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The relationship between the CEFI, as a measure for executive function, and the BASC-3, as a measure of externalizing behavior, on school problems for children receiving special education services

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by

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DEDICATION

This dissertation is dedicated to my family for being there for me every step of the way through this journey called life.

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All of my gratitude goes to my wife, Julie, and our 3 boys, Connor, Noah, and Zachary, for being one of the main drives for me during this dissertation process. We started this program shortly after the birth of our first son and are finishing it right after the birth of our third. I could not have done this without the patience, love, and constant encouragement of my wonderful wife. I would also like to extend my deepest appreciation to my friend and colleague Mike for the countless hours of consultation and extended working lunches. Your insight and perspective on life and the field of psychology has helped me so much in conceptualizing what we do as school psychologists. It has not only made me a better psychologist but also made me a better human being.

The Relationship Between the CEFI, as a Measure for Executive Function, and the BASC-3, as a Measure of Externalizing Behavior, on School Problems for Children Receiving Special Education Services

Abstract

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This study examined the relationship between executive function and externalizing behaviors within a student population that was assessed for special education services. Executive function was measured by using the Comprehensive Executive Function Inventory (CEFI). Externalizing behaviors and school problems was measured using the Behavior Assessment System for Children, Third Edition (BASC-3). Four separate structural equation models were produced and analyzed to examine this relationship. The results from this study indicate that there is a significant direct effect from executive function on externalizing behaviors and school problems, such that higher scores in executive function yielded lower externalizing behavior and school problems scores. Differences in average full scale CEFI scores were noted between types of special education placements and between various groupings of students in regards to what category they qualified in. The data indicates programs that facilitated more environmental supports and services had students with lower full scale CEFI scores, while students that qualified under Other Health Impairment and Emotional Disturbance shared comorbid features with other distinct processing deficits.

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Chapter 1: Introduction

The role of the school psychologist in special education is multifaceted and requires an amassed breadth and depth of the laws, research, and student population that they serve. Often one of the most important components of a school psychologist's job is making a determination for special education eligibility and services. A wide variety of assessment tools may be used in determining if a student requires special education services. Every evaluation will use a unique set of assessment tools based on the areas of suspected disability for the student. Currently, research in the field of psychology has begun to analyze the role that executive function plays in a student's ability to learn, socialize, and adapt to the school environment.

Behavior rating scales offer school psychologists a norm referenced measure that can accurately and efficiently describe the symptoms that may be present in a student. Researchers have criticized rating scales for their undesirable variability, which can be attributed to variability within the rater, setting, instrument, and temperament of the student over time. However, these instruments are simple to administer, easy to score, and generally give a great deal of information about a student, when the respondent's observations are valid and reliable (Lamar 2016). Various ratings scales are used by school psychologists to accurately define and diagnose the behaviors are observed in the school and home environments. Rating scales have a unique ability to quantify what an observer, such as a parent or teacher has seen over a given time period.

The correlation of various executive function constructs and social competence constructs with academic achievement give more validity to the use of behavior rating scales in evaluating students. The link between observable measures and what a student can produce in terms of academics is noted from Kong (2014). In the study it was found that social emotional

competence as rated by teachers on the Devereux Student Strengths Assessment (DESSA; LeBuffe, Shapiro, & Naglieri, 2009) significantly predicted scores of academic achievement above and beyond scores of cognitive ability.

Performance is often measured by what you can do on average, given what your output is. For instance, a golfer may be able to drive the ball 300 yards at a driving range, but when out on the course only able to drive the ball 260 yards on average. The observed variance between golf drives here can be depicted in a student's ability to function in a test setting versus a classroom setting. At times, a student may be able to complete certain assignments, but a majority of the time they may be unable to finish the assignment or turn in quality work. This is one reason why information from teachers regarding executive function in the classroom may be the better indicator of that individuals executive function ability in that environment. Thus, the observable behaviors regarding executive function may be a better indicator of how a student utilizes those abilities.

Studies have shown that executive function has been directly implicated in the social emotional well-being of children. A review by Riggs, Jahromi, Razza, Dillworth-Bart, & Mueller (2006) on executive function and its relationship to social emotional competence stated that executive function has been shown to have a direct link in the social emotional development of children. The deficits in executive function and other related areas of social emotional competence have shown that these skills of inhibition, selective attention, planning, and working memory work together in the development of these domains. Morgan and Lilienfeld (2000) compiled a meta-analysis of 39 studies yielding a total of 4,589 participants illustrating a robust and statistically significant relationship between faulty executive function skills and antisocial behaviors.

One of the main aspects of executive function that appears often in research relating executive function to social emotional/behavioral outcomes is inhibition. Pharo et al., (2011) makes the assertion from their research that one of the main reasons some teens may engage in riskier behavior is a result of the differences in the frontal lobes. These differences are impulse control, self-monitoring, and planning (Pharo et al., 2011). Findings in Woltering et al.'s (2015) study indicated that children classified as having disruptive behavior problems showed that they had poor self-regulation with tasks involving what is known as hot executive function skills. Hot executive function involves problems with an added emotional context that can affect performance. In their study no impairments were detected between the disruptive behavior problem group and the control group on tasks that involved cool executive function skills. Cool executive function is typically associated with measures that seek to examine abstract concepts that are absent of emotional significance. Physiological data also suggested that emotional states were difficult for the disruptive behavior group to regulate as they displayed a higher heart rate than the control group during tasks that involved emotion. Differences between hot and cool executive function are not as distinct within other populations, however, research from populations that may suffer from disruptive behaviors appear to display more difficulty in tasks requiring the use of executive function when an added emotional component is present. Theories to support this distinction between the two groups may rely more on the relationship between the frontal lobes and the amygdala.

Research into CD and ODD as standalone diagnoses do not offer much of an explanation in regards to deficits in executive function. Oftentimes, it is notable that these children are best at manipulating others and their environment to get what they want. However, the ways in which these children get their needs met are not always prosocial. The presence of ADHD when

comorbid alone with CD or ODD has been found to be associated with differences in executive function. Findings from Clark, Prior, & Kinsella (2000) found that only children with a comorbid diagnosis of ADHD displayed executive function deficits. In contrast to this finding, however, some research has found that even when controlling for ADHD and other factors, children with CD performed significantly worse on measures of self-monitoring, inhibition, and planning (Toupin, Dery, Pauze, Mercier, & Fortin 2000). However, Hale and Fiorella (2004) caution that those with disruptive behavior disorders may evidence lower levels of motivation when testing, and thus their performance scores should be viewed with caution.

Studies have found that students with a diagnosis of ADHD tend to perform poorly on executive function tasks relative to their nondisabled peers (Weyandt et al., 2014). ADHD diagnosis was related to poor performance on executive function assessments that measured working memory and planning. This poor performance was associated with more social problems that were observed by the parents and participants (Tseng & Gau 2013). Deficits in inhibition have also been linked to Attention Deficit Hyperactive Disorder (ADHD) and externalizing behavior problems in young children and adolescents (Ford et al., 2007; Friedman et al., 2007; Riccio et al., 2011; Willcutt et al., 2005).

