provide insights regarding questions to pursue in future research with EF in relation to internalizing and externalizing disorders, including integrating modern models of EF with models of psychopathology.

Summary

The literature review that follows will attempt to provide greater understanding of the complex concept of executive functions by examining multiple definitions and models of EFs, as well as neurological correlates and the importance of EF use in effective social/emotional functioning. The relationship between EFs and separate psychological disorders in children and adolescents will be discussed. More specifically, the review will discuss the research indicating that executive function deficits underlie, or are associated with internalizing and with externalizing mental disorders, such as Attention Deficit Hyperactivity Disorder, Oppositional Defiant Disorder, Conduct

Disorder, Depression, Anxiety, Bipolar Disorder, and Obsessive Compulsive Disorder, Autism and Fetal Alcohol Syndrome.

The literature related to current state of the art in EF assessment and current approaches to intervention for mental disorders will be reviewed as well. Limitations in regard to assessment and intervention for those with mental disorders exhibiting executive functioning difficulties will be highlighted, as well as limitations to our current state of knowledge and the lack of research in specific areas. Last, the aims of this study and the specific research problems to be addressed will be presented.

CHAPTER 2

REVIEW OF THE LITERATURE

Background

The concept of executive functions has been a topic of research that has garnered considerable attention over the past few decades. In particular, research regarding executive functions in children has substantially increased in the last two decades. Hughes (2013) noted that a Scopus search using the key word terms, *executive functions* and *children* yielded only 5 studies prior to 1980. The number of studies that were found increased to 26 between 1980 and 1990 and to 216 studies between 1990 and 2000, then increased five-fold to 1092 studies between 2000 and 2010. Search engines, such as PubMed, now generate over 4,000 articles focused primarily on executive functions (Yuan & Raz, 2014).

Although there has there been a rise in interest in the broad construct of executive function in children, in general, more specific attention in this area has recently begun to concentrate on understanding how executive functions are conceptualized in childhood psychopathology (Kluwe-Schiavon, Viola, Sanvicente-Vieira, Malloy-Diniz, & Grassi-Oliveira, 2017). Halpern (2016) notes that the concept of executive functions has become ubiquitous throughout the field of developmental psychopathology. For the past few decades, the association between executive functions and developmental psychopathology has been the center of extensive research, and several conceptual models have been developed for many conditions including, but not limited to, ADHD, autism, schizophrenia, bipolar disorder, learning disorders and aggression/conduct

problems (Halperin, 2016). This significant growth in research is a result of increasing interest in childhood clinical groups, and impairments in EF are considered to be a primary concern with these different developmental disorders (Hughes, 2013). A majority of this literature has indicated, or at least explored the potential for, a causal role for executive functions in the emergence of psychopathology (Halperin, 2016).

Executive Functions Defined

Before a discussion of the specific executive functions thought to be associated with specific mental disorders, however, it is important to identify what executive functions are and to review conceptual models. This is especially critical because there are variable definitions and models offered by different theorists in different fields. Gaining a deeper understanding of the complex concept of executive functions makes it easier to explore further the relationship between executive functions and both internalizing and externalizing disorders. Without an understanding of how executive functions are conceptualized, it is difficult to understand the various ways in which they can influence various aspects of an individual's life, such as his or her social and emotional health. Additionally, it is important to review the literature to understand what past and current studies have revealed about the association between internalizing and externalizing disorders and executive functions.

Providing a concise definition of executive functions remains challenging due to the complex nature of the concept. Discussions of executive functions are numerous in the literature; however, no single definition has gained universal acceptance. Jurado and Rosselli (2007) note that research studies that have explored various aspects of this construct have at times yielded contradictory evidence. Furthermore, there are different

models and theories that attempt to provide an explanation of how and when executive functions develop, grow, and mature. Depending on the research discipline and theoretical orientation, models and theories can provide somewhat different conceptualizations of the nature of executive functions (Meltzer, 2007).

In an attempt to explain the complex nature of executive functions in a comprehensible manner, one of the earliest definitions offered by Neisser (1967) defined executive functions as the orchestration of basic cognitive processes required for goal-oriented behavior. This early definition holds significance because it began the delineation of "basic" cognitive functions from "executive" or "directive" control functions (Welsh & Pennington, 1988). Neisser's perspective also paved the way for subsequent researchers, such as Baddeley and Hitch (1974), who compared EFs to a "central executive" or coordinator of higher level information processing. Additional popular metaphors have compared EFs to the brain's "CEO" or the brain's "control center" (Salus, 2003; Wasserstein & Lynn, 2001). Goldberg (2001) defined executive functions as the directive capacities of the human brain also serving a role similar to that of the conductor of an orchestra. Overarching control metaphors such as the CEO of the brain and the conductor of the orchestra, however, have been viewed as extremely simplistic because they suggest that executive functions are a unitary mental construct or a single trait, rather than being multiple in nature (McCloskey et al., 2009a). This oversimplification leads to an inadequate understanding of what executive functions are, as well as to improper or ineffective assessment methods (McCloskey & Perkins, 2012).

Many definitions of executive functions offered by the research community move away from the singular trait definitions discussed previously (McCloskey & Perkins,

2012). Stuss and Alexander (2000) pointed out that executive functions are not easily operationalized. Their definition of executive functions states that they are a set of distinct processes that relate to different regions of the frontal lobe, which converge on a general concept of control functions. It was their view that, at the most reductionist level, no explicit central supervisory system exists; rather, they stated that the "central supervisory system is the sum of the processes recruited at any moment for any task" (Stuss & Alexander, 2000, p. 296).

Meltzer (2007) describes executive functions as an umbrella term for a set of complex cognitive processes involved in the regulation of goal-directed behaviors. Meltzer (2007) highlighted goal setting and planning, organization, flexibility, attention and memory, and self-regulatory processes, such as self-monitoring, as key components of EFs.

Banich (2009) provided a general definition in which executive functions are viewed as a set of abilities necessary to guide behavior toward successfully accomplishing a goal in novel situations. According to Banich, the components involved include self-regulation (organize, analyze, evaluate/compare, monitor) and self-analysis.

Lezak (1995) refers to executive functions as separate, but interrelated capacities that aid in the successful execution of independent, purposeful, and goal-directed actions, including self-direction and self-regulation. Lezak, Howieson, Loring, Hannay, and Fischer (2004) note four key components of executive functions: volition, planning, purposive action, and effective performance. Volition is a process that involves determining one's wants and needs, and then conceptualizing a goal. Planning is referred to as identifying and organizing the steps in order to meet this goal, which involves

conscious thought and self-monitoring. Purposive action happens when one's intentions are being executed in order to carry out a plan, which requires the use of initiating, maintaining, shifting, and stopping of behaviors. Effective performance results from the successful ability to self-monitor, self-correct, and regulate behaviors. Executive control is crucial for appropriate behavior, social responsibility, and self-serving conduct. Lezak et al. (2004) believed so strongly in the importance of EFs that they claimed as long as these four key components of executive functions are intact, one could continue to live an independent and productive life, despite considerable cognitive loss.

Jurado and Rosselli (2007) stressed the importance of executive functions for everyday human functioning because of their involvement with shifting mind set, inhibiting inappropriate behavior, creating and initiating a plan, persevering, organizing thoughts, and engaging in socially appropriate behavior.

Berninger & Richards (2002) were interested in how executive functions were involved in academic skill performance, particularly in the different stages of writing. Their definition of executive functions relates to how their effective use enables students to produce work in school that meets the curriculum standards. They define executive functions as mental capacities that play a role in self-regulation of the components within each of the levels of language (listening, speaking, reading, and writing).

Barkley has been most interested in executive functions in relation to how they play a role in the manifestation of ADHD. The foundation of his model rests on the idea that the inability to self-regulate is the main cause of many of the difficulties that individuals with ADHD exhibit (Barkley, 1997a). Barkley's observations of the difficulties with inhibiting impulsive responding exhibited by individuals diagnosed with

ADHD led to the development of a theory of self-control (Barkley, 1997b; Barkley, 2001). Barkley proposed that the executive function of inhibition was the key component to effective self-regulation. His definition of inhibition involves three related processes: a) inhibiting an initial dominant response, b), interrupting ongoing activity, and c) preventing disruption of the previous two processes (interference control) (Barkley, 1997b). He then defined self-regulation, which hinges on this concept of inhibition, as any action towards oneself that will change an individual's future behavior in order to avoid a future negative consequence or obtain a future reward (Barkley, 1997b). Barkley (1997b) proposed that ADHD impairs healthy development of inhibition and other self-directed executive functions, eventually leading to a self-regulation disorder that hinders the ability to choose, enact, and sustain actions toward goals. Barkley's model breaks executive functions down into four self-regulatory areas, including nonverbal working memory, internalization of speech (verbal working memory), self-regulation of affect/motivation/arousal, and reconstitution (planning and generativity) (1997b).

Brown (2006) also proposed a model that attempted to understand executive functions as the brain's mechanism for self-regulation. Similar to Barkley, Brown (2006) views ADHD as a condition that results from delays or deficits in executive functions. Unlike Barkley, however, Brown does not believe that inhibition is the overarching executive function. Rather, he believes it is only one of many interrelated executive functions. Brown (2006) developed a model which divides executive functions into six different "clusters": 1) organizing, prioritizing and activating for tasks, 2) focusing, sustaining and shifting attention to task, 3) regulating alertness, sustaining effort and processing speed, 4) managing frustration and modulating emotions, 5) utilizing working

memory and accessing recall, and 6) monitoring and self-regulating actions. Each of these clusters encompasses multiple cognitive functions and each cluster is necessary for effectively self-regulating daily tasks.

None of these clusters represents a unitary variable, such as height. Rather, even within each cluster, there is great variability because each cluster includes a variety of separate, yet related, cognitive functions. According to Brown (2006), these clusters work in an integrated fashion, yet because there exists a variety of cognitive functions within a cluster, individuals diagnosed with ADHD tend to struggle in at least some component of each cluster. The extent to which an individual with ADHD may present with difficulties within or between domains can vary, which Brown attributes to personal interest. Brown (2006) explains that, "this situational variability of the symptoms can be viewed as evidence that the impairments of the brain involved in ADHD are not with these fundamental cognitive functions themselves, but with the central management networks that turn them on and off" (p. 40).

The authors of the Behavior Rating Inventory of Executive Functions, (BRIEF; Gioia, Isquith, Guy, & Kenworthy, 2000) define executive functions as "an umbrella term encompassing distinct, but interrelated, abilities that contribute to management of goal directed behaviors including inhibiting, shifting, regulation emotions, initiating, planning, organizing, and monitoring while holding goals in working memory" (p. 1). Within the context of this general definition, Gioia et al. (2000) have identified several executive functions on the basis of observable, behavioral manifestations. This process led to a conceptualization and organization of executive functions that includes eight factorially-derived subdomains of executive function. These eight subdomains include Inhibit, Shift,

Emotional Control, Initiate, Working Memory, Plan/Organize, Organization of Materials, and Monitor. The revised version of the BRIEF (BRIEF-2, Goia et al., 2015) includes 9 subdomains: Inhibit, Shift, Emotional Control, Initiate, Working Memory, Plan/Organize, Organization of Materials, Task Monitor and Self- Monitor.

Dawson & Guare (2010) refer to executive skills as cognitive processes that are essential in regulating one's behavior, making decisions, and setting and accomplishing various goals. These executive skills include task initiation and follow through, planning/organization, working memory, performance monitoring, inhibition of impulses, and self-regulation.

McCloskey et al. (2009a) attempt to address the complex nature of executive functions by describing them as, "a set of directive capacities that are responsible for a person's ability to engage in purposeful, self-regulated, self-aware, goal-directed processing of perceptions, emotions, thoughts, and actions" (p. 15). Rather than referring to executive functions as a unitary trait, or the CEO of the brain, McCloskey (2016) chooses the more explicit metaphor of executive functions as representing the management structure of a multinational mind corporation. This metaphor acknowledges the multidimensional nature of executive functions and, similar to Stuss & Alexander (2000), also recognizes that there are multiple levels of executive control. This multidimensional, multi-level conception of executive capacities is referred to by McCloskey as a holarchical model of executive functions (HMEF; McCloskey et al., 2009a; McCloskey et al., 2009b; McCloskey & Perkins, 2012, McCloskey, 2016).

The Holarchical Model of Executive Functions

The HMEF proposed by McCloskey attempts to integrate various perspectives on executive functions that have been offered in the professional literature over the course of multiple decades (McCloskey, 2016; McCloskey & Perkins, 2012; McCloskey et al., 2009a). The HMEF conceptualizes and organizes the interactions between multiple executive functions that are associated with activation of different regions of the frontal lobe. This model organizes executive functions into 4 holarchical tiers representing different levels of specificity: 1) Self-Regulation, 2) Self-Realization and Self-Determination, 3) Self-Generation and 4) Trans-Self Integration. Individuals vary considerably in their development of executive capacities across these tiers. Because this is not a hierarchical model, the development of executive capacities within a higher tier is not necessarily dependent on the full development of the executive capacities within lower tiers. For example, while still engaged in the development of self-regulation executive capacities, most individuals enter into the development of self-realization and self-determination capacities. In this situation, self-regulation capacities continue to develop even after the emergence of self-realization and self-determination capacities. As time progresses, self-generation and trans-self-integration may begin and progress even as self-regulation, self-realization and self-determination continue to develop. Within such a conceptual model of development, it is even possible for an individual to exhibit better developed capacities at higher levels than at lower levels. For example, a person might have self-determined goals that are guiding self-regulation, but be unable to self-regulate effectively enough to enable the accomplishment of the self-determined goals.

Self-Regulation Executive Capacities

The first tier of executive control within the HMEF encompasses the various executive capacities that are involved in daily self-regulation (McCloskey et al., 2009a; McCloskey 2016). The current version of the model (McCloskey, 2016) proposes 33 distinct self-regulation capacities: that are organized into 7 basic clusters or divisions: 1) Attention, which encompasses the self-regulation capacities (SREC) of Perceive, Focus, and Sustain; 2) Engagement, which encompasses the SRECs of Energize, Initiate, Inhibit, Stop, Interrupt, Flexible, and Shift; 3) Optimization, which encompasses the SRECs of Modulate, Balance, Monitor, and Correct; 4) Efficiency, which encompasses the SRECs of Sense Time, Pace, Use Routines, and Sequence; 5) Memory, which encompasses the SRECs of Hold, Manipulate, Store and Retrieve; 6) Inquiry, which encompasses the SRECs of Gauge, Anticipate, Estimate Time, Analyze, and Compare/Evaluate, and 7) Solution, which encompasses the SRECs of Generate, Associate, Plan, Organize, Prioritize, and Decide.

Consistent with the metaphor of the management system of a multinational mind corporation, the Self-Regulation Tier consists of the first-line managers that are responsible for directly supervising the workers within the corporation; the term "workers" being a metaphor for the various neural networks in the brain. These workers (neural networks) are organized into four general classes: Perception, Emotion, Cognition, and Action, referred to as Domains of Functioning. The workers within these domains represent the various mental, physical and emotional capabilities that are associated with various parts of the human brain and nervous system that can be cued and directed (managed) by the 33 Self-Regulation capacities (managers).

Although these 33 self-regulation executive capacities are organized into 7 clusters, they are highly dissociable; each one follows its own developmental trajectory and these individual trajectories can vary significantly (McCloskey, 2016). For example, a child might be very effective at using the *initiate* cue in order to begin a task, but very ineffective in the use of the *shift* cue when it comes time to transition from that task to another task.

Within this self-regulation tier it is important to distinguish between cueing awareness of the need to make a plan (i.e., knowing when to plan), and cueing the parts of the brain needed to make a plan (i.e., knowing how to make a plan). According to the HMEF, the part of the neural network that becomes aware of the need to plan is called the Executive Function (the Executive Function manager), and the part of the neural network that cues and directs the parts of the brain needed to actually make the plan is called the Executive Skill (the Executive Skill manager) (McCloskey, 2016; McCloskey, Gilmartin, & Stanco, 2014).

This distinction between executive function and executive skill is essential because it helps clarify the difference between knowing when to plan and knowing how to plan. Each of the 33 self-regulation capacities includes both an executive function manager and an executive skill manager. The executive function and executive skill portions of a neural network must coordinate their efforts to ensure that a person knows when he or she should be planning and activates the areas of the brain needed to actually make a plan. Dissociations can occur, however. Therefore, it is possible that the Executive Function manager may be operating effectively but the Executive Skill manager may not be operating effectively. Conversely, the executive function manager

may not be operating effectively, but the Executive Skills manager may be operating effectively. Last, it is possible that both the Executive Function manager and the Executive Skill manager are operating ineffectively. (McCloskey, 2016; McCloskey et al., 2014). It is important to keep in mind that the concepts of executive function and executive skill managers are metaphors that refer to the activation within the frontal lobes of portions of neural networks that connect to the rest of the brain (the workers).

Illustrating the double dissociation that is possible between an executive function and an executive skill, it is possible that a person may be aware of when to plan but not know how to plan. Conversely, a person may not know when to plan even though he or she knows how to plan. Additionally, a person may be unaware of when to plan, and also not know how to plan even when someone else cues them to plan. In all three of these instances, the end result is a lack of effective planning. Knowing if the lack of planning is due to a lack of executive function, a lack of executive skill, or a lack of both makes it possible to tailor an intervention to address the specific need. For example, in the case of planning, an intervention focused on an executive skill deficit might teach a cognitive strategy indicating how to make plans that address specific conditions. An intervention focused on an executive function deficit might focus on helping to recognize the conditions in which a plan is likely to be required in order to increase awareness of the time when to cue oneself to plan. An intervention designed to address both an executive skill and an executive function deficit would start by teaching a strategy for planning and then move to increasing awareness of situations that would require the use of the newly learned planning strategy.

Self-Regulating within Arenas of Involvement

The HMEF describes four arenas of involvement to help explain the significant variability in engagement of self-regulation capacities, depending on the context in which they are being used. The model identifies 4 specific arenas of involvement, noting that any self-regulation capacity may be effectively engaged within one or more arenas, but not be effectively engaged in the other arenas. The four arenas are identified as the Intrapersonal Arena, the Interpersonal Arena, the Environment Arena, and the Symbol System Arena (McCloskey, 2016; McCloskey et al., 2014).

Within the intrapersonal arena, self-regulation capacities are used to cue and direct perceptions, feelings, thoughts, and actions in relation to the self. They affect how one perceives, feels and thinks about, and acts towards oneself. Successful cueing and directing of executive capacities in this arena result in effective self-management, self-control, and self-discipline Effective self-regulation in the intrapersonal arena helps an individual to avoid addictions, self-mutilation, and other maladaptive behaviors, as well as manage symptoms related to internalizing disorders such as depression and anxiety (McCloskey, et al., 2009a; McCloskey et al., 2009b).

Within the interpersonal arena, self-regulation executive capacities are used to cue perception, feeling and thinking about, and acting toward others. Effective use of executive capacities in this arena foster appropriate social interactions and cooperation and collaboration with others, thereby avoiding externalizing disorders (McCloskey, et al., 2009a; McCloskey et al., 2009b).

With the environment arena, self-regulation executive capacities are used to cue and direct perception of feeling and thinking about, and action in relation to, aspects of the man-made and the natural environments. Effective use of executive capacities within

this arena allow one to function in a manner that makes appropriate use of resources and enables sustainability of environments. This includes interactions with animals, organisms, inanimate materials, machines, and other man-made devices and objects. Effective self-regulation within this arena also prevents one from engaging in "accidents" by cueing and directing the prediction of the potential consequences of one's own behavior in relation to the physical environment (McCloskey, et al., 2009a; McCloskey et al., 2009b).

Within the symbol system arena, self-regulation executive capacities are used to cue and direct perceptions of feelings and thoughts about, and actions relating to the processing, storage, and use of culturally-based information. Use of executive capacities within this arena enables effective self-regulation when reading, writing, performing mathematics, speaking, and using means of communication and symbol processing such as computers and smart phones. It is important to note that within this particular arena, the use of executive capacities can dissociate. For example, a person might exhibit difficulties when self-regulating in writing about their thoughts but have no difficulties when self-regulating reading for comprehension or when speaking with others (McCloskey, et al., 2009a; McCloskey et al., 2009b).

Self-Realization and Self-Determination

The second tier of the HMEF includes two distinct executive capacities: self-realization and self-determination. Self-Realization executive capacities enable awareness of self as well as awareness of self in relation to others. Self-realization executive capacities cue for self-reflection to realize personal strengths and weaknesses as well as the strengths and weaknesses of others, to understand how one's behavior has

an influence on others, and to realize when personal change is needed (McCloskey, et al., 2009a; McCloskey et al., 2009b). This tier is not directly involved with the cueing and directing of perceptions, feelings, thoughts, or actions; instead, it oversees the Self-Regulation managers that cue and direct perceptions, feelings, thoughts, and actions (McCloskey, 2016).

When engaged in self-regulation, one does not necessarily have to be aware of that fact that self-regulation executive capacities are in use. As the brain matures, a person becomes more aware of the self-regulation process, which allows one to consciously control his or her self-regulation and thus improve his or her performance in that very moment. Although this conscious control indicates that some awareness is present, it is very limited and does not involve self-realization (McCloskey et al., 2009; McCloskey & Perkins, 2012; McCloskey, 2016).

Self-realization involves a deeper awareness that goes beyond just the basic "in the moment" awareness that is associated with self-regulation. Managers at the self-realization level have the ability to become aware of all facets of self-regulation, to judge performance overall and judge specific aspects of self-regulation, and to realize the need for improvement of specific aspects of self-regulation. McCloskey (2016) states that, "The executive functions involved at this level therefore include (a) an awareness of the capacity for self-regulation and how to influence it, (b) an awareness of the fact that other persons can self-regulate, (c) an awareness of how one's own self-regulation (or lack of it) affects others, and (d) a capacity for self-analysis to identify specific self-regulation strengths and weaknesses" (p. 10). Eventually, the Self-Realization managers enable an individual to reflect and judge, which leads to a better understanding of oneself in

relation to what one perceives, feels, thinks, and does (McCloskey et al., 2009a; McCloskey & Perkins, 2012; McCloskey, 2016).

