VALIDITY OF THE CEFI WITH ADOLESCENTS

A Dissertation

by

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Submitted to the Office of Graduate and Professional Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

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August 2018

Major Subject: School Psychology

ABSTRACT

Parent and self-report ratings were obtained for 57 adolescents using the Comprehensive Executive Function Inventory and the Behavior Assessment System for Children-Second Edition. Results indicate there were no differences among raters with regards to race/ethnicity and gender. Adolescents rated themselves as having significantly more problems, compared to parent ratings, on all subscales and composites comprising the CEFI and on the BASC-2 clinical and adaptive composites. These findings suggest that parent and self-ratings of executive function together, when evaluated using the CEFI, may offer useful information for treatment planning and intervention that may be missed if only one rater is used. Future attempts to validate the CEFI should focus on including clinical groups as previous studies have shown that they lag behind peers in the development of executive functioning skills.

DEDICATION

I am dedicating this dissertation and all of my academic achievements to my mother Judy Primus Goodwin and to my father, the late Henry Napoleon Primus, who planted and watered the seeds of hard-work, dedication, and tenacity in my life. Your love, sacrifice, prayers, and belief in my accomplishments have kept me focused on this challenging but ultimately rewarding journey. Although you are no longer with us daddy, your spirit, vision, and legacy lives on.

ACKNOWLEDGEMENTS

First and foremost, I would like to thank my Lord and Savior Jesus Christ for allowing me to live to see this dissertation through. He has provided me with abundant blessings, tremendous faith, unwavering hope, perseverance, strength, and many revelations along this academic journey.

I would also like to thank my loving mother, Judy Primus Goodwin, and stepfather, Lewis Goodwin, for their support, understanding, and never-ending words of encouragement when I needed them the most. Thanks mom and stepdad for your incessant phone calls and innumerous flights from Georgia to Texas to spend time with me during times of celebration and tragedy. To my sister, Joycelin, you are my superhero. Your character, integrity, work ethic, words of encouragement and conversations filled with laughter meant so much to me and kept me propelling towards the finish line.

Thank you Jessica for providing me with a listening ear and providing honest but loving feedback. You are and always will be like a sister to me. I also am also thankful for the ladies who were like my aunts, affectionately known as the “Prayer Warriors”. All of you provided me with unwavering support, prayers, and encouraging words.

To my loving husband, David, thank you for standing by my side, remaining committed, and showing moral support every step of the way. You helped keep my goals and aspirations alive despite having to push your own aspirations and goals aside momentarily. I am grateful for your sacrifice and staying awake with me during sleepless nights in order to see me carry out this research successfully. Your highest regard for my well-being showed me that I could do anything I put my mind to do. I love you and I could not have done this without you.

I would also like to thank my committee chair, Dr. Cynthia Riccio, and committee members, Dr. Krystal T. Simmons, Dr. William Rae, and Dr. Robert Heffer, for the support during my graduate studies at Texas A&M University. Thank you for your guidance and mentorship throughout this process and for contributing to my academic as well as life-long success.

As I continue to reflect over the past seven years, I have learned that it truly takes a village to raise someone who is unafraid to create a path and follow his or her passion no matter what it takes. With that being said, I would like to thank my extended family and friends who supported me along my academic journey. I am truly thankful for my Texas A&M graduate school cohort and my Lewisville ISD internship cohort. Thank you to my supervisors on the Doctoral Training Committee (DCT) in Lewisville ISD who stretched me and fostered exponential growth during my internship year. I will always remember your support, words of wisdom, and words of encouragement.

CONTRIBUTORS AND FUNDING SOURCES

This work was supported by a dissertation committee consisting of Cynthia Riccio, Ph.D. [advisor], Krystal Simmons, Ph.D., William Rae, Ph.D., and Robert Heffer, Ph.D., of the Department of Psychological and Brain Sciences.

The data analyzed for Chapter III was provided from primary data sources. All other work conducted for the dissertation was completed by the student independently. The current research was not supported by outside funding.

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CHAPTER I

INTRODUCTION

Research in the area of executive function (EF) has increased rapidly in the past two decades. There are various ways to conceptualize EF. Most researchers agree that EF refers to a set of mental processes used to regulate behavior such as attentional control, working memory, inhibition, goal setting, planning, problem solving, mental flexibility, inhibition, and abstract reasoning (Anderson & Castroppa, 2005; Ganesalingam et. al 2011; Senn, Epsy, & Kaufman, 2004; Welsh, Pennington, & Groisser, 1991). EF also enables complex goal directed behaviors (Gilbert & Burgess, 2008; Johnson & Reid, 2011; Levin & Hanten, 2005; Miller, 2005). Several researchers further consider EF as being divided into several separate components such as self-regulation and metacognition (Hunt, Turner, Polatajko, Bottari, & Dawson, 2013; Johnson & Reid, 2011; Meltzer et al., 2007; Miller, 2005; Stuss & Alexander, 2007; Zimmerman & Tsikalas, 2005). Self-regulation includes those processes such as inhibition, shifting, and emotional control, whereas metacognition includes processes of working memory, problem solving, organization, planning and self-monitoring (Johnson & Reid, 2011; McClelland, Ponitz, Messersmith, &Tominey, 2010; Meltzer, 2007; Stuss & Alexander, 2007; Miller, 2005; Zimmerman & Tsikalas, 2005).

The most studied metacognitive EFs are mental flexibility (Anderson, 2002; Miyake et al., 2000; Stahl & Pry, 2005), working memory (Barcelo & Knight, 2002; Pennington & Ozonoff, 1996; Welsh, 2002), and planning (Burgess & Shallice, 1996; Owen, Downes, Sahakian, Polkey & Robbins, 1990). Regardless of the model of

definition of EF, component processes are linked to the acquisition of early academic skills in areas such as reading comprehension (Durand, Hulme, Larkin & Snowling, 2005; van der Sluis, de Jong, & van der Leij, 2007) and mathematics (Bull, Espy, & Wiebe, 2008; Bull & Lee, 2014; Cragg & Gilmore, 2014; Toll, Van der Ven et al., 2011; Van der Ven, Kroesbergen, Boom, & Leseman, 2012). EF also are associated with behavioral outcomes (Sasser & Bierman, 2012; Schoemaker, Mulder, Dekovic, & Matthys, 2013; Woltering, Lishak, Hodgson, Granic & Zelazo, 2015) and psychological adjustment (Jacobson, Williford, & Pianta, 2011; Lawson et al., 2015; Lin, Lai, & Gau, 2012; Whittingham, Bodimeade, Lloyd, & Boyd, 2014).

Self-Awareness/Self-Monitoring

Although not traditionally considered within EF, self-awareness is the ability to accurately recognize one's abilities and limitations. It is a necessary component in self-monitoring and influenced by many factors including memory, decreased sensory or perceptual abilities, impulsivity, and an inability to plan for the future. Deficits include displaying very limited or no apparent appreciation with regard to the nature of difficulties or impairments and the impact of everyday functioning. In many models, it may be subsumed under self-monitoring as a metacognitive skill (Miller & Cohen, 2001; Sohlberg & Mateer, 2001; Stuss & Alexander, 2007).

It is important to analyze EF from a developmental perspective for several reasons. The developmental trajectory of EF possibly begins before an individual is born and continues into adulthood (Zelazo, Craik, & Booth, 2004; Diamond, 2002; Romine & Reynolds, 2005). Several research studies have shown that the developmental trajectory of component processes is not linear but rather that each component has a different

trajectory (Huizinga, Dolan, & van der Molen, 2006; Miller, Loya, & Hinshaw, 2013; Romine & Reynolds, 2005; Taylor, Barker, Heavey, & McHale, 2013; Welsh, Pennington, & Groisser, 1991). For example, Romine and Reynolds (2005) analyzed effect size differences across age groups and found that EF components develop at different rates, follow different developmental trajectories, and reach peak levels at different ages. However, there is a linear and continued progression of improvement in EFs during adolescence and early adulthood (Delis, Kaplan, & Kramer, 2001; De Luca et al., 2003). These findings suggest a leveling off of EF development by early adulthood across components.

Measurement Issues and EF

Despite the vast research in EF, numerous questions about how to best measure the construct remain unanswered. Different definitions and conceptualizations of EF often yield different ways to measure this construct. Performance-based and rating measures are commonly used to assess EF in clinical and neuropsychological assessments. Researchers have consistently debated whether performance-based and rating measures of EF are interchangeable and whether they measure the same EF components (Zeidner, Roberts, & Matthews, 2002; Toplak, West, & Stanovich, 2013). For example, despite the potential ease of use, several studies found that parent-ratings of children's EF behaviors correlate very poorly with children's performance on EF assessments (Buchanan, 2016; Ten Eycke & Dewey, 2015).

Although neuropsychological tests are valuable in both research and clinical settings, they often have been criticized for not being able to generalize to real world settings (Silver, 2000). It has been argued that rating measures are just as valuable with

clinical and non-clinical populations and tend to assess how a child performs in everyday contexts (Barkley & Fischer, 2011; Johnco, Wuthrich, & Rapee, 2014; Kamradt, Ullsperger, & Nikolas, 2014). The most commonly used rating scale of EF has been the Behavior Rating Inventory of Executive Function (BRIEF; Gioia, Isquith, Guy, & Kenworthy, 2000). Recent rating scales developed to assess various EF components include the Delis-Rating of Executive Function (D-REF; Delis, 2012), the Barkley Deficits in Executive Functioning Scale (B-DEFS; Barkley, 2012), and the Comprehensive Executive Function Inventory (CEFI: Naglieri & Goldstein, 2013). Limited research has been conducted on the D-REF and B-DEFS and there have been no known studies evaluating the validity and the utility of the CEFI. Therefore, this study seeks to add to the extant EF literature by examining the evidence base in relation to the interpretation and use of the scores as intended by the developer to support the validity of the CEFI as an adequate measure of EF.

Statement of the Problem

Research consistently indicates that EF components play an important role in one's cognitive functioning, behavior regulation, emotional control, and social interaction (Barkley, 2013; Hoffman, Schmeichel, & Baddeley, 2012; Liew, 2012; Niendam et al., 2012; Roskam et al., 2014). The development of EF continues through adolescence and into early adulthood; yet, there is limited research investigating the status of EF components during adolescence. Several research studies have shown that the developmental trajectory of EF is not linear but rather that each component has a different trajectory (Huizinga et al., 2006; Romine & Reynolds, 2005; Welsh, Pennington, & Groisser, 1991). Moreover, many EF components are not fully developed

until middle adolescence or early adulthood (Anderson et al., 2002). Nevertheless, executive dysfunctions during every-day events are widely observed among non-clinical samples comprising subjects who have no history of psychiatric or neurological diseases and who do not have substance abuse disorders (Chan, 2001; Wu et al., 2011). Increasing evidence suggests that conditions associated with executive dysfunction, such as autistic spectrum disorders and attention-deficit hyperactivity disorder, are on a continuum with normality (Baron-Cohen et al., 2003; Levy et al., 1997). Furthermore, the full impact of deficits in EF development may only have a substantial impact in adolescence and adulthood, when individuals are required to act more independently, utilize planning and reasoning abilities, and monitor their own progress and success (Castroppa & Anderson, 2002).