Many of the cognitive processes that fall under the term executive function are related to an individual's ability to maintain attention, plan, and self-regulate. The assertion can be made that having a more developed ability to perform these actions will allow an individual to be more successful in a variety of tasks. Given the complexity under which these abilities may operate, it is important to understand how these executive function abilities may effect such tasks as learning and controlling behavior. Tseng et al. (2013) was one of the first studies to examine whether executive function was a mediator between ADHD and social problems. The authors

found that executive function measures of working memory and planning mediated the effect of ADHD on social problems, independent of a control group. A study by Piehler, Bloomquist, August, Gewirtz, Lee, and Lee (2014) examined executive function as a mediator for conduct problems. Conduct problems and executive function were assessed in the children using a longitudinal growth modeling methodology with data collected 4 times across the span of two years using scores from the BASC-2 parent rating scale. The children that participated in the Early Risers intervention program showed improved executive function scores as rated by the parents. A parallel process latent growth model showed that these changes in executive function fully mediated conduct problems scores. A research study by Riggs, Greenberg, Kusche, & Pentz (2006), showed that a social emotional program called Promoting Alternative Thinking Strategies curriculum (PATHS; Greenberg & Kusche, 1993) resulted in a decrease in internalizing and externalizing behaviors, which were mediated by inhibitory control.

Statement of the Problem

The relationship between executive function and school problems has been documented in children with symptoms of attention deficit disorders, conduct problems, mood disorders, and learning disabilities. School psychologists working with students examine various cognitive processes and skills during psychoeducational evaluations. Performance based tests and rating scales of executive function are becoming more common in psychoeducational evaluations with the understanding that executive function may be able to explain more in regards to a student's performance in the classroom.

One aspect of evaluation is to identify strengths and weaknesses regarding the student as a whole. This takes into account how the students process information, manage emotions, interact with teachers and peers, and produce academic work. The relationships regarding these

constructs within the tests, setting, and school work help to determine the needs of the child. Behavior, along with various areas of cognitive processing can have an important impact on determining whether a student qualifies for special education, what interventions are needed, and what services will be provided. Executive function may share a distinct relationship with those students that are having behavior problems in the classroom. However, research examining the relationships between executive function and externalizing behaviors has been somewhat limited, especially with measurements that are widely used by school psychologists working in the schools today.

Significance of the Study

This study examined the relationship between executive function and externalizing behaviors within a student population that was assessed and found to qualify for special education services. The measurements used for this study are nationally normed behavior rating scales that are widely used by school psychologists throughout the nation. Executive function will be measured by using the Comprehensive Executive Function Inventory (CEFI). Externalizing behaviors and school problems will be measured using the Behavior Assessment System for Children, Third Edition (BASC-3). Identifying the relationships between these constructs may help professionals in the field of education, to establish better school-based interventions and/or treatments including modifications to existing interventions and treatments for students receiving special education services. As a way to further examine these relationships between executive function, externalizing behavior, and school problems, this study will examine if executive function has a direct effect on these measures.

Research Questions

The following questions were addressed:

1. Does executive function as measured by the Full Scale CEFI score directly effect Externalizing Problems and School Problems as measured on the BASC-3?

2. Does executive function as measured by the Full Scale CEFI score directly effect Hyperactivity and Learning Problems as measured on the BASC-3?

3. Does executive function as measured by the Full Scale CEFI score directly effect Aggression and Learning Problems as measured on the BASC-3?

4. Does executive function as measured by the Full Scale CEFI score directly effect Conduct Problems and Learning Problems as measured on the BASC-3?

To investigate the relationship between executive function and externalizing behaviors, a structural equation model will be used to analyze the direct effects that the full scale CEFI score has on the externalizing behaviors and school problems composites, along with the subscales that make up those composites found in the BASC-3.

Chapter 2: Review of the Literature

Executive Function History

Executive function has a research history that dates back into the 1840s with neuropsychological research just beginning to test and attempt to understand the processes that occur in the frontal lobes. The term executive function did not become present until the 1970s, but researchers were interested in a conceptualized function that they described as a control mechanism. This concept of a control mechanism was initiated by the case study of Phineas Gage. Phineas Gage was a railroad worker that sustained a traumatic head injury when a rod went through his skull. The damage that was sustained by Phineas's frontal lobes were heavily documented and gave researchers at the time a closer look at how the brain regulates itself. Although many other case studies can be found regarding brain trauma and its relationship to various neurocognitive deficits, this study is referenced as the most impactful towards the understanding of the role the frontal lobes may have with cognition.

There are many definitions that are used to describe executive function, and currently, there is no one accepted operational definition. Within the research arena, there are approximately 30 definitions of executive function, which make it unclear as to what researchers agree on in regards to executive function. Goldstein et al., (2014) describe the current state of executive function as an umbrella of terms used for many different abilities or skills: planning, working memory, attention, inhibition, self-monitoring, self-regulation and initiation, all of which are carried out by the pre-frontal areas in the frontal lobes of the brain. Executive functions are used to perform activities such as planning, organizing, strategizing, paying attention to and remembering details, and managing time and space. Furthermore, Goldstein et

al., suggest that executive function is a unitary construct, meaning that it is best described as one function that encompasses the aforementioned skills or abilities associated with it.

Most working models of executive function contain a core set of neurological constructs. These skills can be grouped together to make up executive function ability as a whole or can be discussed as individual skills that are better described as constructs of executive function. Executive function models can be further categorized according to how executive function is conceptualized. Executive function is seen most often as a standalone composite of cognitive processing, as it is absent from most general models of cognitive abilities, and construct validity is not as established as compared to other measures of cognitive processing (Jewsbury et al., 2016). Executive function differs from overall cognitive ability in that it involves the cueing other cognitive processes on the following: what you should do, when you should do it, how you should do it, how long you should do it, etc. This functioning ability is very directive and specific in nature. To date there has been little research that has examined the differences between executive function and nonexecutive cognitive processing (Salthouse, Atkinson, & Berish 2003).

Research has given us a good understanding of what executive function is, however, an overall consensus regarding definition and theory is still being closely sought out. The switching, inhibition, and updating model of the executive function system is supported by various factor analytical studies. A study from Miyake & Friedman (2000) chose to examine executive function using various tasks that made up these 3 areas of executive function. The shifting aspect of this model is defined as being able to shift between tasks, operations, or mental sets. The tasks used to examine shifting were the plus-minus task (Jersild, 1927), local-global task, and the number-letter task (Rogers & Monsell, 1995). The updating aspect of this model is

defined as updating and monitoring working memory representations. Tasks used for the updating aspect of this model were the keep track task (Yntema, 1963), the tone monitoring task, and the letter memory task (Morris & Jones, 1990). Inhibition is defined in this model as the ability to deliberately inhibit dominate, automatic, or prepotent responses when necessary. Tasks used for testing inhibition were the Stroop task (Stroop, 1935), stop-signal task (Logan, 1994), and the antisaccade task (Hallett, 1978). This executive function model has also been replicated and thus is the only model on executive function to do so (Jewsbury, Bowden, Strauss 2016). This means that the role of executive function; is often based upon an individual's ability to inhibit, switch, and update.

One of the main challenges that researchers have observed in understanding the assessment of executive function is that most measures of executive function involve non-executive processes within the task (Toplak et al., 2012). Miyake et al., (2012) identify this as the impurity problem. The impurity problem states that it is hard to measure individual executive function skills due to their interconnectedness with other cognitive processing skills. Another aspect of the impurity problem is that most executive function tests have low internal retest reliability, which is a function of the finding that the examinee gets better at the task with repeated testing. The best measure of an individual's executive processing abilities is when the task is novel (Miyake et al., 2000). One way that Miyake et al., propose to get around this impurity problem is to use latent variables within the research model. This is accomplished by taking instruments that measure a specific executive function construct and then loading the results of that measure along with other measures that may be examining the same construct. This is very similar to what a neuropsychological evaluation looks like when using various subtests from other cognitive measures to evaluate a specific broadband measure. If a researcher

is looking at measuring attention then they may utilize 2-3 measures that focus on attention and load those measures into the latent variable. This approach has been shown to alleviate some of the structural weaknesses that occur when using individual measures, and provides more validity for the latent variable.

