

**PREDICTING COLLEGE STUDENTS' POSITIVE PSYCHOLOGY
ATTRIBUTES WITH DIMENSIONS OF EXECUTIVE FUNCTIONING**

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I dedicate this research to my two little munchkins, Cole and Owen. Never stop working hard and chasing your dreams.

ABSTRACT

The purpose of this study was to investigate how, and to what extent, dimensions of executive functioning (EF) predicted college students' positive psychology attributes, namely grit, optimism, positive affect, and life satisfaction. Seventy-nine participants were administered a self-report EF measure, the Behavior Rating Inventory of Executive Function-Adult Version (Gioia, Isquith, Guy, & Kenworthy, 2000), which assesses EF behavior regulation and metacognitive skills. In addition, four self-report positive psychology surveys were completed by each participant. Results indicated that EF behavior regulation and metacognitive skills successfully predicted grit and optimism. In addition, EF metacognitive skills predicted positive affect and life satisfaction. In general, findings extend previous EF and positive psychology research by investigating dimensions of EF that appear to contribute to life well-being factors.

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CHAPTER I

Introduction

The purpose of the current study is to examine the relationship between executive functioning (EF) skills and positive psychology traits. The two main EF constructs in this study are inhibition and working memory. The main positive psychology traits in this study are grit, optimism, affect, and life satisfaction. In the first section of the literature review, EF is operationally defined. The brain regions and developmental trajectories associated with EF are also reviewed. Correspondingly EF inhibition and working memory are defined and current research related to each is presented. In the second section of the literature review, positive psychology is introduced. The history and status of this movement is explored. Correspondingly, each of the four positive psychology traits are defined and current research is reviewed. Lastly, the purpose of this study and hypotheses are presented.

Executive Functioning

The first main construct of this study is executive functioning (EF). EF refers to a broad set of cognitive processes that allow individuals to regulate and maintain the day-to-day operations that lead to long-term performance (Kaufman, 2010). Operational definitions of EF and its components vary, but researchers generally include the constructs of goal setting, planning, organizing, flexibility, attention, working memory, and self-regulation (Meltzer, 2007). Together, these and other EF skills contribute to higher order problem solving, complex multi-tasking, and logical reasoning (Koechlin, 2011; Stuss & Alexander, 2000). Martha Denckla (1994), a leading EF researcher, outlined four key control processes that comprise EF namely, 1. initiate, 2. sustain, 3.

inhibit, and 4. shift. One, initiate, refers to the ability to independently start a task through goal setting and organizing time and materials. For example, when an individual is presented with a project, they must utilize problem solving strategies to successfully begin the activity. Two, sustain, refers to the ability to utilize goal-directed attention and self-monitoring to complete initiated goals (Kaufman, 2010). For example, when working towards task completion, an individual must maintain focus and continually reassess their progress towards task completion. Three, inhibit, is characterized by the ability to maintain attention and disregard prepotent responses (Denckla, 2005). For example, when working toward a goal, an individual must resist becoming distracted and override the urge to engage in activities that are more pleasurable than the task at hand. Four, shift, refers to the ability to smoothly transition from one task to the other (Denckla, 1994; Kaufman, 2010). For example, when an individual is working on two tasks, they must be able to transition back and forth between the two. Together, these four main components of EF promote successful problem solving, execution, and completion of long term goals.

EF and the Brain. The frontal cortex of the brain is generally recognized as the primary area associated with EF processing (Stuss & Benson, 1984). This brain area is located behind the forehead and appears to be the last portion of the brain to develop. It is now recognized as having a developmental trajectory that extends into young adulthood (Kaufman, 2010; Sowell, Thompson, Holmes, Jernigan, & Toga, 1999). Connections with the frontal regions of the brain have been linked to almost all other brain areas, demonstrating its role in regulating and coordinating complex brain processes (Stuss & Benson, 1984; Buchsbaum, 2004). To illustrate, the frontal lobes are closely

connected with the limbic system that are associated with mood and motivation (Fuster, 2001). Associative chains also connect the frontal lobes to sensory-motor regions that assist in detecting external stimuli and coordinating behavioral responses (Fuster, 2001). In general, the frontal lobes appear to be implicated in a broad array of motor, cognition, and affect regulations. Together, these interactive EF processes account for higher order thought and behavior (Alexander & Stuss, 2000; Buchsbaum, 2004).

EF Deficits. Multiple studies demonstrate that EF deficits are associated with many negative outcomes, such as behavior problems, academic difficulties, grade retention, goal neglect, and increased traffic accidents and violations (Barkley, Murphy, Dupaul, & Bush, 2002; Best, Miller, & Naglieri, 2011; Biederman et al, 2004; Duncan, 1986; Duncan, Emslie, Willimas, Johnson, & Freer, 1996; Morgan & Lilienfeld, 2000;). For example, Morgan & Lilienfeld (2000) investigated the relationship between EF skills and anti-social behaviors. Using meta-analysis, researchers reviewed thirty-nine studies with a total of 4,589 participants. Results indicated that individuals who exhibited increased overt and covert antisocial behaviors performed .62 standard deviations worse on tests of EF skills than control groups. Overall, the findings suggest an association between EF weaknesses, antisocial behaviors and other poor outcomes, such as criminality and conduct disorders.

