Investigation of Working Memory Across Behavioral and Executive Function Variables in Adolescents with Emotional Disturbance

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INVESTIGATION OF WORKING MEMORY ACROSS BEHAVIORAL AND EXECUTIVE FUNCTION VARIABLES IN ADOLESCENTS WITH EMOTIONAL DISTURBANCE

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Submitted in Partial Fulfillment of the Requirements of the Degree of Doctor of Psychology
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PHILADELPHIA COLLEGE OF OSTEOPATHIC MEDICINE
DEPARTMENT OF PSYCHOLOGY

Dissertation Approval

This is to certify that the thesis presented to us by Eleazar Cruz Eusebio on the 22nd day of July, 2010, in partial fulfillment of the requirements for the degree of Doctor of Psychology, has been examined and is acceptable in both scholarship and literary quality.

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Abstract

Newer insights into working memory may have important implications for understanding varying cognitive abilities in adolescents and their corresponding degrees of success and efforts to accomplish real-world goals. It is important to investigate the construct of working memory in relation to academic, behavioral, and emotional success at school for students classified with an Emotionally Disturbance (ED). In the educational system, students are classified as ED, based upon IDEA regulations present within a multiplicity of these cognitive, behavioral, socio-emotional, and academic difficulties. The associated cognitive deficits often involve poor working memory skills thought to be related to frontal lobe processes. Considering the seat of psychopathology to be within the frontal-subcortical circuitry, one can assume that cognitive processes such as working memory may be relationally involved with certain behavioral phenotypes. This is especially true when accounting for executive deficits often observed in students with ED. This study purports that a relationship may exist between working memory processing, executive dysfunction, and behavioral difficulties in students with ED. Utilizing the WISC-IV Working Memory Index (WMI) as a measure of working memory processing, the BASC-2 to determine behavioral typology, and the BRIEF to determine deficits of executive functioning, this study revealed no relationships between varying levels of working memory processing, executive deficits, or distinct behavioral phenotypes in this sample of students with ED. Although these results are in direct opposition to studies demonstrating relationships amongst these variables, the results must be viewed in lieu of several limitations in the study. Future research could benefit from investigation of cognitive, behavioral, and executive function variables in students with ED as they are often considered a homogeneous group.
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Chapter 1
Introduction

The number of students in the United States who present with disabling conditions for which they require specialized educational instruction and supportive academic accommodations is of great importance and interest to school psychologists and educational professionals. According to the United States Surgeon General, annually, one in five children exhibit signs and symptoms of a DSM-IV disorder and five percent of children suffer from an emotional disorder that causes severe impairment (U.S. Public Health Service, 2000). Most students classified as Emotionally Disturbed (ED) in the schools present with a variety of psychiatric disorders in combination with behavioral and associated academic, social, and attention problems (Boucher, C. R., 1999; Roberts, Vernberg, Biggs, Randall, & Jacobs, 2007). ED students meet the criteria for disorders ranging from, Major Depressive Disorder (MDD), Anxiety Disorder, and Obsessive Compulsive Disorder (OCD) to Bipolar Depressive Disorder (BDD), child and adolescent Personality Disorders, and emotionally based conditions such as Post Traumatic Stress Disorder (PTSD) and Panic Disorder (PD) (Bower, 2006). Some ED students have a diagnosis of two or more of these disorders (Egger & Angold, 2006; Friedman, Katz-Levy, Manderscheid, Sondheimer, & Mattison, 1996; Wagner, 1995) accounting for considerable comorbidity and heterogeneity in disorders within the ED construct. In the schools, a special education classification of ED is reserved for students who are considered the most severe population in this population due to idiosyncratic behavior problems and academic skill deficits that require distinct prevention and treatment programs (Costello, Messer, Bird, Cohen, Reinherz, 1998; Popkin & Skinner, 2003).

Since the enactment of the Public Law 94-142, the Education of All Handicapped Children Act of 1975, less than one percent of school children have been identified for special
education and related services as having an emotional disturbance (Tharinger, Laurent, & Best, 1986). Since then and continuing with 2004 revisions, the term emotional disturbance has been applied under the Individuals with Disabilities Education Act (IDEA; Code of Federal Regulations, Title 34, Section 300.7(c)(4)(i)). The percentage of school children actually identified and served in the special education category of Emotional Disturbance (ED) remains slightly less than 1% of children enrolled in school today (U.S. Department of Education, 2007). The twenty-first century report by the U.S. Surgeon General noted that about one in five children and youth receive classifications of ED; however, some estimates suggest the true prevalence is probably three to six times greater (Wagner, Kutash, Duchnowski, & Epstein, 2005). Reasons for under identification of ED include economic factors, concern about stigmatized labeling, confusion among clinicians and professionals, and a vague definition of the construct (U.S. Department Public Health Service, 2000).

A thorough understanding of the ED construct may provide useful evidence for more effective diagnostic assessments for classification purposes and individualized interventions to use in the schools. Discussions of varied and often seemingly ambiguous procedures utilized in assessing ED according to federal, state, and district procedures have brought up the issue of proper identification for special education services (Wagner et al., 2005). Similar to the classification of Specific Learning Disability (SLD), the ED construct is rather heterogeneous by nature with children being identified as ED due to internalizing, externalizing, and executive function behavior problems (Paduska & Kenzier, 2001). Indeed, this poses several concerns about how to program for these disparate types of children with ED. It appears then that the ED classification lacks specificity and requires a more stringent and detailed assessment protocol in which clinicians can guide their conceptualization of the conditions. A more streamlined and
specific protocol to suggest or recommend the classification may also be considered and implemented by clinicians across the United States. Investigating which type of problem is evident in the ED student can be useful in designing effective intervention (Wagner, et al., 2005).

Various conditions associated with Emotional Disturbance have a distinct neuropsychological basis. Working Memory (WM) and Executive Function (EF) are two critical neuropsychological constructs that have great impact on the cognitive, academic, and behavioral functioning of students classified as Emotionally Disturbed (ED).

Research indicates evidence of frontal lobe/executive dysfunction in several of these select mental disorders and conditions ranging from ADHD, Unipolar Depression, Bipolar Depression (BD), Mood Disorder, Generalized Anxiety Disorder (GAD) and other anxiety disorders, Tourette's Syndrome, Obsessive Compulsive Disorder (OCD), Autism Spectrum Disorder (ASD) and Pervasive Developmental Disorder Not Otherwise Specified (PDD NOS), Conduct Disorder (CD) and Oppositional Defiant Disorder (ODD) (McCloskey, Hewitt, Henzel, & Eusebio, 2009). A large body of research indicates associated deficits in working memory in children with learning difficulties in reading (Gathercole, Alloway, Willis, & Adams, 2006a; Gathercole, Lamont, & Alloway, 2006b; Siegel & Ryan, 1989; Swanson, 2003), mathematics (Bull & Scerif, 2001; Geary, Hoard, Byrd-Craven, & DeSoto, 2004; Gersten, Jordan, & Flojo, 2005) language (Archibald & Gathercole, 2006b; Weismer, Plante, Jones, & Tomblin (2005); Montogomery, 2003), and attention (Barkley, 1997; Martinussen & Tannock, 2006). Alloway, Gathercole, Kirkwood, and Elliott (2009) found that children with working memory problems have an exceptionally high risk of making poor academic progress and display a highly distinctive profile of inattentive behavior, learning difficulties, low self-esteem, and other behavioral problems typically seen in children classified with an Emotional Disturbance. In
addition, these behavioral conditions are often associated with a compromised prefrontal cortex posing the devastating effects on academic learning and scholastic functioning often seen in children and adolescents categorized as Emotionally Disturbed (Leonard-Zabel & Feifer, 2009).

**Statement of the Problem**

Given the fact that the neuropsychological literature has clearly established how WM and EF deficits can adversely affect behavior and academic learning and production, it seems imperative that measures of WM and EF be included when assessing the cognitive and behavioral capacities of students being considered for classification as ED. Although WM measures such as the WISC-IV Working Memory Index (WMI) and EF measures such as the Behavior Rating Inventory of Executive Functions (BRIEF, Gioia, Isquith, Guy, & Kenworthy, 2000b) are available for use by school psychologists, the clinical utility of these instruments in relation to the identification of ED has not been investigated in depth. The current study examines the performance of students classified as ED on the WISC-IV WMI subtests and select BRIEF and BASC-2 scales in an effort to increase understanding of what these measures indicate about student working memory, executive function capacities, and behavior.