Executive function models can be categorized based upon how executive function is categorized. Miller (2009) conceptualizes how researchers approach executive function in the following three ways. The first approach involves models based on abilities that theoretically comprise executive function skills as a higher order cognitive mechanism. An example of this approach is the switching, inhibition, and updating model. This model takes various cognitive constructs that are measuring executive function and uses them in a specified model. The second approach utilizes factor analytic studies of neuropsychological batteries to determine the function of these executive skills. A problem with this approach is that researchers take clusters of skills together and then describe them as separate entities. This can be misleading as measures being used often contain non-executive functioning abilities as well. The third approach involves conceptualizing the narrow abilities that comprise executive function domains and operational tasks based on the multiple narrow abilities within that domain. This third approach closely mimics the approach used to describe cognitive processes that encompass the Cattell-Horn-Carroll (CHC) theory, which currently pervades the field of intellectual assessment.

Development of Executive Function

The prefrontal cortex has a protracted course of maturation, and it is proposed that developmental changes in this area of the brain parallel the cognitive maturation and the development of cognitive, behavioral, and emotional control during childhood and adolescence (Vuontela, Carlson, Troberg, Fontell, Simola, Saarinen, & Aronen, 2012). These early executive

function skills may be simpler in nature at a young age, but will begin to become more complex as the brains grow and mature. The development of executive functioning skills is greatly influenced by experiences in the home and school settings due to prefrontal plasticity and a long period of post-natal development (Lawson, Hook, Hackman, Farah, 2016). This long period of development makes researching executive function cumbersome with regards to accounting for the various significant variables that may have an effect on development.

There are a series of developmental changes that are accounted for within various working models of human development. During the ages of 5-11 years old, children have one of the highest rates of growth in brain development, and this is particularly seen in the Brodmann Area 10, which covers the biggest area of the frontal cortex. Brodmann Area 10 has been associated with biasing attention, deliberate concentration, and set shifting amongst others. It has also been the area of the brain that is referred to as the "gate-way" for which information is given priority within a given environmental setting (Kaufman, 2010). During this period of early childhood, improvements in cognitive abilities such as verbal fluency, inhibition, working memory, and planning help students become successful in the classroom and social arena (Otero & Barker 2014). Executive function abilities continue to further develop in what Johnson and de Haan (2011) describe as a rise and falls pattern of brain development. This way of describing the development of executive function takes note of the individual's own growth patterns regarding the many different aspects of executive function. Due to other abilities of executive function becoming more developed at times there may be a regressing or falling of some abilities relative to the whole. Researchers have noted that it is during adulthood that our executive function abilities become fully developed.

Executive function skills in early childhood such as impulsivity control, and task shifting will eventually give way to more complex planning abilities. As these skills build upon themselves and the child matures, more complex executive function tasks will be developed. Researchers credit Barkley's (1997) theory on executive function as one of the most influential theories defined by a hierarchical perspective on executive function development. Barkley proposed that the first step in the development of executive function is when children are able to inhibit their initial responses. This provides a delay for other tasks to operate. Research regarding development of executive function skills, academics scores, and behavior all support the importance of inhibition.

Executive Function and Behavior

LeDoux (1996) reported neural pathways that interconnect with certain regions of the prefrontal cortex that modulate attention, working memory, and sensitivity to reward (i.e., executive functioning) and also interconnect with emotional structures, primarily the amygdala. This interconnectivity provides some anatomical evidence that a relationship may exist between executive function constructs and brain regions that modulate emotional regulation. This link between executive function and behavior can also be found in research examining the relations between behavior problems and executive function. The key relationship between the prefrontal cortex and the amygdala is an important developmental route in regards to emotional regulation. Emotion related self-regulation develops rapidly in the early years of life based on brain maturation and interaction with the environment; and, although it continues to develop into adulthood, it tends to be more gradual in development (Vuontela et al, 2012).

Moffitt and Lynam (1994) summarize the relationship that executive function plays in emotional disorders here: First, these students likely had difficulty learning from environmental

consequences and may not generalize the negative impact of their behavior on others around them. Second, these students tend to display relatively poor working memory skills, thus rendering them vulnerable to forgetting abstract ideas about ethical values and future rewards when confronted with a compromising situation. Lastly, students with poor executive function skills may have difficulty adapting their behavior to the constant changing of social circumstances, especially school-related ones involving verbal proficiency. Researchers have suggested that executive function skills are of critical importance for establishing and maintaining socially appropriate interactions within a classroom setting, by allowing students to self-monitor emotional impulses and regulate motoric processes. In support of this idea, executive function impairment is seen in many different mental health disorders such as: ADHD, OCD, depression, conduct disorder, schizophrenia, and various addictions (Diamond 2016).

Executive Function and Attention Deficits

Research regarding the relationship between executive function deficits and Attention Deficit Disorder has been extensive. Studies have found that students with a diagnosis of ADHD tend to perform poorly on executive function tasks relative to their nondisabled peers (Weyandt et al., 2014). ADHD diagnosis has been related to poor performance on executive function assessments that measured working memory and planning. This poor performance was related to increase social problems that were observed by the parents and participants (Tseng & Gau 2013). This link between executive function and behavior can also be found in research examining the relations between behavior problems and executive function. Deficits in inhibition have been linked to Attention Deficit Hyperactive Disorder (ADHD) and externalizing behavior problems in young children and adolescents (Ford et al., 2007; Friedman et al., 2007; Riccio et al., 2011; Willcutt et al., 2005). Research from a study by Nigg et al., (2017) suggested that slow

processing speed was a nonspecific indicator of externalizing psychopathology, while executive function deficits were more specific to a particular subset of psychopathology such as ADHD.

Research today is beginning to examine the magnitude of the role executive function plays in the cognitive processes. This role has been demonstrated with the ADHD/Attention Deficit Disorder (ADD) population. To date, Barkley (2012) has one of the most comprehensive theories on executive functioning as it relates to ADHD. Barkley asserts in his theory that there are three brain networks associated with ADHD and executive functioning deficit. The first network, often referred to as the "what" system is the frontal-stratial circuit, which is related to deficits in response suppression, inhibition, working memory, organization and planning. The second network, referred to as the "when" network is located in the frontal-cerebellar circuit. This circuit is connected to motor coordination deficits and difficulties with timeliness of behavior. The third network is associated with the "why" network. In the "why" network the frontal limbic circuit is related to the systems of emotional control, motivation deficits, hyperactivity/impulsivity, and low frustration tolerance or aggression. With this model, many of these executive functioning deficits are identified as symptoms of ADHD. One of the changes that has evolved over the years to Barkley's model is the addition of attention as an executive function and the importance that working memory has within the cognitive framework. This has led Barkley and other researchers to label ADHD as an executive functioning deficit disorder; with a deficit in the individual's ability to inhibit behavior serving a vital role in self-regulation (Antshel, Hier, & Barkley 2014).

Executive Function and Social Emotional Problems

Studies have shown that executive function has been directly implicated in the social emotional well-being of children (Riggs, Jahromi, Razza, Dillworth-Bart, & Mueller 2006). The

deficits in executive function and other related areas of social emotional competence have suggested that the skills of inhibition, selective attention, planning, and working memory work together in social and emotional development. Morgan and Lilienfeld (2000) compiled a meta-analysis of 39 studies yielding a total of 4,589 participants illustrating a robust and statistically significant relationship between faulty executive function skills and antisocial behaviors. Rinsky and Hinshaw (2011) found that childhood planning and response inhibition predicted adolescent social functioning and comorbid internalizing/externalizing disorders in girls with ADHD. Another important finding from the Rinsky and Hinshaw (2011) study was that lower scores on the executive function measures resulted in poor social functioning in all of the girls in the study.