Self-determination involves an awareness of personal agency and self-direction and a capacity and desire for developing personal goals for the future along with a capacity for long-term planning that will lead to the realization of personal goals. As self-determination grows, it exerts more and more control over self-regulation to ensure that a person will self-regulate in the moment in a manner consistent with long-term goals. Without self-determination, a person can effectively self-regulate through individual days, but such daily self-regulation does not result in the accomplishment of any long-term goals. Self-determination also builds the capacity for delayed gratification, enabling a person to realize that many long-term goals cannot be accomplished unless one is willing to forego self-regulating in a manner that satisfies only immediate desires. (McCloskey et al., 2009a; McCloskey & Perkins, 2012; McCloskey, 2016).

It is helpful to think of Self-Realization and Self-Determination as the next level of management in the corporation of the mind because these executive capacities are needed in order to manage the self-regulation managers in ways that are consistent with what a person realizes about him or herself and what a person wants to accomplish over time. Self-Realization and Self-Determination must work in an integrated manner with each other and also work in an integrated manner with all of the self-regulation executive function managers (McCloskey et al., 2009a; McCloskey & Perkins, 2012; McCloskey, 2016).

Self-Generation

Beyond self-realization and self-determination, the next level of executive control is Self-Generation. As Self-Generation emerges, it triggers the tendency to question the reasons why specific goals were selected by Self-Determination. It also can trigger in a person the tendency to ask broader questions about the meaning of life; i.e., who he or she truly is, why he or she exists, and what his or her purpose is here on earth. These questions often lead to the development of a personal sense of morals and ethics by posing and attempting to answer questions such as, "What if I set a goal and accomplish it but the accomplishment of my goals hurts others or destroys part of the environment?" As Self-Generation capacities grow, they have the potential to exert control over Self-Realization and Self-Determination. Consistent with the metaphor of the corporation of the mind, Self-Generation managers become responsible for directing the Self-Realization and Self-Determination managers (McCloskey et al., 2009a; McCloskey & Perkins, 2012; McCloskey, 2016).

Trans-self-Integration

At this level, an individual seeks to achieve a unified state of consciousness, to see beyond the autonomous self, and to contemplate the meaning of all existence. Activation of executive control at this level would be considered synonymous with the role of the CEO within a corporation, providing the individual with an ultimate sense of purpose and vision that has its greatest influence on the managers at the self-generation level (McCloskey, et al., 2009a).

Summary of the HMEF

Overall, the HMEF is a model that attempts to integrate theoretical perspectives from philosophy, psychology and education with the research literature from neuroscience and neuropsychology. Models that conceptualize executive functions as a general construct provide a very limited view, and one that fails to take into account the complex interplay of neural connections within the frontal lobes of the brain. In contrast, multifaceted conceptions of executive capacities such as the HMEF have led to a more advanced understanding of the complex nature of the frontal lobes, as well as a more advanced models of the neuroanatomy of executive functions (Stuss and Alexander, 2000). Different executive capacities seem to be associated with different areas of the frontal lobe. This is the reason why it is so imperative to move one's understanding past simplistic definitions and models of executive functions as being unitary in nature.

Neuropsychology of Executive Functions

Earlier Research. Beginning models of executive functions were, for the most part, developed as a result of work with clinical populations, and these models had neuropsychological foundations. Perhaps the earliest exploration of the role of executive control was initiated by the unfortunate work accident experienced by Phineas Gage, who suffered a traumatic brain injury that destroyed specific portions of his frontal lobe. Previous to his injury, Phinaes was a well-liked, friendly, intelligent, shrewd and energetic manager who exhibited well-developed goal-setting and planning. After his injury, however, he underwent significant personality changes. More specifically, he made plans and then changed them rapidly, failed to follow through on goals, was impatient, used profanity, was irritable, and seemed depressed. The fact that he was "no

longer Gage" and was so radically different suggested that the frontal lobe has a principal role in personality and emotion. Through his case and other early work, researchers became aware that the frontal lobe serves as a type of executive, aids in decision making and the forming of goals and following through with tasks, as well as with organization, and planning (Coolidge & Wynn, 2001).

Alexander Luria (1966), a Russian neuropsychologist who studied individuals with frontal lobe damage, researched and wrote extensively about the mental capacities he believed to be associated with the frontal lobe or prefrontal cortices, including problem solving, intentionality, formulating goals, planning, sequencing, shifting, and evaluating. It is now known that these are specific aspects of executive control. He also viewed the frontal lobe as an overarching structure that supervised the functions of the occipital, temporal, and parietal lobes. With this view in mind, he claimed that the prefrontal cortex (PFC) was a supervisory attentional system (SAS) that oversaw the programming, regulating, and verification of behavior.

Norman and Shallice (1986) incorporated the SAS concept in their own conceptualization of executive control. Pribram (1973) offered one of the earliest definitions of executive control; however, he discussed the concept only in the context of an overarching frontal lobe system, rather than providing details of specific frontal regions involved with specific aspects of executive control. Stuss & Benson (1986) also noted the role of the frontal lobes in many different aspects of behavior. Pennington, Bennetto, McAleer, and Roberts (1996) noted that frontal lobe dysfunction was found in individuals with many different kinds of behavior disorders. These findings led them to question the idea of a generalized role for the functioning of the frontal lobe. How can it

be that one supposedly unitary functional unit could produce so many different kinds of difficulties in behavior? This led them to conclude that there must be functionally different units within the frontal lobe, which would suggest that executive functions are not a unitary trait.

More Recent Research. Earlier findings of the neurological correlates related to EFs lacked specificity; however, recent research has led to a more advanced theoretical understanding because the frontal regions have structurally distinct organized functions (Siddiqui, Chatterjee, Kumar, Siddiqui, & Goyal, 2008; Jurado & Rosselli, 2007). In fact, neuroanatomical models of EFs now actively refute the idea that the frontal lobes function as a singular central executive. Rather, they suggest that frontal functions are domain specific capacities that are discretely dispersed throughout various frontal regions but work together to achieve specific goals (Stuss, 2011; Stuss & Knight, 2013). The prefrontal cortex, specifically, can be viewed as a heterogeneous entity that houses multiple functions (Siddiqui et al., 2008). This area can be broken down into the dorsolateral PFC, ventral PFC, frontal pole cortex, dorsal and medial prefrontal areas, anterior cingulate cortex, and orbitofrontal cortex (Siddiqui et al., 2008). These separate areas of the PFC are responsible for different functions and specialize in discreet, purposeful behavior (Stuss & Alexander, 2000; Stuss & Knight, 2013). Although many studies have supported this notion of specialized functions of the prefrontal cortex, further research is warranted in order to explore the exact functions of each area (Aron, 2008).

Yogey, Hausdorff, and Giladi (2008) proposed that the anterior parts of the frontal lobes are involved with aspects of self-regulation, such as inhibition and self-awareness,

whereas the dorsal parts are activated during processes related to reasoning. These same authors also indicated that the dorsolateral prefrontal cortex (e.g., Brodmann's area 9), which is located on both sides of the outer frontal lobe, is associated with a wide range of "cold" aspects of EFs, otherwise known as cognitive functions of EFs. These include actively maintaining information in working memory, changing behavior according to task demands or representing past events, current goals, and future predictions, selective and sustained attention, and organizational and strategy skills (Yogey et al., 2008). The ventromedial prefrontal cortex region, on the other hand, is associated with the "hot" aspects of EFs, or more emotional aspects. The ventromedial region regulates emotion in decision making and is also involved with the retrieval of information from long-term memory and metacognitive processes (Siddiqui et al., 2008). The orbitofrontal cortex (Broadmann areas 10, 11, 47), which is located in the cranial cavity just behind the eyes, is involved in a paralimbic loop involving response inhibition, mnemonic functions, and delayed response (Siddiqui et al., 2008). This region has also been associated with reward expectation and anticipation of future events, and plays a significant role in the regulation of social and emotional aspects of behavior (Siddiqui et al., 2008) Last, the anterior cingulate located at the front of the corpus callosum in the medial frontal lobe enables the anterior cingulate cortex (ACC) to make connections to the "emotional" limbic system and to the "cognitive" prefrontal cortex (Stevens, Hurley, & Taber, 2011). Thus, the ACC is likely imperative for integrating these two structures in order to produce intact affect regulation, which is the ability to cope with and effectively deal with uncomfortable or negative emotions. Stevens et al. (2011) emphasize the idea that this area can be identified as a distinctive region in understanding psychopathology; impairments in the

ACC are likely implicated in mental disorders due to its strong association with managing different feelings and emotions. Supporting this contention, weaknesses in the anterior cingulate circuit can result in a lack of interest, reduced engagement, low perseverance, and a low level of motivation, which can then lead to cognitive or emotional deficits (Maricle, Johnson, & Avirett, 2010).

Integrity of the Whole Brain

Some researchers have proposed that many different regions of the brain other than the frontal lobe are involved with executive control, leading to the conclusion that the entire brain must be intact in order for one to be the most successful with tasks involving executive control (Jurado & Rosselli, 2007). The prefrontal cortex, which is the most strongly associated with EFs, is dependent on input through neuronal connections with the occipital, temporal, and parietal lobes, as well as with the limbic system and other subcortical regions of the brain (Stuss & Benson, 1984). Therefore, if other parts of the brain are not functioning effectively, and lower areas of the brain are dysfunctional, then the resulting behavior can appear as an EF problem. This explains the reason why even damage to other parts/structures of the brain other than the frontal lobes, such as the caudate nuclei, can also result in deficits with executive functions (Hughes, 2013).

There are numerous studies that support this notion of other brain regions being involved in what appears to be executive control, as well as the premise that executive functions are dependent on the integrity of the entire brain. For example, behavioral, motor, and cognitive impairments previously associated solely with impairments to the frontal-lobe (Alexander & Stuss, 2000) have also been found in individuals with damaged parts of the brain beyond the front lobe (Alvarez & Emory, 2006). In addition,

Hughes (2013) discussed clinical studies that provide evidence for this interrelated system and the importance of multiple neural structures for adequate executive control, with results demonstrating that early pathology in any brain region led to executive deficits. Last, through their work with patients who experienced impairments in various regions of the brain, Stuss et al. (1988) found that those who had basal ganglia damage performed in a manner similar to those with frontal deficits.

For children, especially, intact EF relies on the cohesion of the whole brain, and not only the frontal regions (Hughes, 2013). Impact to any area of the brain can cause executive function difficulties. These executive function difficulties can manifest themselves in various ways in a child's functioning, especially because they are involved in different goal-directed behaviors, impact different facets of our lives, and serve many different roles in our daily tasks.

The relevance of this literature is not in refuting the conceptualization of executive control being housed in the frontal lobes, but rather in encouraging the realization that an intact frontal lobe with an intact and effective supervisory system can be taught through effective intervention; ideally, the result is a way to mediate the problems resulting from damage in other areas of the brain. McCloskey (2016) uses the analogy of teaching the managers how to recruit new workers to accomplish the tasks typically assigned to the workers that are absent for whatever reason.

EFs and Everyday Functioning

Despite the lack of consistency on *what* executive functions are and *"where"* the neurological correlates are located in the brain, there is little confusion about the reasons *why* they are so integral. Overall, there seems to be a general consensus in regard to the

complex nature and significance of executive functions in relation to an individual's adaptive behavior (Jurado & Rosselli, 2007). EFs are important because they are involved with the abilities to self-control and self-regulate (or "willpower"), both having a significant impact on individuals' everyday lives (Miyake & Friedman, 2012). In fact, executive functions are needed in order to manage nearly all of individuals' independent activities of daily living (Snyder et al., 2015). For example, common tasks that children and adolescents perform that require executive skills include running errands, following directions, tidying the bedroom, completing homework, bringing books to and from school, performing simple chores, inhibiting behavior (raising hand before speaking, following safety rules, refraining from bad language), managing time, organizing school work, making good use of leisure time, babysitting younger siblings, and many more day-to-day tasks. To be successful with these tasks requires creativity, flexibility, self-control, and discipline, all of which are central to executive functions (Diamond & Lee, 2011). Executive functions aid in the successful execution of these tasks because they assist in developing a plan, beginning its execution, and persisting in carrying out the task at hand until it is fully accomplished. In other words, intact executive functions allow people to carry out these goal-directed plans, engage in behaviors that are necessary for appropriate and socially responsible conduct, such as these mentioned previously, and live an independent and productive life (Jurado & Rosselli, 2007).

EFs and Social/Emotional Health

Executive functions also are critical to a person's overall social, emotional, and intellectual life. More specifically, executive functions are involved in many different areas that are important to human health and functioning, such as academics and learning,

occupational functioning, interpersonal relationships, avoidance of substance use, physical health, social/emotional health, and mental health (Snyder et al., 2015). Executive functions are critical to social/emotional well-being because they are responsible for regulating behaviours, monitoring thoughts, and manging emotions (Dawson & Guare, 2010). McCloskey et al. (2009a) note that executive functions accomplish this by cueing and directing the appropriate regulation of emotional control and expression of emotions. In addition, these authors indicated that executive functions are also involved in other aspects of behaviour related to social/emotional well-being, such as self-awareness, empathy, and social sensitivity. This is accomplished by cueing appropriate social behaviour and thinking about social situations that assist individuals in perspective taking and thinking about others so that they can interpret how others are feeling or what they are likely to be thinking during interpersonal interactions or when thinking (McCloskey et al., 2009a). Therefore, without the effective use of executive capacities to regulate emotions and behaviour, one is at increased risk for social emotional difficulties and mental disorders (Rinksy & Hinshaw, 2011). In fact, Snyder et al. (2015) pointed out that poorly developed executive capacities are "a potent risk factor for multiple forms of psychopathology, and EF deficits may be transdiagnostic intermediate phenotypes or risk factors for emotional, behavioral, and psychotic disorders." (p. 2). Similarly, Halperin (2016) observed that higher cortical executive functions seem to be implicated in many different psychotic disorders.

Arnsten (2009) described the connection between executive functions and emotions, stating "the PFC is critical for regulating behavior/emotion, especially for inhibiting inappropriate emotions, impulses and habits. The PFC is needed for

allocating/planning to achieve goals and organizing behavior/thought. These regulatory abilities are often referred to as executive functions" (p. 33). In fact, studies have indicated impaired executive functions in particular regions of the prefrontal lobe in individuals with a wide range of psychiatric disorders (Siddiqui et al., 2008). Research and clinical observation has established the relationship connection between executive dysfunction and mental disorders to such a degree that Arnsten & Robbins (2002) observed,"Deficits in PFC [prefrontal cortex] function are evident in every neuropsychiatric disorder (indeed, the term "psychiatric problem" seems synonymous with PFC dysfunction)" (p. 51).

EFs' Relationship with Mental Disorders

Executive function deficits have been implicated in psychiatric conditions involving both internalizing and externalizing behavioral issues. Externalizing behaviors involve socially troublesome difficulties such as verbal aggression, oppositional defiance, and conduct problems (McClintock, 2005). Internalizing behaviors are ones in which the child has more inward difficulties that are associated with mood or emotion, involving social withdrawal, somatic complaints, loneliness, anxiety and depression (McClintock, 2015). Examples of internalizing or externalizing disorders involving EF deficits are Autism/Asperger's Syndrome, ADHD and ADD, Conduct Disorder, Oppositional Defiant Disorder, Depression and/or Anxiety, Obsessive-Compulsive Disorder, and Fetal Alcohol Syndrome (McCloskey et al., 2009a). Research on these clinical groups illustrates a clear interplay between particular executive functions and disorders (Hughes, 2013). This relationship, however, does not indicate that difficulties with executive functions are the sole contributing factor to all of these internalizing and externalizing

disorders; nor does it mean that only individuals with these disorders will have frontal lobe dysfunction. It is evident, however, that executive function difficulties are present in some way with all of these disorders (McCloskey et al., 2009a). Nigg et al. (2017) also note that executive function direction of problem-solving, impulse control and emotion regulation makes executive dysfunction central to the nature of numerous mental disorders. The relationships between specific executive functions and particular mental disorders are described in the sections that follow.

EFs' Relationship with Attention Deficit Hyperactivity Disorder (ADHD)

The relationship between AD/HD and executive function difficulties is probably the most apparent, so much so that psychologists and experts on ADHD have suggested renaming this disorder as EF deficit disorder (Barkley, 2016). These EF deficits are central to the underlying behavioral problems so commonly observed in those with ADHD (Chiang & Gau, 2014). More specifically, individuals with ADHD show significant degrees of impulsivity, inattention, and disorganization in their day to day lives (Hughes, 2013). In fact, the *Diagnostic and Statistical Manual of Mental Disorders, 5th ed.* (DSM-V) criteria clearly specify behaviors, such as a lack of inhibition and inattention, as the hallmark indicators of ADHD (American Psychiatric Association, 2013). McCloskey et al. (2009a) note that the definition of ADHD included in the DSM represents impairment of the specific self-regulation executive function capacities of Modulate, Inhibit, Focus/Select, and Sustain (McCloskey, et al., 2009a). Consistent with the perspectives noted here, many studies support the contention that the core EF deficit in ADHD is behavioral inhibition (Pennington & Ozonoff, 1996; Barkley, 1997b; Crosbie et al., 2008; Kerns et al., 2001; Nigg, 2001; Oosterlaan et al., 1998). McCloskey

(2017), however, points out that one of the most important self-regulation deficits exhibited by individuals diagnosed with AD/HD, that of Modulate, has largely been ignored in the studies that specify the EF deficits related to AD/HD, despite reference to it in the name of the condition – hyperactivity. Within the HMEF, Modulate is considered to be one of the 33 self-regulation EFs and is grouped together with Monitor, Balance, and Correct in the Optimization Cluster. Operationally defined, the executive skill of modulate directs the adjustment of the intensity of perceptions, feelings, thoughts and actions; the executive function of modulate cues for the awareness of the need to adjust the intensity of perceptions, feelings, thoughts and actions. McCloskey notes that individuals diagnosed with AD/HD often have difficulties with keeping perceptions, feelings, thoughts and actions within acceptable ranges. These individuals often demonstrate over excitability or excess, such as running when they should be walking, or talking loudly when they should be whispering. In contrast, deficits in inhibition relate to the inability to prevent oneself from initiating perceptions, feelings, thoughts, or actions when doing so would be the most effective course of action.

EFs' Relationship with Autism Spectrum Disorder (ASD)

Children with ASD, a term encompassing children with autism, Asperger's syndrome (AS), or Pervasive Developmental Disorder –Not Otherwise Specified (PDD-NOS), often exhibit even greater severity in executive function deficits and behavioral regulation difficulties than those with ADHD (Geurts et al., 2004; Goldberg et al., 2005). Although the executive function difficulties associated with ASD typically involve all self-regulation deficits in cueing and directing all four domains of perception, emotion, cognition, and action, these EF deficits tend to be exhibited mainly within the

interpersonal arena. In addition to self-regulation deficits, individuals diagnosed with ASD have difficulties with self-analysis and self-awareness, and self-determination (McCloskey et al., 2009a). This association between EF difficulties and symptoms of ASD is apparent in the behavioral manifestations of the diagnosis. Rigid, repetitive behavior and difficulties adjusting to change or transitioning are diagnostic features of ASD, and these behaviors have been linked to PFC damage (Happe, Booth, Charlton, & Hughes, 2006). Studies have consistently demonstrated a connection between the ASD population and the extreme dysfunction they experience both in social and in cognitive areas (Geurts et al., 2004; Happe et al., 2006; Pennington & Ozonoff, 1996). Evidence for the relationship between ASD and executive deficits is substantial. Russell (1997) refers to ASD as an executive disorder due to the fact that EF deficits are so primary in the manifestation of the condition.

Studies indicate that the executive function most significantly impacted in individuals diagnosed with ASD is cognitive flexibility (Kenworthy et al., 2008; Pennington & Ozonoff, 1996; Ozonoff & Jensen, 1999; Ozonoff et al., 1994). Cognitive flexibility is so impaired in those with ASD that Hovik et al.'s (2017) extensive review concluded that, "The severity and pattern of EF deficits are distinct for ASD and ADHD, with larger effect sizes being associated with impaired cognitive flexibility in ASD than for any other executive dysfunction measured in ADHD or TS" (p. 812). In addition to cognitive flexibility, other areas of executive function deficits for those with ASD include planning, and working memory (Bishop, 1993; Hughes et al., 1994; Joseph, 1999; Ozonoff & Strayer, 1997; Robins, 1997). Research suggests that certain EF areas are not as significantly affected in those with ASD in comparison with other clinical groups,

however. For instance, unlike those with ADHD, inhibitory control seems to be relatively less affected in those with autism (Ozonoff, 1997; Kana et al., 2007; Buhler et al., 2011).

EFs' Relationship with Fetal Alcohol Spectrum Disorder (FASD)

Executive function deficits are also at the core of FASD, which is an umbrella term used to describe the wide range of impairments (physical, mental, behavioral, and/or learning) that can potentially occur in an individual who was exposed to alcohol prenatally (Rasmussen, 2005). Research has indicated that this prenatal alcohol exposure is linked with the disruption of the healthy development of the frontal cortex (Rasmussen & Bisanz, 2009). As a result, abnormalities within the frontal lobe of those diagnosed with FASD lead to impairments in executive functions (Rasmussen & Bisanz, 2009). A study involving 18 children ranging from ages 8-15 indicated that the children who were diagnosed with FASD performed worse than the control group on executive function tasks related to planning ability, selective inhibition, concept formation, and reasoning (Mattson et al., 1999). An even larger study done by Noland et al. (2003) involved 300 four-year-olds who were exposed prenatally to alcohol, cocaine, or marijuana. Results indicated that in comparison with the healthy control group, the four-year-olds who were exposed to alcohol prenatally performed significantly worse on an inhibition tapping task (Noland et al., 2003). Children diagnosed with FASD also demonstrate impairments with complex adaptive behaviors that require the successful integration of several different executive functions, such as set-shifting, planning, attention, spatial working memory, and longer reaction and decision time (Green et al., 2009).

EFs' Relationship with Obsessive Compulsive Disorder

OCD also has been associated with executive function deficits, particularly in relation to disruption to the fronto-striatal circuitry (Chang et al., 2007). Definitions of OCD commonly refer to repetitive, inflexible cognition and behavior (Gruner & Pittenger, 2017). Consistent with this clinical observation, impaired cognitive flexibility, as well as deficits in inhibition, appear to be the most common EF deficits exhibited by individuals diagnosed with OCD (Hosenbocus & Chahal, 2012; Morein-Zamir et al., 2014; Snyder et al., 2015; Gruner & Pittenger, 2017; Shin et al., 2013; Watkins et al., 2005). In addition to impaired cognitive flexibility and inhibition, individuals diagnosed with OCD have also demonstrated inferior performance on spatial working memory and spatial planning tasks (Chamberlain et al., 2007; Shin et al., 2013). However, although the EF deficits related to OCD seem to be supported in the adult literature, there is little research involving children diagnosed with OCD. Of the studies that are available involving children with OCD, the findings are inconsistent (Hosenbocus & Chahal, 2012). In addition, some studies have indicated no difference in executive capacities between individuals diagnosed with OCD and nonclinical controls (Chang et al., 2007; Watkins et al., 2005).Other studies have found impairments in EF in children diagnosed with OCD, such as deficits in visual attention (Chang et al., 2007).