Purpose of Study

The purpose of this study is to examine the relation between the EF constructs as measured by the CEFI (Naglieri & Goldstein, 2013) and the social/emotional/behavioral constructs of the BASC-2 (Reynolds & Kamphaus, 2004) with a sample of adolescents. This would add to the evidence base about the relation between the EF components as measured by the CEFI and psychological adjustment as measured by the BASC-2. Comparing parent and self-report as a measure of self-awareness using the CEFI would further add to the evidence base with regard to the impact of different raters on the results as well as potentially providing an indication of the developmental status of self-awareness in adolescents. Consideration of unintended consequences specific to group differences based on demographic factors is a further consideration in the validity of the CEFI as results may be one component used for diagnostic or placement purposes.

Research Questions

1. What is the relation between the composite and subscale scores of the CEFI and the clinical and adaptive scales of the BASC-2? What is the relation between the CEFI and the BASC-2 EF content scale? It is hypothesized that there will be a moderate correlation between the composite and subscale scores of the CEFI and the clinical and adaptive scales of the BASC-2. Specifically, it is hypothesized that there will be an even stronger correlation among the EF scales on the CEFI and BASC-2 EF content scale. It is also hypothesized that there will be a negative correlation between parent and self-report on the CEFI and Self-Monitoring subscale.
2. What is the level of agreement for parent- and self-ratings on the CEFI? To what extent do differences between parent- and self-report on the CEFI correlate with composite overall adjustment (BSI) on the BASC-2 and with the Self-Monitoring subscale of the CEFI? It is hypothesized that there will be a moderate correlation between parent and self-ratings on the CEFI. Further, it is hypothesized that lower correlation between parent and self-report on the CEFI will be associated with greater behavioral symptoms (Behavioral Symptom Index) on the BASC-2 and more impaired Self-Monitoring.
3. To what extent do CEFI, BASC-2, and rater differences (self-awareness) differ across demographic factors (racial/ethnic group, gender, age group)? It is hypothesized that there will be no difference in ratings of self-awareness across demographic factors (e.g., age, sex, gender). It is also hypothesized that there will be no difference across parent educational level or racial/ethnic groups.

Conversely, it is expected that there will be gender differences on the Attention, Emotion Regulation, Flexibility, Inhibitory Control, Initiation, Organization, Planning, Self-Monitoring, and Working Memory scales. Age differences also are expected on the Emotion Regulation, Inhibitory Control, Organization, and Planning scales.

4. To what extent do CEFI, BASC-2, and rater differences (self-awareness) differ across groups based on special education placement, grade retention, or other diagnosis? It is hypothesized that there will be differences in ratings of self-awareness across groups based on special education placement, grade retention, or other diagnosis. It is further hypothesized that there will be differences between groups based on special education placement, grade retention, or other diagnosis. Specifically, those with special education placement, grade retention, or other diagnosis are hypothesized to obtain lower ratings compared to typically developing peers.

Clinical Significance

The construct of EF has become important in the assessment of typically developing children (Davidson, Amso, Anderson, & Diamond, 2006), special populations (Nigg, 2006; Pennington, 2006), and aging adults (Salthouse, Atkinson, & Berish, 2003; Kirova, Bays, & Lagalwar, 2015). Ratings scales were developed to provide an ecologically valid indicator of functioning in everyday problem-solving situations (Gioia, Isquith, Guy, & Kenworthy, 2000; Roth, Isquith, & Gioia, 2005). Although the most commonly used rating scale of executive function is the BRIEF (BRIEF; Gioia et al.,

2000), other rating scales have been developed recently to address EF deficits in children and adolescents.

The CEFI (Naglieri & Goldstein, 2013), in particular, is a newer rating scale of executive function in children and adolescents. Very little research has been done on the CEFI except for the research conducted in the process of instrument development by the authors. It is important that additional research be completed on the CEFI in order to establish the evidence related to the validity of the CEFI consistent with accepted standards (AERA, APA, NCME, 2014). Thus, it is important to assess the extent to which components of EF measured the CEFI are associated with overall psychological adjustment and adaptive functioning as measured by an established measure, in this case the BASC-2. It is also of interest to examine the extent to which CEFI results are consistent with the BASC-2 EF content scale. These findings would be useful in determining if there is value added to including the CEFI in addition to an omnibus measure like the BASC-2.

Further, other than the data from the standardization sample, there is little research that considers the extent to which gender or racial/ethnic differences exist with the CEFI. Establishing some evidence of comparability across gender and racial/ethnic groups is important. Given that the CEFI is available in Spanish as well as English, and determining the extent to which differences exist would be useful in establishing an evidence base for the use of the measure with Spanish-speaking parents and their children. Similarly, it is of interest to identify if there are differences by clinical groups in EF as measured by the CEFI. Findings of differences would support the use of the CEFI to further identify deficit areas to be considered in intervention planning.

Finally, it is established that self-awareness/self-monitoring is critical for academic, physical, and psychological outcomes of children and adolescents including the recovery and rehabilitation of neurological conditions such as traumatic brain injury, ADHD, and Autism (Bivona et al., 2008; Francis, Stan, Steward, & Bunner, 2014; Verhoeven et al., 2012). Impaired self-awareness has been shown to adversely impact the ability to accurately provide information about one's own emotional and behavioral functioning. Several studies have found strong correlations between EF and self-awareness (Amanzio et al., 2013; Shimoni, Engel-Yekger, & Tirosh, 2012). Decreased self-awareness is correlated with increased problems in some components of EF (Amanzio et al., 2013; Bivona et al., 2008; Steward et al., 2014) and may contribute to lower levels of motivation and barriers to treatment when it comes to rehabilitation (Malec & Moessner, 2011; Poletti et al., 2012; Verhoeven et al., 2012). Therefore, it is important to include self-awareness in the overall assessment of EF in order to improve EF in youth and improve treatment outcomes.

CHAPTER II

LITERATURE REVIEW

Defining EF

Executive function (EF) has been defined as a set of inter-related skills necessary to maintain an appropriate problem-solving set for attainment of a future goal (Gioia, Isquith, & Guy, 2001). EF has also have been defined as a generic term that refers to 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). EF impairments have been reported in numerous clinical populations such as traumatic brain injury (Garth, Anderson, & Wrennall, 1997), attention deficit hyperactivity disorder (Grodzinsky & Diamond, 1992), autism (Bishop, 1993), frontal lobe lesions (Eslinger, Biddle, Pennington, & Page, 1999), and others.

The executive system is a theorized cognitive system that controls and manages other cognitive processes. To date, there is very little agreement on one model of how the executive system functions. Across models, EF involves complex cognitive processes (Anderson, 2002; Barkley, 1997; Lezak, 1995; Miyake & Friedman, 2012; Sohlberg & Mateer, 2001; Stuss & Benson, 1986; Welsh, Pennington, & Groisserc, 1991; Zelazo, Carter, Resnik, & Frye, 1997). It is not the same as intelligence (Davis, Pierson, & French, 2011; de Frias, Dixon, & Strauss, 2006; Lamar, Zonderman, & Resnik, 2000; Salthouse, 2005; van der Sluis, de Jong, & van der Leij, 2007). In fact, EF is not exclusive to cognitive processes, but also is implicated in emotional responses and behavioral actions (Anderson et al., 2002; Gioia, Isquith, Guy, & Kenworthy, 2000). In

particular, mood, affect, energy level, initiative, and moral and social behavior can be disrupted in children and adults exhibiting EF deficits (Anderson, Bechara, Damasio, Tranel, & Damasio, 1999; Barkley, 1997; Barrash, Tranel, & Anderson, 2000; Eslinger, Grattan, Damasio, & Damasio, 1992).

The importance of EF and particularly those mechanisms implicated in the initiation, planning, modulation, and inhibition of behavior, stems from their impact on learning and social behavior. There is growing empirical evidence showing that executive functioning has a substantial impact on academic achievement (Best, Miller, & Naglieri, 2011; Swanson & Alloway, 2012; Willoughby, Blair, Wirth, Greenberg, & the Family Life Project Investigators, 2012). Reading and math skills are complex academic skills that have been found to be related to EF such as working memory (Bull, Espy, & Wiebe, 2008; Bull & Lee, 2014; Clark, Pritchard, & Woodward, 2010; Lan, Legare, Ponitz, Li, & Morrison, 2011), mental flexibility (Bock, Gallaway, & Hund, 2015; Smerud-Clikeman, Fine, & Bledsoe, 2013), and inhibition (Lan, Legare, Ponitz, Li, & Morrison, 2011). Youth experiencing difficulties with EF may frequently experience significant impairments in these academic areas. These academic skills tend to continue to develop from infancy through late adolescence. Bryce, Whitebread, and Szucs (2013) found a strong positive relationship between EF, metacognitive skills, and achievement in 5 and 7-year olds. Research has just begun to explore the ability of EF to predict social behavior in children with neurological conditions, mood disorders, ADHD, Autism, and brain injury (e.g., Happe, Booth, Charlton, & Hughes, 2006; Pellicano, 2010).

The development of EF in childhood and adolescence has currently come under scrutiny to more clearly understand and assess the mechanisms of control and

organization of behavior. The knowledge of neurodevelopmental aspects of cognition and EF has increased in the last two decades but the bulk of this knowledge is mainly based on observation and informal assessment of individuals with brain injury (Leon-Carrion et al., 2010). Extensive research regarding typical neurodevelopmental trends, particularly in conjunction with higher order cognitive skills, continues to be needed, and research to determine the extent of additional development beyond age 12 is necessary (Riccio et al., 2001).

Conceptual Models of EF

There are multiple models of EF (Anderson, 2002; Barkley, 1997; Lezak, 1995; Miyake & Friedman, 2012; Sohlberg & Mateer, 2001; Stuss & Benson, 1986; Welsh, Pennington, & Groisserc, 1991; Zelazo, Carter, Resnik, & Frye, 1997). Depending on the model, there are different component processes that are considered important and integral to EF. Historically, EF was conceptualized as a single construct with the central executive responsible for multi-modal processing and high-level cognitive skills (Anderson, 2002; Hughes et al., 2010; Weibe et al., 2008; Weibe et al., 2011). An example of a model with a central executive component would be the Supervisory Attentional System (SAS; Norman & Shallice, 1986). This model places an emphasis on the metacognitive system. The "metacognitive system" is a system in which one's ability to view, observe, and assess more basic cognitive procedures and includes self-awareness, self-monitoring, and self-control of cognition while performing an activity (Kennedy & Coelho, 2005). It is viewed as a dynamic process such that lower order processes are automatic (outside of EFs) and do not contribute to the higher order skills. The idea central to the SAS is that routine or well-established schemas automatically

respond to routine situations, while EF is used when individuals are faced with novel situations (Friedenberg & Silverman, 2006; Norman & Shallice, 1986). Thus, it is a two-level framework with the SAS involved in the use of flexible strategies that may generate new schema. Miller and Cohen (2001) postulated that the prefrontal cortex directs cognitive control and that the "control is implemented by increasing the gain of sensory and motor neurons that are engaged by task or goal directed elements of the external environment" (p. 171).