Other researchers have investigated the association between EF deficits and goal directed behavior. For example, Manly, Hawkins, Evans, Woldt, & Robertson (2002) compared EF processing in 10 participants with brain injuries and 18 participants without. Participants were given 15 minutes to complete a variety of tasks such as sorting coins, looking up telephone numbers, alphabetizing labels, proofreading a leaflet,

and opening a garage door. Researchers then observed participants' ability to prioritizing, initiate, and manage time on tasks. Results indicated that individuals in the impaired group, when compared to the non-impaired group, made less attempts to complete tasks and had more difficulty allocating time effectively. Overall, these findings support the notion that compromised EF skills are associated with a variety of difficulties related to task conceptualization, initiation, and execution difficulties.

Poor EF skills are also linked to academic weaknesses (Biederman et al, 2004; Bull & Scerif, 2001; Weber, Gerber, Turcios, McCloskey, VanDivner, & Perkins, 2008; Wagner, & Forbes, 2006). Multiple studies have documented that EF weaknesses are associated with a variety of difficulties that impact academic performance, including generating original ideas, managing time appropriately, remembering information while applying it, sequencing ideas, organizing materials, focusing on activities until completion, and breaking a project apart in to workable units (Denckla, 1996; Landon & Oggel, 2002; Miyake, Friedman, Emerson, Witzki, Howerter, & Wager, 2000; Stuss & Alexander, 2000). For example, Best, Miller, & Naglieri (2011) investigated the relationship between EF and academic skills by administering clinical EF tasks from the Cognitive Assessment System and academic tasks from the Woodcock-Johnson Tests of Achievement-Revised (WJ-R) to 2,036 children ages 5-17. Results indicated that children's EF scores were significantly correlated with both math and reading scores across ages ($r=.28$ to $r=.60$). Furthermore, results indicated that the levels of association between EF and academics changed as children aged. Correlations tended to be stronger in younger children. The authors indicated this was possibly due to less automatic responses problem solving that younger children exhibit. Overall, these findings support

the idea that EF processes are correlated with reading and math achievement, especially in younger children.

In general, EF skills are linked to problem solving, execution, and completion of goals. Inversely, EF deficits are associated with difficulties in managing time appropriately, maintaining focus over periods of time, and organizing effectively. These deficits also appear to contribute to learning and academic difficulties, behavior problems, and goal neglect.

EF Variables. This study will focus on two main components of EF, namely inhibition and working memory. Below, each of these constructs is defined and corresponding research is provided.

Inhibition. Inhibition appears to be a main component of behavioral regulation. (Barkley, 1997b; Roth, Isquith, & Gioia, 2005). Broadly, the construct is defined as the ability to control impulses and stop behavior (Gioia, Isquith, Guy, & Kenworthy, 2000). Others have defined it as the deliberate suppression of prepotent responses, (Barkley, 1997a; Schachar, Tannock, & Logan, 1993). For example, an individual with a prepotent response of interrupting others when talking may learn that the behavior is problematic and successfully inhibit the dominant behavior during conversations. Lack of inhibitory control has been linked to numerous negative outcomes, such as obesity, eating disorders, drug and alcohol addiction, and delinquency (Lubman, Yucel, & Pantelis, 2004; Paulit-Pott, Albayrak, Hebebrand, & Pott, 2010; Kerr, Tremblay, Pagani, & Vitaro, 1997; Wu et al, 2013). For example, Carroll, Hemingway, Bower, Ashman, Houghton & Durkin (2007) investigated the EF inhibition skills of 129 adolescents who were categorized as early-onset offenders, late-onset offenders, or non-offenders.

Participants were administered a measure of delinquency and a variety of EF measures that assessed inhibition, cognitive tempo, processing speed, and risk taking behaviors. Results indicated that both offender groups exhibited significantly higher rates of impulsivity than the non-offenders ($F(2, 122) = 15.17, p < .001$). Moreover, individuals in the early-onset offender group displayed more EF inhibition difficulty than the other two groups ($F(2, 121) = 3.66, p < .05$). In addition, early-onset offenders reported significantly higher delinquency in five areas, namely stealing offences, school misdemeanors, vehicle-related offences, physical aggression, and hard drug use. Though differences in impulsivity between early-offenders and late-offenders were inconclusive, both groups displayed significantly elevated rates of impulsivity compared to non-offenders. In general, findings supported the idea that adolescents who engage in delinquent behavior display higher rates of impulsivity than non-offenders.