**Research Questions**

1. How do middle school students classified as ED perform on the WISC-IV WMI?

2. How do middle school students classified as ED perform on the BASC-2 Hyperactivity, Anxiety, Attention, and Depression Scales?

3. How do middle school students classified as ED perform on the BRIEF Inhibit, Emotional Control, Working Memory, and Plan/Organize Scales?

4. What are the relationships among WISC-IV Working Memory Index level of performance and BASC-2 and BRIEF scale teacher ratings?
Chapter 2

Review of the Literature

Working Memory

Working Memory (WM) is thought to be one of the most important mental faculties critical for success with tasks involving planning, problem solving, and reasoning (Ashcraft & Radvansky, 2010). A variety of theories and models reflect diverse and often disparate perspectives on the nature, structure, and functions of WM (Anderson, Reder, & Lebiere, 1996; Baddeley, 1996; Barnard, 1985; Cowan, 1988; Ericsson & Kintsch, 1995; Just & Carpenter, 1992; Schneider & Detweiler, 1988). The term “working memory” has been used in various ways by different communities of researchers in behavioral neuroscience, education, and cognitive psychology (Shah & Miyake, 1999).

Behavioral neuroscientists have been attempting to pin down the pathways by which attention and working memory are critical to the influence and likelihood of future performance. Rowland and Kentros (2011) have discovered indirect pathways from the cingulate to some areas of the midtemporal lobe as important in the process of stabilizing neuronal activity in the formation of memories.

In education, researchers have discovered the importance and influence of working memory on the success of learning and comprehension in reading and other academic areas (Anderson, 2000; Bruning, Schraw, & Ronning, 1999). There appears to be strong evidence of a relationship between the active processing of information in WM and the performance of traditional executive functions such as suppression and the inhibitory control of attention in education (Barkley, 1990; Barkley, 1997d).
In cognitive psychology, WM is the theoretical construct that has been used specifically to refer to the system or mechanism underlying the maintenance of task-relevant information during the performance of a cognitive task (Baddeley & Hitch, 1974; Baddeley, 2002; Daneman & Carpenter, 1980). Barkley (1997) described an individual’s working memory as having the characteristics of what we now believe are our executive functions. Baddeley (1986) further suggest that working memory represents a control system with limits on its storage and on its processing capabilities, but with a specific function to transfer information to long-term memory. This function appears to play a significant role in whether or not an individual can successfully translate information into stored knowledge for work and academic success.

WM has been described as a mechanism that holds events in the mind, manipulates or acts on the events, imitates complex behavioral sequences, provides hindsight and forethought, gives an individual an anticipatory set and a sense of time, and organizes individual behavior (Barkley, 1997). Although a single definition of working memory has not been universally agreed upon, most psychologists favor the conceptualization of WM, at least in part, as a temporary storage system that provides a useful workplace in which complex cognitive activities can be conducted (Ashcraft & Radvansky, 2010).

A large number of studies suggest the presence of deficits in dorsolateral prefrontal cortex (PFC) functioning during performance of WM tasks in individuals with severe emotional problems such as schizophrenia (Barch, Csernansky, & Snyder, 2003). However, WM deficits may also be present in other psychiatric disorders, such as anxiety and major depression (Channon, Baker, Robertson, 1993; Darke, 1988). For example, it has been observed through the use of functional magnetic resonance (fMRI) imaging, that individuals with major depression
appear to demonstrate impaired prefrontal activation during performance of WM tasks (Barch et al., 2003).

Eysenck (1979, 1985) has suggested that anxiety interferes with the normal functioning of WM. Eysenck (1985) further proposed that the cognitive performance deficits often associated with elevated levels of anxiety reflect an underlying restriction in the functional Working Memory Capacity (WMC). Redick and Engle (2006) argue that this WMC is the ability to control attention reinforcing the connections of working memory to one’s ability to attend (Redick & Engle, 2006). Furthermore, Schmeichel, Volokhov, and Demaree (2008) found that WMCs and a higher cognitive ability contribute to better control of one’s emotional response. Because anxiety problems are common among the internalizing problems exhibited by many children and adolescents classified as ED, it is important to examine its influence on the relationship between ED and WM deficits. WM deficits have been identified in students demonstrating difficulties with self-regulation such as impulse control problems and poor judgment, (Barkley, 1998). Students identified as Emotionally Disturbed tend to have great difficulty in these areas and often need assistance and interventions such as self-monitoring and evaluating their choices to manage throughout the school day.

Executive Functions

Because the frontal lobes have a variety of responsibilities in education, it is necessary to look to their function when examining academic and behavioral success in the schools. The frontal lobes house the prefrontal cortex (PFC) which is the most well connected area of the brain as well as the most widely responsible for Executive Function (EF). The three primary cortices responsible for EF within the PFC are the dorsolateral prefrontal cortex (DPC), the anterior cingulate cortex (ACC), and the orbitofrontal cortex (OFC).
Malfunctioning or underdeveloped executive functions appear to lead to many adverse academic, emotional, and social effects for students and, particularly, among those classified as having an ED. In addition to assisting children in cognitive and academic areas, executive functions play a key role in the ability to self-regulate. The self-control capacities of a child with executive function difficulties will be influenced negatively to some degree by a child's prevailing emotional state. Negative moods associated with depression, anxiety, and other emotional disturbances can have a tremendous impact on how a child perceives, feels, thinks, and acts. In turn, negative mood states influence the child's capacity for self-control and can perpetuate one's moods (McCloskey et al., 2009). Without proper treatment, executive function difficulties have a profoundly negative impact on the quality of life of the child and on those around them, thereby perpetuating emotional distress and continuing the cycle.

Many researchers and clinicians think of the frontal lobes as the area of the brain where executive function resides and accomplishes its work. The Diagnostic Statistics Manual (DSM) is often thought of as a behavioral user's guide to all the possible things that can go wrong with the frontal lobes. This is particularly concerning when frontal lobe functions are operationally defined as all executive capacities in combination with working memory processes (Arnsten & Robbins, 2002; Goldberg, 2002; Lichter & Cummings, 2001; McCloskey et al., 2009; Miller & Cummings, 2007; Pennington, Bennetto, McAleer, & Roberts, 1996; Stuss & Knight, 2002). Therefore, it is critical not to reduce the definition of executive function to what the frontal lobes do and continue to ascertain whether or not they are a manifestation of the frontal cortex, the neuronal tracts that connect the frontal lobes to the rest of the brain, or both. It is more important to understand that an individual’s frontal lobes are widely understood as having a clear involvement with EFs (Pennington & Ozonoff, 1996; Stuss & Knight, 2002).
Executive Function is a term that has been established in the literature and defined in a variety of ways from an array of viewpoints. Therefore, finding the best and most applicable working definition for the term Executive Function involves looking into the extensive history of the term over the past several decades. It is not enough to define it simply as a complex construct of many systems or as an entity describing a sum of its many parts or functions.