In contrast to a single central executive, EF has been conceptualized as multi-process systems that are inter-related, inter-dependent, and function together as an integrated control system (Stuss & Alexander, 2000; Miyake et al, 2000). Hierarchical models of EF are based on the premise that EFs receive input from lower level or more basic processes, such as attention and language, as well as higher level metacognitive processes (Stuss, 1991). Inhibition and drive, response inhibition, task persistence, and organization are lower level cognitive processes, whereas generative thinking and awareness are postulated to be higher level cognitive processes (Sohlberg & Mateer, 2001). The concept of a multi-process system is probably more accurate since specific executive processes are thought to be associated with distinct frontal systems, and executive processes demonstrate different developmental profiles (Huizinga, Dolan, & van der Molen, 2006; Klenberg, Korkman, & Lahti-Nuuttila, 2001; Miyake et al., 2000).

Table 1

Component Processes of Executive Function (EF)

Component	*Definition*	*EF Model(s)*
Attentional Control	Capacity to selectively attend to specified stimuli, the ability to maintain attention over time (Anderson, 2002; Norman & Shallice, 1986; Shallice & Burgess, 1996)	Supervisory Attentional System (SAS)
Inhibition	The ability to resist and inhibit prepotent responses (Barkley, 2007; Sohlberg & Mateer, 2001; Miyake, 2000; Welsh & Pennington, 1991)	Barkley's Model of Behavioral Inhibition Miyake 3-factor model of Executive Function
Information Processing/Cognitive Efficiency	Refers to the efficiency and speed of output (Sternberg & Sternberg, 2012)	Working Memory Model
Cognitive Flexibility	Ability to shift between response sets and process multiple sources of information (Castroppa & Anderson, 2006; Keil & Kaszniak, 2002; Miyake, 2000; Welsh & Pennington, 1991)	Miyake 3-factor model of Executive Function
Goal Setting/Planning	Ability to plan in advance and be able to develop new initiatives (Lezak, 1995; Luria, 1966; Stuss & Benson, 1986)	None identified
Working Memory	Holding events in mind while manipulating or performing a task acting on an event (Baddeley, 1986; Barkley, 2007; Miyake, 2000; Norman & Shallice, 1986)	Baddeley's Multicomponent Model of Working Memory Barkley's Model of Behavioral Inhibition

Component	*Definition*	*EF Model(s)*
		Miyake 3-factor model of Executive Function
Self-Awareness/Self-Monitoring	Age-appropriate insight into one's own strengths and weaknesses (Lezak, 1995; Luria, 1966; Sohlberg & Mateer, 2001; Stuss & Benson, 1986)	None identified

Table 1 Continued.

EF and Self-Awareness

Self-monitoring is one component of EF, often considered as part of metacognition (Fernandez-Duque, Baird, & Posner, 2000; Fleming & Dolan, 2012; Frith, 2012; Schneider, 2008; Shimamura, 2000). Less research has considered the self-monitoring component of EF, yet self-monitoring is critical to self-regulation (Fernandez-Duque et al., 2000; Zelazo & Lyons, 2011; Schneider, 2008; Shimamura, 2000). Related to self-monitoring, and of increased importance in adolescence and adulthood, is self-awareness. Self-awareness can be defined as a "process by which an individual is able to rate their behavioral responses (physical, somatic, cognitive, and affective) in accordance with ratings with some objective standard, usually from an informant who knows the individual well" (Bach & David, 2006, p. 398). Other researchers have defined self-awareness as a reflection of the ability (or deficit) in the individual's ability to consciously perceive and experience a disturbance in higher cognitive functioning that disrupts thinking and feeling (Prigatano, 1991). Individuals with deficits in self-awareness may exhibit a lack of information about themselves; they may experience

confusion when given feedback about their behavioral or functional limitations; and they may exhibit a cautious willingness or indifference when asked to work with this new information about themselves. Impairments in self-awareness have received particular attention in the literature due to the association of self-awareness with motivation for treatment and long-term functional outcome (Caldwell et al., 2014; Fischer, Gauggel, & Trexler, 2004; Malec & Moessner, 2000).

Development of EF

Regardless of the model or components, it is critical that the developmental trajectory of executive processes be well understood. It is particularly important to understand the developmental progression of EF skills in childhood because they have been found to predict important developmental outcomes. It is also important to understand that EF skills develop rapidly in childhood and may not necessarily progress linearly (Anderson, 2002; Leon-Carrion, Garcia-Orza, & Perez-Santamaria, 2004; Romine & Reynolds, 2005). Many executive skills emerge in the first year of life and continue to develop until puberty and beyond (Castroppa & Anderson, 2006; Huizinga, Dolan, & van der Molen, 2006; Zelazo, Craik, & Booth, 2004); however, these EF tasks are subject to different rates of development (Best & Miller, 2010). The development of attentional control, future oriented, intentional problem solving, and self-regulation of emotion and behavior is considered to begin in infancy (Isquith, Gioia, & Espy, 2004) and continues into the preschool period (Espy, Kaufmann, McDiarmid, & Glisky, 1999; Welsh, Pennington, & Grossier, 1991). Furthermore, several studies show that EF development in childhood and adolescence progress at different rates when assessed in adulthood (Diamond, 2002; Welsh, 2002). One of the reasons researchers have taken particular interest in EF is because the capacity for EF processes is believed to parallel

brain development (Miller & Cohen, 2001; Stuss & Anderson, 2004; Stuss & Knight, 2002). Although the preschool years may be an especially sensitive period for EF, there is also considerable reorganization of pre-frontal systems during the transition to adolescence, when gray matter volume in prefrontal cortex reaches a peak (Zelazo & Carlson, 2012). This reorganization is likely to be sensitive not only to events in the internal environment (Spear, 2000) but also to events in the external environment, and as it is associated with another increase in the rate at which EF develops.

Infancy to Early Childhood

Infants younger than 9 months of age have difficulty inhibiting previously learned responses but by 12 months of age most infants can inhibit certain behaviors and shift to anew response set (Anderson, 2002; Garon, Bryson, & Smith, 2008;). In early childhood, increments in response speed and verbal fluency are observed, especially between 3 and 5 years of age (Espy, 1997; Gerstadt, Hong, & Diamond, 1994; Welsh et al., 1991). The capacity to switch rapidly between two simple response sets emerges between 3 and 4 years of age, but children in this age range have difficulty switching when rules become more complex (Espy, 1997). Although previous research found that simple planning skills emerge by 4 years of age and they struggle with advanced organization and planning (Welsh et al., 2001), children as young as 5 to 7 years of age can plan sequenced responses with increased efficiency (Chevalier, James, Wiebe, Nelson, & Espy, 2014; Freier, Cooper, Mareschal, 2014). Preschoolers can verbalize their knowledge of what is the right thing to do but often are not able to actually follow through on it. The capacity to learn from mistakes and devise alternative strategies emerges into early childhood and develops throughout middle childhood (Friedman-Krauss et al., 2014). The ability to

successfully implement strategies to limit impulsive responses, however, are not yet developed, though emerging (Best & Miller, 2010).

School Age

As children mature and change, they continue to gain inhibitory control and attentional capabilities. During the primary school years and into early adolescence, the main advances are made in the ability to consider multiple variables and act accordingly. Seven-year-olds struggle when switching depends on multiple dimensions; however, the ability to cope with these multi-dimensional switching tasks improves greatly between 7 and 9 years of age (Anderson et al., 2000). Children age 9 years and older tend to monitor and regulate their actions well, although an increase in impulsivity occurs for a short period around 11 years of age (Anderson et al., 2000; Anderson, Anderson, & Lajoie, 1996). Similarly, significant gains in processig speed can be observed between 9-10 years and 11-12 years (Kail, 1996). Planning and organizational skills develop rapidly between 7 and 10 years of age (Anderson et al., 1996; Krikorian & Bartok, 1998), and gradually into adolescence (Krikorian & Bartok, 1998; Welsh et al., 1991). Although young children utilize inefficient strategies, children between the ages of 7 and 11 years of age exhibit more organized and strategic behavior and reasoning abilities (Anderson, Anderson, Garth, 2001; Levin et al., 1991). Some researchers found that inhibition reaches adult levels of maturation around the age of 9 or 10 years. In contrast, other research shows that inhibition development lasts at least from 6 to 12 years, and others suggest that impulse control does not reach maturity by age 12 (Carrion, Garcia Orza, & Perez- Santamaria, 2004). Gains in planning, goal setting/directed behaviors, problem solving, and cognitive flexibility are continuing and providing the basis for social skills and academic success during pre-adolescence and adolescence (Latzman et al., 2010).

Adolescence

One can also expect improvements in efficiency and fluency during adolescence (Anderson, Anderson, Northam, Jacobs, & Castroppa, 2001; Levin et al., 1991), although increments are likely to be minimal after 15 years of age (Hale, 1990; Kail, 1986). Cognitive flexibility or switching fluency continues to improve throughout middle childhood and into adolescence (Anderson et al., 2000). Despite having developed more efficient strategies, regression from conceptual strategies to fragmented strategies may occur around 12-13 years of age suggesting a developmental period in which cautious strategies are used (Anderson et al., 2001). Refinement of strategies and improved decision making continues during adolescence (Anderson et al., 2001; Levin et al., 1991).

The role of EF development is most clearly demonstrated and often most acknowledged during the teenage/adolescent years. This is in part due to high-risk behaviors that are observed during adolescence, such as alcohol/drug use and unprotected sex. By the age of 15, working memory, inhibitory control, and the ability to sustain and appropriately shift attention are close to adult levels and remain relatively stable with some small increases noted into adulthood (Shing et al., 2010). Though the teen is functioning at or near adult levels, their self-monitoring and self-reflective abilities are not fully mature (Lyons & Zelazo, 2011). Further, when placed in highly complex situations or a situation in which one is required to integrate numerous pieces of information to make an informed decision, the adolescent may show inefficient EF skills.

As the executive system matures, adults are able to use stored knowledge about themselves and draw on their past experience in making decisions.

Adulthood

In adulthood, gains and declines in executive skills are noted. Between the ages of 20 to 29, EF skills are at their peak. As the adult ages, EF skills show a decline (Salthouse, Atkinson, & Berish, 2003). Declines in higher order cognitive skills have been clearly noted in working memory (Brown, Brockmole, Gow, & Geary, 2012; Jarrett, 2016; McCabe, Roediger, McDaniel, Balota, & Hambrick, 2010), self-monitoring, and spatial skills (Ávila, de Paula, Bicalho, Moraes, Nicolato, Malloy-Diniz & Diniz, 2015; Brown, Brockmole, Gow, & Geary, 2012). Young children and older adults tend to exercise EFs in response to environmental demands (reactively), whereas older children and young adults tend to be more planful and anticipatory (Czernochowski, Nessler, & Friedman, 2010; Karayanidis, Whitson, Heathcote, & Mitchie, 2011; Munakata, Snyder, & Chatham, 2012).