To further examine the relationship between inhibitory control and negative outcomes, Raaijmakers, Smidts, Sergeant, Maassen, Posthumus, van Engeland, & Matthys (2008) compared EF and aggressive behaviors in 188 preschool children who were categorized as either aggressive ($n=89$) or non-aggressive ($n=99$). Participants were administered a variety of measures that assessed intelligence, inhibitory control, working memory, switching, and cognitive flexibility. Results indicated that inhibition difficulties were associated with more aggressive behaviors ($r = 0.287, p = 0.00$). Additionally, of the EF abilities measured, inhibition was the only trait that could be distinguished. This provided support that inhibition is a core component of EF and that deficits are associated with the development of aggressive behaviors over time. Together, these and other studies suggest that EF inhibition is central to behavioral control and regulation time.

Working Memory. Working memory is defined as the ability to hold an event in the mind so as to maintain or complete a task (Barkley, 1997a; Roth, Isquith, & Gioia, 2005). The term was originally coined by Baddeley & Hitch, in 1974, to describe a type of memory that is separate from long-term memory. Working memory is conceptualized as being a “central executive” that regulates the ability to hold information for immediate recall, and the ability to create and maintain visual-spatial representation in the mind that persist through distractions (Baddeley & Hitch, 2010). For example, when an individual is completing a mutli-step set of instructions, they must hold the information temporarily in mind. As each step is completed, the information is manipulated and updated. Essentially, this mental flexibility allows for intricate planning and creative problem solving.

Multiple studies have suggested that working memory has limited capacity. In other words, information stored for temporary use and manipulation is prone to be interrupted and forgotten (Courtney, Petit, Haxby, & Ungerleider, 1998; Oberauer, Sub, Wilhelm, & Sander, 2007). Research suggests that working memory is associated with a number of skills, such as language comprehension, academic achievement, and conceptual learning, (Banas & Sanchez, 2012; Daneman & Merikle, 1996; Luo, Thompson, & Detterman, 2003). For example, Ruthsatz & Urbach (2012) examined the cognitive profiles of eight prodigy children who had been recognized nationally for their abilities in areas such as art, music, math, and science. Participants were administered the Stanford-Binet Intelligence Test-5th edition, among other measures. Results indicated that the children’s IQ scores were

moderately elevated and ranged from 108 to 149 ($M = 128, SD = 15.30$). However, all the children's working memory scores were consistently at or above the 99th percentile ($M = 147, SD = 5.32$). These findings suggest that working memory is a key component in the cognitive profiles of high performing individuals.

Research also suggests that working memory is linked to goal maintenance in adults (Kane & Engle, 2003). To extend this theory to young children, Markovitch, Beseovski, Knapp, & Kane (2010) administered two EF sorting tasks and three working memory capacity tasks to 65 children, ages four and six, to determine if working memory predicted the ability to maintain goals. Results indicated that children's working memory scores significantly predicted their sorting task scores ($b = .11, t(61) = 2.8, p < .01$; $b = .10, t(61) = 2.1, p < .05$, respectively). These results suggest that working memory plays a role in goal-directed behavior in preschoolers. Overall, these and other findings suggest that working memory is linked to goal-directed behavior. If working memory difficulties are present, the ability for individuals to flexibly plan and coordinate multi-step tasks may be negatively impacted.

Positive Psychology

Broadly, the second main construct of this study is positive psychology traits. Positive psychology is a relatively recent branch to emerge in the field of psychology. It's primary focus is to assist individuals in building positive qualities that lead to more fulfilling lives (Seligman & Csikszentmihalyi, 2000). In 2007, Martin Seligman, former president of the American Psychological Association, established the Positive Psychology Center to more fully advance the "scientific study of the strengths and virtues

that enable individuals and communities to thrive” (Seligman, 2007). The main focus of positive psychology is threefold, namely, to increase: 1. positive valued experiences, 2. positive individual traits, and 3. positive civic virtues. One, valued experiences are defined as life events that are viewed in a positive way (Seligman, 2002). These experiences are generally associated with feeling of well-being, contentment, satisfaction, hope, optimism, and happiness (Seligman & Csikszentmihalyi, 2000). Two, positive individual traits are conceptualized as strengths and virtues that contribute to personal improvement (Seligman, 2002). Examples of these traits include the capacity for love, courage, perseverance, forgiveness, spirituality, wisdom, and interpersonal skill (Seligman & Csikszentmihalyi, 2000). Three, civic virtues are defined as collective strengths that lead to improved communities and shared environments (Seligman, 2002). Civic virtues may include traits such as responsibility, altruism, civility, tolerance, and work ethic (Seligman & Csikszentmihalyi, 2000). Together, these three areas of focus encompass the purpose and research areas within positive psychology. Generally, the purpose is to increase flourishing within individuals, families, schools, work environments, and overall community (Compton & Hoffman, 2013; Gable & Haidt, 2005; Seligman, 2011; Seligman & Csikszentmihalyi, 2000)