Inhibition is often implicated in research relating executive function and social emotional/behavioral outcomes. Pharo et al., (2011) makes the assertion that one of the main reasons some teens engage in riskier behavior has to do with the differences in the frontal lobes, in particular differences related to impulse control, self-monitoring, and planning. Findings from Woltering et al's. (2015) study found that children classified as having disruptive behavior problems showed poor self-regulation with tasks involving hot executive function skills. Hot executive function involves problems with an added emotional context that can affect the individual. No impairments were detected between the disruptive behavior problem group and the control group on tasks that involved cool executive function skills. Cool executive function is typically associated with measures that seek to examine abstract concepts that are absent of emotional significance. Physiological data also suggested that emotional states were difficult for the disruptive behavior group to regulate, as evidenced by a higher heart rate than the control group during tasks that involved emotion. Theories to support this distinction between

individuals who evidence disruptive behaviors from those who don't may rely more on the relationship between the frontal lobes and the amygdala.

Executive Function and Conduct/Oppositional Disorders

The DSM-5 criteria for individuals diagnosed with Conduct disorder (CD) states that they display a persistent pattern of behavior in which the basic rights of others or major age-appropriate societal norms or rules are violated and display aggression towards people or animals, destruction of property, and/or deceitfulness or theft (DSM-5). Oppositional defiant disorder (ODD) is characterized by a pattern of angry/irritable mood, argumentative/defiant behavior, or vindictiveness (DSM-5). Research into CD and ODD as a standalone diagnosis does not offer much of an explanation in regards to executive function deficits. What does offer some difference in executive function is when ADHD is comorbid alone with CD or ODD. Findings from Clark Prior, & Kinsella (2000) showed that only children with a comorbid diagnosis of ADHD displayed executive function deficits. However, some research has supported findings that even when controlling for ADHD and other factors, children with CD performed significantly worse on measures of self-monitoring, inhibition, and planning (Toupin, Dery, Pauze, Mercier, & Fortin 2000). Executive function skills have been shown to have a link with antisocial behaviors. However, Hale and Fiorello (2004) caution that those with disruptive behavior disorders may evidence lower levels of motivation when testing, and thus their performance scores should be viewed with caution.

Executive Function and Learning Problems

Rating scales that attempt to examine learning problems such as the BASC-3, typically contain items that pertain to reading, math, spelling, assignment completion, and critical thinking ability. The following studies investigate a link between these aspects of learning problems and

observed deficits in executive function. It should be noted that the way in which these aspects of learning are measured may differ between studies, however, deficits in these areas would arguably be a source of academic problems.

A study by Langberg, Dvorsky, and Evans (2013) evaluated associations between parent and teacher ratings of executive function using the BRIEF to multiple academic measures such as: school grades, homework problems, and achievement. Results from this study indicated that the planning and organization skills rated by the BRIEF had a strong association with school grades. Parent ratings on student's ability to shift between tasks effectively was also a strong predictor of school grades. For predicting homework problems, parent ratings of symptoms associated with ADHD (inattention, hyperactivity/impulsivity, planning/organization) appeared to be the best at predicting homework problems. In the school setting, teacher ratings of inattention accounted for 32% of the variance in school grades, and ratings of organization were significant for predicting homework problems.

In a study by Jarratt, Riccio, and Siekierski (2005), significant correlations were found between the learning problems index of the BASC-2 and multiple measures of the BRIEF. The study was primarily examining the relationship between these two measures in regards to ADHD assessment, however, correlational results from teacher ratings indicated that a significant relationship did exist between executive function, as rated by the BRIEF, and learning problems, as rated by the BASC-2. The strongest relationships were found between learning problems and the initiate (r=.78), working memory (r=.78), and planning/organization (r=.66) subscales. The correlational relationship between the Metacognition Index (r=.67) and the Global Executive Functioning Index (r=.65) for the BRIEF also had a statistically significant relationship with the learning problems subscale of the BASC. It should also be noted that the Global Executive

Functioning Index also had significant correlations with School Problems (r=.72, Learning Problems (r=.65), and Attention Problems (r=.68).

A (2010) study from Best, Miller, and Naglieri examined the relationship between the executive function constructs related to the Planning subscale of the CAS and the academic achievement scores from the Woodcock Johnson Tests of Achievement Revised. The study built upon a previous research study (Naglieri & Das, 1997), that found a moderate correlation between executive function and academic achievement (r=.49-.57). The authors found that there was a domain general contribution of executive function and academics across age groups, with executive function scores steadily increasing from early childhood into adolescence. There were also some notable differences in complex executive function tasks and math problem solving. The results suggested that complex executive function skills may have a stronger relationship with math concepts such as applied problem solving.

Research on executive function and academics have shown varying results in regards to correlations between executive function measures and standardized test scores, and behavior ratings of executive function and academic classroom performance. The main distinction that is made in the research is that performance based measures of executive function correlate moderately with standardized academic testing. Given that testing environments are typically the same for these measures, researchers have noted that these scores are better indicators of executive function and academic knowledge. However, scores from behavior rating scales of executive function appear to have a stronger correlation with academic performance in the classroom.

Researchers differentiate academic performance in the classroom from standardized academic measures by accounting for more than just academic knowledge. This takes into account the classroom performance, participation, effort, behavior, attendance, and homework performance that an individual is displaying in class over a period of time. Standardized academic tests typically examine only academic knowledge. Langberg, Dvorsky, and Evans (2013) lay out some of the main limitations in the research between executive function and academics. The first limitation noted is that performance based measures of executive function have poor ecological validity in regards to real life performance, and that rating scales of executive function appear to be better predictors at measuring executive function deficits in settings outside of academics. Real life experiences and expectations may include many short term goals that make up one long term goal. The second limitation is that there is no consensus for a definition of executive function. Due to the variance seen in definitions and working models of executive function, very little research has examined specific executive function abilities. Specifically, the authors call for a micro examination of executive function skills and academics in order to make interventions more specific. For example, research has suggested that aspects of executive function such as planning, self-monitoring, working memory, and impulsivity control are important for success in academics.

An assertion that can be made from the literature is that rating scales of executive function have a stronger correlation with overall academic performance. This long term view of an individual's executive function ability and academic performance may be the best indicator of academic success, due to the observation of these skills over time. The rater has a chance to observe how well the individual completes tasks, self-regulates, etc., in the classroom setting. When discussing supports and interventions it is often the classroom environment that is changed

first to make up for the displayed deficit in the student. With this logic, it can be assumed that the best indicator of executive function within a given environment would be what you observe that individual doing in that environment.

The Direct Effects of Executive Function

In order to examine the relationship between executive function and disruptive behaviors, it is important to understand how these behaviors can influence problems in school. The symptoms that are most commonly associated with problems in the academic setting tend to evolve around a student's ability to pay attention and learn. From an information processing model, attention is a pre-requisite for further processing; if attention is not paid to the stimulus (in this case academic content knowledge), then no further processing into working memory, or subsequently long-term memory occurs. Attention problems are also strongly associated with other disruptive behaviors such as Oppositional Defiant Disorder and Conduct Problems (Ghosh & Sinha, 2012). The School Problems composite for the BASC-3 is derived from the Attention Problems and Learning Problems subscales. Items pertaining to the Attention Problems subscale measure problems of distractibility and the ability to pay attention. The Learning Problems subscale is focused on critical thinking skills, completion of assignments, math, reading, and spelling. The following body of research attempts to examine how executive function may directly effect the relationship between disruptive behaviors associated with attention problems and learning. Many of these articles focus on executive function as having a mediating effect on outcome variables.