EFs' Relationship with Oppositional Defiant Disorder/Conduct Disorder (ODD/CD)

In contrast to the large body of literature on EF deficits in AD/HD, a much smaller number of studies have been conducted focusing on the EF deficits of individuals diagnosed with Oppositional Defiant Disorder (ODD) and Conduct Disorder (CD). Of the studies that are available regarding this population, the results have varied. However, one EF impairment in individuals diagnosed with ODD/CD that is consistently reported in

studies is slower motor inhibition speed (Hobson et al., 2011). A meta-analysis of 8 studies involving 456 children investigating response inhibition indicated that ODD/CD children demonstrated slower inhibitory speed compared with controls (Oosterlaan et al., 1998). Hobson et al., (2011) also found that the ODD/CD group was impaired in motor inhibition, as well as in other areas of executive function, including sustained attention and response execution, but not in cognitive switching. Other studies have proposed that deficits in executive function are a significant link, and possibly even contributing cause, of ODD and CD (Barkley, 1997a; Moffitt, 1993). On the contrary, however, some of the more recent studies have yielded results indicating no EF deficits associated with ODD/CD (Thorell & Wahlstedt, 2006; McBurnett et al., 1993). In fact, some studies have even suggest that ODD/CD is associated with enhanced performance on measures of EF (Oosterlaan et al., 2005). In addition to the limited research and mixed results in this area, previous studies involving individuals diagnosed with ODD/CD fail to control for the presence of comorbid ADHD, therefore making it difficult to determine the relationship between executive function deficits and ODD/CD, independent of the effects of ADHD (Hobson et al., 2011). For example, some studies showed worse performance for the ODD/CD group in the areas of working memory, planning and organizing, and inhibition; yet when comorbid ADHD was considered, these deficits no longer exist for the ODD/CD group only (Thorell & Wahlstedt, 2006; Schoemaker et al., 2012; Waschbusch, 2002). Thorell and Wahlstedt (2006) attributed these findings to the fact that executive function deficits are primarily related to ADHD and the association between executive functions and ODD/CD is caused by the large overlap and shared common characteristics between these disorders. Further research is needed in order to

explore the connection between OCD and CD and executive functions, especially because any previous studies have failed to control adequately for the high comorbidity of ODD/CD with ADHD (Thorell & Wahlstedt, 2006). However, despite the lack of clarity about what specific executive function deficits are associated with ODD/CD, the behavioral problems frequently exhibited by children diagnosed with ODD/CD appear to be related to multiple self-regulation and self-realization deficits (McCloskey et al., 2009a).

McCloskey et al. (2009a) posit that one of the problems with the research that has examined the relationship between executive deficits and ODD/CD is that these studies examined only EF deficits of cognitive functioning within the symbol system arena of involvement. These studies operationally defined EFs only in terms of norm-referenced tests of cognitive control within the symbol system arena and did not examine the nature of the EF deficits that could be inferred from the disruptive behaviors and disordered thinking exhibited in the interpersonal arena of involvement.

EFs' Relationship with Anxiety

Deficits in EF also appear to be associated with anxiety disorders, which are characterized by fear, hopelessness, and other forms of emotional dysregulation. McCloskey et al. (2009a) note that the symptoms associated with anxiety disorders have a neurological basis because Generalized Anxiety Disorder involves neural circuits whose paths pass through the frontal lobes. Any disruption to these neural circuits can have significant implications for the frontal lobe, and thus result in executive function deficits while one is experiencing increased levels of anxiety. In other words, the EF deficits associated with anxiety disorders do not cause the problems with anxiety; rather,

the problems with anxiety make it difficult to engage EFs effectively. Because the neural circuits that connect the limbic system and the frontal lobes are both afferent and efferent, it is possible to learn how to engage specific self-regulatory EFs to reduce the disruptive effects of anxiety that originate in the limbic system. Studies related to the association between anxiety and executive functions have produced inconsistent findings. Castaneda et al. (2011) found no major cognitive or executive impairments for those with anxiety disorders, when compared with healthy participants. In fact, a beginning study even found that increased levels of anxiety were associated with faster learning by participants, of a complex motor task, in comparison with participants low in trait anxiety (Martens, 1969). On the contrary, other studies indicate that high levels of anxiety impair performance on executive function tasks involving goal-directed behavior (Horwitiz & McCaffrey, 2008; Berggren et al., 2013; Kalanthroff et al., 2016). A study done by Hosebocus & Chahal (2012) involving individuals diagnosed with anxiety showed that these participants performed the worst on executive function tasks that measured visual reaction time, visual search, and response inhibition. This weakened performance on EF measures may be due to the fact that anxiety reduces executive control of attention and impairs one's ability to filter out emotional distracters, therefore impacting inhibition, shifting, and components of working memory (Pacheo-Unguetti et al., 2010; Kalanthroff et al., 2016).

Similar to the nature of studies that examined the relationship between EF and ODD/CD, McCloskey et al. (2009a) point out that studies examining the relationship between EFs and anxiety focus on cognitive functioning in the symbol system arena rather than the relationship of EFs and anxiety in the intrapersonal arena of involvement.

Anxiety is classified as an internalizing disorder, with symptomatology involving problems with the regulation of emotions and excessive rumination. These symptoms also may impair functioning in the interpersonal arena; some individuals may find it difficult to relate to others when experiencing anxiety. Anxiety also may impair functioning in the symbol system arena; some individuals may find it difficult to perform cognitive tasks when experiencing anxiety. Conversely, however, clinical interviews, classroom observations and course grades reflect the fact that individuals who report suffering from anxiety symptoms frequently are able to perform well with cognitive tasks in the symbol system arena and relate well to others in the interpersonal arena despite their reported emotional distress. In these cases, the EF impairments may be limited to the intrapersonal arena, and measures of cognitive functioning would not reflect EF deficits.

EFs' Relationship with Depression

Executive functions also seem to be impaired in individuals with mood disorders, such as depression. Mayberg et al. (1999) attributed this association between depression and executive function deficits as a result of disruption in the communication between the cortical-limbic pathways. More specifically, Fossati et al. (2002) elaborated that, "The neocortical (prefrontal and parietal regions) and superior limbic elements (dorsal anterior cingulate) are postulated to mediate impaired attention and executive function, whereas ventral limbic regions (ventral anterior cingulate, subcortical structures) are postulated to mediate circadian and vegetative aspects of depression" (p. 97). This disruption in pathways in depressed individuals is associated with a state of reduced dopamine transmission, which has been supported by neuroimaging studies (Dunlop & Nemeroff,

2007). Research involving meta-analysis of studies of individuals with depression provides evidence that these impaired pathways in individuals with major depression (MDD) lead to poor performance on EF tasks measuring tapping shifting, inhibition, updating, and working memory (Snyder et al., 2015). This impaired performance on EF tasks may be due to the cognitive distortions that depressed individuals often demonstrate, specifically rumination (i.e., the tendency to think about one's symptoms and problems), that is at the core of depression (Watkins & Brown, 2002). This rumination occupies central executive resources and draws resources from limited capacity cognitive processes, and therefore reduces the capacity for use of executive functions and leads to less efficient "operating" (Watkins & Brown, 2002). A causal relationship has not yet been proven, and rumination may not be the sole contributing factor to executive function deficits in individuals with depression (Watkins & Brown, 2002). For example, Wang et al. (2016) indicate that although cognitive factors have been highlighted in all psychological models, they suggest that the interaction of stress and an array of cognitive vulnerabilities other than rumination only, contribute to depressive episodes throughout the life span. For example, risk factors other than rumination that contribute to depression may include: negative self-schemas and hopelessness.

In addition, this rumination and perseverating on negative thoughts central to depression is associated with suicidal symptoms (Harwell, 2001). In fact, Hosenbocus and Chahal (2012) point out that, "Suicidal thinking has been seen as a maladaptive 'executive decision' made by someone who exhibits cognitive rigidity and dichotomous thinking, i.e. a person who fails to see solutions to problems other than suicide. As the

'executive decision center' of the brain, the frontal lobe may be dysfunctional in suicidal patients" (p. 226).

EFs' Relationship with Bipolar Disorder

Similar executive functions seem to be impaired in those with BD as are impaired in those with depression, including shifting, inhibition, visuospatial WM, verbal WM manipulation, and verbal WM maintenance (Snyder et al., 2015). Studies involving individuals diagnosed with Bipolar Disorder (BD), however, have indicated slightly increased impairments in executive functioning in comparison with individuals diagnosed with depression (Hosenbocus & Chahal, 2012). Of these executive functions that are impaired, results suggest that loss of inhibition might be a core feature of BD (Mur et al., 2007). Impairments of EF, specifically inhibitory control, response inhibition and strategic thinking, are more likely to persist, regardless of the current mood state, in comparison with other EFs (Goldberg & Chengappa, 2009).

Lack of Research Regarding Internalizing Disorders

After an analysis of the separate psychopathological disorders, it is evident that executive function deficits are pervasive throughout and a core characteristic contributing to the symptoms of most, if not all, internalizing and externalizing disorders (Arnsten & Robbins, 2002). The studies reviewed here focused on the neurocognitive dimension of EFs and their relationship to developmental psychopathology (Halperin, 2016). Additionally, the majority of the studies on the relationship of EF to mental disorders have concentrated on externalizing behaviors (e.g., aggressiveness, hyperactivity, and delinquency). This emphasis on externalizing behaviors has left a gap in the research

concerning the relationship between internalizing behavior disorders (e.g., anxious, depressed, withdrawn) and EFs (Kaslow & Thompson, 1998). The ways in which EFs and internalizing behaviors are related deserves attention, however, because internalizing behavior problems, like externalizing behavior problems, are problematic and may negatively influence functioning in multiple arenas of involvement (Plante & Sykora, 1994). In addition, internalizing behaviors, similar to externalizing behaviors, are a risk factor for the development of psychopathology (Ollendick & King, 1994).

Assessment of EFs and Mental Health Disorders

Before an intervention is devised, an assessment must be administered in order to determine if EFs are contributing to the overall observed problems. If EF difficulties do result in being a factor, then the assessment should identify the nature of the difficulty. The goal of assessing EFs is to help identify the specific pattern of strengths and weaknesses that accurately characterize an individual's EF capacities. Ideally, this information will then drive an intervention that will help aid an individual to achieve his or her goals by engaging EF strengths and remediating EF weaknesses. When assessing EFs, various methods are available. These methods can be categorized, based on whether or not they are direct or indirect in their approaches and whether or not they involve formal or informal assessment techniques. Because of the certain limitations of these methods, ideally, executive functions should be assessed with a multidimensional, multimethod approach in mind. This involves both formal and informal techniques that can be utilized directly with the child and indirectly with parents, teachers and others who have a good understanding of the child. Some commonly used direct and indirect methods include direct observations, behavior ratings, behavior observations, clinical

interviews, anecdotal records, and case history (McCloskey et al., 2009a; McCloskey & Perkins, 2012).

Direct Formal Methods. Direct methods of executive function assessment involve gathering information through direct interactions or observations of the individual while they engage in a task potentially involving the use of executive functions (McCloskey & Perkins, 2012). Direct formal methods employ norm-referenced tests so that performance can be compared with a standardization sample of similar-age peers. Two well-known standardized neuropsychological assessments that attempt to assess executive functions are the Developmental Neuropsychological Assessment (NEPSY-II; Korkman, Kirk, & Kemp, 2007) and the Delis-Kaplan Executive Function System (D-KEFS) (Delis, Kaplan, & Kramer, 2001). These assessments include specific tasks that measure certain aspects of executive function, such as cognitive flexibility, working memory, selective attention, planning, organization, self-monitoring, goal-setting, problem-solving, and prioritizing. Another commonly administered executive function assessment is the Wisconsin Card Sorting Test (WCST), which is a test of cognitive reasoning that assesses flexibility of thinking and set-shifting, as well as organization and problem-solving (Heaton, 1981). The Rey Complex Figure Test, which requires individuals to reproduce a complicated line drawing, is often used to assess executive functions in relation to visual spatial ability and visuospatial memory, as well as planning and monitoring (Shin, Park, Park, Seol, & Kwon, 2006). Additional direct formal assessments of executive functions are currently available and utilized (e.g., *Behavioral Assessment of Dysexecutive Syndrome in Children*, etc.)

However, although all of these norm-referenced, individually administered tests attempt to assess executive functions, there are various ways in which they are limited in scope and focus. First, these tests assess only the child's use of EFs with specific tasks over a short time frame rather than tapping into multidimensional components of EFs for proloinged periods of time, as often demanded in real world situations. In addition, these tests focus assessment of executive function only within the domains of perception, cognition, and action and not emotion. Last, these tests focus on the use of executive function capacities only as they apply within the symbol system arena. As a result, there is a lack of executive function assessments used to address social, emotional, and adaptive functioning within the Intrapersonal, Interpersonal, and Environment Arenas (McCloskey & Perkins, 2012).

Because current assessments of EFs have concentrated on the role of executive functions solely within the symbol system arena, these assessments have limited utility when evaluating executive function difficulties for those with significant emotional difficulties. Assessing EF deficits within the symbol system arena in children whose primary executive function problems were not manifested in this arena, but rather in their functioning in the intrapersonal or interpersonal arenas, would likely fail to identify EF deficits in the performance of these individuals. According to the HMEF, one may function effectively in one arena, yet function ineffectively within a different arena. Just because individuals may present with executive difficulties in the intrapersonal and/or interpersonal arenas does not mean they would also demonstrate difficulties in the symbol system, or in the environment arenas. Therefore, focusing assessment on only one arena may not be adequate enough to capture executive function strengths and

weaknesses. Assessment involving the role of executive functions in cueing and directing perception, cognition, and action within all four arenas is necessary in order to determine in which arena the executive difficulties are manifesting (McCloskey, et al., 2009a; McCloskey et al., 2009b; McCloskey & Perkins, 2012).

Indirect Formal Methods. Behavior rating scales are an indirect, formal method that can be used in conjunction with other methods to help overcome some of the limitations of direct formal measures. Direct norm-referenced tests typically focus assessment a limited number of EFs; however, norm-referenced rating scales are developed to measure a broad range of EFs. Therefore, rating scales are better able to assess EFs across various domains of functioning within multiple arenas of involvement. Additionally, rating scales tend to be more sensitive and take into account the multimodal construct of EFs, which involve many separate executive functions, rather than treating EFs as a unitary construct. Another advantage of these rating scales is that they can provide multiple perspectives (parent, teacher, child, etc.) regarding how often these behaviors related to executive function difficulties are occurring. In addition, although direct formal tests are designed to assess EF direction of cognitive functions only during a short period of assessment, rating scales assess real-world behaviors and have applications to everyday functioning beyond the testing situation. However, many currently available rating scales differ in their structure and scope, and are based on varying theoretical perspectives. As such, they present with their own advantages and disadvantages (McCloskey & Perkins, 2012).

The Delis Rating of Executive Functions (D-REF) is a rating scale which includes parent and teacher rating forms intended to measure executive functions in children and

adolescents ages 5 to 18 years of age. In addition, there is a self-rating form assessing the same constructs for individuals, ages 11 to 18 years. The D-REF is a short, 10-minute, measure that is used for rapid identification of executive function problems, based on behavioral observations. Results from the D-REF produce a composite score measuring overall executive function. This composite score is developed, based on three core indices: Behavioral Functioning, Emotional Functioning, and Executive Functioning. Additionally, there are four clinical indices, including Attention/Working Memory, Activity Level/Impulse Control, Compliance/Anger Management, and Abstract Thinking/Problem-Solving. The structure of the D-REF is a simple checklist with minimal instructions. Part 1 of this scale involves a 36-item rating scale with four options for each item, based on the frequency of occurrence of the behavior (seldom/never, monthly, weekly, or daily); Part 2 requires the rater to select five behaviors that are the biggest stressors in the child's or adolescent's life from a list of 36 statements (Delis, 2012).

Although the D-REF is convenient for users due to the quick completion time, the scales may be too short (36 items) in order to fully assess the wide range of executive functions that are specified in models such as the HMEF. In addition, the structure of the item rating scale is limited by the fact that it allows raters to indicate only frequency, but not degree, of occurrence of behaviors related to EFs. In addition, this scale is intended to gather a quick overview of the individual's EF difficulties, but does not measure the individual's strengths. Therefore, this scale does not aid in a comprehensive understanding of an individual's use of executive functions that is essential for specifying appropriate interventions.

The Comprehensive Executive Function Inventory (CEFI; Naglieri & Goldstein, 2013) is another rating scale that was developed in order to assess daily behaviors related to executive function in children and adolescents. The CEFI has three forms, which include parent (5-18 years), teacher (5-18 years), and self (12-18 years). The CEFI consists of 100 items scored on a Likert scale. The measure yields a full scale and nine scales: *Attention*, *Emotion Regulation*, *Flexibility*, *Inhibitory Control*, *Initiation*, *Organization*, *Planning*, *Self-Monitoring*, and *Working Memory* (Naglieri & Goldstein, 2014).

As with the D-REF, the structure of the CEFI fails to provide the opportunity for raters to elaborate on the degree of use of behaviors related to EFs, and rather, includes only a Likert scale. In addition, the authors of the CEFI, Naglieri & Goldstein (2014), indicated that, "Executive function as measured by the behaviors included in the CEFI should be considered a unidimensional construct for parent, teacher, and self-ratings" (p. 225). Therefore, the theory behind the development of this scale indicates that it is not meant to assess the multidimensional nature of EFs. Unlike the D-REFS, the Likert scale used to rate items allows raters to identify both EF strengths and weaknesses. Both the CEFI and the D-REF have weaknesses with their content coverage, however, because items are highly nonspecific and often combine many EFs, arenas, and domains at once (McCloskey & Perkins, 2012).

One of the most commonly used assessments of executive functions in schools is the Behavior Rating Inventory of Executive Function, Second Edition (BRIEF-2), which is a rating scale that consists of parent, teacher, and self-report forms (Gioia et al., 2015). Information from these rating scales is organized into three composite indices, including

the Behavior Regulation Index, the Metacognition Index, and the Global Executive Composite. Within these indices are individual Clinical Scales, including Inhibit, Shift, Emotional Control, Initiate, Working Memory, Plan/Organize, Organization of Materials, Task-Monitor and Self-Monitor. The users of this scale report the frequency of a child's ineffective use of executive functions based on behavior during the previous six months. Items are rating based on frequency of occurrence (never, sometimes, often). All items are negatively worded so that the BRIEF assesses only EF deficits and not EF strengths.

As with all EF rating scales, this scale has its limitations. The BRIEF-2 is helpful in assisting with the identification of ADHD; however, research has indicated that children with only behavioral concerns and not ADHD also had elevated scores on the BRIEF (McAuley, Chen, Goos, Schachar, & Crosbie, 2010). Because this measure is not sensitive enough to distinguish between specific areas of EFs, it may lead to the over identification of ADHD instead of capturing the true nature of the individual's difficulties. Therefore, this scale is not an effective diagnostic instrument when used in isolation, and should be used in conjunction with many measures or methods.

In addition, scales on the BRIEF-2 may not be measuring what it purports to measure. For example, McCloskey (2016) suggested that the BRIEF-2 Working Memory Scale items are assessing the executive functions of Focus and Sustain instead of actually measuring the holding and manipulating of information in working memory. Placement of items on specific clinical scales also is problematic. The Inhibit Scale is composed of items that assess the EFs of Modulate and Stop as well as of Inhibit. Although one of the scales is named Plan/Organize, only one item on the scale assesses the EF of Plan and

one item assesses the EF of Organize. This lack of discrimination between scales could lead to the misidentification of those aspects of EF that are problematic for an individual.

Another weakness of this scale lies within the scoring of responses. Users can respond to items in significantly different ways, yet still produce identical BRIEF Scale T-scores. Significant impairments with specific EFs may not be captured due to low T-scores based on the aggregation of multiple items that assess many different self-regulation EFs. Because each BRIEF Scale is an amalgam of multiple EFs, the T-score may not reflect an area of EF difficulty. As noted previously, the BRIEF Inhibit Scale includes items that measure Inhibit, Modulate, and Stop. If a client exhibits difficulties only in relation to Modulating, the overall Inhibit Scale T-score may not be elevated. Thus, the low T-score will overlook the Modulation difficulties reported by the rater. Use of only three options for rating frequency can also produce difficulties. An elevated T-score can result from a rating of "Sometimes" for all, or nearly all, items on a Scale, or from a rating of "Often" for a smaller subset of items on a Scale. Although the T-scores may be identical, these rating configurations represent very different perspectives on the frequency and number of EF difficulties exhibited by the child being rated. Additionally, raters' interpretations of the meaning of "sometimes" can vary greatly. Some raters are of the mindset that one can never say "never" and therefore, they rate behaviors that are not particularly viewed as problematic as occurring "sometimes"; however, raters who are much more flexible with their interpretations of "never" will use that category to describe behaviors that occur sometimes, but do not really represent a problem and reserve the use of "sometimes" to reflect a problem. (McCloskey & Perkins, 2012).

One of the BRIEF's biggest disadvantages is in relation to the organization and structure of the scale. Although this measure addresses a wider range of Arenas and Domains than other scales, items are highly nonspecific and often combine many executive functions, arenas and domains at once. Additionally, four arenas of involvement could have been addressed equally; however, items are dispersed in an unorganized fashion, which does not allow for every arena to be adequately addressed within each executive function sub-category. As such, this scale does not capture the full range of EFs across multiple dimensions within multiple arenas. Last, one of the main goals of assessment should be to identify *both* strengths and weaknesses so that appropriate interventions that address difficulties can be developed and those that highlight strengths of the individual, as well. However, the BRIEF fails to assess the strengths of these individuals, and rather focuses on whether or not an executive function deficit is present. As such, the brief does not take a comprehensive, fully oriented approach (McCloskey & Perkins, 2012).