In many ways positive psychology contrasts with a more traditional psychology that focuses more on identifying and treating mental disorders, or broadly psychopathology. Often called the disease model, traditional psychology has focused more on naming and categorizing disorders for the purpose of treatment (Terjesen, Jacofsky, Froh, & DiGiuseppe, 2004). Though the model has led to many advances, it has not generated the needed focus on health and prevention (Terjesen, et al, 2004). In

comparison, positive psychology seeks to do this. Its main emphasis is on enhancing health and well-being with a strong focus on prevention. It is noted that positive psychology is not an attempt to replace traditional psychology, but aims to augment and balance traditional psychology (Seligman & Csikszentmihalyi, 2000).

In recent years, the positive psychology movement has expanded rapidly. Hundreds of books and articles have been published in the area (Seligman, Steen, Park, & Peterson, 2005). The approach has spread to many professional areas such as mental health, medicine, education, neuroscience, psychotherapy, and even the armed services (Trustees of University of Pennsylvania, 2006). This has been promoted by a number of studies that have documented associations between positive psychology traits and a variety of health factors such as aging, coping with stress, recovery from illnesses, and improving quality of life (Buchanan, 1995; Harker & Keltner, 2001; Leedham, Meyerowitz, Muirhead, & Frist, 1995; Ostir, Ottenbachen, & Markides, 2004). For example, Fredrickson and Losada (2005) investigated the relationship between positive emotions and “flourishing”, or living within an optimal range of functioning. A sample of 101 individuals were assessed and categorized according to levels of flourishing. Participants then rated twenty different positive and negative emotions that they experienced daily for 28 consecutive days. Examples of positive emotions included gratitude, joy, and contentment. Examples of negative emotions included anger, fear, and sadness. Results indicated that individuals who were flourishing differed significantly from non-flourishing in ratings of positivity ($t(99) = 1.62, p = .05$). Flourishing individual experienced increased self-acceptance, purpose in life, environmental mastery, social acceptance, and social contribution. On the other hand, individuals who rated

themselves as non-flourishing rated themselves as having experienced significantly lower levels of goodness, generativity, growth, and resilience. In general, the authors concluded that people who experience higher levels of positive emotions, including contentment, gratitude, and joy, experience better resilience, goodness, and personal growth.

Similarly, Seligman, Ernst, Gillham, Reivich, & Linkins (2009) investigated how positive psychology traits influenced educational outcomes. Researchers utilized a positive psychology program designed to help adolescents identify character strengths. Ninth graders ($n=347$) were randomly assigned to a treatment group or a control condition. The treatment group received 20-25 positive psychology sessions that lasted 80-minutes each. Students completed a questionnaire indicating their strengths, social skills, behavioral problems, and love of school before and after the program, and 2-years after finishing the program. Results based on self, parent, and teacher ratings indicated that students in the treatment group displayed improved social skills, enjoyment, and school engagement. The treatment group also showed improved language arts achievement 2-years later. The authors concluded that the results appear to support the efficacy of a positive psychology program that is embedded into school curriculum. Long-term impacts of the program appear to extend beyond academics alone for students of varying backgrounds and abilities.

In another example, Lester, Harms, Herian, Krasikove, & Beal (2011) utilized positive psychology principles to establish a Comprehensive Soldier Fitness program (CSF) for individuals serving in the United States Army. The main purpose of the program was to increase the psychological resilience of soldiers and their family before,

during, and after soldier deployment (Casey, 2011). The program focused on metacognitive strategies to better handle stressful situations. Results from the study were based on 22,000 soldiers in eight Brigade Combat Teams (BCTs). Four BCTs were assigned to a treatment condition where soldiers received Master Resilience Training (MRT). Four BCTs did not receive MRT and were considered a control group. Soldiers rated their resiliency among other positive health variables three times over a 15-month period. Results indicated that soldiers receiving the treatment program scored significantly higher on emotional fitness and social fitness measures. In addition, the soldiers in the treatment condition indicated they used less catastrophic thinking and improved significantly in emotional fitness, friendship, and coping over time. In contrast, the control group showed no significant changes and reported experiencing higher rates of catastrophic thinking over time even when controlling for quality of leadership and unit cohesion. The authors concluded that resiliency training appears to improve soldier's emotional health, well-being. Correspondingly, the U.S. Army has recently expanded this training for soldiers to reduce the long-term effects of post-traumatic stress (Cornum, Matthews, & Seligman, 2011).

Overall, the positive psychology movement has gradually emerged as an area that enhances a more traditional psychology. The emphasis on positive experiences, individual traits, and institutions continues to be an active area of research and practice. However, more research is needed that further explores how positive psychology traits correspond with day-to-day functioning. For example, more information is needed to further understand what constructs build strengths, the role of positive experiences and

emotions, and how these factors correspond with better health and well-being (Gable & Haidt, 2005; Seligman & Csikszentmihalyi, 2000)

Positive Psychology Variables. Though there are many positive psychology traits, this study will focus on four, namely: grit, optimism, life satisfaction, and affect. Each trait is described below and corresponding research is presented.