Many of the cognitive processes that fall under the term executive function have a clear relationship to an individual's ability to maintain attention, plan, and self-regulate. The assertion can be made that having a more developed ability to perform these actions will allow an

individual to be more successful in a variety of tasks. Given the complexity under which these abilities may operate it is important to understand how these executive function abilities may function as a mediator for such tasks as learning and controlling behavior. Deficits in executive function have been invoked to explain many forms of psychopathology (Luciana 2016).

A study by Forner, Miranda, Fortea, Casetellar, Diago, & Casas (2017), examined the mediational relationship between executive function and peer problems in individuals with ADHD. They identified the behavioral regulation index (BRI) of the BRIEF as being a partial mediator for the relationship between hyperactivity/inattention and peer relationship problems. The BRI accounted for 39% of the path from ADHD manifestations to peer problems. Executive function measures of working memory and planning have been shown to mediate the effects of ADHD on social problems (Tseng et al. 2013) and have significant indirect influences on social dysfunction through measured attention problems. This relationship between executive function (working memory, inhibition, and planning) and social functioning has been found to be mediated by attention problems (Hilton, Jarrett, McDonald, & Ollendick 2017).

Piehler, Bloomquist, August, Gewirtz, Lee, and Lee (2014) examined executive function as a mediator for conduct problems. Conduct problems and executive function were assessed in the children using a longitudinal growth modeling methodology, the researchers collected data 4 times across the span of two years using scores from the BASC-2 parent rating scale. The children that participated in the Early Risers intervention program showed improved executive function scores from the parents. A parallel process latent growth model showed that these changes in executive function fully mediated conduct problems scores. In a review of research on executive function and social emotional competence by Riggs, Greenberg, Kusche, & Pentz (2006), the authors referenced a social emotional program called Promoting Alternative Thinking

Strategies curriculum (PATHS; Greenberg & Kusche, 1993) that had a decrease in internalizing and externalizing behaviors, which were mediated by inhibitory control.

An understanding of how executive functioning deficits impact individuals may allow for more successful interventions to be administered. Luciana & Collins (2012) describe the changing internal and external demands that are put onto these executive functioning abilities as an executive load**.** They assert that the magnitude of what an individual's executive load can handle will determine the variability in how well they self-regulate behavioral and emotional needs. This suggests that a better developed executive function system is a resilience factor, and, thus, can be seen as a mediator in the face of psychopathological illness.

Based on the previous research findings discussed in this literature review, it is predicted that there will be a significant relationship between executive function, as measured by the CEFI and externalizing/disruptive behaviors, as measured by the BASC-3. Studies such as Jarratt et al. (2005) noted that correlations between the BASC-2 and BRIEF were high, however, although they were both measuring similar behavioral constructs, the executive function rating scale was measuring observable metacognitive behavior. This study will also examine the influential relationship that executive function may have on externalizing/disruptive behaviors, and what influence those externalizing/disruptive behaviors may have with learning in school. It is predicted that executive function will have a direct effect on the scores pertaining to the externalizing behavior subscales and the school/learning problems, as measured by the BASC-3.

Chapter 3: Methodology

This study examined the relationship between executive function and externalizing behaviors using the CEFI as a measurement of executive function and the BASC-3 as a measurement of social-emotional/behavioral symptoms. The correlational relationships between these two constructs will help to identify more significant relationships between executive function and externalizing behaviors as they relate to school problems. Correlational analysis will be employed for this part of the study to identify which variables have the strongest relationship between one another. Scores from the parent and teacher rating scales of the CEFI and BASC-3 will be utilized for this analysis.

Relationships that are found to be statistically significant between the two constructs will be used to further investigate through a structural equation model that will examine the direct effect that the overall executive function score from the CEFI may have on various psychopathological symptoms as reported on the BASC-3. The full scale score from the CEFI will serve as the executive function score in this analysis. The relationships between composite scores from the BASC-3 will serve as a marker for symptoms that may be impeding the student's learning. Data will be taken from these scales in the form of standard scores for the CEFI and T-scores for the BASC-3. Scores from the CEFI and BASC-3 incorporate overall composite scores as well as individual subscale scores, all of which will be used as variables within the analysis. Hierarchal multiple regression analysis will be performed to examine whether the overall score of executive function from the CEFI acts as a mediator between externalizing behaviors and school problems, as indicated from BASC-3 data.

Participants

The data utilized in this study will be archival data obtained and used with permission from students attending school in Northern California who were referred for a psycho-educational assessment, regardless of whether the student qualified for special education services. Ages vary from 6-18 years of age. Clinical diagnosis of these students will be noted as demographic variables but will not be utilized within the main framework of the study. Students from district programs, charter schools, county operated school programs, and non-public schools will be included in this study. Students utilized for this study receive varying levels of support and services based upon their individual needs as special education students.

Procedures

Archival data will be utilized from records of students that were evaluated for special education services within a California school system. These evaluations measure areas of cognition, language, memory, executive function, attention, social/emotional behavior, and academic achievement. All examiners were either fully credentialed under state law and currently working within the California State Education system or were intern school psychologists working under the supervision of a credentialed school psychologist. All tests and measures were administered with the consistent standardization protocol that is appropriate for the given tests.

Only evaluations that have utilized data from the CEFI and BASC-3 will be used. Scores will be compiled into a data set onto a statistical program that will be used to perform various mathematical analyses. Demographic data such as FHI code, age, medical diagnosis, program placement, ethnicity and gender will be included. No personal identifying information will be included, and all participants will be assigned a numeric ID solely for the purposes of data entry.

Instrumentation

Comprehensive Executive Function Inventory (CEFI). The Comprehensive Executive Functioning Scale (CEFI) is a rating scale designed to measure behaviors that are associated with Executive Function in children and youths aged 5 through 18 years old. The CEFI is composed of items related to attention, emotion regulation, flexibility, inhibitory control, initiation, organization, planning, self-monitoring, and working memory. Both parent and teacher rating scales will be utilized for data analysis. The full scale score is made up of 90 items from nine different areas that are conceptually related to executive function. Reliability coefficients for the full scale score on the teacher ratings range indicated a Cronbach's Alpha of .99. Parent ratings range from .97 to .99.

Behavior Assessment System for Children, Third Edition (BASC-3). The Behavior Assessment System for Children, Third Edition (BASC-3) is a comprehensive measure of both social/emotional, adaptive, and problem behaviors in the home and school settings. The BASC-3 is composed of items related to hyperactivity, aggression, conduct problems, anxiety, depression, somatization, attention problems, atypicality, withdrawal, adaptability, social skills, leadership, functional communication, and activities of daily living. These items make up composite scales related to externalizing problems, internalizing problems, behavioral symptoms index, and adaptive skills. Reliability coefficients for the Externalizing Problems composite on the teacher ratings range from .95 to .97 and parent ratings range from .93 to .97 for the child and adolescent age groups. Reliability coefficients for the School Problems composite on the teacher rating scales range from .93 to .96 for the child and adolescent age groups.