Another difficulty that is apparent in all of the rating scales described here is the fact that the items and/or rating schemes do not allow for the distinction between executive functions (knowing what and when) and executive skills (knowing how). Ratings obtained with these scales, therefore, cannot provide the kind of information that is most helpful in identifying appropriate interventions.

Although the D-REFS, CEFI and BRIEF-2 assess multiple EFs, none of the scales is based on a comprehensive theory of executive control. In contrast to this lack of theoretical specificity, the McCloskey Executive Functioning Scales (MEFS) were developed based on the Holiarchical Model of Executive Function (HMEF) described

earlier in this literature review. In describing the MEFS, McCloskey (2016) states that "A basic premise of the MEFS is that executive functions cannot be accurately characterized by a single, global score because executive functions are multiple in nature with different executive functions reflecting different aspects of an individual's capacity to self-regulate perceptions, feelings, thoughts, and actions and to exhibit self-realization and self-determination" (p. 42). As such, the MEFS attempts to address the need for a broader, more comprehensive, rating scale that effectively captures executive function strengths and weaknesses and executive skill deficits, and also assesses self-realization and self-determination, which ultimately aids in more targeted intervention with children and adolescents (McCloskey, 2016).

Although Parent, Teacher and Self-rating forms of the MEFS exist, only the Teacher form has been standardized for use as an indirect, formal method of assessment. The MEFS teacher Form assesses teacher judgements about students' degrees of effectiveness with the use of 33 self-regulation executive capacities within the context of two distinctly separate arenas of involvement (academic arena and self/social arena), as well as three aspects of self-realization and two aspects of self-determination. The MEFS Teacher Form emphasizes the importance of assessing self-regulation executive functions across distinct arenas of involvement based on the assumption of dissociation of EFs between arenas. In other words, self-regulation executive functions and skills can significantly differ, depending on the context of the arena in which they are operating. A child may be self-regulating effectively in one arena, but he or she may be manifesting difficulties with self-regulating in another arena. Therefore, it cannot be assumed that because one is struggling within the symbol system arena that he or she is also struggling

in the other arenas. Therefore, the MEFS captures the need to assess EFs within the context of different arenas. Although the intention of the MEFS was to assess self-regulation of perception, feeling, thought, and action across all 33 executive capacities and within all four arenas of involvement, the total number of items required by such a comprehensive structure was prohibitive. Early pilot testing of the scales, however, indicated that most raters were not able to differentiate effectively and consistently between self-regulation within the four domains of functioning for all 33 executive capacities. Additionally, most raters were not able to assess effectively the executive capacities applied in the environment arena and many raters had difficulty distinguishing between intrapersonal and interpersonal self-regulation. As a result, the MEFS includes some items that assess self-regulation of a combination of perception, cognition and action and some items that assess self-regulation of emotion; these items are organized into two arenas of involvement: the Academic Arena that represents the symbol system arena of the HMEF, and the Self/Social Arena, which represents a combination of the Intrapersonal and Interpersonal arenas of the HMEF model (McCloskey, 2016).

The MEFS provides a strengths and weaknesses (deficits) item analysis for the 33 Self-Regulation Executive Functions (SREF) and also for the 3 aspects of Self-Realization and the two aspects of Self-Determination. For the 33 Self-Regulation executive capacities, the MEFS structures a unique rating format in which there are three levels of differentiation. McCloskey (2016) elaborated that, “This rating format enables the identification of three discrete levels of executive capacity use: executive function strengths (always or almost always does it without being prompted); executive function deficits (seldom does it without prompting or only does it after prompting); and executive

skill deficits (only does it with direct assistance or cannot do it even with direct assistance)" (p. 45). Unlike the traditional rating format, which asks raters to report only the frequency of specific behaviors related to EFs, this item rating structure also allows the rater to choose the degree to which the student uses executive functions and/or skills. This provides additional information that can further assist in making clinical decisions about a student's use, or disuse, of executive capacities. In addition, the differentiation of executive function strengths, executive function deficits, and executive skill deficits can help guide a specifically tailored intervention based on the individual's detailed EF profile (McCloskey, 2016).

The MEFS offers a unique structure and incorporates different constructs that are commonly overlooked on other EF rating scales. Usage of this rating scale can lead to an increased understanding of the problems that individuals are demonstrating, related to their abilities to self-regulate perceptions/thoughts/actions and feelings within the context of two different arenas, as well as their abilities to express self-realization and self-determination. This knowledge can then result in more relevant clinical decision-making and targeted development and implementation of interventions (McCloskey, 2016).

Interventions for EF Difficulties Associated with Emotional Difficulties

Before an intervention is implemented, there should be the administration of an EF assessment that is able to a) identify whether an EF skill or deficit is present and b) gather information about the individual's EF strengths (McCloskey et al., 2014). This knowledge can then be used to identify an effective intervention. Currently, there is a wide variety of intervention techniques available that can be used to address EF difficulties exhibited by children with emotional issues.

Cognitive Behavior Therapy.

CBT is an intervention technique that helps an individual develop personal coping strategies that can be used to self-regulate perceptions, feelings, thoughts and actions more effectively. Although originally developed to help individuals deal with depression, it is currently used as an intervention for individuals with a wide array of mental disorders, including ADHD, ODD/CD, anxiety and ASD. CBT incorporates various techniques to help foster internal self-regulation. For example, a CBT technique called verbal mediation involves private speech meant to facilitate problem-solving and learning. It also increases one's ability to engage in internalized language and improves self-regulation capacities. This approach is particularly helpful for those with ADHD, who have difficulties with impulsivity because self-talk leads to an increase in self-control and inhibition. In addition, self-talk is also especially helpful for those with internalizing disorders, such as depression and anxiety, which is due to their tendency to think in a negative manner and be unduly critical of themselves. By reframing self-talk to be positive instead of negative, this tool can help challenge maladaptive thoughts and beliefs. Social story techniques also have been helpful in aiding mediated language that ultimately results in behavior improvement (McCloskey et al., 2014).

Although many CBT intervention techniques utilize "self-talk" to foster internal feedback, this feedback can also be achieved by means of nonverbal processing of mental imagery. One technique involves verbal or nonverbal labeling. This strategy leads to the creation of a common vocabulary or set of metaphors or a common set of nonverbal symbols or images that represent cues for the usage of executive capacities or for communicating internal thoughts and feelings. CBT-oriented strategies, such as Ross

Greene's collaborative problem solving approach (Greene & Ablon, 2006) and Myrna Shure's, "I can problem solve" program (Shure, 2005), aid in the production of this common vocabulary, which then helps the child communicate his or her internal experiences of perceptions, feelings and thoughts. These mental experiences are then used for routines to improve behavior control. For children who are less verbal and more visually-oriented, or for those who have severe language impairments, nonverbal labels can achieve the same thing and be equally effective. For example, one can visualize the image of a green traffic light to represent the initiate cue. Once this is accomplished, knowing how and when to self-talk or activate mental visualizations to guide perceptions, feelings, thoughts and actions will allow for complete internal control of self-regulation executive capacities, as well as other higher level executive capacities (McCloskey et al., 2014).

Other CBT techniques have also shown efficacy in the improvement of mental health symptoms, as well as of executive functions. For example, Klumpp et al. (2017) performed a study with patients, consisting of diagnosed Social Anxiety Disorder (SAD) and impaired executive functions. Treatment included once a week sessions of manualized individual CBT for 12 weeks, which included CBT techniques such as psychoeducation, cognitive restructuring, in vivo exposure to fears, and relapse prevention. With regard to treatment outcome, findings indicated significantly reduced social anxiety symptoms. In addition, compared with their performance on executive function tasks before CBT treatment, SAD patients performed significantly better on tasks that required attentional control and working memory. In regard to the attentional control, self-report results also revealed a significant increase after completing CBT in

patients with SAD. Additionally, self-regulation in these patients also resulted in increased post CBT treatment.

Another study conducted by Goodkind et al. (2015) included 156 participants who met diagnostic criteria for major depression, as well as impaired executive functions based on an array of neuropsychological tests administered pre-treatment. These participants included treatment in the form of 12 sessions of individual CBT, consisting of techniques such as behavioral activation, cognitive restructuring, and social skills training. Level of depression was measured based on the BDI-II, and executive functioning performance was measured using three executive functioning tasks, including the WCST, Stroop Task, and verbal fluency, both pre and post treatment. Results indicated that participants performed significantly better on these executive functioning tasks of set shifting, cognitive flexibility, and response inhibition after treatment; they also demonstrated a significant drop in depression symptoms after CBT sessions.

Mindfulness.

Older children who have increased Self-Realization and Self-Determination capacities may benefit from mindfulness-based cognitive behavior therapy (CBT) in order to improve self-regulation capacities. Similar to traditional CBT, mindfulness-based CBT involves the teaching of strategies to help improve self-control of perceptions, emotions, thoughts and actions. Mindfulness-based techniques also attempt to improve self-awareness and help the child reflect on his or her own perceptions, emotions, thoughts and actions. Children with more fully developed self-awareness capacities are better equipped to routinely monitor their perceptions, emotions, thoughts and actions and are

aware when CBT problem-solving strategies they have been taught must be implemented (McCloskey et al., 2009b).

This mindfulness-based CBT approach emphasizes developing the child's ability to become cognizant of his or her own perceptions, emotions, thoughts and actions, and also become aware of the strategies that can be implemented in order to restructure negative or uncomfortable perceptions, emotions, thoughts and actions. This therapeutic approach has similarities, familiar to those children who briefly take medication, which sometimes results in randomly increased awareness. With both approaches, the focus is increased awareness of what self-regulation is and how to activate it in an effective manner. However, the therapeutic regimen differs between the two strategies. Medication unintentionally fosters conscious awareness from a nonconscious source. Conversely, mindfulness-based CBT intentionally develops conscious awareness from a conscious source (McCloskey et al., 2009b).

One example of a mindfulness based approach was developed in the early '90s by Segal et al. (2002) in order to develop a cognitive behavioral treatment aimed at preventing common depressive relapse. They developed a theoretical model of depressive relapse that resulted in their eight-week manualized group treatment, which incorporates both mindfulness training and cognitive therapy principles. The basis of their program is designed in order to help patients become more self-aware of their negative thinking processes (thoughts, moods, and assumptions), as well as to learn strategies to break these ruminating thoughts and patterns. Beneficial cognitive strategies, such as paying attention and being self-aware to thoughts and feelings related to pleasant and unpleasant events, are presented in class in order to restructure negative thought patterns. In regard to the

structure of the program, their mindfulness based cognitive therapy program consists of eight-weeks that takes the form of a class-like setting with up to 12 participants. Each class is structured with a theme and curriculum, and involves training in mindfulness practices, such as sitting meditation, body scan meditation, hatha yoga, and walking meditation. A core feature of this program is homework, which participants are encouraged to partake in daily; it involves a 45 minute taped instruction of mindfulness and meditation. Class leaders, who prepare for and lead the class, are also expected to engage in ongoing meditation and mindfulness. The goal is that, through this increased self-awareness and attention to thoughts, moods, and feelings, the individual has a better chance of not relapsing from depression.

Siegal (2007) also came up with a unique mindfulness theory in order to foster and maintain mental health and well-being. Siegal purported three human experiences that have been documented as promoting well-being: secure attachment, mindfulness meditation, and effective psychotherapy. Based on this, he developed a unifying theory that aims to demonstrate that the effects of these three experiences have a similar neural mechanism. His theory involves both science and personal anecdotes to reveal how to transform the brain as well as promote well-being. According to Siegal, mindfulness means COAL, which is an acronym standing for curiosity, openness, acceptance, and love. He also explains mindfulness as the practice of purposeful, yet nonjudgmental, awareness of moment-to-moment experience.

Siegal then goes on to explain the functioning of the mind, which he describes as the wheel of awareness (WoA), involving the rim, spokes, and hub. The sectors of the rim are divided into: first five (outer world), sixth (body), seventh (mind), and eighth

(relationships). The spokes in this model are intentional focus of attention, and the hub contains the ability to keep track of the target of attention. This was initially supposed to be an integrative practice, but is now considered a mindfulness practice, as well.

Other mindful awareness practices that Siegal mentions include yoga, tai chi, qigong, centering prayer, chanting, and mindfulness meditation. Siegal stresses the importance of mindfulness practices due to increased immunity, significant improvements in attentional regulation and other executive functions, especially in adolescents, symptom improvement in those diagnosed with OCD, borderline personality, drug addiction, and the prevention of depressive relapse.

Greenland (2010) has also developed a framework for promoting mindfulness. Greenland states that mindful awareness is effective because it enables one to pay closer attention to what is happening *within* oneself, such as thoughts, feelings and emotions, so that one can better understand what is happening to oneself. Her book, *The Mindful Child,* offers techniques for mindfulness training to children from four to eighteen years old with developmentally-appropriate exercises, songs, games. These are often fun techniques for kids, yet at the same time, fostering outer awareness and attention. This, in turn, can increase their academic performance, as well as their social and emotional skills, such as developing friendships, being compassionate and kind to others, and playing sports. These mindfulness techniques also provide tools to handle stress and overcome difficulties, such as insomnia, overeating, ADHD, hyper-perfectionism, anxiety, and chronic pain. Rather than acting immediately, children are encouraged to stop and think before responding to stressful situations. This helps them respond in a

more productive and healthy way and guides them to becoming more thoughtful, resilient, and empathetic individuals.

Greenland also offers interactive workshops that are designed for parents, teachers, health care professionals, friends, and others who want to promote and encourage concentration, mindfulness, and compassionate practices to children. Her workshops offer and explain practical ways to teach mindfulness to children, such as showing them how to sing songs, play games, and practice simple mindfulness exercises. These techniques are meant to foster concentration, mindfulness, and compassion for children and their families not simply in daily life at home, but also in the schools and elsewhere. Her workshops are also meant to help children develop greater mind-body awareness, reduce stress, and increase caring relationships between children and adults. There are plenty of opportunities to ask questions, and both new and experienced meditators can participate.

Additional Techniques

McCloskey et al. (2014) discuss several techniques that can be used as bridging strategies to enable children to move from being externally prompted by others to being internally self-regulated. These include reflective questioning, feedback about the accuracy of performance, modeling, and practice and rehearsal.

Reflective Questioning. Through reflective questioning, children can engage their executive functions with the help of teachers and parents, as well as clinicians, known as mediators. A child who seeks help from another person, as opposed to thinking about the answer individually, or who may not even realize the need to ask for help that is necessary for active learning and adequate production, fails to engage in executive

functions that are required for self-reflection. When a child asks a question of another, in order to assist that child with reflective questioning, the mediator repeats that question to the child instead of answering it. When the child does not realize the need to ask a question in order to engage, then self-reflection involves the mediator's asking the child a question that is meant to make the child aware of the need to engage in executive capacities, and then, to engage in these capacities. In both situations, the child is being prompted in order to engage in these capacities and self-reflect in order to answer questions on his or her own. Additionally, the child's response style helps the mediator gain valuable information regarding the child's executive capacities after being cued and prompted. After the child receives a response, the mediator should continue on to the next strategy, which is providing feedback about the accuracy of performance.

Feedback. Providing feedback about the accuracy of performance should be done as often as possible when a child attempts to engage in executive capacities or every time a child answers a question that is intended to cue engagement of executive capacities. By providing feedback regarding performance right away, as frequently as possible or feedback regarding the adequacy of answers to question performance, results in a significant likelihood of the child engaging in self-regulation capacities, as well as moving from external to internal control.

Modeling. Modeling appropriate use of executive functioning is a beneficial technique in order to help children engage executive capacities to self-direct functioning, whether it be on a conscious or unconscious level.

Practice and Rehearsal. Research indicates that practice is the number one best strategy for increasing proficiency. It is imperative for a child struggling with executive

functions to practice the areas in which he or she is deficient with his or her executive functions in order to apply them more successfully in a more self-regulated manner. Practice is also the most effective way to accelerate growth in neurons, which helps to close the gap caused by delays in maturation. Additionally, in common situations where these executive capacities are used, they are able to be rehearsed beforehand so that they are more effectively used when the situation requires them.

Overall, in regard to intervention, research indicates that the most effective way to treat and improve EFs and social/emotional development is not to focus on either of these in isolation, but rather to take both of them into account in a combined effort (Diamond & Lee, 2011). Despite this need to incorporate both emotional and social factors, as well as executive functions when intervening, EFs tend to be overlooked (Diamond & Lee, 2011). Children and adults with mental health issues, such as depression, OCD, etc., visit professional after professional for years, and although executive function deficits play a critical role in these disorders, they are not acknowledged. Therefore, they receive inadequate treatment that fails to address a core contributing problem (Hosenbocus & Chahal, 2012).

In addition, researchers aiming to improve social/emotional functioning rarely take EF into account as a significant factor when developing models of intervention (Riggs et al., 2006). Dawson & Guare (2010) support this need by indicating “to date, only one practical application handbook has been published that directly addresses intervention for educational and psychological problems associated with executive function deficits” (p. 33). Furthermore, although there has been a rise in interest in regard to the assessment of cognition, behavior, and social/emotional factors in relation to

executive functions, the manuals for these assessments lack information regarding treatment, as well as how to develop and implement interventions for those who perform poorly on these tests (McCloskey et al., 2009a).Therefore, there is a significant need for practical resources in order to help support both professionals and the public with the implementation of interventions that address *both* psychological disorders and executive function problems (McCloskey et al., 2009a).

Although there is no specific "cure" for executive function deficits, interventions that address both executive function deficits and social/emotional issues are associated with better outcome. Hosenbocus and Chahal (2012) believe that with these intervention efforts, "Children with EF disorders can achieve a sense of success and avoid getting into difficulties as long as they have support from another person, a parent, teacher, mentor or friend to act as a 'surrogate frontal lobe' to guide them and keep them on track" (p. 228). Treatment requires life-long monitoring and needs to be managed in accordance with a multi-modal approach (Hosenbocus & Chahal, 2012). This involves experts from multiple disciplines integrating their findings and knowledge, as well as working collaboratively without any undermining or mixed messages to the child and parents (Hosenbocus & Chahal, 2012).

Research Problem

Effective interventions are dependent upon comprehensive and integrated assessments. If assessment is lacking in certain domains or areas or is too vague, the treatment approach may not be targeted enough to address specific EF difficulties. Norm-referenced rating scales are able to address this limitation and measure a vast array of EFs, therefore, allowing the researcher to garner information regarding how one is

functioning across various domains of functioning within multiple arenas of involvement. Additionally, rating scales are typically sensitive and account for the fact that EFs are a multimodal construct. Another advantage of these rating scales is the multiple perceptions that can be obtained, whether though parents, teachers, child, etc. This is significant because of possible varying opinions regarding how often behaviors related to executive function difficulties are occurring. In addition, rating scales assess real-world behaviors and have applications to everyday functioning beyond the testing situation. However, although they are advantageous in many ways, many currently available rating scales differ in their structure and scope, and have been developed according to varying multiple theoretical perspectives. Therefore, they present with their own advantages and disadvantages (McCloskey & Perkins, 2012).

A significant limitation to the assessment of EFs is the fact that rating scales potentially can cover various arenas of involvement; however, they fail to use the arenas as a context for their interpretation. Therefore, they do not reach their full potential and are not utilized in the most effective ways in order to identify EF strengths and weaknesses. Additionally, currently available rating scales have taken into account only the role of executive function's cueing and directing perception, cognition, and action only as they apply within the symbol system arena. As a result, these rating scales fail to address the usage of executive functions in regard to social and emotional functioning or adaptive functioning within the intrapersonal, interpersonal, or environmental arena. In addition, some rating scales, such as the CEFI and the D-REF have weaknesses with their content coverage because items are highly nonspecific and often combine many EFs, arenas, and domains at once (McCloskey & Perkins, 2012). This makes it difficult to

interpret the true areas of EF strengths and weaknesses because it is hard to tease out when areas are combined together into one. The BRIEF takes into account a more comprehensive range of Arenas and Domains than other scales; however, it still includes many limitations. The items listed on this scale are highly nonspecific and often combine many arenas and domains together. Additionally, although four arenas of involvement could have been addressed equally, items are dispersed in an unorganized fashion, which makes it impossible for every arena to be adequately addressed within each executive function sub-category. Therefore, this scale does not capture the full range of EFs across multiple dimensions within multiple arenas.

Because this comprehensive assessment does not include all arenas, overgeneralization of results has occurred. Professionals have frequently and incorrectly assumed that results based on measures to assess EFs in a very broad domain general manner are able to apply to the engagement of executive functions with all domains of functioning within all arenas of involvement. Overgeneralization of executive function rating scales that assess only within the symbol system arena may be inappropriate for effective identification of the EF strengths and weaknesses of individuals presenting with difficulties with executive function control of emotions. Despite this knowledge, current assessment focuses on EF control of perception, thought, and action only within the symbol system arena in an attempt to capture EF deficits in individuals whose primary EF deficits are related to emotional control deficits primarily within the context of the interpersonal arena. However, it is incorrect to believe that just because one is demonstrating problems in the interpersonal arena that these problems will also arise in

the symbol system, intrapersonal, and environmental arenas (McCloskey & Perkins, 2012).

This is especially important when attempting to assess EFs in relation to emotional difficulties. In order to accomplish this, there needs to be an understanding of the relationship between executive functions and emotional disturbance in relation to the concepts of *domains of functioning* and *arenas of involvement*. For example, the behavioral problems demonstrated by children diagnosed with Oppositional Defiant Disorder (ODD) or Conduct Disorder (CD) result from several self-regulation and self-realization deficits. Both of these disorders involve deficits that result from a specific arena of involvement, the *Interpersonal Arena*, yet they can influence functioning within all four domains, including perception, emotion, cognition, action. The difficulties associated with CD or ODD are most apparent during the cueing and direction of perceptions, emotions, thoughts and/or actions throughout interaction with others. Along with this, impairments with self-analysis and self-awareness are also present. (McCloskey et al., 2009b).

The McCloskey Executive Functions Scale (MEFS) attempted to address this issue by taking into account the limitations of currently available rating scales. McCloskey offers a unique perspective on EFs that may be very beneficial in determining the EFs associated with mental disorders because of its structure and method of rating. The MEFS brings awareness to the fact that 33 self-regulation executive functions (SREFs) can vary, depending on the context or Arena of Involvement. The MEFS assesses SREFs within two separate Arenas of Involvement, the Academic Arena and Self/Social Arena. The Academic Arena involves engagement of self-regulation

executive capacities needed to cue and direct activities related to school tasks, including participation, completion of in-class projects and assignments and test-taking. The Self/Social Arena covers the execution of self-regulation executive capacities to cue and direct appropriate and effective interactions with others, as well as the ability to self-control (McCloskey, 2016).