Grit. Grit is defined as the perseverance and passion needed to achieve long-term goals (Duckworth, Peterson, Matthews, & Kelly, 2007). It is also conceptualized as the ability to maintain focus regardless of positive feedback or praise from others. Essentially, grit is the motivation that is internally driven (Duckworth et al., 2007). For example, along with her colleagues, Angela Duckworth (2007), a leading grit researcher, described a “gritty person” as someone who maintains focus on goals over time despite hardships and setbacks. The person does not simply maintain short-term intensity, but they pursue a goal over a long period of time.

Recent research suggests that grit is associated with a wide variety of variables, such as time spent practicing, engaging in moderate and high intensity levels of exercise, academic success, and teacher effectiveness (Duckworth, Kirby, Tsukayama, Berstein, & Ericsson, 2011; Reed, Pritschet, & Cutton, 2012; Robertson-Kraft & Duckworth, 2012). For example, Reed, Pritschet, & Cutton (2012) surveyed 1171 participants and investigated the relationship between grit, conscientiousness, and exercise intensity. Results indicated that grit predicted levels of moderate and high intensity exercise ($\beta = .19, p = .045$; $\beta = .26, p = .001$ respectively). In contrast, conscientiousness did not predict moderate or high levels of exercise ($\beta = .07, OR = 1.07, NS$; $\beta = .08, OR = 1.08, NS$ respectively). Moreover, individuals who scored at least a standard deviation higher

in grit were 30% more likely to engage in more intense exercise. The authors concluded that grit predicted the consistent effort to maintain fitness and increase intensity over time (Reed, Pritschet, & Cutton, 2012).

In another study, Duckworth, Peterson, Matthews, & Kelly (2007) investigated the relationship between grit, GPA, and SAT scores. Researchers had 139 elite undergraduate students fill out self-ratings of the grit scale. Scores were then compared to GPA and SAT scores. Results indicated that student's grit scores were significantly correlated with higher GPAs ($r = .25, p = .01$) but lower SAT scores ($r = .20, p = .03$). Given these findings, researchers concluded that grit was an important factor associated with high levels of academic success (Duckworth, et al, 2007).

In efforts to better understand the relationship between grit and retention, Duckworth et al. (2007) administered a variety of surveys that measured variables such as grit, self-control, retention, GPA, leadership, and military performance to 1,218 cadets attending West Point Military Academy, a competitive and rigorous training academy. Results indicated that cadet participants' grit levels predicted completion of the summer training program, more so than self-control, leadership potential, or physical aptitude ($r = .48, p = .001$). Grit scores also predicted summer retention ($r = .39, p = .03$). In general, results suggest that a gritty person is better able to accomplish tasks that challenge a person's physical or emotional limits.

Similarly, Duckworth et al. (2007) studied the grit levels of Scripps National Spelling Bee participants ($n=175$) to better understand the relationship between grit, verbal IQ, and spelling bee performance. The Scripps National Spelling Bee is a national competition where the best spellers in the country compete. Spelling bee participants,

ages 7-15, were administered a verbal IQ measure and a grit survey. Results indicated that grit levels were significantly associated with students' advancement to higher rounds of the competition ($r = .34, p = .04$). Individuals with grit scores a standard deviation or more above the mean were 41% more likely than their same-aged peers to advance further in the competition. Researchers speculated that individuals with high levels of grit most likely spent more time studying for competition and advanced accordingly (Duckworth, et al., 2007; Duckworth, Kirby, Tsukayama, Berstein, & Ericsson, 2011).

Robertson-Kraft and Duckworth (2012) also studied grit by surveying 154 novice teachers in their first or second year of teaching. The goal was to better understand how grit predicted teaching effectiveness and retention. Teachers were considered effective if their students made at least one year's growth during the academic year based on state standardized testing. Results of the study demonstrated that teachers who remained through the year had higher grit ratings than those who resigned ($p < .001, d = .79$). More effective teachers also had higher grit scores than less effective teachers ($p < .05, d = .42$). Additionally, teachers who were at least one standard deviation higher than their peers in grit were 60% more likely to outperform peers ($B = .47, p < .05$). These findings highlight the importance of grit, especially in situations that require perseverance, little positive feedback, and high levels of achievement across time.

Together, these studies suggest that as grit levels increase people tend to experience higher levels of success than peers of equal ability. Grittier individuals also appear to be better able to maintain focus on long-term goals, handling adverse circumstances, and attaining higher levels of success (Duckworth et al, 2007; Robertson-Kraft & Duckworth, 2012).