The externalizing problems, and school problems composites along with their respective clinical scales will be used for this study. The externalizing problems composite is derived from

the hyperactivity, aggression, and conduct problems scales. A central characteristic of the externalizing problems composite is the disruptive behavior that the student displays. The Hyperactivity scales measures the hyperactive and impulsive aspects of ADHD. The aggression scale assesses both verbal and physical aggression, with verbal aggression being measured by behaviors such as teasing, arguing, and making verbal threats. The Conduct Problems scale measures behaviors that are deemed socially deviant and disruptive. The School Problems composite is derived from the attention problems and learning problems scales. This composite reflects academic difficulties, which include motivation, attention, and learning/cognition. The Attention Problems scale measures a student's inability to maintain attention and the tendency to be easily distracted.

Data Analysis and Presentation

This first step in the analysis was to investigate correlations between the full scale CEFI and the composites/subscales in the BASC-3 utilizing SPSS (Version 23). Variables that are shown to have statistically significant relationships will then be used for analysis using structural equation modeling. The structural equation models that will be analyzed will have the overall executive function score from the CEFI as the independent variable. Dependent variables within the model will consist of composites of externalizing behaviors, school problems and their sub scales from the BASC-3. Gender and ethnicity will serve as control variables. Paths will be estimated from the control and independent variables to the dependent variables. The comparative fit index (CFI) Tucker-Lewis index (TLI) with values above .95 and the root mean-square error of approximation (RMSEA) with values below .05 will indicate appropriate model fit. AMOS version 23.0.0 will be used to analyze the data. The CFI provided a population estimate of the improvement in fit for the null model and the TLI provided an adjustment for

parsimony to the model. Determining the fit for the model to the data utilizing these fit statistics, Keith (2015) suggests values approaching 1.0 demonstrate a better fit with values over .95 demonstrating a good fit. RMSEA was used to explore the fit of the model as it relates to the degrees of freedom. Values below .05 suggest a good fit (Keith, 2015).

1. Does executive function as measured by the Full Scale CEFI score directly effect Externalizing Problems and School Problems as measured on the BASC-3?

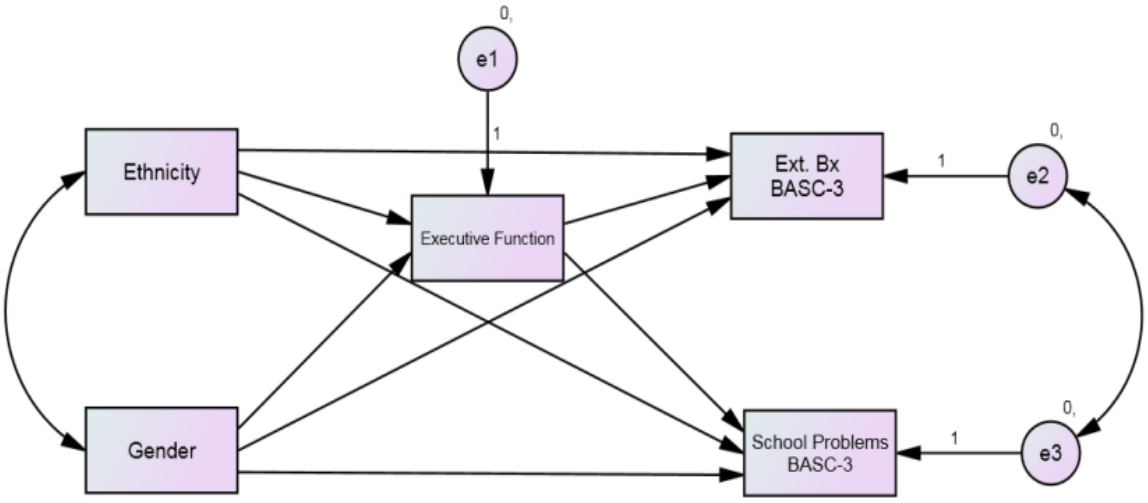

Figure 1. Executive function on externalizing behaviors and school problems.

2. Does executive function as measured by the Full Scale CEFI score directly effect Hyperactivity and Learning Problems as measured on the BASC-3?

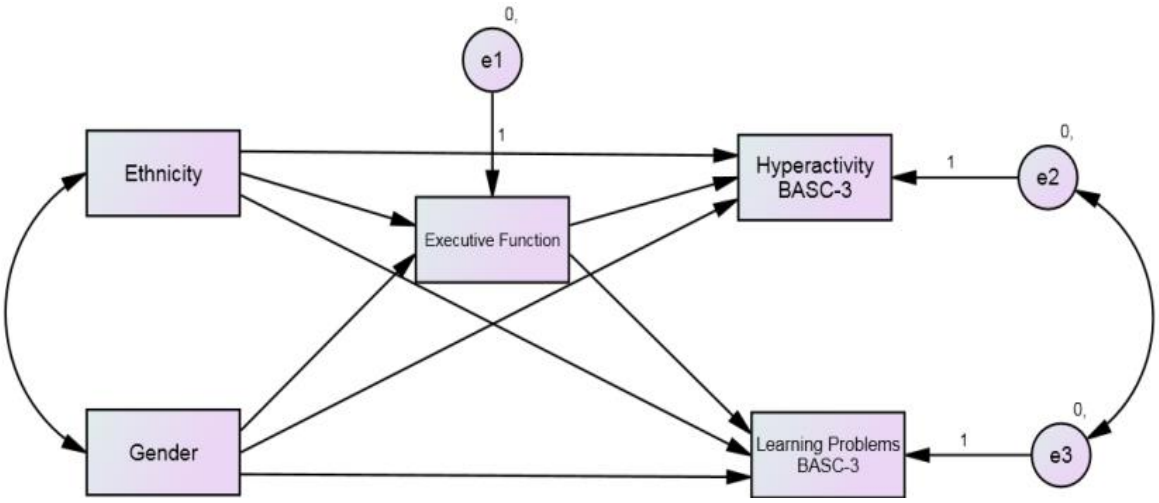

Figure 2. Executive function on hyperactivity and learning problems.

3. Does executive function as measured by the Full Scale CEFI score directly effect Aggression and Learning Problems as measured on the BASC-3?

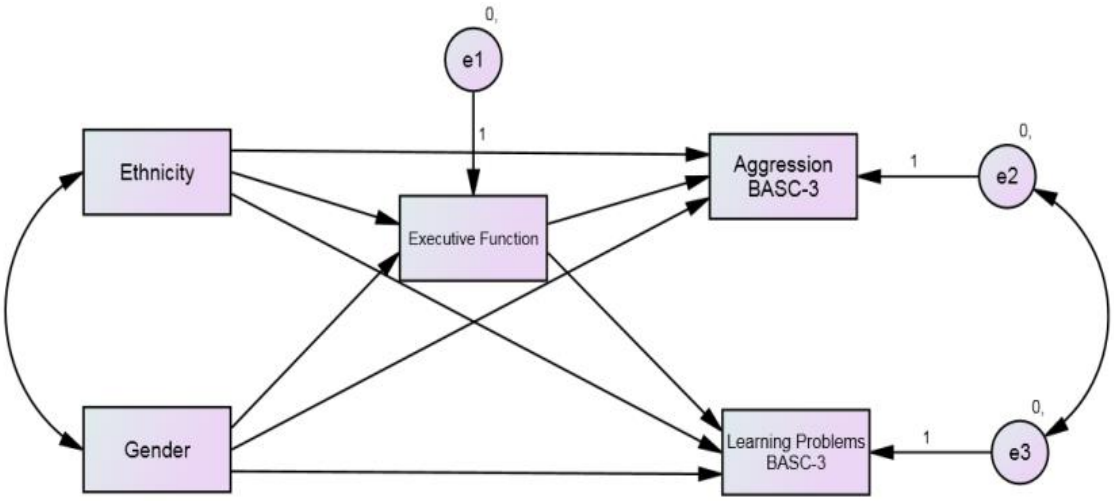

Figure 3. Executive function on aggression and learning problems.