Neurological Correlates

As noted earlier in this chapter, the capacity for EF is believed to parallel brain development. EF processes are subserved primarily by the prefrontal regions of the frontal lobe with multiple neuronal connections to other cortical, subcortical, and brainstem regions (Anderson, 2002; Lezak et al., 2012; Miller & Cohen, 2001; Robinson et al., 2014). The study of EF is closely related to the role of the frontal lobes; however, there is a paucity of evidence within the neuropsychological literature that shows a parallel between frontal lobe pathway maturation, which are the last to mature, and EF development (Damasio, Anderson, & Tranel, 2011). The development of this region of

brain commences early in life and does not end until puberty (Martin-Rodriguez & Leon-Carrion, 2010). For example, Diamond (1988) found that important frontal lobe development occurs between 12 and 18 months in humans. The development of how children respond to social and emotional stimuli develops from approximately 3 and 6 years of age (Schonert-Reichl, 2012). The frontal lobes are not fully myelinated until adolescence and do not end until puberty (Cummings, 1993; Klimberg et al., 1999).

Much of what is known of the relation between frontal lobe function and EF is based on studies of those with frontal lobe injury. It should be noted that prefrontal injury does not directly affect specific cognitive or linguistic processes; however, it affects their regulation and effective use, likely through alteration of the numerous neuronal connections between the prefrontal cortex and other brain regions (Strangman et al., 2005). Neuroimaging and lesion studies from a variety of neurological diseases and injury models support frontal lobe involvement for specific EF (see Table 2).

Table 2

Neurological Correlates for EF Processes

EF Domain	*Structures Implicated*	*Studies to Support*
Attention	Posterior Cingulate Cortex	Stuss (2006)
Emotion Regulation	Anterior Cingulate Cortex	Anderson (2002) Stevens, Hurley, Taber & Hayman (2011)
Cognitive Flexibility	Dorsolateral Prefrontal Cortex, Parietal Cortex	Fink et al., (1997); Gurd et al., (2002); Rogers et al., (2000); Wilkinson et al., (2001)

Inhibitory Control	Anterior Cingulate Gyrus, Right Orbital frontal, Left Inferior Frontal, Temporal and Parietal Lobes	Aron, Robbins, & Poldrack, (2004) Roberts & Wallis, (2000)
Initiation	Anterior Cingulate Cortex; Ventromedial PFC	Caruana, Brock, & Woolgar (2015) Collette et al., (2001); Nathaniel-James & Frith (2002)
Organization	Dorsolateral Prefrontal Cortex	None Specified
Planning	Dorsolateral Prefrontal Cortex	Carlson (2005); Haber (2003); Zelazo & Muller (2002)
Self-Monitoring/Self-Awareness	Ventromedial Prefrontal Cortex, Orbitofrontal Cortex, Anterior dorsolateral Prefrontal Cortex	Craig (2009); Fontaine et al., (1999) Flashman et al., (2001); Schmitt et al., (2017) Ries, et al., (2007)
Working Memory	Mid-Dorsolateral Prefrontal Cortex, Anterior Cingulate, Posterior Parietal Lobe	Bender & Raz, (2012); van Ewijk et al., (2015) Narayanan et al., (2005) Smith & Jonides, (1997) Takeuchi et al., (2012)

Table 2 Continued.

Different functional imaging studies have explored the activation pattern on various EF component processes. For example, the anterior regions of the brain are thought to mediate EF deficits in attention, emotional regulation, initiation, and working memory as EF deficits often follow damage to the prefrontal cortex (Anderson, 2002; Stevens, Hurley, Taber, & Hayman 2011). Supporting this view, functional

neuroimaging studies have also observed significant activation within the prefrontal cortex in individuals performing EF tasks tapping into cognitive flexibility (Fink et al., 1997; Gurd et al., 2002; Rogers et al., 2000; Wilkinson et al., 2001), organization, planning (Carlson, 2005; Haber, 2003; Zelazo & Muller, 2002), self-monitoring (Craig, 2009; Flashman et al., 2001; Fontaine et al., 1999; Schmidtt et al., 2017; Ries et al., 2007), and working memory (Bender & Raz, 2012; van Ewijk et al., 2015; Narayanan et al., 2005; Smith & Jonides, 1999; Takeuchi et al., 2012). Damage or loss of function at any level of one of these neural systems may result in cognitive and/or behavioral deficits.

Gallup (1991) was the first to suggest that a higher level of self-awareness is distinct from dysfunction in other frontal EF abilities although it is related to frontal functions. For the processes that underlie self-awareness, current evidence from both lesion studies and activation studies points to a critical role for the right frontal lobe. Inaccurate self-appraisal in traumatic injury patients is related to reduced medial PFC glucose metabolism (Fontaine et al., 1999), and unawareness of symptoms in schizophrenic patients is related to bilateral dorsolateral PFC atrophy (Flashman et al., 2001).

Self-evaluation accuracy is related to anterior dorsolateral PFC activation, particularly on the right, in traumatic injury patients as well as healthy participants (Schmitt et al., 2017). Functional neuroimaging studies with healthy participants correspondingly demonstrate increased right dorsolateral PFC activation during self-referential appraisal tasks (Fossati et al., 2003; Northoff & Bermpohl, 2004). Other studies propose that self-referential processing depends on activation of bilateral cortical

midline structures (Johnson et al., 2002; Northoff et al., 2006; Ries et al., 2007). Neuroimaging studies also emphasize the role of the anterior insula in self-awareness (Berti et al., 2005; Schmitz and Johnson, 2007; Craig, 2009).

Dysfunction of EF Components

When development of any EF components are delayed or deviate from typical trajectory for some reason, the individual may exhibit problems in learning or social processes that rely on those component processes (Jacobson et al., 2011; Janke et al., 2014; Rosenthal et al., 2013). In children, cognitive deficits that may be associated with EF deficits include poor impulse control, difficulties monitoring or regulating performance, planning and organizing problems, poor reasoning ability, difficulties generating and/or implementing strategies, perseveration and mental inflexibility, poor utilization of feedback, and reduced work memory. In addition, children with EF deficits may present as apathetic, unmotivated, and unresponsive; however, others may be impulsive and argumentative. Many children exhibiting EF deficits display poor interpersonal skills and experience difficulties maintaining meaningful social relationships. Delay or deviation in brain development, and subsequently in EF maturation may be the result of any number of factors and potentially may be identified as a clinical disorder (e.g., Attention Deficit Hyperactivity Disorder [ADHD]). As noted earlier, EF deficits are frequently associated with academic problems associated with learning disabilities, emotional disturbance, and other psychiatric disorders.

Measurement of EF

Performance-Based Measurement

A major limitation of the existing research is related to measurement of EF skills. Traditionally, the measurement of EF has relied on performance-based measures (Buchanan, 2016; Isquith, Roth, & Gioia, 2013). Some studies have shown that performance-based measures predicted EF deficits during preschool and early childhood (Brocki et al., 2010; Pauli-Pott & Becker, 2011; Wilcutt et al., 2005) while other studies have shown that reliance on performance-based measures can provide a restricted and inadequate assessment of EF skills (Gioia & Isquith, 2004; Silver, 2000). While performance-based tests tend to provide an assessment of EF within controlled task demands, multiple confounds limit their ability to be generalizable (Barkley & Fischer, 2011). It has been argued that neuropsychological tests alone are inadequate for assessing EF because they tend to provide only a partial view of an integrated system (Burgess, 1997; Isquith, Roth, & Gioia, 2013). Performance-based measures try to tap individual components of EF over a short time frame rather than the cohesive and systematic decision making that is often needed in real world situations (Goldberg & Podell, 2000; Shallice & Burgess, 1991). Most of the current research regarding the ecological validity of performance based measures and rating measures is the result of studies examining early childhood (Gioia & Isquith, 2004; Chevignard et al., 2009; Silver, 2000) and adult populations (Burgess et al., 1998; Chevignard et al., 2008; Chaytor & Schmitter-Edgecombe, 2003). To

date, there are limited studies regarding the relationship between test performance and every day functioning in adolescents and is, therefore, less understood.

Use of performance-based measures of EF alone also poses a problem when it comes to comparing descriptions of individual EF profiles in different clinical populations. To date, investigations of EF profiles have relied on a mixed battery of tests that have different normative populations and psychometric properties. As a result, it remains unclear whether differences in EF profiles reflect actual differences within the individual or differences in the characteristics of the tasks (McAuley et al., 2010). For example, several studies using the Delis-Kaplan Executive Function System (D-KEFS; Delis, Kaplan, & Kramer, 2001), a performance-based measure of EF, found limited or no differences between specific clinical groups such as individuals with ADHD, individuals with frontal lobe lesions, and typical controls (Keifer & Tranel, 2013; Wodka et al., 2008). Notably, often the findings on performance-based measures do not reflect the concerns of others (e.g., parents, teachers) who interact with the individual on a daily basis (Ten Eycke & Dewey, 2015).

Self- and Other Ratings of EF

Given the challenges to ecologically valid assessment of EF, alternative methods of evaluation with greater ecological validity are critical (Lippa et al., 2014; Silver, 2000). Thus, ecological validity refers to the degree to which real-world performance can be generalized from controlled settings (Chevignard et al., 2012; Slick et al., 2006). Although it is recognized

that there is no absolute method for the quantification of real- life executive functioning as any method of assessment will involve a certain degree of error, an informant-based questionnaire appeared to be the best choice for the current purposes for a number of reasons. Reliable reports of the child's everyday dysfunction allows for a high degree of ecological validity in understanding the child's real world

strengths and weaknesses relative to test performance in a contrived setting (Roth, Isquith, & Gioia, 2005).

The Behavior Rating Inventory of Executive Function (BRIEF; Gioia et al., 2000) was the first measure developed to reflect children's EF in the everyday environment.

The BRIEF assesses EF by gathering parent and teacher ratings of the child's behavior in the home and school settings. The EF components assessed by the BRIEF are closely aligned with the theoretical model proposed by Shallice and Burgess (1991).

Since the development of the BRIEF, many others have become available. These include the Delis-Rating of Executive Function (D-REF; Delis, 2012), Barkley Deficit in Executive Functioning Scale-Children and Adolescents (B-DEFS-CA; Barkley, 2012), and the Comprehensive Executive Function Inventory (CEFI; Naglieri & Goldstein, 2013). The D-REF is an individually administered rating scale used to identify executive difficulties in children and adolescents ages 5 through 18. It yields a total composite score along with three core index scores in the areas of Behavioral Functioning,

Emotional Functioning, and Cognitive Functioning and four second level index scores in the areas of Attention/Working Memory, Activity Level/Impulse Control, Abstract Thinking/Problem Solving, and Compliance Management. The BDEFS-CA is an individually administered rating scale used to evaluate EF development and deficits in problem-solving, self-restraint, self-motivation, organization, time management and self- regulation of emotions in children and adolescents ages 6 through 17. The CEFI is a rating scale that is designed to assess EF deficits in attention, emotion regulation, flexibility, inhibitory control, initiation, organization, planning, self-monitoring, and

working memory in children and adolescents. The CEFI can be used during the screening, assessment, and diagnostic process.