The term Executive Function has been used for many different abilities, including planning, organization, attention, self-regulation, initiation, working memory, inhibition, self-monitoring, and a variety of other constructs carried out by the pre-frontal cortex. In 1966, A. R. Luria described Executive Function as an individual's ability to correctly evaluate his or her own behavior and the adequacy of his or her actions (Luria, 1966). Then, in 1973, Pribram followed with a description of executive programming as a means to maintain brain organization (Pribram, 1973). Stuss and Benson (1986) described executive function as “a variety of different capacities that enable purposeful, goal-directed behavior, including behavioral regulation, working memory, planning and organizational skills and self-monitoring” (Stuss & Benson, 1986). Soon after, Welsh and Pennington (1988) defined the construct as “the ability to maintain an appropriate problem-solving set for attainment of a future goal” (Welsh & Pennington, 1988). In 1995, Lezak described executive function as “a collection of interrelated cognitive and behavioral skills that are responsible for purposeful, goal-directed activity” and further, how and whether a person “goes about doing something” (Lezak, 1995). Shortly after, in 1996, Denckla described EF as “a set of domain-general control processes” (Denckla, 1996) and, in the same year, Roberts and Pennington called it “a collection of related but somewhat distinct abilities such as planning, set maintenance, impulse control, working memory, and attentional control” (Roberts & Pennington, 1996). In 2000, Gioia, Isquith, Guy, and Kenworthy saw Executive
Function as “a collection of processes that are responsible for guiding, directing, and managing cognitive, emotional, and behavioral functions” (Gioia, Isquith, Guy, & Kenworthy, 2000). In 2001, Barkley referred to the EFs as the “general forms or classes of self directed actions that humans use in self-regulation” (Barkley, 2001). In 2004, Delis described EF as the ability to manage and regulate one’s behavior (Delis, Kramer, Kaplan, & Holdnack, 2004). McCloskey, Perkins, and Van Divner (2009) defined it as “a diverse group of highly specific cognitive processes collected together to direct cognition, emotion, and motor activity” as well as “the ability to engage in purposeful, organized, strategic, self-regulated, goal directed behavior” (McCloskey, Perkins, & Van Divner, 2009). In 2010, Dawson and Guare described the term in which “executive” skills allow us to organize our behavior over time” (Dawson & Guare, 2010). Then, Barkley (2011) stated EF is simply a self-directed set of actions (Barkley & Fischer, 2011). Finally, in 2012, Naglieri, Das, and Goldstein defined executive function as how efficiently an individual does what he or she you decide to do. (Naglieri, Das, & Goldstein, 2012).

In addition to the variety of definitions for Executive Function, researchers tend to subscribe to one of a few popular viewpoints. Some equate EF to the intelligence's "g" much like a conductor of an orchestra, an executive for a company or a soccer coach in which the relationship involves an orchestration of a set of cognitive skills. A second viewpoint is that EF is a set of supervisory skills in which the orchestration is handled by co-conductors, a set of executive administrators, or a coaching staff. Still, another viewpoint is that EF is an umbrella term for a set of complex cognitive skills. Whichever viewpoint one prefers, EF continues to involve how efficiently an individual does something while utilizing various cognitive skills.
Given the fact that Executive Function as a cognitive construct has been widely researched and defined, it is critical to understand that whichever definition one uses, the effects of deficiency, dysfunction, or poor functioning within the component abilities can be devastating, particularly in school-aged children. Because of the complexity of compounding areas of concern, comorbidity of disorders, and neurophysiological differences in children diagnosed with an Emotional Disturbance (ED), it appears completely plausible that these children also have difficulties with Executive Function.

Specific EF components that may cause compounding school difficulties for ED children are Response Inhibition, Self-Regulation, Self-Monitoring, Attentional Control, Working Memory, Planning/Organizing, Task Initiation, Setting Goals, and Cognitive Flexibility/Shift. Response Inhibition is the ability to inhibit responses such as blurting out answers or acting without thinking. Self-Regulation and Self-Monitoring involves self-control and insight when difficulty in this area may lead to poor impulse control and problems in learning from past experiences. Attentional Control is the ability to stay focused for a sufficient period of time to complete tasks without distraction. Working Memory is the ability to temporarily store information so that complex cognitive activities can be conducted. Difficulties with Planning/Organization can lead to inefficient use of time. Task Initiation problems can lead to reduction in self-generated behaviors and procrastination. Difficulties with Setting and Achieving Goals can lead to problems with students staying on course. Finally, difficulties with Cognitive Flexibility can lead to perseveration on thoughts, concepts, or tasks and with difficulty shifting to separate tasks. All of these executive function components are areas that might provide great difficulty for a child with an Emotional Disturbance.
One problem with taking an empirical approach to identifying the major components of EF is that there is an absence of a consensus and, subsequent definition of EF. However, there are areas of EF that are typically found as deficits within populations of school aged children who suffer from conditions ranging from Anxiety and Depression, Bipolar Disorder, ADHD, DBD, ODD and CD, and Learning Disabilities. Children who have one or more of these conditions to a pervasive and debilitating degree are often identified as having an Emotional Disturbance, typically if they have experienced significant difficulties regulating and monitoring their behaviors while at school. Students with Anxiety Disorders and PTSD tend to have EF deficits in set-shifting, cognitive flexibility, concept formation, interference control, and verbal fluency. Some studies have suggested a degree of sensitivity with EF tasks in identifying unipolar depression in older children, but with less specificity (Emerson, Mollet, & Harrison, 2005). Several other studies have identified the comorbidity between mood disorders and bipolar disorder and impairments in EF in adolescents, particularly with working memory and set shifting (Barkley, 2002; Biederman, Monuteaux, Doyle, Seidman, Wilens, Ferrero, Morgan, & Faraone, 2004). Furthermore, there is a growing consensus regarding the nature of Bipolar Disorder among children who also experience EF difficulties (Ahn, Breeze, Makris, Kennedy, Hodge, Herbert, & Frazier, 2007; Cateno, Olvera, Glahn, Fonseca, Pliszka, & Soares., 2005; Pavuluri, Schenkel, Aryal, Harral, Hill, Herbener, & Sweeney, 2006). EF impairments measured in children with ADHD tend to reflect specific rather than global impairments; however, they can negatively affect academic performance and are typically a comorbid condition. A child with ADHD may have minimal to significant EF deficits and the relationship is not specific to the conditions (Piek, Dyck, Nieman, Anderson, Hay, Smith, McCoy, & Hallmayer, 2004). Early reviews reported initially that EF deficits were not characteristic of children and adolescents with
ODD and CD after co-morbid ADHD was factored out of the equation. However, more recent studies suggest that inhibition and working memory deficits may be characteristic of both ADHD and CD (Barkley, 2006, Barkley, 2001).

Although students identified as having an Emotional Disturbance may also have learning disabilities that compound their difficulties at school, not all ED students have a diagnosable LD. Specific EF deficits that are related to academic performance are planning, organization, shift, and inhibit; however, more research is necessary to look further into these areas. Wagner (1995) suggests that the working memory and executive function deficits found in children classified with ED contribute to the poor classroom performance of these children and places them at greater risk of not completing high school.

**Emotional Disturbance**

Teachers and parents often report that students classified as having an Emotional Disturbance (ED) have a variety of cognitive, behavioral, and emotional problems at school and at home. The emotionally dysregulated behaviors exhibited many of these students are a result of frontal-subcortical circuit dysfunction (Stuss & Knight, 2002; LeDoux, 1996). Students identified as having emotional and behavioral issues appear to have improper executive functioning as a common core feature (McCloskey, Hewitt, Henzel, & Eusebio, 2009). These students tend to have primary difficulties with executive function in self-regulation, one of the key skills often needed to gain academic success (Giancola, Mezzich, & Tarter, 1998). It is important for children and adolescents to identify and regulate their emotions and feelings as essential and fundamental skills crucial for their success. When investigating the cognitive processes related to Emotional Disturbance (ED) in children and adolescents, it is important to examine the different overarching subtypes of the population. Children with ED can demonstrate
a variety of types, ranging from the internalizing (anxiety/depressive disorders) to the externalizing disorders (ADHD, oppositional defiant disorder) with these same disorders being mediated by frontal-subcortical circuits (Cummings, 1993). Not all children with ADHD have difficulties in the schools; however, if the condition is severe enough, and comorbid with another psychological disorder or combined with elevated environmental stress, the student may seek special accommodations or services as a student with an Emotional Disturbance.

In addition to the EF deficits, students with ED often have problems with working memory processes. A large number of studies suggest the presence of deficits in dorsolateral prefrontal cortex function during the performance of working memory tasks in individuals with severe emotional problems and schizophrenia (Barch, Csernansky, & Snyder, 2003). However, working memory deficits may also be present in other psychiatric disorders, such as major depression. People with major depression also appear to demonstrate impaired prefrontal activation while performing working memory tasks as seen through the use of functional magnetic resonance imaging (fMRI) (Barch et al., 2003). M.W. Eysenck (1979, 1985) has suggested that anxiety interferes with the normal functioning of working memory. Because anxiety problems are among the internalizing issues of children with ED, it is pertinent to investigate the effect that elevated anxiety has on working memory. Eysenck (1985) proposed that the cognitive performance deficits often associated with elevated levels of anxiety reflect an underlying restriction in the functional capacity of working memory.