4. Does executive function as measured by the Full Scale CEFI score directly effect Conduct Problems and Learning Problems as measured on the BASC-3?

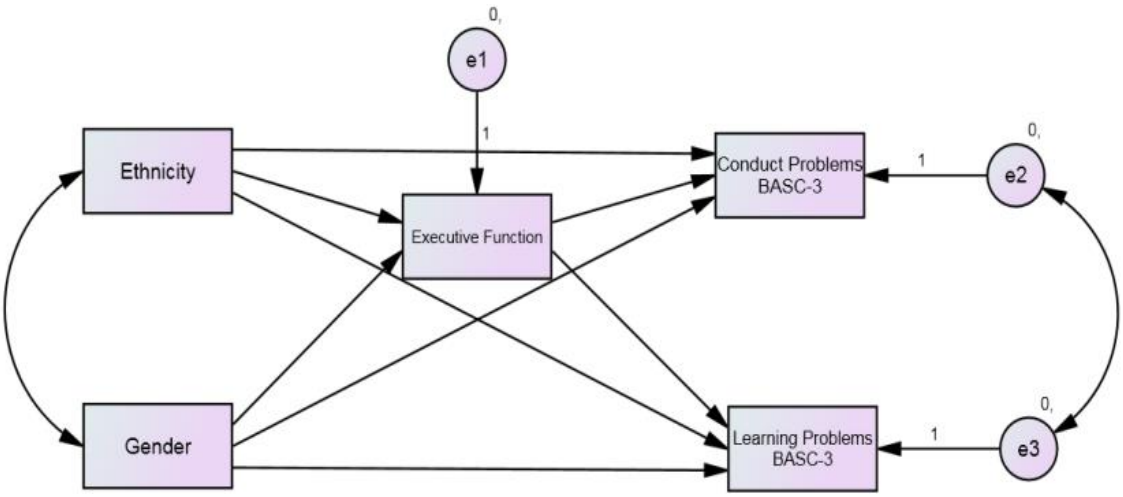

Figure 4. Executive function on conduct problems and learning problems.

Chapter 4: Results

To examine the direct effects that executive function may have on externalizing behaviors and school problems, four separate structural equation models were produced and analyzed. The models used the full scale score from the teacher form of the CEFI as a measure of executive function, along with the teacher forms of the externalizing problems and school problems composites and their sub-scales from the BASC-3. Path coefficients for the models analyzing standardized direct effects are presented in Table 2.

Table 1

Frequencies and Descriptives for Control Variables Gender and Ethnicity

Variable	Frequency
Male	75
Female	40
White	46
Hispanic	43
African American	15
Non-White, Hispanic, or African American	4

The first model was produced to examine the direct effect of executive function on externalizing behaviors and school problems. Standardized coefficients indicate that there is a statistically significant relationship between the full scale score on the CEFI and externalizing problems (β=-.763, p< .01) and school problems (β=-.555, p< .01) composites on the BASC-3. The second model examined the direct effect of executive function on hyperactivity and learning problems. Standardized coefficients indicate that there is a statistically significant relationship between the full scale score on the CEFI and the hyperactivity (β=-.671, p< .01) and learning

problems (β=-.552, p< .01) sub-scales on the BASC-3. The third model examined the direct effect of executive function on aggression and learning problems. Standardized coefficients indicate that there is a statistically significant relationship between the full scale score on the CEFI and learning problems (β=-.675, p< .01) sub-scale on the BASC-3. There was no significant relationship between executive function and aggression (β=.072, p<=.459). The fourth model examined the direct effect of executive function on conduct problems and learning problems. Standardized coefficients indicate that there is a statistically significant relationship between the full scale score on the CEFI and the conduct problems (β=-.490, p< .01) and learning problems (β=-.673, p< .01) sub-scales on the BASC-3. Data for various groups of students were also computed. Table 3 provides mean full scale CEFI scores for various categories of special education qualification and educational placement.

Table 2

Standardized Path Coefficients of Full Scale CEFI

Variable	Standardized Coefficient	Sig.
Externalizing Problems	-.763	<.01
School Problems	-.555	<.01
Hyperactivity	-.552	<.01
Aggression	.072	.459
Conduct Problems	-490	<.01
Learning Problems	-.671,-.673,-.675	<.01

Table 3

Mean Full Scale CEFI Score Based on SPED Qualification and Placement

Variable	Mean	N
Other Health Impairment	81.48	29
Specific Learning Disability	87.94	31
Emotional Disturbance	83.00	17
Do Not Qualify	95.68	22
Intellectual Disability	78.00	2
Autism	86.25	4
District	87.25	4
County	85.25	13
Non Public School	83.22	9
Other (Charter/Alt. Ed.)	87.10	81

Chapter 5: Discussion

The goal of this study was to examine the effect that executive function may have on specific observable behavior and school problems. The measures used in this study were rating scales that are commonly used by many school psychologists across the nation. Results from this study may thus be useful to practicing school psychologists. As noted in the review of literature, previous research has indicated that executive function has an influence on behavioral, academic, and even emotional outcomes. However, the relationship between executive function and behaviors using nationally normed rating scales and students identified as being served in special education has been lacking. The results from this study indicate that there is a significant direct effect from executive function on externalizing behaviors and school problems, such that higher scores in executive function, as measured by the CEFI, yielded lower externalizing behavior and school problems scores, as measured by the BASC-3.

The relationship between executive function and behavior that was seen in the Jarratt et al. (2005) study was also seen in this current study. The study from Jarratt et al. (2005) found that the BRIEF and BASC were measuring similar, but different, constructs of dysfunction. This dysfunction was tied to behaviors that were related to ADHD, which was their main participant base. When examining the areas of deficit between the OHI and ED groups in this current study, it was shown that they share similar areas of dysfunction that may be associated with frontal lobe activity as a whole. This symptom comorbidity may be a result of executive dysfunction between the groups. The strong correlational relationship that is noted between these two studies give more validity to the relationship that executive function has on behavioral and academic outcomes.

Results consistently showed that when executive function scores increased scores on behavior problems decreased. Standardized regression weights from AMOS indicated that executive function had a direct effect of -.555 on the externalizing behaviors composite, and a direct effect -.763 on the school problems composite. According to Cohen (1988), these effect sizes are considered to be "moderate." This relationship was relatively consistent throughout the models with the exception for aggression, which showed no significant relationship. In laymen's terms, this means that as executive function ability increases, for every 15 points (one standard deviation), there is a corresponding 5 point decrease on externalizing behaviors and a 7 point decrease on behaviors that lead to school problems.

While it is clear from the data in this study that executive function does appear to have a direct relationship with observable behaviors, the data also showed that there were some notable differences between various groupings of students in regards to scores of executive function on the CEFI. When examining the average full scale CEFI score as a function of how the students were qualified for special education, those who were found to qualify under Other Health Impairment had the second lowest score of 81.48. Students who were found to qualify under Emotional Disturbance had an average full scale CEFI score of 83. These two groups do share much symptom overlap and the noted deficits in executive function could be explaining some of that comorbid variance that is observed between the groups. Mean scores taken from the treatment scales of the CEFI showed that the two groups were within 1 point of each other in regards to flexibility, self-monitoring, planning, and inhibition. Vuontela et al. (2012) found that inhibitory control was the most important cognitive ability that predicted better adaptive functioning, school performance, and fewer symptoms of internal stress. Results from this study indicated that individuals with the most difficulty inhibiting behavior also fell between the two

groups that yielded significant executive function deficits. Namely those students found to qualify under ED or OHI. The ability to inhibit is also noted as an important skill regarding Barkley's (2014) model of executive functioning. These four treatment scales cover a great deal of the comorbidity found between the ED and OHI group in this data set. Conversely, the biggest differences between the two groups were in working memory at 5 points and emotional regulation at 6.34. The OHI group had the lower score for working memory, while the ED group had the lower score for emotional regulation.