Because the structure of the MEFS incorporates many self-regulation EFs which are organized into 7 overarching clusters addressing multiple arenas, items can be interpreted in order to develop specific interventions tailored to that area of particular weakness. This is especially useful for identifying EF deficits associated with those demonstrating emotional difficulties. For example, those with emotional difficulties may result in difficulties within the Engagement Cluster due to deficits related to Inhibiting in the Self/Social Arena; this should then be the focus of intervention to improve peer relations. Specific item analysis might then suggest taught strategies that increase one's ability to inhibit acts of aggression towards others, refrain from inappropriate and impulsive comments, and be patient in waiting one's turn (McCloskey, 2016).

In addition, with individuals who present with emotional difficulties, assessment of executive functions should specifically identify the particular executive function problems that are present within the individual, as well as capture potential executive function strengths. This comprehensive assessment can then lead to interventions that capitalize on strengths yet also aid in the resolution of specific problems and concerns. As such, assessment of executive functions based on the MEFS includes a well-rounded orientation from a theoretical perspective that encompasses EFs involved in all arenas, especially those most closely associated with emotional and social difficulties. The very

purpose of expanding these 33 distinct self-regulation executive functions is to identify areas of self-regulation weaknesses that allow for the development of intervention plans that can help children overcome their emotional difficulties by allowing greater development of integral self-regulation capacities (McCloskey, 2016).

The MEFS acknowledges the fact that the engagement of executive function capacities is dependent on the domains of functioning and arenas of involvement, especially in relation to emotional difficulties. Therefore, the variable factors that can lead to fluctuation in the usage of executive functions requires a multimodal approach to assessment. The approach utilized, such as the MEFS, should have the goal to determine the effectiveness of executive functions for the cueing and directing of perceiving, feeling, thinking, and acting in relation to self (interpersonal), others (interpersonal), the world (environmental) and the cultural tools of communication (symbol system) (McCloskey et al., 2009b).

By addressing multiple domains of functioning and arenas of involvement that may be influenced differently by emotional difficulties, the structure of the MEFS could lead to better assessment and understanding of how and why EF is so broadly influenced across mental health disorders. This will then allow the researchers to better map unique EF profiles, which may provide for more useful clinical implications (Snyder et al., 2015; Happe et al., 2006). Ideally, this will lead to improvements in regard to the ways in which children with executive function deficits and mental health disorders are treated (Hosenbocus & Chahal, 2012). Hovik et al. (2017) also stress the importance of this by saying that, “Identifying the specific deficit in EF for individual children may guide treatment toward more targeted interventions versus a global omnibus EF rating or

intervention" (p. 820). In addition, "Proper understanding of the EF deficits in various psychopathological disorders may lead to better acceptance and compliance for the adaptations or accommodations that are required in the home, at school and in the community to avoid complications or crisis situations" (Hosenbocus & Chahal, 2012, p. 228).

Given the limitations of the assessment methods used to date, as well as the goal of understanding the connection between EF and psychopathology at a level of detail and specificity that can translate into more effective interventions, this study will examine in more detail how the MEFS teacher ratings characterize students classified as ED and students who are not classified as ED. The aim of this study is to analyze specific executive functions more closely in regard to their relationship to mental disorders.

The McCloskey Executive Functions Scale (MEFS), which is an internet, web-based rating scale designed to assess teacher perceptions about students' use of executive functions, will be utilized. Cluster, specific EF and item level teacher ratings gathered with the MEFS will be examined to determine the extent to which specific items might discriminate between students classified as ED and a group of matched controls. More specifically, scores will be compared by the 7 self-regulation clusters, 31 separate self-regulation executive functions and skills, the self-realization and self-determination executive functions, as well as by individual items. Furthermore, these 31 separate self-regulation executive functions will then be item analyzed across two separate Arenas of Involvement (Academic and Self/Social). These two arenas will be compared in order to determine if more deficits are noted in the self/social arena than in the academic arena in individuals classified as ED.

"Although executive function teacher rating scales have been in use since the mid-1990s, the scales have focused on a narrow group of core executive functions, and information regarding specific executive function deficits has not been available" (McCloskey, 2016, p. 1). In addition, executive function rating scales that have been used in past studies typically focus only on whether or not an executive function deficit exists. They do not provide the detailed information that allows for interpretation of a full range of executive strengths and deficits (McCloskey, 2016). This narrow concentration solely on the negative behaviors may result in increased difficulties being identified and does not address the strengths of the individual that can be extremely useful in the development of intervention (McCloskey, 2016). The MEFS takes this into account and "represents an advance in the assessment of executive functions for several reasons: (a) the MEFS is based on a comprehensive model of executive functions that encompasses aspects of self-regulation, self-realization, and self-determination; (b) the MEFS assesses a broad range of executive skills and functions; and (c) the MEFs offers a uniquely designed, full range of rating options that enable the identification of executive skill deficits, executive function deficits, and executive function strengths" (McCloskey, 2016, p. 1).

It is the hypothesis of this study that individuals classified as ED will present with elevated teacher ratings on the MEFS in many self-regulation executive functions, in comparison with the matched control and with the non-clinical standardization sample. In addition, it is hypothesized that individuals classified as ED will present with elevated teacher ratings on the MEFS in both Arenas of Involvement (Academic and Self/Social) in comparison with the matched control and with non-clinical standardization sample.

The third and last hypothesis is that students classified as ED present with elevated teacher ratings on the MEFS in both Arenas of Involvements; however, these same students will present with even higher elevated teacher ratings in the Self/Social Arena of Involvement as compared with the Academic Arena of Involvement.

Research Questions

Research Question 1: Do teacher ratings of students classified as Emotionally or Behaviorally Disordered identify any specific patterns of EF strengths and weaknesses and ES deficits within the Self-Regulation, Self-Realization or Self-Determination Clusters that are different from patterns exhibited by a group of matched controls?

Research Question 2. Do teacher ratings of students classified as Emotionally or Behaviorally Disordered identify any specific patterns of EF strengths and weaknesses and ES deficits at the level of individual Self-Regulation executive capacities that are different from patterns exhibited by a group of matched controls?

CHAPTER 3

METHODS

This study will examine archival data collected during the standardization of the McCloskey Executive Functions Scale Teacher Report Form (MEFS-TR), which is an internet, web-based rating scale developed in order to assess teacher perceptions regarding students' use of executive functioning. The information gathered from the MEFS-TR assists in the identification of executive function strengths, executive function deficits, and executive skill deficits in children referred for a psychological evaluation. This rating scale can be used with individuals ranging from 5 through 18 years of age.

Source of Data

The source of the archival data that was used in this study is the MEFS-TR item raw score file that was created from the standardization data collection file. The data were collected during the scale standardization project during the 2013-2014 and 2014-2015 school years. In particular, the source of the archival data to be used in this study that will be of greatest interest are the MEFS-TR item raw scores for the twenty-one students classified as Emotionally Disturbed or Behaviorally Disordered (EBD) and a matched control sample of twenty-one students that did not have any clinical classification.

Data Used in the Study

Norming data for the MEFs were collected between March 2014 and April 2015. The sample included 1,127 subjects from 167 communities in 29 states in the United

States. A total of 255 teachers completed the ratings for the 1,127. Of the 1,127 students that were rated by teachers, 813 did not have any clinical classification or known social or emotional difficulties. Of the remaining 314 subjects, 21 were classified as Emotionally Disturbed or Behaviorally Disordered (EBD). A control sample was created by selecting the ratings of a nonclinical sample of 21 standardization cases that matched the clinical sample cases, using the demographic data variables of age, gender, ethnicity, and teacher-provided academic skills rankings.

Teacher ratings reflected teacher perceptions of the frequency and effectiveness of students' performances of behaviors that reflected the degree of use or disuse of executive functions and executive skills. Teachers rated each student in the standardization sample with a pool of 104 items that represented 31 self-regulation executive functions organized into 7 self-regulation clusters, and 3 facets of self-realization and 2 facets of self-determination (see Appendix A for the MEFS-TR form). Self-regulation items were rated on a 6-point scale ranging from 0 to 5. Appendix A shows the MEFS-TR rating rubric.

Characteristics of the Teacher Raters

The teachers who provided the MEFS-TR ratings were regular- and special-education teachers from across the United States. A total of 255 teachers completed ratings on 1,127 children and adolescents who were their students. Of the 255 teachers, 11.4% were male and 88.6% were female.

Characteristics of the Rated Students

A total of 1,127 students were rated by teachers in the MEFS standardization sample. The student samples' demographic characteristics closely approximate the 2010 U.S. Census percentages. More specifically, the sample of students matched, as closely as possible, a nationally representative sampling plan defined by targeted percentages of subjects, based on U.S. demographic data.

The normative sample consisted of 200 subjects (100 male and 100 female) in each of five age groups. Students were from 167 communities in 29 states. Of the sample, 18.7% consisted of individuals with disabilities. In addition to these 1,000 students, the ratings for an additional 127 students with clinical diagnoses and/or special education classifications were collected. Of the total 1,127 students, 813 did not have a clinical diagnosis or educational classification and no known social or emotional difficulties and 314 did have clinical diagnoses and/or special education classifications.

This particular study, however, focused on 21 students classified as emotionally disturbed or behaviorally disordered and a group of 21 matched controls.

Variables Used in the Analyses

The variables to be used in the data analyses include: 1) Raw score sums based on teacher ratings for 7 self-regulation executive function clusters (Attention, Engagement, Optimization, Efficiency, Memory, Inquiry, and Solution, 1 Self-Realization composite and 1 Self-Determination composite; 2) raw score sums based on teacher ratings for each of the 31 self-regulation executive functions, and 3 facets of Self-Realization and 2 facets of Self-Determination, and 3) raw scores based on teacher ratings for each of the 104 items of the MEFS, and 4) demographic data for student age and clinical status.

Psychometric Properties of MEFS

Item Ratings. Each MEFS Self-regulation item was rated by teachers, using six potential responses:

5-AA = ALMOST ALWAYS does it on own without prompting

4-F = FREQUENTLY does it on own without prompting

3-S = SELDOM does it on own without prompting

2-AP = Does it, but only AFTER PROMPTING

1-DA = Only does it with DIRECT ASSISTANCE

0-UA = UNABLE to do it even with ASSISTANCE

The rating options for the items comprising the Self-Realization and Self-Determination facets were:

3-VO = Does this VERY OFTEN

2-O = Does this OFTEN

1-S = Does this SOMETIMES, but not much

0-N = NEVER does this

Evidence of Reliability and validity. Teacher ratings were examined using a measure of inconsistent responding. The MEFS Inconsistency scale is composed of six self-regulation items that were altered slightly in wording. The original items and the slightly altered items were included on the rating form but were placed in different locations. Ratings on the original item and the slightly altered item were compared to obtain a rating difference score. The absolute values of these rating difference scores were summed across all six pairs of consistency items to produce the score for the Inconsistency Index. An acceptable level of variation that was not likely to be cause for

concern about the consistency of teacher ratings was established (raw score of 6). All teacher ratings of the consistency items for students in the ADHD and ASD clinical samples and students in the matched control samples produced Consistency Index scores within the acceptable level.

The MEFS manual also reports internal consistency and split-half reliability coefficients for the 7 self-regulation clusters and 14 subclusters (each self-regulation cluster was divided into items assessing the Self/Social Arena and items assessing the Academic Arena) and the Self-Realization and Self-Determination composites by six age groups. The large majority of these coefficients were above .90 and no coefficient was less than .85. Test-retest reliability coefficients also were provided for the cluster, subcluster, and composite scores, with all but two of these coefficients at or greater than .80.

The MEFS manual cites several methods used to establish the validity of the scale. These include evidence based on test content, evidence based on response processes, evidence based on internal structure, and evidence based on relations to other variables, including comparisons of clinical samples and matched controls, comparison of MEFS scores with scores from other measures of executive function (the NEPSY-II and the BRIEF), and teacher ratings of academic competence.

Statistical Analyses

Data analyses will employ descriptive and inferential statistical analysis techniques to examine differences in teachers' ratings of students classified as EBD and students designated as matched controls.

Differences between the ratings of the clinical samples and the matched controls will be tested for statistical significance. This will be accomplished using t-tests to determine the statistical significance of differences between Cluster and sub-cluster scores.

Frequency counts will be generated for the item scores obtained by the clinical groups and the matched controls. Differences in frequency of item ratings between clinical and matched controls will be described in detail. Differences between the ratings of the clinical samples and the matched controls will be tested for statistical significance. This will be accomplished by calculating the percentage of students in each sample that were rated as exhibiting executive deficits (ratings of 0-3). The proportion of the clinical group rated as exhibiting executive deficits will be compared with the proportion of nonclinical matched controls rated as exhibiting executive deficits, using a chi square analysis.

CHAPTER 4

RESULTS

This chapter reports the results of the analyses of teacher ratings of the executive capacities of groups of clinical and nonclinical students, using the McCloskey Executive Functions Scale Teacher Report form (MEFS-TR). The data used in these analyses were obtained from the standardization data files of the MEFS-TR and included the item ratings of 21 students classified as Emotionally Disturbed or Behaviorally Disordered (EBD) and a matched control sample of 21 students with no clinical diagnosis.

Table 4.1 shows the demographic characteristics of the sample of students classified as EBD and the matched control sample, based on the variables used to match the samples. Table 4.2 shows the demographic characteristics of the sample of students classified as EBD and the matched control sample for variables not used to match controls.

Table 4.1

Demographic characteristics of the sample of students classified as EBD and the matched control samples based on the variables used to match the samples

	EBD Sample		Matched Control Sample	
	n	%	N	%
Gender				
Female	7	33.3	7	33.3
Male	14	66.7	14	66.7

Total	21	100	21	100
Ethnicity				
African-American	2	9.5	3	14.3
Hispanic	6	28.6	6	28.6
White	12	57.1	12	57.1
Asian	0	0	0	0
Other	1	4.8	0	0
Total	21	100	21	100
Region				
Midwest	7	33	2	10
Northeast	3	14	4	19
South	5	24	10	48
West	6	29	5	24
Total	21	100	21	100
Academic Skills Level				
Above Average	4	19	5	24
Average	7	33	11	52
Below Average	10	48	5	24
Total	21	100	21	100

Gender of Teacher Rater				
Female	19	91	19	91
Male	2	10	2	10
Total	21	100	21	100
Student Age				
5	1	5	2	10
6	2	10	2	10
7	4	19	3	14
8	2	10	2	10
9	-	-	-	-
10	-	-	-	-
11	1	5	1	5
12	2	10	2	10
13	1	5	1	5
14	1	5	1	5
15	1	5	1	5
16	-	-	-	-
17	2	10	2	10
18	4	19	4	19
Total	21	100	21	100

Table 4.2

Demographic characteristics of the sample of students classified as EBD and the matched control samples on variables not used to match controls

	EBD Sample		EBD Matched Control Sample	
Student Grade				
	n	%	n	%
K	2	10	3	14
1	3	14	2	10
2	4	19	2	10
3	-		2	10
4	-		-	
5	-		-	
6	2	10	1	5
7	2	10	3	14
8	-		1	5
9	2	10	1	5
10	-		-	
11	1	5	1	5
12	5	24	5	24
Total	21	100	21	100

Research Questions

The results of the data analyses shown in this chapter were used to address the following research questions:

Research Questions 1: Do teacher ratings of students classified as Emotionally or Behaviorally Disordered identify any specific patterns of EF strengths and weaknesses and ES deficits within the Self-Regulation, Self-Realization or Self-Determination Clusters that are different from patterns exhibited by a group of matched controls?

It was hypothesized that the MEFS-TR teacher ratings of the students in the EBD sample would exhibit greater executive deficits than the teacher ratings of the students in the non-clinical group for items within all 7 of the Self-Regulation Clusters. It was also hypothesized that within each of the 7 Self-Regulation Clusters a greater proportion of students classified as EBD would be rated as exhibiting more EFD and ESD deficits than the matched control group on items representing the Self/Social Arena of Involvement than on items representing the Academic Arena of Involvement.

Additionally, it was hypothesized that a larger proportion of teacher rating of the EBD-classified group would reflect developmental delays within the Self-Realization and Self-Determination Clusters than the ratings of the nonclinical matched controls.

Research Question 2. Do teacher ratings of students classified as Emotionally or Behaviorally Disordered identify any specific patterns of EF strengths and weaknesses and ES deficits at the level of individual Self-Regulation executive capacities that are different from patterns exhibited by a group of matched controls?

It was hypothesized that the MEFS-TR teacher ratings of the students in the EBD sample would exhibit greater executive deficits than the teacher ratings of the students in the non-clinical group for items within all 31 of the Self-Regulation Executive Capacities. It was also hypothesized that within each of the 31 Self-Regulation Executive Capacities, a greater proportion of students classified as EBD would be rated as exhibiting more EFD and ESD deficits than the matched control group on items representing the Self/Social Arena of Involvement than on items representing the Academic Arena of Involvement.

The research questions of this study were addressed by comparing the teacher ratings of a clinical sample of students classified as EBD with the teacher ratings of a nonclinical matched control sample. The analyses were conducted using the MEFS-TR individual item ratings organized by the Self-Regulation, Self-Realization and Self-Determination Clusters. Frequency counts were generated for the item scores obtained by the clinical groups and the matched controls. For each of the comparative analyses, the proportions of teacher ratings reflecting executive function deficits (EFDs) and/or executive skill deficits (ESDs) for each MEFS-TR item were tested for statistical significance, using Fisher's Exact z test.

Table 4.3 shows the proportions of the sample of students classified as EBD and the matched controls who were rated by teachers as exhibiting either an EFD (seldom does it unless told to do so or only does it when told to do so) or an ESD (unable to do it even when shown how) on the MEFS Attention Cluster items.

Table 4.3

Proportions of the sample of students classified as EBD and the matched controls who were rated by teachers as exhibiting either an executive function deficit or an executive skill deficit on the MEFS Attention Cluster items.

Attention Cluster		EBD Proportion Rated as EFD or ESD	Matched Control Proportion Rated as EFD or ESD	Fisher's *z*	Significance Level ($p<.01$)
SREF Arena of Involvement	Item				
Perceive Academic	Knows what he or she should be doing for school tasks and knows when to do it.	67%	29%	2.472	0.007*
Perceive Self/Social	Makes eye contact with, listens to, and touches others in an appropriate way in social situations.	62%	24%	2.494	0.006*
Focus Academic	Focuses attention on school tasks.	71%	48%	1.572	0.058
Focus Self/Social	Focuses attention on others in social situations.	57%	19%	2.453	0.007*
Sustain Academic	Sustains attention for school tasks until a task is completed.	76%	52%	1.61	0.054
Sustain Self/Social	Sustains attention to others in social situations.	62%	19%	2.739	0.003*

**indicates a statistically significant difference*

The results in Table 4.3 indicate statistically significant differences between the proportions of EBD and nonclinical students rated as having either an EFD or an ESD for 4 of the 6 items within the Attention Cluster. Notably, all but one of the statistically

significant items rated as an EFD or ESD within the Attention Cluster were in the Self/Social Arena.

Table 4.4 shows only the proportions of the sample of students classified as EBD and the matched controls who were rated by teachers as exhibiting an ESD for each of the MEFS Attention Cluster items.

Table 4.4
Proportions of the sample of students classified as EBD and the matched controls who were rated by teachers as exhibiting executive skill deficits on the MEFS Attention Cluster items.

Attention Cluster		EBD Proportion Rated as ESD	Matched Control Proportion Rated as ESD	Fisher's z	Significance Level (p<.01)
SREF Arena of Involvement	Item				
Perceive Academic	Knows what he or she should be doing for school tasks and knows when to do it.	10%	5%	0.341	0.366
Perceive Self/Social	Makes eye contact with, listens to, and touches others in an appropriate way in social situations.	10%	0%	0.658	0.253
Focus Academic	Focuses attention on school tasks.	14%	14%	0.000	0.500
Focus Self/Social	Focuses attention on others in social situations.	5%	0%	0.340	0.367
Sustain Academic	Sustains attention for school tasks until a task is completed.	24%	10%	0.974	0.165
Sustain Self/Social	Sustains attention to others in social situations.	5%	0%	0.340	0.367

**indicates a statistically significant difference*

Although teacher ratings for all items but one indicated more severe skill deficits for a larger percentage of students classified as EBD than matched controls, there were

no statistically significant differences between teacher ratings of the EBD and nonclinical group. Only 1 item in the Academic Arena produced an equal proportion of ESD ratings for the EBD sample and matched control group.

Table 4.5 shows the proportions of the sample of students classified as EBD and student matched controls who were rated by teachers as exhibiting either an EFD or an ESD on the MEFS Engagement Cluster items.

Table 4.5
Proportions of the sample of students classified as EBD and the matched controls who were rated by teachers as exhibiting either an executive function deficit or an executive skill deficit on the MEFS Engagement Cluster items.