Rating scales such as these and others used routinely in the assessment process also can present their own limitations in terms of providing a more global level of behavior and less process-specific information. In other words, behavior rating measures tap into the individual's overall goal of the decision making process rather than the efficiency of processing underlying EF skills which are often measured by performance- based measures (Toplak, West, & Stanovich, 2011; Toplak, West, & Stanovich, 2013). Using self-and informant ratings assume that family members are the most knowledgeable about the child's day to day functioning. Consideration must be given to the potential that rater bias can influence the ratings, particularly if the parent or teacher has certain expectations for the child's behavior (Bertrand & Willis, 1999; Dassel

& Schmidtt, 2008; Richardson, Nadler, & Malloy, 1995). Rater bias in assessment of EF occurs when an informant's rating of the child is significantly impacted by their own judgment or perceptions of the child's current functioning. As a result, the informant may under- or over-report EF skills and deficits, which does not yield an accurate depiction of the child's behavior.

The relationship between parent and self-report ratings of EF varies. Although studies have shown there is generally poor to moderate levels of agreement between parent and self- report ratings (Green , Godfrey, Soo, Anderson, & Castroppa, 2012; Vanderploeg, Curtiss, Luis, & Salazar, 2007; Wilson, Donders, & Nguyen, 2011; Yasuda et al., 2004), other studies have shown high agreement between parent and self- ratings (Cusik, Gerhart, & Mellick, 2000; Port, Willmott, & Charlton, 2002). Individuals with EF deficits often rate themselves as being less impaired when compared with parent ratings (Wilson, Donders, & Nguyen, 2011). Conversely, a 10- year longitudinal study of children and adolescents with traumatic brain injury found that self-ratings of EF showed greater awareness of deficits when compared to parent ratings (Barrett, McLellan, & McKinlay, 2013). Therefore, solely relying on parent or self-rating as indicators of EF functioning may lead to inaccuracies.

Measurement issues also complicate the interpretation of studies of impaired self- awareness. For example, different methods are used to measure impaired self-awareness in different studies. All methods for estimating impaired self-awareness involve estimating the disparity between the

adolescent's self-perception or self-report and some external criterion of his/her status. These differences in raters, particularly other and self- report differences are believed to reflect the individual's self-awareness. All methods for estimated impaired self-awareness involve estimating the disparity between the individual's self-perception or self-report and some external criterion of his/her status.

Another important measurement issue is that the individual rating versus collateral rating often is expressed as a subtracted score (i.e., a discrepancy score) with the implication being that the size of the score estimates the magnitude, or severity, of impaired self- awareness. Different methods used to measure impaired self-awareness in different studies make it difficult to make comparisons across studies.

Summary

The development of EF skills is critical for early academic success and positive behavioral, social and psychological outcomes from childhood throughout adulthood. However, adolescence is a critical period characterized by increased need for the integration of EF skills, particularly metacognitive skills including self-awareness, when faced with highly complex situations and decisions. Although studies have shown that children and adolescents with various neurological disorders experience a disturbance in the normal development of EF processes, individuals without disabilities may also experience similar difficulties with EF. To date, studies regarding the development and

assessment of EF and metacognitive skills in adolescents are sparse. Furthermore, with the increased interest in assessing EF in children and adolescents the discrepancy as to how best to measure these skills using either performance-based or rating scale measures continue to widen. Several new rating scales have been specifically designed to measure the EF skills of children and adolescents within the past decade but very little research has been conducted to establish their validity and reliability. The current study purports to examine the relationship between the EF constructs and self-awareness/self- monitoring, as well as EF constructs and psychological adjustment as reported by parent and adolescent ratings using the CEFI. This study will add to the evidence base needed to establish the usefulness of the CEFI as an additional measure of EF skills in adolescents.

CHAPTER III

METHODS

Research Design

This was a cross-sectional study that included typically developing adolescents, some of whom were bilingual or whose parents chose to complete forms in Spanish, as well as adolescents who have chronic illnesses (i.e., epilepsy, asthma) or other possible diagnosis. The study used a sample of convenience, rather than randomized sampling to maximize the number of participants. This study used only the data from the CEFI and the BASC-2, although additional data was available for the participants.

Participants

It was hoped that 250 participant dyads would be recruited, with one parent and an adolescent, 12-17 years of age. Participants were recruited through a variety of venues, including community groups, schools, churches, and hospitals. Adolescents receiving special education services due to Intellectual Disability would have been excluded; however, there were none. In recruitment, efforts were made to ensure representation of diverse groups of adolescents (e.g., diverse racial/ethnic groups).

A total of 57 parent-child dyads were recruited. The resulting sample of 54 participant dyads included child participants who were predominantly female (N=30; 55.56%) and predominantly identified as Caucasian (N=21; 38.89%). Other racial/ethnic groups included African American (N=17; 31.48%) and Hispanic (N=14; 25.93%). The remaining child participants were

Asian American (N=1) or Biracial (N=1); three participants declined to identify. More detailed demographic data is presented in Table 3.

Table 3

Demographic Data for the Sample

Variable	Percent (%)
Gender	
Male	42.11
Female	52.63
Did not identify	5.26
Race/Ethnicity	
African American	29.82
Asian American	1.75
Caucasian	36.84
Hispanic	24.56
Biracial	1.75
Did not identify	5.26
Variable	Percent (%)

Socioeconomic Status Indicators Receiving Free/Reduced Lunch (N=55) Maternal Education College Degree or higher (N=53) Paternal Education College Degree or higher (N=51)	29.82 92.98 89.47
Educational Indicators Special Education placement	8.77
Chronic Illness (e.g., epilepsy, asthma)	8.77
	Mean/Standard Deviation
Child Age	14.54 (1.76)
Child Grade	8.98 (2.22)

Table 3 Continued.

Procedures

Approval was obtained from the Institutional Review Board (IRB) for data collection. Adolescents and their caregivers were recruited through flyers and distribution of packets to the community through various groups and organizations such as English as a Second language classes, places of worship, and a Dallas-based Counseling and Assessment Clinic. Additionally, brief presentations were provided to two adolescent bible classes in Houston, Texas. Participants were also recruited through word of mouth to individuals the researcher previously knew. Packets were provided to the adolescents and/or their caregivers. The packet contained a

consent form, permission form, assent form, demographic information form, Behavior Rating Inventory of Executive Functioning (BRIEF; Gioia et al., 2000) self-report and parent forms, Comprehensive Executive Functioning Inventory (CEFI; Naglieri & Goldstein, 2013) self-report and parent forms, Behavioral Assessment Scale for Children, Second Edition (BASC-2; Reynolds & Kamphaus, 2004), adolescent and parent forms of a language proficiency survey, and two business-return envelopes. Data collection was conducted jointly with others; an additional form was included in the packet but was not considered in this study. This was approved by IRB before being implemented. Altogether, 80 packets were distributed for the monolingual group.

Interested parents were given a packet with consent, permission, and assent forms, a cover letter explaining the option for a charitable donation, rating scales, and a demographic questionnaire. When the parent and child participants completed the packet, it was mailed back to the researcher in a postage paid mailer. After the packet was sent back in the mail, all data were scored, coded, and entered in a database without identifying information. Consent, permission, and assent forms were stored in a separate location in a locked cabinet. There was no link between the results and the consent/assent forms. Participants were not compensated but had the option to be included in a drawing for a $100 gift card.

Instruments

To obtain basic descriptive information on all participants, a

demographic information form was used (see Appendix A). In addition, also for descriptive purposes, an omnibus measure of adjustment was included with an emphasis on specific behavioral considerations. In order to measure inhibition, shift, and working memory, scales from the Behavior Assessment System for Children-Second Edition and CEFI were utilized, as seen in Table 7. All instruments for the caregivers were given in English.

Demographic/History Form. This was created for the larger study and includes basic demographic information such as age, gender, and race/ethnicity. Parents were asked to provide information regarding their highest level of education and the primary language used for communicating with their child. Questions regarding the child's educational (i.e., child's current grade, has child received bilingual services or prior special education services, etc.) and medical history (i.e., history of significant medical conditions such as traumatic brain injury, asthma, epilepsy, current medications, etc.) also were included on the demographic/ history form.

***Comprehensive Executive Function Inventory (CEFI*).** The Comprehensive Executive Function Inventory (CEFI; Naglieri &Goldstein, 2013) is an individually administered assessment tool that may be used to evaluate children and youth ages 5 to 18. The CEFI can be used during the screening, assessment, and diagnostic process in a clinical or research setting as a time and cost-efficient means of identifying those with EF difficulties. For this study, results are only for research purposes.

The CEFI consists of three versions that may be used to measure a wide spectrum of behaviors associated with EF; only the parent and self-report were

of interest for this study. The parent version is available in Spanish and inquires as to the frequency with which the child has exhibited certain behaviors over the past four weeks. The self-report version is completed by the child or youth and contains the same items as the parent versions. Items on the self-report, teacher, and parent versions use a 6-point Likert scale, ranging from *Never (1)*, *Rarely* (2), *Sometimes* (3), *Often* (4), *Very Often* (5), to *Always* (6).

The CEFI includes 100 items, taking the average individual 15 minutes to complete. Individual items on the CEFI are easy to read and comprehend. The CEFI was administered with the paper-pencil format. Instructions were standardized for all versions to ensure accurate administration and reduce examiner error or bias. All forms of the CEFI contained nine subscales and a composite that were used to assess EF deficits in specific areas. These scales are identified with findings from the standardization sample in Table 4. On all of the subscales and overall composite, scores $\geq$130 are within the Very Superior range, the Superior range is between 110-119, the Average standard score range is 90- 109, the Low Average range is between 80-89, the Below Average range is between 70-79, and Well Below Average standard scores are $\leq$69. It should be noted that a high score is indicative of better EF skills. Notably, gender effects (median d=0.25) were found for all subscales and the Full Scale for parent report. Race and parent educational level were examine for the Full Scale with no significant differences for race, but effect for parent educational level. It should be noted that "race" was dichotomous

and only considered Black and White participants. The disparite impact analyses for Black-White and Hispanic-White were not significant. For clinical samples, mean differences emerged on specific scales depending on the diagnosis. The manual also includes the correlations between the BRIEF and CEFI, as well as the CEFI and an achievement measure, but not with an omnibus measure of psychological adjustment.

See Table 4.

Table 4

Scales and Subscales of the CEFI

Scale/ Subscale	*Description*	*Reliability/ Validity Findings/ Indices (CEFI; Naglieri & Goldstein, 2013)*
Attention	This subscale describes how well a child or youth can avoid distractions, concentrate on tasks, and sustain attention.	Cronbach's alpha = .87 and .86 (clinical sample) to .93 and .86 (normative sample) for parent and self-report respectively. Significantly affected by gender on parent report.
Emotion Regulation	This area evaluates the child's or youth's control and management of emotions, including staying calm when handling small problems and reacting with the right level of emotion.	Cronbach's alpha = .87 and .83 (clinical sample) to .90 and .78 (normative sample) for parent and self-report respectively. Significantly affected by gender on parent report and age for parent report.
Flexibility	This subscale pertains to a child's or youth's level of skill at adjusting behavior to meet circumstances, including coming up with different ways to solve problems, having many ideas about how to do things, and being able to solve problems using different approaches.	Cronbach's alpha = .78 and .72 (clinical sample) to .85 and .77 (normative sample) for parent and self-report respectively. Significantly affected by gender on parent report.