One area that often distinguishes the qualification between one category or the other, is the etiology of the behavioral or academic deficits. When emotion regulation appears to be the driving force of educational difficulties, then Emotional Disturbance would appear to be appropriate. Academic difficulties that evolve around attention problems may lend the label of OHI to be more appropriate. Tseng & Gau (2013) found that participants with a diagnosis of ADHD also displayed deficits on the working memory and planning tasks. These deficits were, in turn, related to social problems. This finding was consistent in this current study showing that students that qualified for special education under OHI displayed the strongest deficit in working memory when compared with other groups. Students with a medical diagnosis of ADHD or ADD typically qualify under Other Health Impairment. One take home from the data in this study is that students from both groups exhibit similar executive dysfunction. The differentiating of those other executive skills (i.e., attention, emotional regulation) may be the defining characteristics between the groups.

Students that qualified for special education under Specific Learning Disability in this study had an overall average full scale CEFI score of 87.94. The SLD group did show that executive function was approaching a normative weakness. However, the main basis for

qualifying under SLD is that the student has a cognitive processing deficit. It would make sense that these students would be displaying behavior that would indicate executive dysfunction, however, the etiology of the academic difficulty may stem from a more cognitive processing deficit (e.g., working memory).

Differences in average full scale CEFI scores were also noted between types of special education placements. Students in this study were categorized by their special education placement being served in a district program (n=4); county program (n=13); non-public program (n=9); or other (n=81). Overall, full scale CEFI scores were found to be similar for students receiving services from district or other programs with an average of 87. The data indicates that programs that facilitated more environmental supports and services had students with lower full scale CEFI scores. This is consistent with students who have deficits in executive function needing more environmental supports in place to help regulate their behavior. Students receiving services in a county placement had an average overall full scale CEFI score of 85, and students receiving services in a non-public school placement had an average overall full scale CEFI score of 83. When you compare these numbers with the students that did not qualify, who had an average full scale CEFI score of 95.68, you can get a clear picture of how the level of need is met within the special education system.

While this study may have not fully examined the relationship between executive function and behavior, it may have helped to serve as a starting point for future research regarding the matter. It is quite clear from the data in this study that the executive deficits observed in the classroom hold a tremendous amount of weight regarding special education placement and qualification. A better understanding of how these special education programs

work to foster these executive function skills may lead to more successful interventions and strategies for those being served.

Implications of this study show is that there is a clear relationship between observable executive function and behavior. This means that interventions targeting executive function may also improve behavior and school outcomes. The specific mechanisms that executive functions are tapping into may need further explanation but the outcome may yield progress in multiple areas of behavioral and academic functioning. Given the complexity that this system is working within it may be noted that interventions focused on developing executive function may not yield the results that program wide strategies may. Simply put, 30 minutes of intervention weekly will not be sufficient enough to develop the skills need to drastically change executive function and behavior. The relationship between executive function and behavior may best be modified and developed through program wide strategies that enable students to use interventions daily and consistently.

Executive function interventions generally focus on academic or behavioral tasks. The academic interventions that focus on increasing math or reading ability appear to revolve around how the individual is conceptualizing the task at hand. Studies from Haddad et al, (2003) & Iseman & Naglieri (2011) has shown that interventions based around the planning aspects of math or reading had a moderate effect for those students who displayed a processing deficit in planning. It is important to note that the planning and attention composites within Naglieri's PASS model are associated with more frontal lobe functions, and research also indicates that these are the two areas that individuals with a diagnosis of ADHD tend to struggle in. Conceptualization of a task is also seen as a main component of other executive function interventions as evidenced in the Goal-Plan-Do-Review System by Ylvisaker (1997). The

system aims to encourage the student to engage in goal setting, self-awareness activities, organization/planning, strategy use, and monitoring. A common thread among these interventions is the constant use of executive function throughout the day.

Judy Willis (2007) states that information from working memory needs to be generalized in about 20 minutes or it is at risk of being lost. A strategy to get students to generalize is to connect the new information with previous knowledge. A performance based example of this is on the Feifer Assessment of Reading (Feifer, 2015). On the word recall subtest, students are asked to recite a set 12 words, then on the second trial they are asked to recite the words by categorical association. If the student is able to recite more words on the second trial then this indicates that they have an executive function strategy for working memory. If the student doesn't perform better on the task, Feifer suggests that it is likely due to a problem with executive function. This example indicates that a change in strategy can lead to the recall of more information. The research regarding executive function seems promising, because a simple change in how a problem is perceived can make a dramatic effect on the outcome.

It should also be noted that many of these academic interventions address cold executive function skills. With executive function interventions that target behavior, the system that is being tapped into is referred to as hot executive function. The common thread with these interventions is that they are geared at calming down the amygdala. A review of mindfulness strategies from Malow & Austin (2016) found that use of mindfulness decreased psychological symptoms of depression and anxiety, had a positive influence on self-regulatory processes, and helped those suffering from difficulties in modulating attention. The study by Malow & Austin (2016) examined a mindfulness curriculum on students in a self-contained school with emotional/behavioral disorders. After 6 weeks of the curriculum the 15 students appeared to

demonstrate a higher level of mastery regarding mindfulness techniques. And the students also perceived a significant decrease in levels of emotional reactivity. Other interventions that focus on behavior and emotion for executive function stem from early behaviorism techniques. Many of the main stays in behavior modification involve the use of timers to increase an individual's awareness of what they should or shouldn't be doing. An exhaustive list could be made from the various therapy models that encompass aspects of regulating frontal lobe activity but one take away that should be made in this discussion is that regulating the amygdala should be the prime target when working with individuals with emotional and behavioral needs. Practitioners cannot even begin to tap into an individual's cognitive processing ability if they under a heighted state of mind. A model focusing on hot executive function skills first may yield more successful skill acquisition in the cool executive function interventions.

This study presents several limitations in regards to the profiles that were used in this data set. Data came primarily from students that attended a charter school or other alternative education program. A more inclusive set that represented students from other programs may have served to increase the generalizability of the results and give more validity to distinct profile deficits that may be shown by different groups. However, this study is unique in the fact that it did use data from students in special education. The study also utilized scores from rating scales only. The observed deficits in executive function may explain more variance with the addition of performance based measures. Males are over-represented more in this study and that may have influenced how some of the scales were interpreted regarding the externalizing behaviors. For example, girls, because they are socialized differently, may show qualitative differences in how deficits may be manifested. This qualitative aspect is apparent in depression and anxiety rating scales as differing gender groups are normed based upon the manifestation of

symptoms. Rating scales for executive function have yet to be normed based on these qualitative gender differences.

Further research may want to explore whether differing profiles exist between students that qualify for special education in regards to executive dysfunction. This distinction between groups may yield potential modifications for pre-existing services. An example of this may be the modification of cognitive behavioral therapy with executive function strategies embedded within the treatment. Another area of research may examine how school programs foster the development of executive function skills. It was noted that students with lower executive function scores tended to be placed in more restricted academic settings. How these more restrictive settings seek to foster the development of executive function may yield more understanding in intervention and outcomes.

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