Engagement Cluster		EBD Proportion Rated as EFD or ESD	Matched Control Proportion Rated as EFD or ESD	Fisher's z	Significance Level (p<.01)
Arena of Involvement	Item				
Initiate Academic	Starts school work.	71%	48%	1.572	0.058
Initiate Self/Social	Initiates socially appropriate interactions with other students.	67%	24%	2.79	0.003*
Energize Academic	Puts adequate energy into, school tasks.	76%	43%	2.201	0.014
Energize Self/Social	Puts adequate energy into interacting with others.	71%	19%	3.32	0.001*
Inhibit Self/Social	Waits for turn.	62%	24%	2.494	0.006*
Inhibit Self/Social	Considers the consequences before saying or doing things he or she may regret.	86%	43%	2.201	0.010*

Inhibit Self/Social	Refrains from acts of physical aggression.	62%	14%	2.974	0.002*
Inhibit Self/Social	Does not make inappropriate or thoughtless comments (for example, name-calling, insulting, inappropriately tattling on others).	71%	33%	2.472	0.007*
Inhibit Self/Social	Maintains emotional control in frustrating situations.	86%	43%	2.201	0.010*
Inhibit Academic	Maintains emotional control when doing challenging school work.	86%	33%	2.79	0.003*
Inhibit Self/Social	Maintains emotional control when disagreeing with others.	86%	43%	2.201	0.010*
Stop Self/Social	Knows when to stop talking about a single topic.	71%	33%	2.472	0.007*
Stop Self/Social	Stops playing a game or stops doing something that is fun when asked to do so.	71%	43%	1.871	0.031
Stop Self/Social	Stops doing things that annoy others when asked to do so.	76%	43%	2.201	0.014
Pause Academic	Returns to a school task after a brief pause.	71%	43%	1.871	0.031
Pause Self/Social	Pauses to listen to what another person has to say during conversations.	62%	19%	2.739	0.003*
Flexible Academic	Willing to try a different way to do	95%	33%	2.79	0.003*

	school tasks when he or she gets stuck.				
Flexible Self/Social	Accepts a good idea when it is what most others in a group want to do.	71%	19%	3.32	0.001*
Flexible Academic	Accepts changes in school work or school routines without getting upset about it.	76%	29%	3.09	0.001*
Flexible Self/Social	Accepts changes in a person he or she knows or to accept unfamiliar persons without getting upset.	81%	29%	3.09	0.001*
Shift Academic	Moves from one school task to another without difficulty.	71%	38%	2.17	0.015
Shift Self/Social	Changes from one activity to another in social situations without difficulty.	67%	33%	2.16	0.015

**indicates a statistically significant difference*

As shown in Table 4.5, teacher ratings indicated more severe executive skill and executive function deficits for a larger percentage of students classified as EBD than for matched controls. Statistically significant differences between teacher ratings of the EBD sample and the nonclinical group occurred for 15 of the 22 items of the Engagement Cluster. Notably, 12 of the 15 items that reached statistical significance evaluated engagement within the Self/Social arena of involvement.

Table 4.6 shows only the proportions of the sample of students classified as EBD and the matched controls who were rated by teachers as exhibiting ESDs on the MEFS Engagement Cluster items.

Table 4.6

Proportions of the sample of students classified as EBD and the matched controls who were rated by teachers as exhibiting executive skills deficits on the MEFS Engagement Cluster items.

Engagement Cluster		EBD Proportion Rated as ESD	Matched Control Proportion Rated as ESD	Fisher's z	Significance Level (p<.01)
Arena of Involvement	Item				
Initiate Academic	Starts school work.	29%	10%	1.27	0.102
Initiate Self/Social	Initiates socially appropriate interactions with other students.	10%	0%	0.658	0.255
Energize Academic	Puts adequate energy into, school tasks.	29%	5%	1.543	0.061
Energize Self/Social	Puts adequate energy into, interacting with others.	5%	0%	0.34	0.367
Inhibit Self/Social	Waits for turn.	24%	0%	1.53	0.063
Inhibit Self/Social	Considers the consequences before saying or doing things he or she may regret.	29%	5%	1.543	0.061
Inhibit Self/Social	Refrains from acts of physical aggression.	19%	0%	1.251	0.106
Inhibit Self/Social	Does not make inappropriate or thoughtless comments (for example, name-calling, insulting, inappropriately tattling on others).	29%	0%	1.803	0.036
Inhibit Self/Social	Maintains emotional control in frustrating situations.	48%	5%	2.622	0.004*

Inhibit Academic	Maintains emotional control when doing challenging school work.	48%	0%	2.85	0.002*
Inhibit Self/Social	Maintains emotional control when disagreeing with others.	48%	5%	2.622	0.004*
Stop Self/Social	Knows when to stop talking about a single topic.	19%	5%	0.967	0.167
Stop Self/Social	Stops playing a game or stops doing something that is fun when asked to do so.	24%	5%	1.26	0.104
Stop Self/Social	Stops doing things that annoy others when asked to do so.	33%	5%	1.819	0.035
Pause Academic	Returns to a school task after a brief pause.	19%	5%	0.967	0.167
Pause Self/Social	Pauses to listen to what another person has to say during conversations.	19%	5%	0.967	0.167
Flexible Academic	Willing to try a different way to do school tasks when he or she gets stuck.	48%	0%	2.85	0.002*
Flexible Self/Social	Accepts a good idea when it is what most others in a group want to do.	14%	0%	0.961	0.168
Flexible Academic	Accepts changes in school work or school routines without getting upset about it.	19%	5%	0.967	0.167
Flexible Self/Social	Accepts changes in a person he or she knows or to accept	24%	0%	1.53	0.063

	unfamiliar persons without getting upset.				
Shift Academic	Moves from one school task to another without difficulty.	29%	10%	1.27	0.102
Shift Self/Social	Changes from one activity to another in social situations without difficulty.	19%	0%	1.251	0.106

**indicates a statistically significant difference*

Although teacher ratings indicated more severe executive skill deficits for a larger percentage of students classified as EBD than for matched controls, statistically significant differences between teacher ratings of the EBD sample and nonclinical group occurred for only 4 of the 22 items. Review of the 4 statistically significant items indicated an even split between Engagement Cluster ESDs in the Academic and Self/Social arenas.

Table 4.7 shows the proportions of the sample of students classified as EBD and the matched controls, who were rated by teachers as exhibiting either an EFD or an ESD on the MEFS Optimization Cluster items.

Table 4.7
Proportions of the sample of students classified as EBD and student matched controls who were rated by teachers as exhibiting either an executive function deficit or an executive skill deficit on the MEFS Optimization Cluster items.

Optimization Cluster		EBD Proportion Rated as EFD or ESD	Matched Control Proportion Rated as EFD or ESD	Fisher's z	Significance Level (p<.01)
SREF Arena of Involvement	Item				
Monitor Academic	Checks school work to avoid careless errors on	86%	48%	1.906	0.028

	tests and other school work.				
Monitor Self/Social	Recognizes situations in which his or her behavior bothers or upsets others.	91%	43%	2.201	0.010*
Monitor Academic	Checks to make sure that he or she has everything they need before leaving class or school.	67%	33%	2.16	0.015
Monitor Self/Social	Checks on his or her appearance, cleanliness and personal hygiene.	48%	10%	2.385	0.009*
Modulate Academic	Physical activity level fits the situation when doing school tasks (Not hyperactive or inactive).	71%	19%	3.32	0.001*
Modulate Self/Social	Physical activity level fits the situation when working in a group (Not hyperactive or inactive).	76%	14%	3.256	0.001*
Modulate Academic	Emotional response fits the situation when working on school tasks (Doesn't overreact or underact).	86%	29%	3.09	0.001*
Modulate Self/Social	Emotional response fits the situation when interacting with others (Doesn't overreact or underreact).	91%	24%	3.395	0.000*
Modulate Self/Social	Avoids being overstimulated or understimulated by sights, sounds, or touches.	71%	14%	3.542	0.000*

Correct Academic	Corrects errors that are made in school work.	86%	38%	2.494	0.006*
Correct Self/Social	Apologizes when aware of offending others.	86%	33%	2.79	0.003*
Balance Academic	Balances the elements of a school assignment (speed vs accuracy, quality vs quantity; general vs specific statements; depth vs breadth, etc.).	86%	33%	2.79	0.003*
Balance Self/Social	Maintains a balance in social situations (talking vs listening, sharing too much vs sharing too little; being humorous vs being serious).	71%	24%	3.09	0.001*
Balance Self/Social	Maintains a balance in his or her own activities (play vs work; time alone vs time with others; sleep vs awake).	86%	19%	3.395	0.001*

**indicates a statistically significant difference*

As shown in Table 4.7, statistically significant differences between teacher ratings of the EBD sample and the matched nonclinical group occurred for 12 of the 14 test items within the Optimization Cluster. 8 of the 12 items reflecting a statistically significant difference were within the Self/Social Arena. For all items, the clinical group was 2 to 5 times more likely than the nonclinical group to be rated as having deficits in the Optimization Cluster.

Table 4.8 shows only the proportions of the sample of students classified as EBD and the matched controls who were rated by teachers as exhibiting ESDs on the MEFS Optimization Cluster items.

Table 4.8
Proportions of the sample of students classified as EBD and student matched controls who were rated by teachers as exhibiting executive skills deficits on the MEFS Optimization Cluster items.

Optimization Cluster		EBD Proportion Rated as ESD	Matched Control Proportion Rated as ESD	Fisher's z	Significance Level (p<.01)
SREF Arena of Involvement	Item				
Monitor Academic	Checks school work to avoid careless errors on tests and other school work.	52%	5%	2.887	0.002*
Monitor Self/Social	Recognizes situations in which his or her behavior bothers or upsets others.	38%	5%	2.09	0.018
Monitor Academic	Checks to make sure that he or she has everything they need before leaving class or school.	38%	5%	2.09	0.018
Monitor Self/Social	Checks on his or her appearance, cleanliness and personal hygiene.	14%	0%	.961	0.168
Modulate Academic	Physical activity level fits the situation when doing school tasks (Not hyperactive or inactive).	33%	5%	1.819	0.035
Modulate Self/Social	Physical activity level fits the situation when working in a group (Not hyperactive or inactive).	33%	5%	1.819	0.035
Modulate Academic	Emotional response fits the situation when working on school tasks	38%	5%	2.09	0.018

	(Doesn't overreact or underact).				
Modulate Self/Social	Emotional response fits the situation when interacting with others (Doesn't overreact or underreact).	38%	5%	2.09	0.018
Modulate Self/Social	Avoids being overstimulated or understimulated by sights, sounds, or touches.	29%	0%	1.803	0.036
Correct Academic	Corrects errors that are made in school work.	24%	10%	.974	0.165
Correct Self/Social	Apologizes when aware of offending others.	43%	5%	2.357	0.009*
Balance Academic	Balances the elements of a school assignment (speed vs accuracy, quality vs quantity; general vs specific statements; depth vs breadth, etc.).	43%	10%	2.113	0.017
Balance Self/Social	Maintains a balance in social situations (talking vs listening, sharing too much vs sharing too little; being humorous vs being serious).	24%	5%	1.26	0.104
Balance Self/Social	Maintains a balance in his or her own activities (play vs work; time alone vs time with others; sleep vs awake).	33%	5%	1.819	0.035

**indicates a statistically significant difference*

As shown in Table 4.8, teacher ratings indicated more severe executive skill deficits for a larger percentage of students classified as EBD than for matched controls, but with statistically significant differences for only 2 of the 14 items within the Optimization Cluster. Statistically significant ESDs within the Optimization Cluster were split evenly both in the Academic and in the Self/Social Arenas.

Table 4.9 shows the proportions of the sample of students classified as EBD and the matched controls, who were rated by teachers as exhibiting either an EFD or an ESD on the MEFS Efficiency Cluster items.

Table 4.9
Proportions of the sample of students classified as EBD and the matched controls who were rated by teachers as exhibiting either an executive function deficit or an executive skill deficit on the MEFS Efficiency Cluster items.

Efficiency Cluster		EBD Proportion Rated as EFD or ESD	Matched Control Proportion Rated as EFD or ESD	Fisher's z	Significance Level (p<.01)
SREF Arena of Involvement	Item				
Sense Time Academic	Keeps track of time (e.g., realizes how much time has passed) when doing school tasks.	71%	43%	1.871	0.031
Sense Time Self/Social	Keeps track of time (e.g., realizes how much time has passed) when talking to or doing things with others.	71%	43%	1.871	0.031
Pace Academic	Changes pace (works slower or works faster) when taking tests or doing school assignments.	91%	52%	1.61	0.054

Pace Self/Social	Changes pace in social situations (for example, talks slower or talks faster to maintain the pace of the conversation).	81%	29%	3.09	0.001*
Routines Academic	Uses well-rehearsed or practiced routines for school tasks (for example, recognizing words by sight, printing or writing letters and words, reciting basic math facts).	67%	29%	2.472	0.007*
Routines Self/Social	Uses well-rehearsed or practiced social greetings or conversation starters.	62%	24%	2.494	0.006*
Routines Academic	Generate good ideas and gets them down on paper quickly and efficiently.	81%	48%	1.906	0.028
Routines Academic	Uses routines and strategies to do well on tests.	81%	48%	1.906	0.028
Routines Academic	Uses routines and strategies to get assignments and projects done.	91%	43%	2.201	0.010*
Routines Academic	Participates in discussions about topics that he or she knows a lot about.	62%	19%	2.739	0.003*
Routines Academic	Brings home all the materials need to complete homework and other school tasks.	81%	29%	3.09	0.001*

Routines Academic	Hands in homework, assignments or important papers when they are completed.	71%	38%	2.17	0.015
Sequence Academic	Gets the steps in the right order when working on school tasks.	71%	24%	3.09	0.001*
Sequence Self/Social	Gets the order of events right when telling stories or explaining things to others.	62%	24%	2.494	0.006*

**indicates a statistically significant difference*

As shown in Table 4.9, teacher ratings comparing students classified as EBD and the matched controls indicated statistically significant differences for 8 of the 14 items within the Efficiency Cluster. Deficits within the Efficiency Cluster were evident both in the Academic and in Self/Social Arenas, with a relatively even split between the two Arenas.

Table 4.10 shows only the proportions of the sample of students classified as EBD and student matched controls who were rated by teachers as exhibiting ESDs on the MEFS Efficiency Cluster items.

Table 4.10
Proportions of the sample of students classified as EBD and the matched controls who were rated by teachers as exhibiting executive skills deficits on the MEFS Efficiency Cluster items.

Efficiency Cluster		EBD Proportion Rated as ESD	Matched Control Proportion Rated as ESD	Fisher's z	Significance Level (p<.01)
SREF Arena of Involvement	Item				

Sense Time Academic	Keeps track of time (e.g., realizes how much time has passed) when doing school tasks.	43%	5%	2.357	0.009*
Sense Time Self/Social	Keeps track of time (e.g., realizes how much time has passed) when talking to or doing things with others.	38%	5%	2.09	0.018
Pace Academic	Changes pace (works slower or works faster) when taking tests or doing school assignments.	48%	5%	2.622	0.004*
Pace Self/Social	Changes pace in social situations (for example, talks slower or talks faster to maintain the pace of the conversation).	24%	0%	1.53	0.063
Routines Academic	Uses well-rehearsed or practiced routines for school tasks (for example, recognizing words by sight, printing or writing letters and words, reciting basic math facts).	24%	5%	1.26	0.104
Routines Self/Social	Uses well-rehearsed or practiced social greetings or conversation starters.	5%	0%	0.34	0.367
Routines Academic	Generate good ideas and gets them down on paper quickly and efficiently.	43%	10%	2.113	0.017

Routines Academic	Uses routines and strategies to do well on tests.	48%	0%	2.85	0.002*
Routines Academic	Uses routines and strategies to get assignments and projects done.	52%	5%	2.887	0.002*
Routines Academic	Participates in discussions about topics that he or she knows a lot about.	5%	0%	0.34	0.367
Routines Academic	Brings home all the materials need to complete homework and other school tasks.	33%	0%	2.069	0.019
Routines Academic	Hands in homework, assignments or important papers when they are completed.	33%	10%	1.557	0.060
Sequence Academic	Gets the steps in the right order when working on school tasks.	19%	5%	0.967	0.167
Sequence Self/Social	Gets the order of events right when telling stories or explaining things to others.	5%	0%	0.34	0.367

**indicates a statistically significant difference*

As shown in Table 4.10, statistically significant differences between the EBD sample and nonclinical groups occurred for 4 of the 14 items within the Efficiency Cluster. Notably, all statistically significant items rated as an ESD within the Efficiency Cluster were in the Academic Arena.

Table 4.11 shows the proportions of the sample of students classified as EBD and student matched controls who were rated by teachers as exhibiting either an EFD or an ESD on the MEFS Memory Cluster items.

Table 4.11
Proportions of the sample of students classified as EBD and student matched controls who were rated by teachers as exhibiting either an executive function deficit or an executive skill deficit on the MEFS Memory Cluster items.

Memory Cluster		EBD Proportion Rated as EFD or ESD	Matched Control Proportion Rated as EFD or ESD	Fisher's z	Significance Level (p<.01)
SREF Arena of Involvement	Item				
Hold/ Manipulate Academic	Can keep information in mind for short periods of time when doing school tasks. (For example, can add 3 or more numbers without pencil and paper; can remember directions that were just given by the teacher.)	71%	29%	2.777	0.003*
Hold/ Manipulate Self/Social	Can keep information in mind for short periods of time when talking with others. (For example, can follow and participate in a longer conversation.)	62%	19%	2.739	0.003*
Store/ Retrieve Academic	Stores and recalls specific information about school subjects no matter	81%	38%	2.494	0.006*

	how questions are worded.				
Store/ Retrieve Self/Social	Stores and recalls specific information about others or about social situations.	67%	19%	3.028	0.001*
Store/ Retrieve Academic	Does well on tests that require recall of stored facts no matter what test format is used.	81%	48%	1.906	0.028
Store/ Retrieve Self/Social	Does well in social situations that require recall of facts about others.	62%	24%	2.494	0.006*
Store/ Retrieve Self/Social	Does well in situations that require recall of facts about himself or herself.	52%	10%	2.656	0.004*

**indicates a statistically significant difference*

As shown in Table 4.11, teacher ratings indicated more severe executive function or executive skill deficits for a larger percentage of students classified as EBD than for matched controls. For all items, the clinical group was 2 to 5 times more likely than the nonclinical group to be rated as having deficits in the Memory Cluster. Statistically significant differences between teacher ratings of the EBD sample and the nonclinical group occurred for 6 of the 7 test items within the Memory Cluster. Four of the 6 items that reached statistical significance were within the Self/Social Arena.

Table 4.12 shows only the proportions of the sample of students classified as EBD and student matched controls who were rated by teachers as exhibiting ESDs on the MEFS Memory Cluster items.

Table 4.12

Proportions of the sample of students classified as EBD and student matched controls who were rated by teachers as exhibiting executive skills deficits on the MEFS Memory Cluster items.

Memory Cluster		ADHD Proportion Rated as ESD	Matched Control Proportion Rated as ESD	Fisher's z	Significance Level ($p<.01$)
SREF Arena of Involvement	Item				
Hold/ Manipulate Academic	Can keep information in mind for short periods of time when doing school tasks. (For example, can add 3 or more numbers without pencil and paper; can remember directions that were just given by the teacher.)	24%	10%	0.974	0.165
Hold/ Manipulate Self/Social	Can keep information in mind for short periods of time when talking with others. (For example, can follow and participate in a longer conversation.)	14%	10%	0.343	0.366
Store/ Retrieve Academic	Stores and recalls specific information about school subjects no matter how questions are worded.	24%	5%	1.26	0.104
Store/ Retrieve Self/Social	Stores and recalls specific information about others or about social situations.	10%	0%	0.658	0.255

Store/ Retrieve Academic	Does well on tests that require recall of stored facts no matter what test format is used.	38%	10%	1.837	0.033
Store/ Retrieve Self/Social	Does well in social situations that require recall of facts about others.	19%	10%	0.667	0.252
Store/ Retrieve Self/Social	Does well in situations that require recall of facts about himself or herself.	14%	0%	0.961	0.168

**indicates a statistically significant difference*

As shown in Table 4.12, teacher ratings indicated more severe executive skill deficits for a larger percentage of students classified as EBD than for matched controls. However, statistically significant differences between teacher ratings of the EBD sample and nonclinical group did not occur for any of the items within the Memory cluster.

Table 4.13 shows the proportions of the sample of students classified as EBD and student matched controls who were rated by teachers as exhibiting either an EFD or an ESD on the MEFS Inquiry Cluster items.

Table 4.13
Proportions of the sample of students classified as EBD and the matched controls who were rated by teachers as exhibiting either an executive function deficit or an executive skill deficit on the MEFS Inquiry Cluster items.

Inquiry Cluster		EBD Proportion Rated as EFD or ESD	Matched Control Proportion Rated as EFD or ESD	Fisher's z	Significance Level (p<.01)
SREF Arena of Involvement	Item				
Gauge Academic	Accurately estimates the	81%	48%	1.906	0.028

	difficulty of school tasks and/or tests and what it takes to complete them and/or do well with them.				
Gauge Self/Social	Figures out how to interact appropriately in various social situations.	71%	24%	3.09	0.001*
Anticipate Academic	Anticipates events at school. (for example, recognizes the need to prepare for tests or assignments; connects homework with grades, etc.).	81%	33%	2.79	0.003*
Anticipate Self/Social	Anticipates how what he or she says or does will affect how others feel, think or act.	91%	38%	2.494	0.006*
Anticipate Self/Social	Anticipates the consequences of his or her own thoughts, feeling and actions. (for example, recognizes that if he or she does not do a chore he or she will not be able to play with a friend and will feel disappointed about it).	91%	52%	1.61	0.054
Estimate Time Academic	Accurately estimates how long it will take to do something when involved with one or more school tasks.	86%	52%	1.61	0.054

Estimate Time Self/Social	Accurately estimates how long it will take to do something when talking to others or doing things with others.	76%	48%	1.906	0.028
Analyze Academic	Examines and analyzes things in more detail when doing school tasks.	71%	33%	2.472	0.007*
Analyze Self/Social	Examines and analyzes in more detail what others are saying or doing in social situations.	76%	43%	2.201	0.010*
Evaluate Academic	Evaluates the quality and/or adequacy of his or her work on school tasks.	86%	52%	1.61	0.054
Evaluate Self/Social	Evaluates the quality and/or adequacy of his or her social interactions.	86%	48%	1.906	0.028

**indicates a statistically significant difference*

The Inquiry Cluster indicated statistically significant differences between teacher ratings of the EBD sample and nonclinical group for 5 of the 11 items of the Inquiry Cluster. Review of the statistically significant items indicated a relatively even split between Inquiry Cluster EFDs or ESDs in the Academic and Self/Social arenas. In all cases, the EBD sample was close to 2 to 3 times more likely than the matched control group to receive deficit ratings.

Table 4.14 shows only the proportions of the sample of students classified as EBD and the matched controls who were rated by teachers as exhibiting ESDs on the MEFS Inquiry Cluster items.

Table 4.14
Proportions of the sample of students classified as EBD and the matched controls who were rated by teachers as exhibiting executive skills deficits on the MEFS Inquiry Cluster items.