On an empirical note, the EF deficits and problems with working memory processing contribute to the functional performance of students with ED in the classroom. ED students have more difficulty attending school and successfully achieving the requirements necessary to pass their classes and experience elevated difficulties in completing schoolwork (Wagner, 1995).
Further research suggests that the lack of academic and social supports, reactive and negative teaching styles, and frequent placement changes contribute to poor academic achievement within the ED population (Kortering & Blackorby, 1992). Many students classified as ED have difficulties functioning successfully in regular education classes and are given special education services typically offered in separate classroom environments for all or most of their academic classes. These students need the assistance of special education instruction and intervention from qualified special education teachers for a variety of academic, behavioral, and social concerns (Mattison & Felix, 1997). Particularly important for those students with ED are the utilization of instructional support teams, child study teams, and school-based intervention teams in developing and implementing positive behavioral supports (Eber, Nelson, & Miles, 1997; Garruto & Rattan, 2009).

Emotionally dysregulated behaviors exhibited by many ED students are a result of these kinds of functioning due to frontal-subcortical circuit dysfunction (Stuss & Knight, 2002; LeDoux, 1996). Students identified as having emotional and behavioral issues appear to have improper executive functioning as a common core feature (McCloskey, Hewitt, Henzel, & Eusebio, 2009). These students tend to have primary difficulties with executive function in self-regulation, one of the key skills often needed to gain academic success (Giancola, Mezzich, & Tarter, 1998). It is important for children and adolescents to identify and regulate their emotions and feelings as essential and fundamental skills crucial for their success in academic and social settings.

The frontal circuits are still mysteriously elusive, even as researchers gain understanding of frontal and prefrontal functions. One or a combination of all or any the circuits involving the frontal lobes can be dysfunctional for a student with an ED (Lichter & Cummings, 2001). For
example, students with ED are often unable to initiate and then unable to inhibit, thereby, demonstrating highly perseverative behaviors (Williams, Barnhofer, Crane, Herman, Raes, Watkins, & Dalgleish, 2007) often seen with autism. The dorsolateral prefrontal circuit is related to the anterior-lateral prefrontal executive functions and a dysfunction in this area leads to the classic signs of attention deficits and executive dysfunction, such as problems with planning, strategizing, organizing, monitoring, evaluating, shifting, and changing behavior. Interior cingulate dysfunction often leads to problems with motivation, persistence, and online monitoring of performance (Hale & Fiorello, 2004). These same circuits that regulate the different brain processes of self-regulation and inhibition guide an individual’s ability to function cognitively (McCloskey et al., 2009), thereby indicating possible cognitive involvement in regulatory constructs. Because executive dysfunction (EdF) is a characteristic feature in a variety of clinical disorders in children, and specifically among ED students, it may also be important to investigate the levels of EdF that are responsible and are associated with emotional dysregulation (Barkley, 1997; Denckla, 1994, 1996a; Pennington & Ozonoff, 1996).

Students with EdF often present with ADHD and difficulties with regulating attention (Reddy, 2001). Children with attention and hyperactivity problems score poorly on inhibition tasks, a classic sign of executive deficits (Charman, Carroll, & Sturge, 2001). On the other hand, students with ED also present with depressive and mood disorders that manifest as extreme sadness, excessive mood lability, or a lack of emotional regulation (Casey, 1996). The regulation of emotion involves the most complex set of competencies; a partial list might include management of emotion expressed in oneself and towards others, management of internal emotional states, and use of emotion in planning and executing goals (Casey, 1996). ED students often have difficulties with attending to academic tasks that require planning and
organizing their materials (Wagner, 1995). Executive function appears to play a significant role in the success of ED students; therefore, investigation into the role and prevalence of executive function variables is important in school psychoeducational assessment and intervention planning.

**Summary**

Because the classification of Emotionally Disturbed (ED) students is reserved for those who are considered the most severely impaired for their behavior problems and academic skill deficits, they tend to require distinct prevention and treatment programs. In addition, these same students have typically had an extensive history of academic difficulties and deficits in the areas of working memory and executive function. WM measures such as the WISC-IV Working Memory Index (WMI) and EF measures such as the Behavior Rating Inventory of Executive Functions (BRIEF) are available for use by school psychologists; however, the clinical utility of these instruments in relation to the identification of ED middle school students has not been investigated in depth.


Chapter 3

Method

Source of data

The data set analyzed in this study was composed of archival data from 41 middle school-aged students who were categorized as Emotionally Disturbed (ED) in the school setting. This archival data were collected from a large, predominantly middle class school district consisting of both urban and suburban middle schools in the state of Delaware. Permission was sought and granted by the participating school district for utilization of the data, following approval by the Philadelphia College of Osteopathic Medicine’s Institutional Review Board (IRB).

The archival data were obtained from the most current comprehensive psychoeducational evaluations and re-evaluation reports. Data utilized for this study examined only students previously classified as students with ED. After all inclusion and exclusion criteria were examined, one initial participant failed to meet ED classification and was excluded from further examination. The final sample of 41 participants ranged in age from 11 years, 5 months to 15 years, 2 months ($M = 13.25$). All but four of the participants were male. The largest percentage of students was in the sixth grade. Table 1 displays the basic demographic characteristics of the participant data in the study.
Table 1

*Basic Demographic Characteristics of Sample*

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>37</td>
<td>90.2</td>
</tr>
<tr>
<td>Females</td>
<td>4</td>
<td>9.8</td>
</tr>
<tr>
<td><strong>Grade</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sixth</td>
<td>17</td>
<td>41.5</td>
</tr>
<tr>
<td>Seventh</td>
<td>11</td>
<td>26.8</td>
</tr>
<tr>
<td>Eighth</td>
<td>13</td>
<td>31.7</td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suburban</td>
<td>22</td>
<td>53.7</td>
</tr>
<tr>
<td>Urban</td>
<td>19</td>
<td>46.3</td>
</tr>
</tbody>
</table>

**Measures**

The data obtained from student records included selected scores from the Wechsler Intelligence Scale for Children-Fourth Edition (WISC-IV), the Behavior Assessment System for Children-Second Edition (BASC-2), and the Behavior Rating Inventory of Executive Functions (BRIEF).

The WISC-IV is a widely used instrument for assessing the intellectual ability of children and adolescents ages 6 through 16 years and 11 months (Wechsler, 2003). In this study, the
Working Memory Index (WMI) and Full Scale Intelligence Quotient (FSIQ) were obtained from the measure to assess for key areas that affect children with emotional difficulties.

The Working Memory Index (WMI) assesses concentration, attention, and working memory. The index is composed of Digit Span (Forward and Backward), and Letter Number Sequencing. In terms of cognitive functioning, these subtests measure working memory to varying degrees (Hale, Hoeppner, & Fiorello, 2002). Digit Span Forward, which measures rote learning and memory, attention, encoding, auditory processing, and sequencing loads on the Cattell-Horn-Carroll (CHC) short-term memory (Gsm) factor (Sattler, 2008). The tasks that comprise the WMI also appear to measure aspects of the phonological loop for holding information in immediate memory as well as immediate rote auditory memory (Hale et al., 2002; Hale & Fiorello, 2004). Digit Span Backward which is a measure of working memory involving mental manipulation and visuospatial imaging (Sattler, 2008; Wechsler, 2003) likely also measures aspects of self-regulatory executive functions such as planning, strategizing, monitoring, maintaining, evaluating, organizing, executing, and changing one’s behavior (Hale & Fiorello, 2004). Both Letter Number Sequencing and Digit Span are considered measures of short-term and working memory processes (Keith, Goldemring-Fine, Taub, Reynolds, & Kranzler, 2006).