Inhibitory Control	This subscale addresses the child's or youth's ability to control behavior or impulses, including thinking about consequences before acting, maintaining self-control, and keeping commitments.	Cronbach's alpha = .87 and .80 (clinical sample) to .90 and .80 (normative sample) for parent and self-report respectively. Significantly affected by gender on parent report and age for parent report.
Initiation	Items on this subscale evaluate a child's or youth's skill at beginning tasks or projects on his/her own including starting tasks easily, being motivated, and taking the initiative when needed.	Cronbach's alpha = .84 and .70 (clinical sample) to .90 and .80 (normative sample) for parent and self-report respectively. Significantly affected by gender on parent report, as well as self-report.
Organization	This area examines the child's or youth's ability to manage personal effects, work, or multiple tasks, including organizing tasks and thoughts well, managing time effectively, and working neatly.	Cronbach's alpha = .85 and .84 (clinical sample) to .92 and .85 (normative sample) for parent and self-report respectively. Significantly affected by gender on parent report and age for parent report.
Planning	Items on this subscale relate to how well a child or youth can develop and implement strategies to accomplish tasks, including planning ahead and making decisions.	Cronbach's alpha = .88 and .82 (clinical sample) to .93 and .85 (normative sample) for parent and self-report respectively. Significantly affected by gender on parent report and by age for parent report.
Self-Monitoring	This area pertains to the child's or youth's ability to evaluate his/her own behavior in order to determine when a different approach is necessary, including noticing and fixing mistakes, knowing when help is required, and understanding when a Significantly affected by gender on parent report; task is completed.	Cronbach's alpha = .78 and .74 (clinical sample) to .89 and .78 (normative sample) for parent and self-report respectively. Significantly affected by gender on parent report.

Working Memory	Items on this subscale reflect how well a child or youth can keep information in mind that is important for knowing what to do and how to do it, including remembering important things, instructions, and steps.	Cronbach's alpha = .86 and .81 (clinical sample) to .89 and .83 (normative sample) for parent and self-report respectively. Significantly affected by gender on parent report.
Full Scale Score	Composite	Cronbach's alpha = .99 and .97 (clinical sample) to .97 and .97 (normative sample) for parent and self-report respectively. Significantly affected by gender on parent report. No significant effect for race, but for parent educational level.

Notes. CEFI = Comprehensive Executive Function Inventory

Table 4 Continued.

In order to look at self-awareness, the parent and self-report of executive function from the CEFI were compared. Based on the standardization sample, there is a strong correlation (.67) between parent report and self-report for adolescents. In addition to the Self-Monitoring subscale, self-awareness was measured by comparing self-report by the adolescents' across various behavioral components with parent ratings. A discrepancy score was be generated as an indirect measure of deficits in self-awareness. This method of measuring self-awareness by parent-child comparison has been the most utilized in research compared to several other ways of measuring self-awareness. Several studies of adolescents and adults with neurological conditions such as traumatic brain injury, ADHD, and

Huntington's disease have established that individuals with self- awareness deficits tend to be less consistent when evaluating their social and emotional competencies (Hoza, Vaughn, Waschbusch, Murray-Close, & McCabe, 2012; Fleming, Strong, & Ashton, 1996; Manor, Vurembrant, Rozen, Geval, Weizman, & Zalman, 2012; Sibley et al., 2012).

Behavior Assessment System for Children-Second Edition (BASC-2). The Behavior Assessment System for Children-Second Edition (BASC-2; Reynolds & Kamphaus, 2004) is a standardized assessment used to evaluate the behavior and self- perceptions of children and young adults aged 2 through 25 years. The BASC-2 has the following components: two rating scales, one for teachers (Teacher Rating Scales, or TRS), and one for parents (Parent Rating Scales, or PRS), and a self-report scale (Self Report of Personality, or SRP). For the BASC-2, only the PRS will be considered for this study; items and scales for the Parent and Self-Report are not the same. The PRS yields ten primary clinical scales, five adaptive scales, seven content scales, and four composite scales. On all of the clinical and adaptive scales, the Average T-score range is 41 through 59. On the clinical scales T-scores within the At-Risk range are between 60- 69, while scores in the Clinically Significant range are 70 and above. On the Adaptive

scales, scores within the At-Risk range are between 31-40 and Clinically Significant 30 and below. The PRS composite scales are the Behavioral Symptoms Index, Externalizing Problems, Internalizing Problems, and the Adaptive Skills.

For the General norm samples, composite score reliabilities of the PRS are very high (low to middle .90s for Adaptive Skills and the Behavioral Symptoms Index (BSI); middle .80s to middle .90s for Externalizing Problems and Internalizing Problems).

Reliabilities for Externalizing Problems and Internalizing Problems tend to be slightly higher at the adolescent levels (from .89 to .95). Reliabilities of the individual scales are also high with median values ranging from .83 to .86 at the adolescent level. Median inter-rater reliability (parent-teacher) is .77 for the adolescent rating scale. For the clinical scales, the highest inter-rater reliabilities are for Conduct Problems at the adolescent level; lowest reliability for the adolescent subscales is for Somatization. The highest adaptive-scale reliabilities are for Activities of Daily Living (adolescent level).

Behavior Assessment System for Children-2—Self-Report of Personality (BASC-2 SRP-A; Reynolds & Kamphaus, 2004). The SRP is a multidimensional personality measure used to assess the emotions and self-perceptions of adolescents between the ages of 12 to 18. This self-report measure contains 176 items and comprises 16 subscales, with five composite scales. The BASC-2 SRP-A takes approximately 20 to 30 minutes to complete.

Item response formats include true =1 or false = 0, or a 4-point Likert scale: 0 (never), 1 (sometimes), 2 (often) and 3 (almost always). The primary scales include 12 clinical scales (Attitude to School, Attitude to Teachers, Sensation Seeking, Atypicality, Locus of Control, Social Stress, Anxiety, Depression, Sense of Inadequacy, Somatization, Attention Problems, and Hyperactivity), for which high scores indicate impaired functioning in multiple settings, and four adaptive scales (Relations with Parents, Interpersonal Relations, Self-Esteem and Self-Reliance), for which high scores indicate lack of symptomalogy. High scores on the four content scales (Anger Control, Ego Strength, Mania and Test Anxiety) and on the five composite scales (Emotional Symptoms Index, Inattention/Hyperactivity, Internalizing Problems, Personal Adjustment and School Problems) also suggest more impaired functioning.

Reynolds and Kamphaus (2004) reported that the SRP-A has demonstrated good reliability. Internal consistency estimates range from .67 to .88 for the subscales and .84 to .95 for the composite scores. Test-retest reliability estimates range from .63 to .84 for the subscales and .76 to .84 for the composite scores.

Executive Functioning Content Scale. The Executive Functioning content scale includes 12 items from the BASC-2 Parent Rating Scales. It measures the ability to control behavior by planning, anticipating, inhibiting, or maintaining goal-directed activity, and by reacting appropriately to environmental feedback in a purposeful, meaningful way. Items on the EF content scale were derived from studies of the original BASC conducted by

Barriger & Reynolds (1995) and Reynolds and Kamphaus (2002) and were based on the BASC Frontal Lobe/Executive Control Scale (Sullivan & Riccio, 2006). High scores on this content scale may identify individuals who experience a myriad of self-regulation difficulties and frontal lobe dysfunctions. Elevated scores may also indicate the presence of ADHD symptoms, co-morbid depressive symptoms, and deficits in self-awareness of behavior deficits (Reynolds & Kamphaus, 2004)

Data Analysis

Research Question #1

What is the relation between the composite and subscale scores of the CEFI and the clinical and adaptive composites of the BASC-2? It was hypothesized that there would be a moderate correlation between the composite and subscale scores of the CEFI and the clinical and adaptive composites of the BASC-2. Specifically, it was hypothesized that there would be a negative correlation among the clinical scales of the BASC-2 and the scales of the CEFI. Conversely, it was hypothesized that there will be a positive correlation between the BASC-2 adaptive composite and the scales on the CEFI. To test these hypotheses, Pearson *r* correlational analyses were used to examine the level of association of the composite scores of the BASC-2 with the subscales and Full scale of the CEFI.

Research Question #2

What is the level of agreement for parent- and self-ratings on the CEFI? It was hypothesized that there would be small to moderate correlations between

parent and self- report on the CEFI and specifically the Self-Monitoring subscale, with youth under- reporting EF deficits. To what extent do differences between parent- and self-report on the CEFI (as a measure of self-awareness) correlate with composite overall adjustment on the BASC-2 and the Self-Monitoring subscale of the CEFI? It was hypothesized that lower correlations between parent and self-report of the CEFI would be associated with greater behavioral symptoms (Behavioral Symptom Index) on the BASC-2 and more impaired Self-Monitoring. To test these hypotheses, Pearson r correlational analyses was used.

Research Question #3

To what extent do CEFI, BASC-2, and rater differences (self-awareness) differ across demographic factors (racial/ethnic group, gender)? It was hypothesized that there will be no differences across racial/ethnic groups. Conversely, it was expected that there would be gender differences on the Attention, Emotion Regulation, Flexibility, Inhibitory Control, Initiation, Organization, Planning, Self-Monitoring, and Working Memory scales. It was hypothesized that parent/self-report differences would not differ by race/ethnicity or gender. To test these hypotheses, a multivariate analysis of variance (MANOVA) was used to analyze differences across demographic factors.

Research Question #4

To what extent do CEFI, BASC-2, and rater differences (self-awareness) differ across groups based on special education placement, grade

retention, or other diagnosis? It was hypothesized that there will be differences in ratings of self-awareness across groups based on special education placement, grade retention, or other diagnosis.

Specifically, those with special education placement, grade retention, or other diagnosis were hypothesized to obtain lower ratings compared to typically developing peers. To test these hypotheses, multivariate analysis of variance (MANOVA) was proposed.

CHAPTER IV

RESULTS

Prior to conducting analyses, the data were examined for scale validity and missing data. All scales were deemed to be valid based on the manuals and validity indices. Missing data was limited to entire forms not completed. It would not be feasible to use methods of imputation to handle missing data when an entire form was incomplete, so analyses were conducted only for those with completed forms. In some cases, items were not answered that affected only a single subscale; these were included without the scale/subscale affected. Descriptive statistics for the sample were generated with consideration of skewness and kurtosis.

Descriptive Analyses

As can be seen in Table 5, the mean scores on all EF indicators for the sample are within the normative range. All variables met the assumptions of normality based on skewness and kurtosis.

Table 5

Descriptive Statistics for the Sample for the CEFI

	Parent		***Adolescent***	
Scale/Subscales	*N*	*Mean (SD)*	*N*	*Mean (SD)*
Attention	52	104.25 (14.01)	46	99.91 (15.70)
Emotion	53	105.09 (14.34)	46	100.83 (16.99)
Regulation				
Flexibility	53	101.91 (15.12)	45	102.80 (14.58)

Inhibitory Control	53	105.81 (13.74)	45	104.69 (13.79)
Initiation	53	101.75 (13.58)	46	97.67 (13.08)
Organization	52	104.17 (13.82)	46	98.67 (17.05)
Planning	53	103.94 (13.65)	46	98.57 (15.37)
Self-Monitoring	53	105.09 (13.84)	46	100.61 (15.54)
Working Memory	53	104.66 (13.99)	46	98.37 (13.73)
Full Scale Score	53	104.83 (13.30)	45	99.64 (14.41)

Notes. CEFI= Comprehensive Executive Function Inventory

Table 5 Continued.