Optimism. Optimism can be defined as the propensity to expect generally good vs. bad experiences in life (Scheier & Carver, 1985). Broadly, optimism refers to the propensity to believe goals can be achieved in the face of obstacles. Buchanan and Seligman (1995) described optimism in terms of ‘explanatory style’. Broadly, this refers to how a person explains the causes of bad events. For example, a person who explains events using global causes can be considered pessimistic, whereas someone who explains negative events with specific external causes can be considered optimistic (Peterson, 2000). Levels of optimism have been shown to correlate with many health variables. For example, Peterson and Seligman (1987) reported that pessimism and passivity predicted higher rates of disease and death, although they were not sure exactly how or why at that time. In the same year, Scheier & Carver (1987) reported that people with higher levels of optimism exhibited less physical symptoms of illness. Further research reported that optimistic people cope with stress more effectively (Scheier & Carver, 1992). Other studies report an association between optimism and less emotional distress in breast cancer patients, healthy lifestyle and dietary habits in older men, and lower rates of depressive symptoms over time with the elderly (Giltay, Geleijnse, Zitman, Buijsse, & Kromhout, 2007; Giltay, Zitman, & Kromhout, 2006; Wimberly, Carver, & Antoni, 2008). Rasmussen, Scheier, & Greenhouse (2009) performed a meta-analysis of 84 studies of optimism and physical health. Results indicated that levels of optimism were associated with many physical health outcomes such as recovery from cardiovascular disease, cancer, pain, physical symptoms, healthy immune function, and positive pregnancy outcomes. Optimism also appears to be related to coping skills during a life transition. Brissette, Scheier, & Carver (2002) investigated the transition to college in 89

freshmen students. Participants were administered measures of optimism, coping, self-esteem, depression, stress, and social support, among others. Results indicated that optimism was positively correlated with greater perceived support at the beginning of the semester ($r = .28, p = .01$). Optimism was also a significant predictor of increased in perceived social support throughout the semester ($\beta = .30, t(87) = 3.03, p < .01$). At the end of the semester higher levels of optimism were associated with less stress ($\beta = .22, t(87) = 2.08, p < .05$) and lower levels of depression ($\beta = .29, t(87) = 2.86, p < .01$) at the end of the semester. Together, these studies suggest that optimism is important in a variety of ways. The attribute can improve emotional well-being in a number of ways such as lessening the impact of serious illnesses and better coping with life transitions.

Affect. Affect is defined as an experienced feeling or emotion that may include both positive and negative aspects (Watson, Clark, & Tellegen, 1988). Positive affect (PA) is conceptualized as an individual's level of enthusiasm, activity, and alertness, with emphasis on an action component (Fredrickson, 2001). For example, a person with high positive affect tends to be full of energy, engaged, and focused (Leue & Beauducel, 2011; Barrett & Russell, 1998). Negative affect is conceptualized as general distress and pervasive negative emotionality (e.g., sad, nervous; Leue & Beauducel, 2011). For example, a person with high negative affect may tend to have more negative self-perception, be more troubled, and have more emotional disengagement (Watson & Clark, 1984; Watson et al, 1999). Researchers speculate that positive and negative affect actually co-occur during stressful periods and the positive affect helps restore balance, improve coping, and lead people toward better emotional well-being (Fredrickson & Joiner, 2002; Folkman, 2008; Tugade & Fredrickson, 2004).

Research findings suggest that high negative affect is associated with a number of health factors such as depression, anxiety, stress, poor coping skills, and more health complaints (Beiser, 1974; Kanner, Coyne, Schaefer, & Lazarus, 1981; Watson & Clark, 1984; Watson & Tellegen, 1985). In contrast, high positive affect has been associated with lower morbidity rates, decreased pain levels with illness, and increased longevity (Cohen & Pressman, 2006; Pressman & Cohen, 2005).

Affect and age also appear to be significantly correlated. Charles, Piazza, Luong, & Almeida (2009) interviewed 1,031 participants daily for eight consecutive days about daily events and their emotional well-being, specifically about arguments, stressors, or discrimination that occurred. Results indicated age was inversely related to negative affect ($F(1, 6138)=3.9, p<.05$). Research also suggests that aging is inversely associated with low negative affect, meaning that as people age they tend to have lower rates of negative affect (Charles & Carstenson, 2007; Charles, Piazza, Luong, & Almeida, 2009). The authors explained that as people grow older, they appear to gain more acceptance and understanding of life, which may be a mediator for negative emotionality (Shallcross, Floerke, Ford, & Mauss, 2012).

Together, these studies suggest that negative affect is associated with stress, anxiety, and health complaints, but positive affect helps negate those negative outcomes. Studies suggest that negative affect decreases with age. Findings also suggest that positive affect is associated with lower morbidity rates and decreased pain after health crisis. Studies suggest that negative affect decreases with age.