The reliability of the WISC-IV WMI is demonstrated by the average internal coefficient of 0.88 across all age groups (Flanagan & Kaufman, 2009, Wechsler, 2003c, Table 4.1, p. 34). The WMI was selected over other Index scores from the WISC-IV because it measures the ability to maintain and manipulate information in short-term memory. Research has indicated that emotionally disturbed students often experience severe anxiety and depression. These symptoms are linked to impairments in concentration, which, in turn, affect working memory
When a student is anxious, thoughts relating to the source of anxiety can dominate and take up valuable processing capacity, thereby reducing the capacity that is available to store information in working memory. Therefore, students classified as emotionally disturbed are likely to exhibit poor use of working memory in classroom settings (Gathercole & Alloway, 2008).

The WISC-IV Full Scale Intelligence Quotient (FSIQ) is a measure of an individual’s general level of intellectual functioning. The WISC-IV consists of four different indexes that contribute to the FSIQ, each with their own subtests. The indices are the Verbal Comprehension Index (VCI), Perceptual Reasoning Index (PRI), and Working Memory Index (WMI). The reliability of the WISC-IV FSIQ is demonstrated by an average internal consistency coefficient of 0.97 across all ages (Flanagan & Kaufman, 2009, Wechsler, 2003c, Table 4.1, p. 34). As with other major intelligence batteries, the WISC-IV FSIQ reliabilities are generally high (0.90+) for each age group (Flanagan & Kaufman, 2009). The WISC-IV FSIQ was used to identify subjects’ general levels of intellectual functioning. For this study, the FSIQ was used to see how students performed overall in comparison to their WMI scores.

The BASC-2 Teacher Rating Scale (BASC-2-TRS; Reynolds & Kamphaus, 2004) is a standardized broad-band behavior rating scale completed by the student’s teacher. Scores from four of the clinical subscales of the BASC-2-TRS were selected for inclusion in this study: Hyperactivity, Anxiety, Depression, and Attention Problems. These four scales were selected because teachers often report difficulties in these areas in their students with elevated emotional difficulties (Casey, 1996; Cummings, 1993; LeDoux, 1996; Stuss & Knight, 2002). The BASC-2 clinical scales are briefly described as follows: Hyperactivity indicates impulsivity and overactive behavior; Anxiety implies nervousness and fearfulness about real or imagined problems;
Depression is presented as unhappiness, sadness, and suicidal ideation; Attention Problems indicates being easily distracted and having difficulty concentrating. Hyperactivity and Attention Problems are considered to be indicative of externalizing problems; Anxiety and Depression are considered to be indicative of internalizing disorders.

The BRIEF Teacher Form (BRIEF-TR; Gioia, Isquith, Guy, & Kenworthy, 2000b) is a standardized broad-band behavior rating scale completed by the student’s teacher. The four different BRIEF Teacher Rating scale scores used in this study were as follows: Inhibit, Emotional Control, Working Memory, and Plan/Organize. These four scales were selected because teachers often report difficulties in these specific areas in their students with elevated emotional difficulties (Eyesenck, 1985; McCloskey, et al., 2009; Reddy, 2001; Wagner, 19955)

These BRIEF-TR clinical scales are briefly described as follows. The Emotional Control Scale rates the manifestation of executive functions within the emotional realm and assesses a child’s ability to modulate emotional responses. Adolescents with difficulties in this domain have exaggerated emotional reactions to seemingly minor events. The Emotional Control Scale, therefore, rates the level to which an individual reacts emotionally in an extreme way, to common events in their lives. Furthermore, Feifer and Rattan (2007) found ratings on the Emotional Control Scale to be a statistically significant variable for students with severe emotional conditions (Feifer and Rattan, 2007). The Inhibit Scale rates an adolescent’s ability to resist or not act on an impulse and the ability to stop one’s own behavior at the appropriate time. Teacher ratings on this scale are typically elevated for students who may have a condition of Attention Deficit Hyperactivity Disorder (ADHD) and/or who have been identified as Emotionally Disturbed (McCloskey et al., 2009). The Working Memory Scale rates the child’s capacity to hold information in mind for the purpose of completing a task. Caregivers describe
children and adolescents with poor working memory as having trouble remembering tasks or recalling information for even a few seconds. This may manifest itself as a child who cannot mentally manipulate information, thereby, becoming either frustrated or shutting down completely (Feiffer & Rattan, 2007). Pennington (1997) states the importance of WM, as observed in a number of clinical populations with executive function deficits. The Plan/Organize scale rates the child’s ability to manage current and future-oriented task demands. Teachers often describe planning and organizing in terms of the ability of a child to start large assignments in a timely fashion or the ability of a child to obtain in advance the correct materials for a project. Students experiencing difficulties in planning and organizing, as expected in everyday school activities, may show elevations on this scale. Relative risk for executive dysfunction in areas of planning and organizing can be calculated with variability in the frequency of clinically elevated Plan/Organize scales (Gioia, Isquith, Kenworthy, & Barton, 2002).

**Analyses**

Descriptive statistics were computed for the WISC-IV, BASC-2 and BRIEF-TR scores obtained for this study. Pearson correlations were computed among all of the WISC-IV, BASC-2 and BRIEF-TR scores used in this study. To allow for a more detailed analysis of the data, the students’ WISC-IV WMI scores were divided into three score ranges based on their level of performance as shown in Table 2. BASC-2 Subscale and BRIEF-TR Scale T-scores also were divided into three score ranges based on degree of problem severity reflected by teacher ratings as shown in the Table 2.
### Table 2

*Score Ranges for the WISC-IV WMI Standard Scores and the BASC-2-TRS Subscale and BRIEF-TR Scale T-scores*

<table>
<thead>
<tr>
<th>WMI Score Range</th>
<th>WMI Low Group</th>
<th>WMI Average Group</th>
<th>WMI High Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTE 89</td>
<td>RTE 90-109</td>
<td>GTE 110</td>
<td></td>
</tr>
<tr>
<td>BASC-2 BRIEF-TR</td>
<td>Non-Elevated</td>
<td>Moderately Elevated</td>
<td>Highly Elevated</td>
</tr>
<tr>
<td>LTE 59</td>
<td>60-64</td>
<td>GTE 65</td>
<td></td>
</tr>
</tbody>
</table>

**WMI Low Group**
- LTE 89
**WMI Average Group**
- 90-109
**WMI High Group**
- GTE 110
Chapter 4

Results

This chapter provides the results of the data analyses conducted with the scores derived from the records of student classified as ED. Results are organized by research question in the sections that follow.

Research Question 1. How do middle school students classified as ED perform on the WISC-IV FSIQ and WISC-IV WMI?

The WISC-IV FSIQ and WMI mean standard scores based on the entire sample of 41 students are shown in Table 3. The FSIQ and WMI averages of the students in this study are below the standardization sample score means of 100; the WMI average is slightly lower than the FSIQ average. For this sample, scores reflected a wide range of performance levels from the low range (71) to the superior range (125), with the average degree of variability among scores being slightly less than one standard deviation. Table 3 also includes the number of students that earned WMI standard scores within each of three score ranges: standard scores equal to or less than 89, standard scores from 90 to 109, and standard scores equal to or greater than 110.
Table 3

*WISC-IV WMI and FSIQ Descriptive Statistics for ED Sample*

<table>
<thead>
<tr>
<th>Composite Score</th>
<th>M</th>
<th>SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Scale Intelligence Quotient</td>
<td>91.63</td>
<td>12.49</td>
<td>72-125</td>
</tr>
<tr>
<td>Working Memory Index</td>
<td>88.98</td>
<td>12.71</td>
<td>71-120</td>
</tr>
</tbody>
</table>

Number of Students with WMI Scores within Specific Score Ranges

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater than or equal to 110</td>
<td>6</td>
<td>15%</td>
</tr>
<tr>
<td>90 to 109</td>
<td>10</td>
<td>24%</td>
</tr>
<tr>
<td>Less than or equal to 89</td>
<td>25</td>
<td>61%</td>
</tr>
</tbody>
</table>

Research Question 2. How do middle school students classified as ED perform on the BASC-2 Hyperactivity, Anxiety, Attention, and Depression Scales?