Table 6

Descriptive Statistics for the Sample on the BASC-2

	Mean (SD)
BASC-2 Parent	
Behavior Symptom Index (N=54)	49.52 (10.89)
Adaptive Skills Index (N=53)	52.28 (10.97)
BASC-2 Adolescent Self Report	
Emotional System Index (N=49)	49.98 (11.11)
Personal Adjustment (N=48)	52.90 (10.14)

Notes. BASC-2 = Behavior Assessment System for Children-Second Edition

Correlational Analysis

It was hypothesized that there would be a moderate correlation between the composite and subscale scores of the CEFI and the clinical and adaptive composites of the BASC-2. As can be seen in Table 7, there are statistically significant and moderate to strong negative correlations between the Parent CEFI and Parent BASC-2 BSI and positive correlations with the Adaptive

Skills Composite (p<.001). In contrast, for the CEFI Self-Report, Emotion Regulation and Initiation were moderately and negatively correlated with the Emotional Symptom Index (p<.01), while Emotional Regulation (p<.01), Self-Monitoring (p<.01), and Initiation (p<.001) were moderately and positively correlated with the Adaptive Skills Composite.

Table 7

CEFI and BASC-2 Correlations

	Behavior Assessment System for Children – 2 Composites			
	Parent (N=52)		Adolescent Self-Report (N=45)	
CEFI Scales/ Subscales	Behavior Symptom Index	Adaptive Index	Personal Adjustment	Emotional Symptom Index
Attention	-.74***	.64***	-.24	.12
Emotion Regulation	-.73***	.67***	-.46**	.41**
Flexibility	-.56***	.64***	-.26	.22
Inhibitory Control	-.76***	.66***	-.31*	.34*
Initiation	-.65***	.63***	-.45**	.52***
Organization	-.66***	.53***	-.26	.25
Planning	-.76***	.65***	-.23	.28
Self-Monitoring	-.69***	59***	-.30*	.43**
Working Memory	-.71***	.59***	-.20	.36*

Full Scale Score	-.78***	.71***	-.31*	.36*

Notes: CEFI= Comprehensive Executive Function Inventory; For parent report CEFI/BASC-2, N=52 except for Attention and Organization (N=51); for Self-report CEFI/BASC-2, N=45 except for Flexibility and Inhibitory Control (N=44). Due to items omitted, not all subscales were computed.
*p<.05 **p<.01 ***p<.001

Table 7 Continued.

Parent-Adolescent Agreement

It was hypothesized that there would be moderate correlations between parent and self-ratings on the CEFI. Parent and Self-Report correlations are provided in Table 8.

Further, it was hypothesized that lower correlations between parent and self-report on the CEFI would be associated with greater behavioral symptoms (Behavioral Symptom Index) on the BASC-2 and more impaired Self-Monitoring.

Correlations for Parent and Self-Report were generally low and non-significant, potentially indicating deficits in adolescent self-awareness. A discrepancy score was generated as an indirect measure of deficits in self-awareness (i.e., adolescents not being aware of deficits and rating themselves higher than the parent). This method of measuring self-awareness by parent-child comparison has been the most utilized in research compared to several other ways of measuring self-awareness (Hoza et al., 2012; Fleming et al., 1996; Manor et al., 2012; Sibley et al., 2012). To compute this, the self- report score was subtracted from the parent score. This yielded both positive and

negative scores, ranging from a high of 52 (parent rating for Flexibility 52 points higher than self-report) to a low of -37 (parent rating of Self-Monitoring 37 points lower than self-report). Frequency of discrepancies for parent higher, self-report higher, and equal scores for each of the CEFI scales (Parent score – Self-Report score) with mean and standard deviation are provided in Table 9. As can be seen in the table, for all scales, more parents rated the adolescent higher than the adolescent rated her/himself.

Table 8

Parent –Adolescent Correlations

Parent Self-Report	ATT	ER	FLEX	IC	INIT	ORG	PLAN	SM	WM	FS
Attention (ATT)	.08	.11	.14	.06	.20	.06	.21	.11	.11	.12
Emotion Regulation (ER)	.47***	.52***	.41**	.48**	.47**	.44**	.50**	.47**	.51***	.53***
Flexibility (FLEX)	.12	-.05	.12	.05	.23	.12	.23	.16	.13	.17
Inhibitory Control (IC)	.16	.34*	.25	.40**	.34*	.29	.35*	.38*	.30*	.35*
Initiation (INIT)	.24	.39**	.42**	.39**	.53***	.24	.37*	.36*	.33*	.36*
Organization (ORG)	.06	.15	.18	.14	.17	.14	,24	.18	.10	.16
Planning (PLAN)	.10	.23	.22	.18	.26	.17	.27	.24	.22	.22

Self-Monitoring (SM)	.07	.28	.18	.25	.30*	.14	.21	. 24	.13	.19
Working Memory (WM)	.79***	.15	.35	.24	.29	.42**	.22	.29	.34*	.31*
Full Scale Score (FS)	.16	.29	.27	.29	.36*	.23	.34*	.32*	.27	.31*

Notes. For Self-Report Attention, N=45, except for Parent Attention, Emotion Regulation, Organization, and Full Scale (N=44); for Self Report Emotion Regulation, N=45, except for Parent Attention, Organization, and Full Scale (N=44); for Self- Report Flexibility, N 44, except for Parent Attention, Organization, and Full Scale (N=43); for Self-Report Inhibitory Control, N=44, except for Parent Attention, Organization, and Full Scale (N=43); for Self-Report Initiation, N=45, except for Parent Attention, Organization, and Full Scale (N=44); for Self-Report Organization N=45, except for Parent Attention, Organization, and Full Scale (N=44); for Self- Report Planning, N=45, except for Parent Attention, Organization, and Full Scale (N=44); for Self-Report Self-Monitoring, N=45, except for Parent Attention, Organization, and Full Scale (N=44); for Self-Report Working Memory, N=45, except for Parent Attention, Organization, and Full Scale (N=44); for Self-Report Full Scale, N=45, except for Parent Attention, Organization, and Full Scale (N=44).

*p>.05, **p<.01, ***p<.001

Table 8 Continued.

Table 9

Parent – Self Report Discrepancies (N, Mean, SD)

CEFI Scale/Subscales	Parent Higher (N) (Mean/SD)	N with No Difference	Self Higher (N) (Mean/SD)
Attention (ATT)	23	4	15
	20.61 (12.99)	-	14.87 (11.84)
Emotion Regulation (ER)	27	-	16
	14.56 (12.41)		7.69 (6.99)
Flexibility (FLEX)	20	2	20
	16.05 (11.58)	-	16.55 (9.17)
Inhibitory Control (IC)	25	-	17
	11.44 (6.55)	-	12.47 (9.79)
Initiation (INIT)	26	3	14
	11.08 (8.46)	-	11.07 (8.55)
Organization (ORG)	24	1	17
	11.58 (2.36)	-	13.12 (2.69)
Planning (PLAN)	27	1	15
	(14.52)	-	10.27 (1.96)
Self-Monitoring (SM)	22	2	19
	16.36 (13.91)	-	9.89 (9.14)
Working Memory (WM)	27	4	12
	15.74	-	12.58 (9.23)
Full Scale Score (FS)	23	1	17
	15.87 (9.78)	-	10.12 (10.29)]

Demographic Differences

It was hypothesized that there would be no difference in ratings of self-awareness across demographic factors (e.g., sex, gender, parent educational level). Specifically, it was hypothesized that there would be no difference across parent educational level or racial/ethnic groups. For this analysis, only those cases self-identified as African American, Hispanic, or Caucasian were considered. An analysis of parent educational

level was not conducted due to the limited variation in parent educational level. Results are presented in Table 10.

For the Parent CEFI, the results were non-significant (Wilks' Lambda F = 1.076; p=.39). Similarly, results with the Self-Report CEFI were non-significant (Wilks' Lambda F=.1.180; p=.30). In addition, due to the limited variation in educational

Table 10

Mean Comparison by Race/Ethnicity

	African American	*Hispanic*	*Caucasian*
Parent CEFI	*N=14*	*N=14*	*N=21*
Attention	103.57 (12.67)	107.21 (17.44)	102.95 (12.79)
Emotion Regulation	104.00 (16.09)	105.43 (17.45)	107.19 (10.41)
Flexibility	102.29 (12.67)	101.21 (14.58)	100.38 (13.08)
Inhibitory Control	102.00 (13.19)	105.43 (16.56)	108.14 (11.64)
Initiation	100.43 (11.13)	105.07 (17. 41)	100.19 (12.61)
Organization	103.07 (11.56)	105.14 (17.13)	103.10 (13.73)
Planning	103.43 (12.41)	104.79 (16.64)	103.43 (11.59)
Self-Monitoring	105.29 (12.19)	108.93 (16.46)	101.76 (11.81)
Working Memory	103.71 (14.82)	106.93 (16.42)	103.57 (14.82)
Full Scale Score	103.36 (11.65)	106.07 (17.17)	103.76 (12.17)
Self-Report CEFI	*N=15*	*N=10*	*N=17*
Attention	95.80 (17.40)	98.10 (18.33)	101.82 (11.70

Emotion Regulation	94.27 (18.46)	106.50 (18.35)	104.94 (11.81)
Flexibility	102.67 (16.06)	100.20 (17.02)	105.00 (11.36)
Inhibitory Control	98.73 (13.79)	110.50 (12.30)	105.65 (14.50)
Initiation	93.53 (12.33)	96.10 (12.02)	103.00 (14.06)
Organization	95.53 (17.53)	98.20 (21.21)	101.29 (15.37)
Planning	94.53 (17.15)	98.60 (18.68)	101.29 (13.11)
Self-Monitoring	96.07 (16.27)	99.90 (20.53)	103.71 (12.04)
Working Memory	92.27 (11.93)	100.30 (15.35)	99.35 (12.29)
Full Scale Score	94.93 (15.10)	100.50 (14.86)	103.29 (12.32)

Notes. CEFI =Comprehensive Executive Function Inventory

Table 10 Continued.

Conversely, it was expected that there would be gender differences on the Attention, Emotion Regulation, Flexibility, Inhibitory Control, Initiation, Organization, Planning, Self-Monitoring, and Working Memory scales. As with race/ethnicity, multivariate analysis of variance (MANOVA) for gender was not significant (Wilks' Lambda F=1.091; p=.39). See Table 11.