Inquiry Cluster		EBD Proportion Rated as ESD	Matched Control Proportion Rated as ESD	Fisher's z	Significance Level (p<.01)
SREF Arena of Involvement	Item				
Gauge Academic	Accurately estimates the difficulty of school tasks and/or tests and what it takes to complete them and/or do well with them.	43%	5%	2.357	0.009*
Gauge Self/Social	Figures out how to interact appropriately in various social situations.	33%	0%	2.069	0.019
Anticipate Academic	Anticipates events at school. (for example, recognizes the need to prepare for tests or assignments; connects homework with grades, etc.).	38%	5%	2.09	0.018
Anticipate Self/Social	Anticipates how what he or she says or does will affect how others feel, think or act.	38%	5%	2.09	0.018
Anticipate Self/Social	Anticipates the consequences of his or her own thoughts, feeling and actions. (for example, recognizes that if he or she does not do a chore he or she will not be able to play with a friend and will	43%	5%	2.357	0.009*

	feel disappointed about it).				
Estimate Time Academic	Accurately estimates how long it will take to do something when involved with one or more school tasks.	38%	10%	1.837	0.033
Estimate Time Self/Social	Accurately estimates how long it will take to do something when talking to others or doing things with others.	29%	5%	1.543	0.061
Analyze Academic	Examines and analyzes things in more detail when doing school tasks.	33%	10%	1.557	0.060
Analyze Self/Social	Examines and analyzes in more detail what others are saying or doing in social situations.	19%	5%	0.967	0.167
Evaluate Academic	Evaluates the quality and/or adequacy of his or her work on school tasks.	43%	5%	2.357	0.009*
Evaluate Self/Social	Evaluates the quality and/or adequacy of his or her social interactions.	29%	5%	1.543	0.061

**indicates a statistically significant difference*

Table 4.14 shows that teacher ratings indicated more severe ESDs for larger percentages of students classified as EBD than for matched controls, but with statistically significant differences between teacher ratings of the EBD sample and nonclinical group occurring for only 3 of the 11 items within the Inquiry Cluster. 2 items in the Academic Arena and only 1 item in the Self/Social Arena produced a statistically significant difference of ESD ratings between the EBD sample and nonclinical group.

Table 4.15 shows the proportions of the sample of students classified as EBD and the matched controls who were rated by teachers as exhibiting either an EFD or and ESD on the MEFS Solution Cluster items.

Table 4.15
Proportions of the sample of students classified as EBD and student matched controls who were rated by teachers as exhibiting either an executive function deficit or an executive skill deficit on the MEFS Solution Cluster items

Solution Cluster		EBD Proportion Rated as EFD or ESD	Matched Control Proportion Rated as EFD or ESD	Fisher's z	Significance Level (p<.01)
SREF Arena of Involvement	Item				
Generate Academic	Comes up with new ways to solve problems with school tasks.	100%	57%	1.309	0.095
Generate Self/Social	Come up with new ideas about things to say to, or do with, others.	91%	43%	2.201	0.010*
Associate Academic	Sees or understands how two or more things or ideas are similar and can use that knowledge to solve a problem with school work.	81%	38%	2.494	0.006*
Associate Self/Social	Sees or understands how one social situation can be similar to another and can use that knowledge to solve a social relationship problem.	86%	38%	2.494	0.006*

Organize Academic	Organizes school tasks.	76%	52%	1.61	0.053
Organize Self/Social	Organizes age appropriate social activities.	67%	38%	1.854	0.032
Plan Academic	Makes plans for school tasks.	86%	38%	2.494	0.006*
Plan Self/Social	Makes plans for age appropriate social activities.	76%	19%	3.618	0.000*
Plan Self/Social	Makes plans for the use of his or her own time.	67%	19%	3.028	0.001*
Prioritize Academic	Orders school tasks according to their relevance, importance, or urgency.	86%	38%	2.494	0.006*
Prioritize Self/Social	Handles social activities according to their relevance, importance or urgency.	71%	38%	2.17	0.015
Decide Academic	Makes own decisions about what to do for school and/or when to do it.	81%	33%	2.79	0.003*
Decide Self/Social	Makes own decisions about what to do with others and/or when to do it.	71%	29%	2.777	0.003*

**indicates a statistically significant difference*

Table 4.15 shows statistically significant differences between teacher ratings of the EBD and nonclinical group for 9 of the 13 items within the Solution Cluster. Review of the statistically significant items indicated a relatively even split between Solution Cluster EFDs and ESDs in the Academic and Self/Social arenas.

Table 4.16 shows only the proportions of the sample of students classified as EBD and the matched controls who were rated by teachers as exhibiting ESDs on the MEFS Solution Cluster items.

Table 4.16
Proportions of the sample of students classified as EBD and student matched controls who were rated by teachers as exhibiting executive skills deficits on the MEFS Solution Cluster items.

Solution Cluster		ADHD Proportion Rated as ESD	Matched Control Proportion Rated as ESD	Fisher's z	Significance Level (p<.01)
SREF Arena of Involvement	Item				
Generate Academic	Comes up with new ways to solve problems with school tasks.	43%	5%	2.357	0.009*
Generate Self/Social	Come up with new ideas about things to say to, or do with, others.	14%	0%	.961	0.168
Associate Academic	Sees or understands how two or more things or ideas are similar and can use that knowledge to solve a problem with school work.	33%	5%	1.819	0.035
Associate Self/Social	Sees or understands how one social situation can be similar to another and can use that knowledge to solve a social relationship problem.	19%	5%	.967	0.167
Organize Academic	Organizes school tasks.	52%	10%	2.656	0.004*

Organize Self/Social	Organizes age appropriate social activities.	19%	0%	1.251	0.106
Plan Academic	Makes plans for school tasks.	38%	10%	1.837	0.033
Plan Self/Social	Makes plans for age appropriate social activities.	19%	0%	1.251	0.106
Plan Self/Social	Makes plans for the use of his or her own time.	19%	5%	0.967	0.167
Prioritize Academic	Orders school tasks according to their relevance, importance, or urgency.	43%	10%	2.113	0.017
Prioritize Self/Social	Handles social activities according to their relevance, importance or urgency.	24%	5%	1.26	0.104
Decide Academic	Makes own decisions about what to do for school and/or when to do it.	48%	10%	2.385	0.009*
Decide Self/Social	Makes own decisions about what to do with others and/or when to do it.	29%	5%	1.543	0.061

**indicates a statistically significant difference*

As shown in Table 4.16, statistically significant differences between teacher ESD ratings of the EBD sample and the nonclinical group occurred for only 3 of the 13 items within the Solution Cluster, all observed within the Academic Arena.

Table 4.17 shows the proportions of the sample of students classified as EBD and the matched controls who were rated by teachers as exhibiting delayed development on the MEFS Self-Realization items.

Table 4.17
Proportions of the sample of students classified as EBD and student matched controls who were rated by teachers as exhibiting delayed development on the MEFS Self-Realization items.

Self-Realization Cluster		EBD Proportion Delayed	Matched Control Proportion Delayed	Fisher's z	Significance Level (p<.01)
Awareness of Self	Makes realistic comments about his or her own mental and emotional strengths and weaknesses.	19%	5%	0.967	0.167
Awareness of Self	Makes realistic comments about his or her own physical abilities.	14%	14%	0.000	0.500
Awareness of Self	Makes realistic comments about what he or she feels or thinks about himself or herself.	24%	38%	-1.001	0.158
Awareness of Others	Makes realistic comments about the mental and emotional strengths and weaknesses of others.	29%	14%	0.982	0.163
Awareness of Others	Makes realistic comments about the physical abilities of others.	19%	14%	0.346	0.365
Awareness of Others	Makes realistic comments about what he or she thinks other people feel or think about others.	19%	10%	0.667	0.252
Awareness of Others	Makes realistic comments about what he or she thinks others feel or think about him or her.	29%	5%	1.543	0.061
Awareness of Others	Makes realistic comments about what he or she thinks other	19%	19%	0.000	0.500

	people feel or think about themselves.				
Self-Analysis	Realistically analyzes and comments about his or her school performance.	33%	10%	1.557	0.06
Self-Analysis	Realistically analyzes and comments about his or her ability to know what others appear to think or feel about him or her.	24%	10%	0.974	0.165
Self-Analysis	Realistically analyzes and comments about his or her ability to manage himself or herself.	29%	19%	0.677	0.249

As shown in Table 4.17, no statistically significant differences occurred between ratings of students classified as EBD and their nonclinical peers within the Self-Realization Cluster. For all but 3 of the 9 items, however, students classified as EBD were rated to have higher proportions of Self-Realization delays compared with their nonclinical counterparts.

Table 4.18 shows the proportions of the sample of students classified as EBD and the matched controls who were rated by teachers as exhibiting delayed development on the MEFS Self-Determination items.

Table 4.18
Proportions of the sample of students classified as EBD and student matched controls who were rated by teachers as exhibiting delayed development on the MEFS Self-Determination items.

Self-Determination Cluster	EBD Proportion Delayed	Matched Control Proportion Delayed	Fisher's z	Significance Level ($p<.01$)

Goal-Setting	States realistic goals for schooling based on personal interests.	38%	5%	2.09	0.018
Goal-Setting	States realistic goals for work beyond school based on personal interests.	38%	10%	1.837	0.033
Goal-Setting	Expresses strong desires to make his or her own decisions about what to do rather than be told what to do by parents or others.	14%	19%	-0.346	0.365
Long-Term Planning	States realistic plans for accomplishing long-term schooling goals.	52%	19%	2.167	0.015
Long-Term Planning	States realistic plans for accomplishing long-term work goals.	43%	14%	1.857	0.032
Long-Term Planning	States realistic plans for accomplishing social and/or personal goals.	38%	14%	1.573	0.058

**indicates a statistically significant difference*

As shown in Table 4.18, no statistically significant differences occurred between ratings of students classified as EBD and their nonclinical peers within the Self-Determination Cluster. For all but 1 of the 6 items, however, students classified as EBD were rated as having a higher proportion of Self-Determination delays compared with their nonclinical counterparts.

CHAPTER 5

DISCUSSION

Discussion of Findings

The purpose of the research study was to determine if teachers' ratings of students' executive functions (EFs) and executive skills (ESs) differ significantly among a group of students who are identified as EBD (Emotionally Disturbed or Behaviorally Disordered), compared with a group of matched controls. More specifically, the study sought to determine if teachers' ratings of students identified as EBD, as compared with the matched controls, indicated a pattern of EF or ES deficits among the items of the 7 Self-Regulation Clusters and the Self-Realization and Self-Determination Clusters. Furthermore, the study examined item ratings to determine if more deficits were noted in the self/social arena than in the academic arena for the students classified as EBD. Table 5.1 summarizes the statistically significant findings when comparing the EBD group with matched controls.

Table 5.1

Summary of the significant differences when comparing students classified as EBD with matched controls who were rated by teachers as exhibiting executive capacity deficits

Cluster	EBD > Control P < .001				Control > EBD P < .001			
	EFD + ESD		ESD Only		EFD + ESD		ESD Only	
	Aca	S/S	Aca	S/S	Aca	S/S	Aca	S/S

Attention	1/3	3/3	0/3	0/3	0/3	0/3	0/3	0/3
Perceive	1/1	1/1	0/1	0/1	0/1	0/1	0/1	0/1
Focus	0/1	1/1	0/1	0/1	0/1	0/1	0/1	0/1
Sustain	0/1	1/1	0/1	0/1	0/1	0/1	0/1	0/1
Engagement	3/8	11/14	3/8	2/14	0/8	0/14	0/8	0/14
Initiate	0/1	1/1	0/1	0/1	0/1	0/1	0/1	0/1
Energize	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Inhibit	1/1	6/6	1/1	2/6	0/1	0/6	0/1	0/6
Stop	0/1	‘1/2	0/1	0/2	0/1	0/2	0/1	0/2
Interrupt	0/1	1/1	0/1	0/1	0/1	0/1	0/1	0/1
Flexible	2/2	2/2	2/2	2/2	0/2	0/2	0/2	0/2
Shift	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Optimization	4/6	8/8	1/6	1/8	0/6	0/8	0/6	0/8
Monitor	0/2	2/2	1/2	0/2	0/2	0/2	0/2	0/2
Modulate	2/2	3/3	0/2	0/3	0/2	0/3	0/2	0/3
Correct	1/1	1/1	0/1	1/1	0/1	0/1	0/1	0/1
Balance	1/1	2/2	0/1	0/2	0/1	0/2	0/1	0/2
Efficiency	6/10	‘3/4	4/10	0/4	0/10	0/4	0/10	0/4
Sense Time	0/1	0/1	1/1	0/1	0/1	0/1	0/1	0/1
Pace	0/1	1/1	1/1	0/1	0/1	0/1	0/1	0/1

Using Routines	5/7	1/1	2/7	0/1	0/7	0/1	0/7	0/1
Sequence	1/1	1/1	0/1	0/1	0/1	0/1	0/1	0/1
Memory	2/3	4/4	0/3	0/4	0/3	0/4	0/3	0/4
Hold/Manipulate	1/1	1/1	0/1	0/1	0/1	0/1	0/1	0/1
Store/Retrieve	1/2	3/3	0/2	0/3	0/2	0/3	0/2	0/3
Inquiry	2/5	3/6	2/5	1/6	0/5	0/6	0/5	0/6
Gauge	0/1	1/1	1/1	0/1	0/1	0/1	0/1	0/1
Anticipate	1/1	1/2	0/1	1/2	0/1	0/2	0/1	0/2
Estimate Time	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Analyze	1/1	1/1	0/1	0/1	0/1	0/1	0/1	0/1
Evaluate	0/1	0/1	1/1	0/1	0/1	0/1	0/1	0/1
Solution	4/6	5/7	1/6	0/7	0/6	0/7	0/6	0/7
Generate	0/1	1/1	0/1	0/1	0/1	0/1	0/1	0/1
Associate	1/1	1/1	0/1	0/1	0/1	0/1	0/1	0/1
Organize	0/1	0/1	1/1	0/1	0/1	0/1	0/1	0/1
Plan	1/1	2/2	0/1	0/1	0/1	0/1	0/1	0/1
Prioritize	1/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Decide	1/1	1/1	0/1	0/1	0/1	0/1	0/1	0/1
TOTAL	22/41	37/46	11/41	4/46	0/41	0/46	0/41	0/46

	Cluster	Cluster
Self-Realization	0/11	0/11
Awareness of Self	0/5	0/5
Awareness of Others	0/3	0/3
Self-Analysis	0/3	0/3
Self-Determination	0/6	0/6
Goal-Setting	0/3	0/3
Long-Term Planning	0/3	0/3

Research Question 1. Do teacher ratings of students classified as Emotionally or Behaviorally Disordered identify any specific patterns of EF strengths and weaknesses and ES deficits within the Self-Regulation, Self-Realization and Self-Determination Clusters that are different from patterns exhibited by a group of matched controls?

Attention Cluster

Teacher ratings of the EBD-classified group identified combined EFD + ESD deficits ranging from 57% to 76% for the 6 items of the Attention Cluster. In contrast, teacher ratings of the matched controls identified combined EFD + ESD deficits for only 19% to 48% for the 6 items of the Attention Cluster. Statistically significant differences between the proportion of combined deficits identified for the EBD-classified group and the matched sample occurred for 4 of the 6 items of the Attention Cluster. Consistent with the hypothesis, all 3 of the items representing the Self/Social Arena of Involvement, but only 1 item representing the Academic Arena of Involvement reflected a significantly

larger proportion of deficits for the EBD-classified students than for the matched controls.

Teacher ratings of the EBD-classified group identified ESD only deficits ranging from 5% to 24% for the 6 items of the Attention Cluster. In contrast, teacher ratings of the matched controls identified ESD only deficits for only 0% to 14% for the 6 items of the Attention Cluster. Statistically significant differences between the proportion of ESD only deficits identified for the EBD-classified group and the matched sample occurred for 0 of the 6 items of the Attention Cluster. Teacher ratings for all items but one in the Academic Arena indicated more severe skill deficits for a larger percentage of students classified as EBD than for matched controls. Consistent with the hypothesis, all of the items representing the Self/Social Arena of Involvement reflected a larger proportion of ESD only deficits for the EBD-classified students than for the matched controls.

Engagement Cluster

Teacher ratings of the EBD-classified group identified combined EFD + ESD deficits ranging from 62% to 95% for the 22 items of the Engagement Cluster. In contrast, teacher ratings of the matched controls identified combined EFD + ESD deficits for only 14% to 48% for the 22 items of the Engagement Cluster. Statistically significant differences between the proportion of combined deficits identified for the EBD-classified group and the matched sample occurred for 14 of the 22 items of the Engagement Cluster. Consistent with the hypothesis, 11 of the 14 items representing the Self/Social Arena of Involvement, but only 3 items representing the Academic Arena of Involvement reflected a significantly larger proportion of deficits for the EBD-classified students than for the matched controls.

Teacher ratings of the EBD-classified group identified ESD only deficits ranging from 5% to 48% for the 22 items of the Engagement Cluster. In contrast, teacher ratings of the matched controls identified ESD only deficits for only 0% to 10% for the 22 items of the Engagement Cluster. Statistically significant differences between the proportion of ESD only deficits identified for the EBD-classified group and the matched sample occurred for 5 of the 22 items of the Engagement Cluster. Review of the 5 statistically significant items indicated a relatively even split between Engagement Cluster ESDs in the Academic and Self/Social arenas.

Optimization Cluster

Teacher ratings of the EBD-classified group identified combined EFD + ESD deficits ranging from 48% to 91% for the 14 items of the Optimization Cluster. In contrast, teacher ratings of the matched controls identified combined EFD + ESD deficits for only 10% to 48% for the 14 items of the Optimization Cluster. Statistically significant differences between the proportions of combined deficits identified for the EBD-classified group and for the matched sample occurred for 12 of the 14 items of the Optimization Cluster. Consistent with the hypothesis, all 8 of the items representing the Self/Social Arena of Involvement but only 4 items representing the Academic Arena of Involvement reflected a significantly larger proportion of deficits for the EBD-classified students than for the matched controls.

Teacher ratings of the EBD-classified group identified ESD only deficits ranging from 14% to 52% for the 14 items of the Optimization Cluster. In contrast, teacher ratings of the matched controls identified ESD only deficits for only 0% to 10% for the 14 items of the Optimization Cluster. Statistically significant differences between the

proportion of ESD only deficits identified for the EBD-classified group and the matched sample occurred for 2 of the 14 items of the Optimization Cluster. Review of the 2 statistically significant items indicated an even split between Optimization Cluster ESDs in the Academic and Self/Social arenas.

Efficiency Cluster

Teacher ratings of the EBD-classified group identified combined EFD + ESD deficits ranging from 62% to 91% for the 14 items of the Efficiency Cluster. In contrast, teacher ratings of the matched controls identified combined EFD + ESD deficits for only 10% to 48% for the 14 items of the Efficiency Cluster. Statistically significant differences between the proportion of combined deficits identified for the EBD-classified group and the matched sample occurred for 9 of the 14 items of the Efficiency Cluster. Consistent with the hypothesis, 7 of the 8 items representing the Self/Social Arena of Involvement reflected a significantly larger proportion of deficits for the EBD-classified students than for the matched control, but only 6 items of the 10 representing the Academic Arena of Involvement reflected a significantly larger proportion of deficits.

Teacher ratings of the EBD-classified group identified ESD only deficits ranging from 5% to 52% for the 14 items of the Efficiency Cluster. In contrast, teacher ratings of the matched controls identified ESD only deficits for only 0% to 10% for the 14 items of the Efficiency Cluster. Statistically significant differences between the proportion of ESD only deficits identified for the EBD-classified group and the matched sample occurred for 4 of the 14 items of the Efficiency Cluster. Review of the 4 statistically significant items indicated that all Efficiency Cluster ESDs were reflected in the Academic Arena.

Memory Cluster

Teacher ratings of the EBD-classified group identified combined EFD + ESD deficits ranging from 52% to 81% for the 7 items of the Memory Cluster. In contrast, teacher ratings of the matched controls identified combined EFD + ESD deficits for only 10% to 48% for the 7 items of the Memory Cluster. Statistically significant differences between the proportion of combined deficits identified for the EBD-classified group and the matched sample occurred for 6 of the 7 items of the Memory Cluster. Consistent with the hypothesis, all 4 of the items representing the Self/Social Arena of Involvement reflected a significantly larger proportion of deficits for the EBD-classified students than for the matched controls.

Teacher ratings of the EBD-classified group identified ESD only deficits ranging from 10% to 38% for the 7 items of the Memory Cluster. In contrast, teacher ratings of the matched controls identified ESD only deficits for only 0% to 10% for the 7 items of the Memory Cluster. Statistically significant differences between the proportion of ESD only deficits identified for the EBD-classified group and the matched sample occurred for 0 of the 7 items of the Memory Cluster.

Inquiry Cluster

Teacher ratings of the EBD-classified group identified combined EFD + ESD deficits ranging from 71% to 91% for the 11 items of the Inquiry Cluster. In contrast, teacher ratings of the matched controls identified combined EFD + ESD deficits for only 24% to 52% for the 11 items of the Inquiry Cluster. Statistically significant differences between the proportion of combined deficits identified for the EBD-classified group and the matched sample occurred for 5 of the 11 items of the Inquiry Cluster. Consistent with

the hypothesis, there were more items representing the Self/Social Arena of Involvement compared with the Academic Arena that reflected a significantly larger proportion of deficits for the EBD-classified students than for the matched controls.

Teacher ratings of the EBD-classified group identified ESD only deficits ranging from 19% to 43% for the 11 items of the Inquiry Cluster. In contrast, teacher ratings of the matched controls identified ESD only deficits for only 0% to 10% for the 11 items of the Inquiry Cluster. Statistically significant differences between the proportion of ESD only deficits identified for the EBD-classified group and the matched sample occurred for 3 of the 11 items of the Inquiry Cluster. Review of the 3 statistically significant items indicated Inquiry Cluster ESDs were reflected in both the Academic and in the Self/Social Arena.

Solution Cluster

Teacher ratings of the EBD-classified group identified combined EFD + ESD deficits ranging from 67% to 100% for the 13 items of the Solution Cluster. In contrast, teacher ratings of the matched controls identified combined EFD + ESD deficits for only 19% to 57% for the 13 items of the Solution Cluster. Statistically significant differences between the proportion of combined deficits identified for the EBD-classified group and the matched sample occurred for 9 of the 13 items of the Solution Cluster. Consistent with the hypothesis, there were more items representing the Self/Social Arena of Involvement compared with the Academic Arena that reflected a significantly larger proportion of deficits for the EBD-classified students than for the matched controls.