The BASC-2-TRS mean T-scores based on the entire sample of 41 students are shown in Table 4. The Hyperactivity, Attention Problems, and Depression Scale T-score averages of the students in this study were within the clinically significant range. The Anxiety T-score mean was just below the T-score cut-off for clinically meaningful scores (T = 65). For this sample, scores reflected a wide range of behavioral severity ratings from the lower end of the non-
clinical range (41) to the very high end of the clinically significant range (90), but with the average degree of variability among scores being less than one standard deviation for each of the four scales. Table 4 also includes the number of students that earned BASC-II T-scores within each of three score ranges: T-scores equal to or less than 59, T-scores from 60 to 64, and T-scores equal to or greater than 65.

Table 4

*BASC-2 Scale T-Score Descriptive Statistics for ED Sample*

<table>
<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyperactivity</td>
<td>70.15</td>
<td>8.11</td>
<td>52-90</td>
</tr>
<tr>
<td>Anxiety</td>
<td>64.44</td>
<td>7.67</td>
<td>41-78</td>
</tr>
<tr>
<td>Attention Problems</td>
<td>75.93</td>
<td>5.17</td>
<td>64-88</td>
</tr>
<tr>
<td>Depression</td>
<td>70.44</td>
<td>6.66</td>
<td>53-89</td>
</tr>
</tbody>
</table>

Number of Students with BASC-II T-scores within Specific Score Ranges

<table>
<thead>
<tr>
<th>Attention</th>
<th>Hyperactivity</th>
<th>Anxiety</th>
<th>Problems</th>
<th>Depression</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Less than or equal to 59</td>
<td>3</td>
<td>7%</td>
<td>9</td>
<td>22%</td>
</tr>
<tr>
<td>60 to 64</td>
<td>10</td>
<td>24%</td>
<td>10</td>
<td>24%</td>
</tr>
<tr>
<td>Greater than or equal to 65</td>
<td>28</td>
<td>69%</td>
<td>22</td>
<td>54%</td>
</tr>
</tbody>
</table>
3. How do middle school students classified as ED perform on the BRIEF-TR Inhibit, Emotional Control, Working Memory, and Plan/Organize Scales?

The BRIEF-TR mean T-scores based on the entire sample of 41 students are shown in Table 4. The BRIEF T-score averages of the students in this study were within the clinically significant range for all four of the BRIEF Scales. For this sample, scores reflected a wide range of behavioral severity ratings from the non-clinical range (56) to the very high end of the clinically significant range (89), but with the average degree of variability among scores being less than one standard deviation for each of the four scales. Table 5 also includes the number of students that earned BRIEF-TR T-scores within each of three score ranges: T-scores equal to or less than 59, T-scores from 60 to 64, and T-scores equal to or greater than 65.
Table 5

*BRIEF Scale T-score Descriptive Statistics for ED Sample*

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inhibit</td>
<td>71.90</td>
<td>5.86</td>
<td>64-89</td>
</tr>
<tr>
<td>Emotional Control</td>
<td>68.24</td>
<td>7.20</td>
<td>56-85</td>
</tr>
<tr>
<td>Working Memory</td>
<td>67.54</td>
<td>6.67</td>
<td>56-82</td>
</tr>
<tr>
<td>Plan/Organize</td>
<td>67.22</td>
<td>4.92</td>
<td>59-81</td>
</tr>
</tbody>
</table>

Number of Students with BRIEF-TR T-scores within Specific Score Ranges

<table>
<thead>
<tr>
<th></th>
<th>Emotional</th>
<th>Working</th>
<th>Plan/Organize</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Inhibit</td>
<td>Control</td>
<td>Memory</td>
</tr>
<tr>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Less than or equal to 59</td>
<td>0</td>
<td>0%</td>
<td>4 10%</td>
</tr>
<tr>
<td>60 to 64</td>
<td>3</td>
<td>7%</td>
<td>10 24%</td>
</tr>
<tr>
<td>Greater than or equal to 65</td>
<td>38</td>
<td>93%</td>
<td>27 66%</td>
</tr>
</tbody>
</table>

4. What are the relationships among WISC-IV Working Memory Index level of performance, BASC-2 T-scores and BRIEF-TR T-scores?

Correlational and descriptive analyses were used to examine the relationships among WMI, BASC-II and BRIEF scores. Results of the correlational analysis are reported in Table 6.
Table 6

Correlation Matrix of Behavioral and Executive Function Variables

<table>
<thead>
<tr>
<th></th>
<th>Anxiety</th>
<th>Attn P</th>
<th>Dep</th>
<th>Inhibit</th>
<th>EC</th>
<th>WM</th>
<th>Plan/Org</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyper</td>
<td>.12</td>
<td>-.07</td>
<td>.66**</td>
<td>.02</td>
<td>.21</td>
<td>-.01</td>
<td>-.04</td>
</tr>
<tr>
<td>Anxiety</td>
<td></td>
<td>.08</td>
<td>.20</td>
<td>-.21</td>
<td>-.22</td>
<td>-.08</td>
<td>.28</td>
</tr>
<tr>
<td>Attn P</td>
<td></td>
<td>-.18</td>
<td>.29</td>
<td>.03</td>
<td>.05</td>
<td>-.01</td>
<td></td>
</tr>
<tr>
<td>Dep</td>
<td></td>
<td>-.08</td>
<td>.01</td>
<td>-.16</td>
<td>.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inhibit</td>
<td></td>
<td>.48**</td>
<td></td>
<td>.33*</td>
<td>.23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC</td>
<td></td>
<td>-.05</td>
<td>.16</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WM</td>
<td></td>
<td>.16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Hyper = Hyperactivity; Attn P = Attention Problems; DEP = Depression; EC = Emotional Control; WM = Working Memory; Plan/Org = Plan/Organize
* p < .05, ** p < .01

Crosstabulation tables were constructed to further examine the relationship between performance on the WISC-IV WMI and teacher ratings completed with the BASC-2 Hyperactivity, Anxiety, Attention Problems and Depression Subscales. Crosstabulations are based on the three-group categorization of students based on WISC-IV WMI standard score levels crossed with the BASC-2 subscale ratings grouped by the three T-score levels. Results of the crosstabulations are shown in Table 7.
Table 7

*Crosstabulations between WMI Groups and BASC-2-TRF Scales*

<table>
<thead>
<tr>
<th></th>
<th>WMI</th>
<th>LTE 89</th>
<th>90-109</th>
<th>GTE 110</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>BASC-2</td>
<td>LTE 59</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Hyperactivity</td>
<td>60-64</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>GTE 65</td>
<td>19</td>
<td>4</td>
<td>5</td>
<td>28</td>
</tr>
<tr>
<td>WMI Total</td>
<td></td>
<td>25</td>
<td>10</td>
<td>6</td>
<td>41</td>
</tr>
<tr>
<td>BASC-2</td>
<td>LTE 59</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>Anxiety</td>
<td>60-64</td>
<td>8</td>
<td>1</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>GTE 65</td>
<td>12</td>
<td>7</td>
<td>3</td>
<td>22</td>
</tr>
<tr>
<td>WMI Total</td>
<td></td>
<td>25</td>
<td>10</td>
<td>6</td>
<td>41</td>
</tr>
<tr>
<td>BASC-2</td>
<td>LTE 59</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Attention</td>
<td>60-64</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>GTE 65</td>
<td>24</td>
<td>10</td>
<td>6</td>
<td>40</td>
</tr>
<tr>
<td>WMI Total</td>
<td></td>
<td>25</td>
<td>10</td>
<td>6</td>
<td>41</td>
</tr>
<tr>
<td>BASC-2</td>
<td>LTE 59</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Depression</td>
<td>60-64</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>GTE 65</td>
<td>21</td>
<td>9</td>
<td>5</td>
<td>35</td>
</tr>
<tr>
<td>WMI Total</td>
<td></td>
<td>25</td>
<td>10</td>
<td>6</td>
<td>41</td>
</tr>
</tbody>
</table>
Crosstabulation tables also were constructed to further examine the relationship between performance on the WISC-IV WMI and teacher ratings completed with the BRIEF-TR Inhibition, Emotional Control, Working Memory and Plan/Organize Scales. Crosstabulations are based on the three-group categorization of students based on WISC-IV WMI standard score levels crossed with the BRIEF-TR Scale ratings grouped by the three T-score levels. Results of the crosstabs are shown in Table 8.
Table 8  *Crosstabulations between WMI Groups and BRIEF-TF Scales*