Table 11

Mean Comparison by Gender

	Male	*Female*
Parent CEFI	*N=18*	*N=24*
Attention	101.95 (11.96)	96.29 (17.24)

Emotion Regulation	102.22 (15.39)	106.92 (11.80)
Flexibility	98.22 (14.51)	104.88 (14.74
Inhibitory Control	106.33 (13.16)	107.12 (12.52)
Initiation	99.11 (14.47)	104.21 (11.89)
Organization	101.94 (16.99)	106.79 (11.43)
Planning	101.61 (14.67)	107.63 (10.85)
Self-Monitoring	102.44 (15.31)	108.67 (11.04)
Working Memory	104.06 (15.54)	107.06 (11.79)
Full Scale Score	102.94 (14.87)	107.17 (10.81)
Self-Report CEFI	*N=19*	*N=24*
Attention	101.95 (11.96)	96.29 (17.24)
Emotion Regulation	100.58 (13.31)	102.58 (18.78)
Flexibility	105.16 (11.74)	100.96 (15.94)
Inhibitory Control	105.79 (10.85)	103.29 (16.27)
Initiation	98.89 (11.67)	97.00 (14.59)
Organization	99.63 (14.14)	97.33 (19.54)
Planning	99.74 (12.96)	96.88 (17.79)
Self-Monitoring	102.05 (9.93)	98.13 (19.14)
Working Memory	96.68 (9.84)	97.33 (15.21)
Full Scale Score	101.32 (9.83)	98.21 (17.71)

Notes. CEFI = Comprehensive Executive Function Inventory

Table 11 Continued

Differences Based on Special Education Placement, Grade Retention, or Other Diagnosis

It was further hypothesized that there would be differences between groups based on special education placement, grade retention, or other diagnosis. Specifically, those with special education placement, grade retention, or other diagnosis were hypothesized to obtain lower ratings compared to typically developing peers. There were too few numbers who received special education or 504 services (N=5), were retained (N=3), or had a disability diagnosis (ADHD: N=2, Dyslexia: N=1) in order to test these hypotheses.

CHAPTER V

SUMMARY

The purpose of this study was to examine the relation between the EF constructs as measured by the CEFI (Naglieri & Goldstein, 2013) and the social/emotional/ behavioral constructs of the BASC-2 (Reynolds & Kamphaus, 2004). There is very little research available beyond the standardization sample for the CEFI. Comparing parent and self-report as a measure of self-awareness using CEFI would further add to the evidence base with regard to impact of different raters on the results, as well as potentially providing an indication of the developmental status of self-awareness in adolescents. Consideration of unintended consequences specific to group differences based on demographic factors is a further consideration in the validity of the CEFI as results may be one component used for diagnostic or placement purposes.

For this sample, consistent with prior research (Sasser & Bierman, 2012; Schoemaker, Mulder, Dekovic, & Matthys, 2013; Woltering, Lishak, Hodgson, Granic & Zelazo, 2015) it was hypothesized that executive function abilities as measured by the CEFI would be significantly correlated with global behavioral symptoms and adaptive functioning as measured by the BASC-2. The results did support the hypothesis and previous research for parent rating. Highest correlations with behavioral symptoms were Attention, Self-Regulation, Working Memory, Planning, and Inhibitory Control.

Notably, self-report on the CEFI and BASC-2 did not evidence these moderate

correlations. Only Emotional Regulation, Inhibitory Control, Initiation, Self-Monitoring, and Working Memory were correlated at a statistically significant level. This was not expected as Woltering, Lishak, Hodgson, Granic & Zelazo, 2015 previously found a strong association using other measures.

In consideration of differences in parent ratings and self-ratings, it was hypothesized there would be small to moderate correlations between raters based on the normative sample (Green, Godfrey, Soo, Anderson, & Castroppa, 2012; Vanderploeg, Curtiss, Luis, & Salazar, 2007; Wilson, Donders, & Nguyen, 2011; Yasuda et al., 2004). A further question related to self-awareness and as such consideration was given to the Self-Monitoring scale in particular. Consistent with the results reported by Naglieri and Goldstein (2012), subscales with the highest inter-rater correlations were Emotion Regulation, Inhibitory Control, Initiation, Self-Monitoring, and Working Memory.

Naglieri and Goldstein (2012) also found high inter-rater correlations on the Attention, Flexibility, Organization, and Planning subscales. It is possible that the small sample size, demographic composition, and regional restriction of the sample for this study affected the outcome.

Of particular interest in this study was self-awareness. As done in previous studies (Hoza et al., 2012; Fleming et al., 1996; Manor et al., 2012; Sibley et al., 2012), in addition to looking at correlations, the discrepancy between parent and self report scores was calculated. It was hypothesized that parents would report greater problems than the adolescent, reflecting difficulties in self-awareness. Results

indicated that parents reported higher levels of adjustment whereas adolescents were found to neither over- or under-report their EF skills or deficits. These results are not consistent with prior research using clinical populations.

With concerns for misidentification across demographic variables, it is important to consider differential impact on specific groups. Naglieri and Goldstein (2012) indicated there were no differences by racial/ethnic group; however, they reported gender differences. With a diverse sample, results by racial/ethnic group were consistent with the standardization sample. In contrast, no gender differences were found for this sample. Again, this sample is small and of a different demographic and regional composition than the standardization sample. This sample was also restricted to adolescents. No other demographics (i.e., retention, special education status, or clinical diagnoses) were able to be considered due to small representation in the sample.

Implications of Findings and Future Research

The current result yielded some important implications for understanding the impact of EF, self-awareness, and development at adolescence and the relation to emotional and adaptive function. Parent report of EF is related to both overall emotional status and adaptive function. In contrast, adolescent self-report of EF did not necessarily correlate with emotional adjustment or interpersonal skills. Further, it was found that parent and self-report are not generally consistent, but not necessarily because the adolescent overestimates their functioning. In fact, more adolescents rated their EF abilities lower than the parent. As such, it is imperative to consider both raters and the differences in interpreting the results of the CEFI. Finally, it is

important to note that with a diverse sample, and consistent with the standardization sample, there was no evidence of differential impact by race/ethnicity.

Limitations

The findings of this study should be interpreted in light of limitations of the study. First, this study was comprised of a small sample size of adolescents and their parents all from the southwest. Due to the small sample size, it may be difficult to generalize the results of this study to the general population. Therefore, it would be beneficial when replicating this study to increase sample size and regional representation in order to yield higher statistical power. This study also sought to examine differences based on parent educational level as a measure of socioeconomic status (SES). However, another limitation of this study is that the sample was homogeneous in terms of parent educational level and functioning which may have contributed to the outcome of this study. This study examined students across the adolescence developmental period, during a time where EF is crucial in decision making. Although examining the adolescent population was the goal of this study, this could also be viewed a limitation. Future research should focus on examining EF measures, including the CEFI, in children ages 6 to 11 in order to reflect the perceived variations in child and adolescent functioning. The current sample included very few adolescents with clinical conditions, or who were receiving special education services, or had been retained. As such, these results may not generalize to those populations. Finally, these results are specific to the measures used in this study. Results may differ for other measures or methods of assessing EF and overall adjustment.

Conclusion

EF is gaining more attention in prevention, assessment, and intervention. As with any measure of a construct, it is important to consider inter-rater reliability and the extent to which EF is related to other measures of adjustment. Results indicate that utilizing both parent and adolescent ratings of EF and emotional adjustment provide a useful way of identifying immediate and potential emotional and executive function concerns in the future (e.g., early adulthood). Further, it is important to consider the measures being used to assess EF with regard to differential impact. The preliminary results of this study suggest the possible utility of using the CEFI for screening EF in adolescents. Although research indicates that rating measures and performance-based measures of EF are low to moderately correlated in assessing similar EF components, rating measures such as the CEFI should also be considered useful and valuable in the context of clinical assessment. Previous research studies also found gender differences in various clinical populations.

Therefore, the findings in this study also highlight the need to further explore the effects of gender on executive function in adolescents from various clinical populations to determine if there is a pattern observed through age 17.

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APPENDIX A

TAPSA INFORMATION SHEET

Case # _____

Age of Adolescent:____years Gender of Adolescent: Male_____Female_____

Race/Ethnicity: African American___Asian/Pacific Islander_____Hispanic/Latino _____

Native American_____White non-Hispanic_____Biracial _____ Other:

Mother's Highest Educational Level: 9th-11th grade__ High School Diploma/GED _____

Community College or Technical School_____Some College _____

Completed 4 year degree_____Completed Graduate Degree _____

Father's Highest Educational Level: 9th-11th grade____High School Diploma/GED _____

Community College or Technical School_____Some College _____

Completed 4 year degree_____Completed Graduate Degree _____

Is your child eligible for free/reduced lunch? Yes_____No _____

What is the primary language in your home? English _____ Spanish

Other:_____

Does your child speak a language other than English? Yes_____No_____

If yes, what language? _____

Educational History:

What grade is this child in currently? _____

Has your child repeated a grade in school? YES_____NO _____

Has your child skipped a grade in school? YES_____NO _____

Did this child participate in a bilingual education program at school?

Yes_____No _____

Does she or he currently receive ESL or LEP services? Yes_____No _____

Does your child receive Special Education services? YES_____NO _____

If yes, for what reason(s)? _____

Does your child receive 504 services or accommodations? YES_____NO _____

If yes, for what reason(s)? _____

Medical History:

Has your child had any of the following or been diagnosed with any of the following?

Loss of consciousness or coma_____Asthma_____ Head Injury _____

Seizure or Epilepsy_____ Concussion___ Cancer_____

Cystic Fibrosis_____ Diabetes_____ ADHD/ADD _____

Sickle Cell Anemia_____ Cerebral Palsy_____Learning Disability_____

Down Syndrome_____ Autism_____ Intellectual Disability_____

_____ Stroke_____ Other: _____

_____

Asperger Syndrome_____

What medications is your child currently prescribed? _____

_____

If you indicated that your child sustained a **head injury or concussion**, please answer the following questions:

To the best of your recollection, how many times did your child experience a head injury or concussion? ___

In conjunction with a head injury, did your child experience dizziness or confusion? YES_____NO _____

Does your child participate in organized sports (e.g., soccer, football, basketball, baseball/softball)? YES__NO _____

If involved in sports, was your child held out from playing in the sport as a result of a head injury or concussion? YES__NO _____

In conjunction with a head injury, did your child lose consciousness? YES_____NO _

If they lost consciousness, for how long were they unconscious? _____

In conjunction with a head injury, was your child ever treated by a physician or neurologist? YES_____NO _____

In conjunction with a head injury, was your child hospitalized for 1 or more days? YES____NO _____

In conjunction with a head injury, was your child ever in a coma? YES___NO _____

If you indicated that your child has **epilepsy**, please answer the following questions: At what age was your child first diagnosed with epilepsy? ____

If you know, what type of epilepsy does your child have? _____

When was your child's last seizure (month and year)? _____

Would you describe your child's epilepsy as "controlled"? YES_NO _____

How many medications is your child currently taking for epilepsy? _____

Is your child restricted from certain activities because of the epilepsy? YES_____NO _____

Has your child had surgery to gain better control of the epilepsy? YES_NO _____

Is surgery being considered as an option for better control of your child's epilepsy? YES_NO _____

How frequent are your child's seizures?

Less than once a year_Once a year _____

A few times a year, but less than once a month_____Once a month _____

Once a week_____Once a day _____

If you indicated that your child has **asthma**, please answer the following questions: At what age was your child first diagnosed with asthma? _

_____

When was your child's last asthma attack (month and year)? _____

Would you describe your child's asthma as "controlled"? YES____NO_____

How many medications is your child currently taking on a daily basis for asthma control? _____

Is your child restricted from certain activities because of the asthma? YES__NO _____