Teacher ratings of the EBD-classified group identified ESD only deficits ranging from 14% to 52% for the 13 items of the Solution Cluster. In contrast, teacher ratings of

the matched controls identified ESD only deficits for only 0% to 10% for the 13 items of the Solution Cluster. Statistically significant differences between the proportion of ESD only deficits identified for the EBD-classified group and the matched sample occurred for only 1 of the 13 items of the Solution Cluster, which was observed within the Academic Arena.

Self-Realization Cluster

Teacher ratings of the EBD-classified group identified delayed development ranging from 14% to 33% for the 11 items of the Self-Realization Cluster. In contrast, teacher ratings of the matched controls identified delayed development ranging from 5% to 38% for the 11 items of the Self-Realization Cluster. Statistically significant differences between the proportion of Self-Realization delays identified for the EBD-classified group and the matched sample occurred for 0 of the 11 items of the Self-Realization Cluster. For all but 3 of the 11 Self-Realization items, however, students classified as EBD were rated to have higher proportions of Self-Realization delays compared with their nonclinical counterparts. Consistent with the hypothesis, a larger proportion of teacher ratings of the EBD-classified group reflected developmental delays within the Self-Realization Cluster than the ratings of the matched controls.

Self-Determination Cluster

Teacher ratings of the EBD-classified group identified delayed development ranging from 14% to 52% for the 6 items of the Self-Determination Cluster. In contrast, teacher ratings of the matched controls identified delayed development ranging from 5% to 19% for the 6 items of the Self-Determination Cluster. Statistically significant differences between the proportion of Self-Determination delays identified for the EBD-

classified group and the matched sample occurred for 0 of the 6 items of the Self-Determination Cluster. For all but 1 of the 6 Self-Determination items, however, students classified as EBD were rated as having higher proportions of Self-Determination delays compared with their nonclinical counterparts. Consistent with the hypothesis, a larger proportion of teacher rating of the EBD-classified group reflected developmental delays within the Self-Determination Cluster than the ratings of the matched controls.

Research Question 2. Do teacher ratings of students classified as Emotionally or Behaviorally Disordered identify any specific patterns of EF strengths and weaknesses and ES deficits at the level of individual Self-Regulation executive capacities that are different from patterns exhibited by a group of matched controls or the MEFS nonclinical standardization sample?

Self-Regulation Capacities within the Attention Cluster

Within the Attention Cluster, statistically significant differences between the proportion of combined EFD + ESD deficits identified for the EBD-classified group and the matched controls occurred for both the Academic and for the Self/Social items of the Perceive capacity. In contrast, only the Self/Social items of the Focus and Sustain capacities reflected statistically significant differences between the EBD-classified group and the matched controls. These findings are consistent with the hypothesis that EBD classified students have more difficulty regulating attention capacities in situations involving self or social activities than in situations involving academic tasks. Additionally, the EBD-classified group has significantly more difficulty than matched controls with knowing when to pay attention and what to do when performing academic tasks.

Within the Attention Cluster, statistically significant differences between the proportion of ESD only deficits identified for the EBD-classified group and the matched controls occurred for none of the Academic or the Self/Social items of the Perceive, Focus, and Sustain capacities.

Self-Regulation Capacities within the Engagement Cluster

Within the Engagement Cluster, statistically significant differences between the proportion of combined EFD + ESD deficits identified for the EBD-classified group and the matched controls occurred for both the Academic and the Self/Social items of the Inhibit and Flexible capacities. In contrast, only the Self/Social items of the Initiate, Stop, and Interrupt capacities reflected statistically significant differences between the EBD-classified group and the matched controls. These findings are consistent with the hypothesis that EBD classified students have more difficulty than non-classified peers with the engagement of their executive capacities in situations involving self or social activities and when performing academic tasks.

Within the Engagement Cluster, statistically significant differences between the proportion of ESD only deficits identified for the EBD-classified group and the matched controls occurred for both the Academic and for the Self/Social items of the Inhibit and Flexible capacities. A larger proportion of the EBD-classified group was rated as having difficulty knowing how to inhibit impulsive responding and how to be flexible than the matched controls.

Self-Regulation Capacities within the Optimization Cluster

Within the Optimization Cluster, statistically significant differences between the proportion of combined EFD + ESD deficits identified for the EBD-classified group and

the matched controls occurred for both the Academic and for the Self/Social items of the Modulate, Correct, and Balance capacities. In contrast, only the Self/Social items of the Monitor capacity reflected statistically significant differences between the EBD-classified group and the matched controls. These findings are consistent with the hypothesis that EBD classified students have difficulty with the optimization of their executive capacities in situations involving self or social activities. Also consistent with the stated hypotheses, a significantly greater proportion of the EBD-classified group were rated as having more difficulty than matched controls with knowing when to modulate, balance and correct when performing academic tasks.

Within the Optimization Cluster, statistically significant differences between the proportion of ESD only deficits identified for the EBD-classified group and the matched controls occurred for the Academic items only for the Monitor capacity. Additionally within this cluster, statistically significant differences between the proportion of ESD only deficits identified for the EBD-classified group and the matched controls occurred for the Self/Social items only of the Correct capacity.

Self-Regulation Capacities within the Efficiency Cluster

Within the Efficiency Cluster, statistically significant differences between the proportion of combined EFD + ESD deficits identified for the EBD-classified group and the matched controls occurred for both the Academic and for the Self/Social items of the Using Routines and Sequence capacities. In contrast, only the Self/Social items of the Pace capacity reflected statistically significant differences between the EBD-classified group and the matched controls. These findings are consistent with the hypothesis that EBD classified students have difficulty with the efficiency of their executive capacities in

situations involving self or social activities. Also consistent with the stated hypotheses, a significantly greater proportion of the EBD-classified group than the matched controls was rated as having difficulty with knowing when to adjust their work pace and when to cue the use of routines when performing academic tasks.

Within the Efficiency Cluster, statistically significant differences between the proportion of ESD only deficits identified for the EBD-classified group and the matched controls occurred for the Academic items of the Sense Time, Pace, and Using Routines capacities. No statistically significant differences between the proportion of ESD only deficits identified for the EBD-classified group and the matched controls occurred for the Self/Social items for the Estimate Time, Pace, Use Routines or Sequence executive capacities.

Self-Regulation Capacities within the Memory Cluster

Within the Memory Cluster, statistically significant differences between the proportion of combined EFD + ESD deficits identified for the EBD-classified group and the matched controls occurred for both the Academic and for the Self/Social items of the Hold/Manipulate and Store/Retrieve capacities. Consistent with the stated hypotheses, the EBD-classified group has significantly more difficulty than matched controls with knowing when to cue and engage their memory executive capacities when performing both self/social and academic tasks.

Within the Memory Cluster, statistically significant differences between the proportion of ESD only deficits identified for the EBD-classified group and the matched controls occurred for none of the Academic or Self/Social items for the Hold/Manipulate or Store/Retrieve capacities.

Self-Regulation Capacities within the Inquiry Cluster

Within the Inquiry Cluster, statistically significant differences between the proportion of combined EFD + ESD deficits identified for the EBD-classified group and the matched controls occurred for both the Academic and for the Self/Social items of the Anticipate and Analyze capacities. In contrast, only the Self/Social items of the Gauge capacity reflected statistically significant differences between the EBD-classified group and the matched controls. These findings are consistent with the hypothesis that EBD classified students have difficulty with the executive capacities of Anticipating, Gauging, Analyzing in situations involving self or social activities. Also consistent with the stated hypotheses, a significantly greater proportion of the EBD-classified group was rated as having more difficulty than matched controls only with knowing when to Anticipate and when to Analyze when performing academic tasks.

Within the Inquiry Cluster, statistically significant differences between the proportion of ESD only deficits identified for the EBD-classified group and the matched controls occurred for the Academic items only of the Gauge and Evaluate capacities. Within this same cluster, statistically significant differences between the proportion of ESD only deficits identified for the EBD-classified group and the matched controls occurred for the Self/Social items only of the Anticipate capacity.

Self-Regulation Capacities within the Solution Cluster

Within the Solution Cluster, statistically significant differences between the proportion of combined EFD + ESD deficits identified for the EBD-classified group and the matched controls occurred for both the Academic and the Self/Social items of the Associate, Plan, and Decide capacities. In contrast, only the Self/Social items of the

Generate capacity reflected statistically significant differences between the EBD-classified group and the matched controls. Additionally, only the Academic items of the Prioritize capacity reflected statistically significant differences between the EBD-classified group and the matched controls. These findings are consistent with the stated hypotheses that the EBD classified students have difficulty with Inquiry Cluster executive capacities in situations involving self or social activities, as well as situations involving academic tasks.

Within the Solution Cluster, statistically significant differences between the proportion of ESD only deficits identified for the EBD-classified group and the matched controls occurred for the Academic items only of the Organize capacities. No statistically significant differences between the proportion of ESD only deficits identified for the EBD-classified group and the matched controls occurred for the Self/Social items in any of the Solution Cluster executive capacities.

Executive Capacities within the Self-Realization Cluster

Counter to the stated hypotheses, no statistically significant differences were found between the EBD-classified group and the matched controls in the proportions of teacher ratings indicating developmental delays in awareness of self, awareness of others, or analysis of self and others.

Executive Capacities within the Self-Determination Cluster

Counter to the stated hypotheses, no statistically significant differences were found between the EBD-classified group and the matched controls in the proportions of teacher ratings indicating developmental delays in goal-setting or long-term planning.

Summary of the Findings

The results of this study are consistent with the current body of research demonstrating that numerous EF difficulties are associated with psychopathologies and mental health disorders, especially in children (Arnsten, 2009; Arnsten & Robbins, 2002). Frequently reported executive aspects that are found to be impaired in those with psychiatric conditions, such as inhibition, focusing, initiating, monitoring, organization, planning, shifting, flexibility, and memory, were also implicated in this present study for a clinical group. As the research highlights, these inadequately developed EFs affect many different aspects of an individual's' day-to-day life across various domains of functioning. Not only do weak EFs influence learning and successful execution of academic tasks (Levine, 1999), but they also affect social/emotional health and interpersonal relations. Supporting this very notion of broad influence, outcomes of the current study indicated that students with mental health disorders possessed increased deficiencies both in academic and in social functioning. Not only was this group rated as having more significant impairments of their self-regulation executive capacities within social contexts, but they also exhibited many difficulties with their self-regulation executive capacities when engaged in school tasks.

Congruent with the findings of this study, prior to analyzing this data, the author predicted that individuals classified as EBD would present with elevated teacher ratings on the MEFS in many self-regulation executive functions in comparison with the matched control group. Comparison between groups found that a greater proportion of students who were in the Emotionally Disturbed/Behaviorally Disordered sample were consistently judged as having both executive function and executive skill deficits across

all seven clusters, for each of the 31 Self-Regulation Executive Capacities, and within both the Academic and Self/Social Arenas. Conversely, much smaller proportions of students in the non-clinical matched sample were rated as having executive function and/or executive skill deficits than those reported for the EBD-classified sample.

Also, prior to analyzing this data, this author predicted that students classified as EBD would present with elevated teacher ratings on the MEFS in both Arenas of Involvements as compared with their matched control group. Results indicated that the EBD sample did have increased deficits in both Arenas of Involvement as compared with the matched control group. It was also predicted that these same students in the EBD sample would present with even higher elevated ratings in the Self/Social Arena of Involvement as compared with the Academic Arena. Comparison of within groups indicated that the EBD sample was consistently rated as having a higher proportion of deficits within the Academic Arena when compared with the Self/Social Arena across a majority of the clusters and individual self-regulation executive capacities. However, in both arenas, a high proportion of the EBD sample struggled to make effective use of their executive capacities in order to engage in school tasks, such as completion of assignments and tests, as well as interaction with others and displays of effective self-control.

Additionally, supporting this hypothesis, comparison between groups revealed that the EBD sample presented with more items related to self/social deficits than with academic deficits. Twenty-five of the 31 SREC's (80%) were significant within the Self/Social items, compared with 16 of the 31 SREC's (52%) that were significant in the Academic Arena. More specifically, only the Self/Social items of the Focus and Sustain

capacities in the Attention Cluster reflected statistically significant differences between the EBD-classified group and the matched controls. Within the Engagement Cluster, only the Self/Social items of the Initiate, Stop, and Interrupt capacities reflected statistically significant differences between the EBD-classified group and the matched controls. Within the Optimization Cluster, only the Self/Social items of the Monitor capacity reflected statistically significant differences between the EBD-classified group and the matched controls. Within the Efficiency Cluster, only the Self/Social items of the Pace capacity reflected statistically significant differences between the EBD-classified group and the matched controls. Within the Memory Cluster, statistically significant differences between the proportion of combined EFD + ESD deficits identified for the EBD-classified group, and the matched controls occurred for both the Academic and the Self/Social items of the Hold/Manipulate and Store/Retrieve capacities. Within the Inquiry Cluster, only the Self/Social items of the Gauge capacity reflected statistically significant differences between the EBD-classified group and the matched controls. Last, within the Solution Cluster, only the Self/Social items of the Generate capacity reflected statistically significant differences between the EBD-classified group and the matched controls.

When comparing executive function and skill deficits *combined* to executive skill deficits *only*, as a group, students in the EBD sample were rated as having lower proportions of executive skill only deficits compared with executive function/executive skill deficits across all clusters and SREC's. This indicates that many students in the EBD sample were viewed as lacking awareness of when or how to cue the executive skill; however, many of them were judged to be able to make use of this executive skill when

prompted. Similarly, more students in the matched control group were viewed as uncertain about "when" the executive skill is needed, as opposed to a lack of knowledge about "how" to perform the execute skill or a lack of practice with performing the skill.

The EBD sample had higher proportions of delayed development in the upper tier Self-Realization and Self-Determination Clusters for all executive capacities within these clusters when compared with the matched control, but these differences, although consistent, were not statistically significant. These findings were not consistent with the stated hypothesis that students classified as EBD would be rated as having significantly more developmental delays than matched controls.

Implications of Findings

The findings of this study lend support to the hypothesis that individuals with psychiatric conditions possess many executive capacity deficits across multiple arenas. Given the multiplicity of deficits prevalent in this group, the measurement of executive functions should be an integral component of psychological and educational evaluations. This could then lead to much better insight about how these EF impairments are interfering with different areas of functioning, such as academic production and/or behavior. With this greater understanding and knowledge, interventions can then be designed and implemented in order to address the specific deficits of that individual, and possibly improve the outcomes of intervention efforts with this population.

Such tailored intervention can be accomplished only through a comprehensive and multidimensional assessment that encompasses a broad range of executive functions and skills, rather than taking a unitary approach. This study illustrates the need for this level of assessment, such as the MEFS. Through the use of this rating scale, the

identification of a constellation of executive capacity weaknesses was possible for the participants. Unfortunately, the results of this study did not indicate any specific aspects of executive control that could be considered strengths for students classified as EBD. Assessment of the executive functions of these individuals at this level more significantly helps clinicians, educators, and parents gain a greater understanding of the pervasiveness of the difficulties these individuals may be experiencing in terms of their abilities to self-regulate perceptions, feelings, thoughts, and actions. This improved understanding can lead to more accurate and effective clinical decision-making and improved planning and implementation of intervention efforts.

This study also highlights the importance of identifying whether the nature of the problem is an executive function deficit or an executive skill deficit. This distinction between Expressive Executive Skills (Executive Skill Deficit) and Directive Executive Functions (Executive Function Deficit) for the self-regulation capacities is built into the rating system of the MEFS. Through this unique rating system, it was apparent that the EBD sample presented with more executive function deficits than with executive skill deficits. This is crucial when planning and implementing interventions for these students. Although an individual may be capable of using an Expressive Executive Skill, he or she may fail to apply the skill independently due to inadequate development of the Directive Executive Function that cues it. For example, teachers rated a higher proportion of the students in the EBD sample as being able to sustain attention (adequate Expressive Executive Skill), yet they lacked awareness of situations in which sustained attention is needed (inadequate Directive Executive Function).Therefore, interventions for students with executive function deficits would focus on increasing awareness of those situations

which require the cueing and engagement of this executive skill. However, if executive skill deficits are identified, interventions will begin with the teaching of the skill and practicing how to perform this skill.

The MEFS also takes into account the dissociation of these executive functions across multiple arenas of involvement. A student can be self-regulating effectively in one arena, but self-regulating ineffectively in another arena. As such, their self-regulation executive functions and skills can vary greatly depending on the arena within which they are being employed.

This is especially important when assessing individuals with mental health disorders because their primary EF deficits related to emotional control deficits are thought to be primarily within the context of the interpersonal arena (part of the Self/Social Arena Combination within the MEFS). The EBD sample in this current study were rated by teachers as having a significantly greater proportion of executive capacity deficits with the effective use of their executive functions and skills in the Self/Social Arena than a matched control sample, in the case of 80% of all the items within the Self/Social Area. Additionally, the EBD-classified students also were rated by teachers as having a significantly greater proportion of executive capacity deficits with the effective use of their executive functions and skills in the Academic Arena than a matched control sample, in the case of 54% of all the items within the Self/Social Arena. These results emphasize the need to assess executive function and skill deficits across Arenas in order to identify appropriate interventions effectively.

Additionally, some children assessed with the MEFS will exhibit very specific patterns of executive functions strengths and deficits. The specificity of these deficits

identified by this rating scale could allow for the development of a specific intervention plan targeting specific deficits. For this study, however, the students in the EBD-classified sample assessed with the MEFS, presented with multiple executive function and executive skill deficits for multiple executive functions across both Arenas of Involvement. This is not surprising for this population because they struggle with an array of executive difficulties related to inhibition, switching, flexibility, organization, planning, modulating, monitoring, problem-solving (generating and associating), and more; all of these can greatly contribute to impairment in daily functioning. Therefore, it will be necessary to prioritize findings so that intervention plans can focus on a few of the most severe deficits.

By addressing multiple domains of functioning and arenas of involvement that may be influenced differently by emotional difficulties, the structure of the MEFS could lead to better assessment and understanding of how and why EF is so broadly influenced across mental health disorders. Ideally, this will lead to improvements in interventions and more targeted treatment for those with executive function deficits and mental health disorders. Furthermore, increased understanding of the EF deficits present across various psychopathological disorders may aid in the acceptance of, and compliance with interventions that may lead to better functioning in the home, school, and community for this population of students.

Last, individuals who suffer from mental health disorders, such as depression and anxiety, are commonly prescribed medication in order to treat the occurring symptoms. Although this medication may be effective in reducing certain symptoms related to the disorder, no medicine addresses every EF. Medication may help the brain understand

what to do in order to accomplish something by "waking up" or activating the EF workers; however, it is important to help the individual understand how to get the manager functioning without the aid of medication. Additionally, medicine is a form of external control, which means this is simply responding to the demands of the medication, rather than teaching the brain to self-regulate. Because the goal is to be internally driven and self-regulated, which yields better results, strategies must also be taught in conjunction with the medicine to cue the EF skill internally and address even the EFs that medicine may be helpful with.

Limitations

There are several limitations to this study that are likely to affect the validity of the results and limit the generalizability of the findings. The limitations include the sample size and demographics of the sample, as well as confounding variables and statistical limitations unaccounted for in this study. These limitations affected the findings and influenced the conclusion of whether or not those identified with emotional disturbance demonstrate significantly more impaired executive functions than their non-clinical counterpart.

Sample Size. This study consisted of a sample size of only 21 students classified as EBD. Due to the limited number of individuals involved in this study, the sample is not a true representation of the population and restricts the generalizability of findings. Ratings may not be indicative of students, especially from school districts with differing environments and that may be very different from the study sample racially, ethnically, culturally, linguistically, and socioeconomically.

Confounding Teacher Variables. Factors, such as teachers' ages, years of teaching experience, and years of training and development that may influence teachers' judgments were not explored in this present study. Thus, the validity of the teachers' ratings is limited due to the variability in the unaccounted characteristics of each teacher. Further, an unconscious psychological phenomena, such as unintentionally judging with severity or leniency (Linacre, 1989), may influence the consistency and accuracy of teachers' ratings of students' use of EFs.

Additionally, research provides evidence that raters potentially rate their students according to characteristics not intended by the questions, but rather, by outside qualities. Therefore, the result might be a halo effect (Nisbett & Wilson, 1977) due to teacher bias, including varying teacher interpretations of the scale's items and varied perceptions of the students whom they rated. Teachers may rate more positively those students for whom they have a preference; however, they may not rate in the same favorable manner those who do not have the same preferential relationship with the teacher. This phenomenon could have led to very positive EF ratings for the non-clinical sample, even though they actually may struggle with the effective use of some EFs. Conversely, students classified as EBD may be rated as having deficits in all areas of EF because of a negative relationship with the teacher who is doing the rating.

Confounding Student Variables. Student factors, such as gender or ethnicity, may also affect the outcomes of this study. For instance, students who belong to an ethnic group that may be associated in some teachers' minds with a low socioeconomic status may be rated lower regarding their EFs. Additionally, gender could have impacted

results. Males and females often display different executive function profiles, and differences in executive functions are especially pronounced between boys and girls who have behavior disorders, such as conduct disorders. These sex differences could have led teachers to rate males as having lower EF abilities and skills than females. While data regarding demographic characteristics of the students in the sample, such as ethnic group membership and gender, was obtained and reported, the potential impact of these demographic variables was not accounted for as a part of this study.

Statistical Limitations. There are also statistical limitations to the current study. Although results may indicate a relationship between emotional disturbance and executive function skills, causal implications cannot be made. Additionally, differences in executive dysfunction may be found between the clinical and non-clinical sample; however, causal relationships are unknown. Therefore, unknown mediating or moderating factors may pose as alternative explanations for the results presented in the study.

Future Directions

The current study established a relationship between executive functions and emotional and behavioral disorders in a sample size of 21 students identified as EBD. Future research should extend to other populations, especially students from school districts that may vary greatly in racial, ethnic, and socioeconomic backgrounds. It may also be beneficial for future research to measure executive functions for those with mental disorders from the perspective of the students and parents. Additionally, it may be interesting to use additional measurements of executive function that differ in modality, such as norm-referenced assessments, in conjunction with this rating scale, to determine

if the two forms of assessments are consistent with their characterizations of executive function strengths and weaknesses. Last, it would be interesting to administer the MEFS to one group of individuals with internalizing disorders and then to a separate group of individuals with externalizing disorders in order to compare and contrast their executive functions. At an even deeper level of assessment, specifying diagnosis (depression, anxiety, ADHD, etc.) may also allow researchers to differentiate between EF profiles of individuals with varying mental health disorders.

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