<table>
<thead>
<tr>
<th></th>
<th>WMI</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>LTE 89</strong></td>
<td><strong>90-109</strong></td>
<td><strong>GTE 110</strong></td>
<td><strong>Total</strong></td>
<td></td>
</tr>
<tr>
<td>BRIEF</td>
<td>LTE 59</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Inhibit</td>
<td>60-64</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>GTE 65</td>
<td>25</td>
<td>10</td>
<td>5</td>
<td>38</td>
</tr>
<tr>
<td>WMI Total</td>
<td>25</td>
<td>10</td>
<td>6</td>
<td>41</td>
<td></td>
</tr>
<tr>
<td>BRIEF</td>
<td>LTE 59</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>4</td>
</tr>
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Chapter 5
Discussion

Working memory refers to a system for temporary storage and manipulation of information in the brain and is a function critical for a wide range of cognitive operations. (Baddeley & Hitch, 1974; D’Esposito, Detre, Alsop, Shin, Atlas, & Grossman, 1995; Engle, Tuholski, Laughlin, & Conway, 1999). Early theory (Jacobs, 1887) presents WM as the capacity to temporarily maintain relevant information in mind and currently remains a good measure of individual intellectual capabilities. Over the past several decades, the term Working Memory (WM) has been described by different, often disparate, models in relation to executive function. Baddeley and Hitch’s WM model is probably the most influential integrative model of cognition of the last several decades (Baddeley & Hitch, 1974; Andrade, 2001). The model’s basic constructs are easily testable, including the phonological buffer which is tested by silent rehearsal of numbers or words, the visuospatial sketchpad which uses mental images in problem solving, and the central executive which is shown by voluntary manipulations of WM functions. The brain basis of these functions is increasingly well understood and has been extensively investigated in the WM literature.

It has been proposed that WM includes a complex and often misunderstood central executive system (CES) to control attention and information flow to and from verbal and spatial short-term memory buffers (Baddeley, 1986). Later, WM was described as the “desktop of the brain” (Logie, 1999), in an effort to encapsulate the on-line, multitask processing and temporary storage system first outlined by Baddeley and Hitch (1974). These theories proposed the role of the central executive, which is considered to be the most complex, but least understood component of WM (Baddeley, 1996; Baddeley, 1998). Baddeley (1996) also found that
maintaining high WM loads requires input from an individual’s strategic executive processes. Coolidge and Wynn (2005) suggested that an enhancement of working-memory capacity occurred in the relatively recent human past and that this development was the final piece to the evolution of human executive reasoning ability, language, and culture. Working memory models are varied in theoretical content, but possess an underlying commonality in describing human cognitive processes as executive processes important to an individual’s academic and social success.

In examining the various models of WM, one can postulate that WM cognitive processes may be involved in other frontal lobe processes that may negatively affect academic and social outcomes for students with ED. Students with ED are reported to have more difficulties with their behaviors and the challenges of every day academic work than regular education students (Wagner, 1995). ED students are purported to have difficulties with WM and regulating their behaviors and emotions. Therefore, these students are often placed in separate emotional support classrooms with teachers who can handle specialized and differentiated instruction and offer specific interventions and accommodations to the student (Wagner, Friend, Bursuck, Kutash, Duchnowski, Sumi, & Epstein, 2006).

The homogeneity of the ED population may be a result of the lack of a streamlined assessment process that examines specific characteristics that may lead to a classification for ED. Some educators have argued that the ED population resembles a “dumping ground” for students who have otherwise not performed well academically and behaviorally in regular classrooms (Paduska & Kenziora, 2001). This can be an area of difficult territory regarding assessment if the regulations for classifying students as ED only involve indirect measures such as teacher reported behavior ratings and observations. Placing students in ED based on behavior rating
scales is an indirect method to assessment and may not identify specific characteristics and needs for the individual. For a student who simply needs accommodations without the label of ED, a classification for special education services may turn out to be a difficult circumstance if the student does not respond well to instruction in emotional support classrooms (Roberts, Vernberg, Biggs, Randall, & Jacobs, 2008). Therefore, it is of importance to include direct measures in addition to indirect measures in providing data for the assessment as a standard in the psychoeducational evaluation of students with ED and to provide more clinical data in the process.

Emotional disturbance as an educational classification has often been thought of as a homogeneous group that includes such varying disabilities from internalizing disorders (Anxiety and Depression) to externalizing disorders (ADHD and Conduct Disorders). To serve ED students in the best way, educational professionals should best understand the behavioral components and executive functioning issues of the population. Outcomes of studies of children with ED indicate they are found to fare poorly compared with youths with disabilities as a whole and youths in the general population (Wagner, 1995). Further outcome studies reveal youth with ED have significantly lower school achievement and graduation rates from high school (Armstrong, Dedrick, Greenbaum, 2003; Karpur, Clark, Carproni, Sterner, 2005; Kutash, Banks, Duchnowski, & Lynn, 2007; Reddy, Newman, De Thomas, & Chun, 2007). A lack of research in understanding the behavioral and executive functioning of children with ED helped guide and direct the groundwork of the current study. More appropriate services and interventions can be delivered to students classified as ED if educational professionals can better understand their cognitive processes and how they relate to the levels of behavioral and executive functioning.
Therefore, this study investigated the relationships between direct measures of working memory, behavioral variables, and executive functioning variables in a sample of students with ED. All of the study variables have been associated with problems in working memory functioning, executive control, and emotional and behavioral regulation in children and adolescents with ED (Jha, Stanley, Kiyonaga, Wong, & Gelfand, 2010; McCloskey, Hewitt, Henzel, & Eusebio, 2009; Pennington, Bennetto, McAleer, & Roberts, 1996). By examining these additional factors, the study hopes to reveal that utilizing cognitive constructs like working memory and executive processes in evaluation is essential in decision making for students with ED and would prove useful in discriminating subtypes and being more prescriptive in educational and treatment planning.

Unlike other studies that have shown relationships between measures of working memory and behavioral and executive variables, this study did not find significant differences in this sample of students with ED. However, using crosstabulations between the students’ WMI and each behavioral and executive scale, one can see themes of the sample population where the students presented with highly elevated teacher rating scale scores regardless of their WMI levels. One interpretation of this result is that the teachers who completed the rating scales scored the participants in the study with perceived elevated issues across all of the study’s measures. This interpretation would support the teachers’ perception that there is elevated risk of behavioral and executive function issues amongst students classified as ED, perhaps from their constant exposure to students with a broad range of psychological and educational problems.

The ED population reveals a broad range of disorders that are present among this homogenous group. Schools represent the largest source of referrals of children with ED to community mental health networks (Paduska & Kendziora, 2001). However, lack of a universal
method to qualify students for ED services is a concern for clinicians and educators. For several years, school psychologists have followed the criteria set forth in the latest IDEA (2004) regulations and, currently, proper assessment of ED students is crucial for assigning appropriate interventions specific to each student. Perhaps, further investigation looking at behavioral and executive function variables that affect this population’s academic and social difficulties would be useful.

In conducting comprehensive assessment for possible frontal-subcortical and executive function involvement, students with executive function difficulties indicate a profound presence of dorsolateral circuit involvement as well as orbitofrontal circuit anterior cingulated involvement due to the higher rates of impulsivity, disinhibition, executive dysfunction, and apathy typically reported for ED students (Mark & Buck, 2006; McCloskey et al., 2009). Research has shown links between various concomitant learning disorders and emotional disorders and the behavioral and executive functioning difficulties often present as problems for ED students (Rock, Fessler, & Church, 1997). Extensive assessment into these areas helps to understand the different behavioral and executive function variables that may be present within ED groups. Some research has shown that working memory issues are evident in ED populations, particularly in the area of sustained attention (Engle, Kane, & Tuholsky, 1999; Silver, Duchnowski, Kutash, Friedman, Eisen, Prange, Brandenburg, & Greenbaum, 1992). Previous research indicated that varying levels of WM can help to predict one’s involvement in behavioral and executive functioning related to the frontal-subcortical circuits (Lichter & Cummings, 2001). Since the dorsal system is responsible for one’s executive control while the ventral system is responsible for emotional tone (Hale & Fiorello, 2004), both areas are likely utilized in self-regulatory processes in ED students. Further data in this area may also provide
useful knowledge for varying cognitive working memory profiles and corresponding levels of behavioral and executive function involvement.