Life Satisfaction. Life Satisfaction is defined as a “global assessment of a person’s quality of life according to his chosen criteria” (Shin & Johnson, 1978). Pavot

& Diener (1993) highlight the importance of the ‘global’ nature of this definition. This allows for individuals to decide what is important in their lives. For example, individuals may rate variables such as money, family, location, career in different ways. The stability of life satisfaction across cultures has been an area of recent interest. For example, Kuppens, Realo, & Diener (2008) investigated with relationship between life satisfaction and positive and negative emotions across cultures with 9,857 participants from 46 countries. Participants were administered surveys that measured their satisfaction with life, experience of positive and negative emotions, level of cultural individualism, and value of self-expression vs. survival within their culture. Results indicated that positive emotions were a significant predictor of life satisfaction across countries ($\chi^2(1, N = 46) = 43.62, p < .0001$). Although significant, the impact did vary across cultures. Results also indicated that in cultures where individualism is valued, the relationship between negative emotions and life satisfaction was moderated, meaning negative emotions had a more adverse impact of life satisfaction in those places. Similarly, in cultures that valued self-expression over survival, positive emotions moderated life satisfaction. The authors concluded that positive and negative emotions impacted life satisfaction across cultures, but this varied to some degree based on cultural norms.

Life Satisfaction appears to be somewhat stable over time, although a person’s genetics and major life events have a strong influence (Fujita & Diener, 2005; Lucas, Clark, Georgellis, & Diener, 2004). For example, Fujita and Diener (2005) examined the idea of a life satisfaction “set point”, defined as an individual baseline of life satisfaction that remains relatively stable over time. Researchers administered a life satisfaction

survey yearly to 3,608 participants for 16 years. Researchers considered the first 5-years of ratings the individual's baseline. When comparing baseline ratings to subsequent ratings, results indicated that 24% of participants had a significant change in life satisfaction over time. This percentage was four times higher than the researcher's hypothesized. The authors concluded that even though factors such as death of a spouse, unemployment, and weight or health changes can have a significant impact on life satisfaction, there appears to be "soft baseline" where many people fluctuate around a relatively stable level of life satisfaction,(Lucas, Clark, Georgellis, & Diener, 2003; Lucas, Clark, Georgellis, & Diener, 2004).

EF and Positive Psychology

Recently, researchers have begun to investigate the relationship between EF and positive psychology dimensions. For example, Miley and Spinella (2006) examined the relationship between EF and satisfaction with life, gratitude, and forgiveness. Surveys were administered to a sample of 154 adults. Results indicated positive relationships between EF and gratitude ($r=.28$, $r=.31$; $p<.001$, $p<.001$) as well as EF and satisfaction with life ($r=.21$, $r=.38$; $p<.05$, $p<.001$). Results also indicated there was a negative correlation between EF impulse control, and forgiveness. In other words, individuals with better impulse control reported that they were less likely to forgive. In a replication of this study, G. Kruger (2011) surveyed 113 college students and added hope and optimism to the measured traits. Results also indicated a positive correspondence between EF and positive psychology's hope and optimism.

In general, researchers have recently begun to investigate the correspondence between EF and hope and optimism. However, more studies are needed that examine the

relationship between EF dimensions and positive psychology traits. Positive psychology is a new research field and not much is known about how it relates to the brain and neuropsychology. To address this need, this study will attempt to make this connection by investigating how and to what extent EF inhibitory control and working memory relates to grit, optimism, affect, and life satisfaction. Below, the study's main hypotheses and corresponding rationales are provided.

Hypothesis

Hypothesis One. It is hypothesized that EF inhibition, as measured by the BRIEF-A Behavioral Regulation Index (BRI), will be a significant predictor of grit as measured by the Grit Scale.

Rationale. Theoretically, as an individual exhibits increased EF inhibitory control, it would be expected that they would be more successful with resisting distractions and completing goals. This inhibitory control may provide an individual with skills that would be important to persevere and regulate behaviors leading to long-term goal maintenance and completion. Essentially, this study proposes that inhibition predicts grit.

Hypothesis Two. It is hypothesized that EF Working Memory, as measured by the BRIEF-A Metacognitive Index (MI), will be a significant predictor of optimism, as measured by the Life Orientation Test-Revised.

Rationale. Optimism is the positive belief that goals can be accomplished despite obstacles, but research suggests that EF deficits can hinder educational performance and goal completion (Kaufman, 2010; Meltzer, 2007; Seligman, 2011). Theoretically, strengths in working memory, the ability to remember information while using it, would

correlate with an optimistic view of goal completion. Working memory is the ability to prepare for the future, so those who are better able to prepare are more hopeful.

Fundamentally, working memory allows for individuals to better prepare for the future and individuals who have a better ability to prepare will most likely exhibit optimism.

Essentially, this study proposes that working memory predicts optimism.

Hypothesis Three. It is hypothesized that EF inhibition, as measured by the BRIEF-A Behavioral Regulation Index (BRI), will be a significant predictor of positive affect, as measured by the Positive and Negative Affect Schedule (PANAS).