In an examination of the presenting problems of this sample of ED students, their screening batteries, psycho-educational assessments and reevaluations, behavioral rating reports, and identifying variables, represented a strong presence of psychopathology in almost every student. As the literature states, ED students tend to have more psychiatric disorders, often comorbid, and severe in presentation than regular education students (Wagner et al., 2005). This study confirmed this notion and presented consideration into how the ED students differed within their group according to cognitive, behavioral, and executive functioning variables. An analyses of varying levels of WM functioning revealed that the most impaired students represented the largest group within the ED classification, but did not indicate significant relations between executive deficits or distinct behavioral phenotypes in this sample. Relationships between the behavioral and executive function variables were not found to be significant for this sample. However, further confirmation that the group was representative of the cognitive functioning reported for regular education students was made as this group obtained similar global and working memory index scores.

**Limitations**

This study used a small sample size of archival data collected from teachers on students who had completed psychoeducational testing from a single school district in an urban and suburban setting in the United States. Non-significant findings may have been improved with a larger sample size. Therefore, generalization of the results is limited to other educational settings with similar demographics. The sample consisted of a higher percentage of males with ED in the schools which was expected according to an analysis of the demographics of the educational
classification (Wagner, 1995). Therefore, the results may not generalize to a predominantly female population. Over 90% of the population was male and less than 10% was female which is considerably different from the near 50% division of regular education populations as expected. However, the higher percentage of male participants in this study was greater than the percentage of males for other disability populations among children which are typically 66.7-75% male and 25-33.3% female (Anderson, 2007; Harry & Anderson, 1994; Wehmeyer & Schwartz, 2001).

Almost 55% of the participants were from a suburban school while slightly over 45% were from an urban school suggesting that the sample was slightly more representative of suburban students with the classification of ED. However, the number of student participants and, subsequent, limited student data greatly limited this study, particularly as all of the participants had similar WMI difficulties.

In addition, data was not collected for the entire WISC-IV standard battery limiting the scope and depth of investigation into specific differences within subtests and indices. Data was also not collected for the entire BASC-2 TRF or BRIEF-TR rating scales, thereby limiting the study. An investigation that is more in depth into the behavioral and executive function variables using complete BASC-2 TRF or BRIEF-TR profiles with component and index scaled scores would yield more comprehensive results.

This study utilized a behavior rating scale, the BASC-2-TRF, which although useful in identification of ED and differentiating specific behavioral and emotional problems of the child or adolescent, is considered a subjective and indirect measure of emotional and behavioral functioning. Although teacher ratings are considered more accurate than parent ratings (Hale et al., 2002), ED classification is usually examined with parent and student input along with extensive clinical assessment of the diagnosis of associated disabilities. Therefore, a future study
including parent and self-ratings would be useful. Also, the BASC-2-TRF is only one type of behavior rating scale and the use of different rating scales such as the Conners Comprehensive Behavior Rating Scales (Conners CBRS) or the Adaptive Behavior Assessment System, Second Edition (ABAS II), although highly correlated, may produce different results.

This study utilized an executive function behavior rating scale, the BRIEF-TF, which is considered a subjective, indirect inventory of children’s regulatory or self-management functioning, but may serve as a supplement to more traditional measures in assessment (Sullivan & Riccio, 2006). The BRIEF-TR is purported to measure the child’s everyday home and school environments and allows the observer to examine the essence of the executive functions (Gioia, et al., 2000; Gioia, Isquith, & Guy, 2000a). However, the measure serves as an indirect measure in clinically evaluating and treating executive function problems. Historically, clinical assessment of the executive functions has been challenging due to their dynamic essence (Denckla, 1994) and the BRIEF-TR is currently one of the few rating scales available in assessing behavioral manifestations of executive function in children. Although the BRIEF is a reliable and valid behavior rating scale of executive functions in children and adolescents, it is considered an indirect and subjective measure that is typically used as an adjunct to clinical evaluation of ED students. With the advent of other dynamic assessments in executive function, perhaps another limitation might be the construct itself.

This study also utilized only one measurement that assesses child and adolescent overall cognitive functioning and WM. Several other cognitive instruments can produce a variety of different results in these areas and may actually measure other components, such as achievement factors. Also, Full Scale IQ as measured by a global cognitive function score may be the best predictor of actual achievement and not the best measure of overall cognitive ability (Hale,
Therefore, the use of global scores over factor or subtest scores based on hierarchical regression techniques is unwarranted and considered a limitation of the study.

Systematic exploration of nomothetic and idiographic patterns of performance is recommended over using global cognitive functioning only (Hale et al., 2002). The data used in this study were obtained from instruments that informally measure cognitive functions and behavioral observations in a manner that testing causal hypotheses was not possible. Furthermore, the study did not include the WISC-IV standard subtests preventing further investigation of commonalities that might suggest relationships among other cognitive function variables and behavioral and executive function variables evident in ED students.

**Implications and Future Direction**

Working memory problems have more recently been explored as being indicative of problems with student behavior problems and academic difficulties for students with ED. Some theorists imply that WM is greatly associated and related with difficulties in self-regulating, planning, organizing, and other behavioral and executive functions (Anderson, Reder, & Lebiere, 1996; Baddeley, 1986; Barnard, 1985; Cowan, 1988; Ericsson & Kintsch, 1995; Just & Carpenter, 1992; Schneider & Detweiler, 1988). WM is also the theoretical construct that has been used specifically in cognitive psychology to refer to the system or mechanism underlying the maintenance of task-relevant information during the performance of a cognitive task (Baddeley & Hitch, 1974; Daneman & Carpenter, 1980). WM is likely best described as the mechanism that holds an event in the mind, manipulates or acts on the events, imitates complex behavioral sequences, provides hindsight and forethought, gives an individual an anticipatory set, a sense of time, and organizes individual behavior (Barkley, 1997). Students who have been
classified as ED are purported to have difficulties in some or all of these cognitive processing areas as well as associated areas of behavioral and executive functioning.

ED classification in the schools is one that has often been referred to as adversarial because educational professionals and special education services have taken on extreme positions with respect to determination of services (Poduska & Kendziora, 2001). Some schools may use special education as the panacea to any problem in the classroom with special education sometimes referred to as a “dumping ground” for students who need services that their teachers do not have strategies or support to provide. The ED classification is no exception to this idea of identifying children and adolescents based on difficulties teachers may have based on lack of proper accommodations or strategies for this group.

This study is an attempt to gather more information about the cognitive processes of an ED population in an effort to differentiate the students based on emotional/behavioral and executive function factors and, therefore, better understand the descriptive statistics of the population. Improvement of academic and behavioral interventions available for children with ED will likely be more readily available for the educational professional if comprehensive evaluation and treatment includes information obtained from these types of emotional/behavioral and executive function evaluations in addition to the standard cognitive and achievement assessments ED students undergo in evaluation. Future studies are warranted to identify the usefulness of emotional/behavioral and executive function evaluations to include direct measures in addition to indirect ones to broaden the knowledge base and further differentiate the characteristics evident in ED populations. Clinicians and educational professionals must specifically address the cognitive, academic, behavioral, emotional, psychosocial, and executive functioning components with ED in order to provide scientifically appropriate research-based
interventions to suit the individual. Educational professionals must continue to look at the 
cognitive processes such as working memory to further investigate relationships and associations 
to the aberrant problems behavioral problems and executive deficits apparent in ED students.
Further studies in this area may help to identify which specific areas and to what extent cognitive 
processes, such as working memory, are related and associated to corresponding behaviors and 
executive functioning of students with ED.
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