Rationale. Positive affect relates to a person's level of engagement and alertness to life, and requires intentional action for it to occur at high levels (Fredrickson, 2001).

Inhibition is a main component of behavioral regulation, and effects an individual's ability to control impulses and behaviors (Barkley, 1997b; Gioia, Isquith, Guy, & Kenworthy, 2000). Theoretically, a person with the ability to control impulses and emotions would have better positive engagement with life, leading to higher rates of positive affect. In contrast, individuals with negative outlook tendencies would have difficulty resisting distractions and controlling negative feelings, leading to higher rates of negative affect. Essentially, this study proposes that EF inhibition predicts positive affect.

Hypothesis Four. It is hypothesized that EF working memory, as measured by the BRIEF-A Metacognitive Index (MI), will be a significant predictor of life satisfaction, as measured by the Satisfaction with Life Scale (SWLS).

Rationale. Theoretically, an individual with difficulty inhibiting negative thoughts and emotions would have more difficulty maintaining a positive outlook on life.

Life satisfaction is a broad global assessment of a person's quality of life, taking in to account multiple events and a span of time (Shin & Johnson, 1978). This would require a person to be able to see past emotions 'in the moment' and take a global perspective that includes many factors. Fundamentally, inhibition would play a major role in this task. Essentially, this study proposes that EF working memory predicts life satisfaction.

CHAPTER II

Methodology

Research Approval

Permission was obtained from the Institutional Review Board (IRB) at Middle Tennessee State University prior to recruitment of participants and data collection. All participants were provided informed consent before their information was used as part of data analysis.

Participants

Participants were recruited from Middle Tennessee State University. The participants were all undergraduate students enrolled in a Developmental Psychology course. Students volunteered to participate in the study in exchange for participation credit in their course. Each signed a letter of informed consent. They were told their participation was not mandatory and they could leave at any time.

The sample was comprised of a total of 79 participants, which included 20.3% males (n=16) and 79.7% females (n=63). 69.6% (n=55) were White or Caucasian, 1.3% (n=1) were Asian or Pacific Islander, 22.8% (n=18) were Black or African American, and 6.3% (n=5) listed themselves as Other. They ranged in age from 18 to 33, with 79.7% ranging from age 19-21.

Procedure

Participants attended one of two designated times for study completion. The rating scales were administered in an auditorium style setting. Each participant was presented with an overview of the study, consent form, demographic data form, and each of the rating scales mentioned above. Subjects answered questions at their own pace, and

were given up to an hour to complete all forms. Only rating scales completed in entirety were collected as data.

Measures

Measures of EF.

Behavior Rating Inventory of Executive Function-Adult Version (BRIEF-A). The BRIEF-A was developed by Drs. Roth, Isquith, and Gioia (2005) as a measure of a executive functioning and self-regulation in adults ages 18-90 years old. A self-report and informant reports are available, but only the self-report measure is used in this study. It is comprised of 75 items and takes about 15 minutes to complete. The BRIEF-A provides an overall summary score (Global Executive Composite) and two broad index scores (Behavioral Regulation Index and Metacognition Index). The Behavioral Regulation Index (BRI) is comprised of the Inhibit, Shift, Emotional Control, and Self-Monitor scales. The BRI addresses the ability to maintain appropriate regulation and control of one's own behavior and emotional responses. The Metacognition Index (MI) is comprised of the Initiate, Working Memory, Plan/Organize, Task Monitor, and Organization of Materials scales. The MI addresses the ability to initiate, generate ideas, sustain memory, plan, and organize one's thoughts and environment. Three validity scales are also included: Negativity, Infrequency, and Inconsistency. Raters choose answers on a three-point Likert scale, thinking about behaviors and emotions over the last month. Their choices include N (Never a problem), S (Sometimes a problem), or O (Often a problem) (Roth, Isquith, & Gioia, 2005). Examples of a few items include "I have trouble changing from one activity or task to another" and "people say I don't think before acting".

Reliability and Validity of the BRIEF-A self-report form was demonstrated with a normative sample of 1,050 adults of various ages and with varying ethnic, educational, financial, and geographic backgrounds. To demonstrate internal consistency, alpha coefficients were calculated for all nine subscales: Inhibit ($\alpha = .73$), Shift ($\alpha = .78$), Emotional Control ($\alpha = .90$), Self-Monitor ($\alpha = .78$), Initiate ($\alpha = .79$), Working Memory ($\alpha = .80$), Plan/Organize ($\alpha = .85$), Task Monitor ($\alpha = .74$), and Organization of Materials ($\alpha = .84$). Using a subsample of 50 individuals (22 male and 28 female), test-retest reliability data was collected across a 4-week period. Pearson product-moment correlation coefficients were calculated for all nine subscales: Inhibit ($\alpha = .91$), Shift ($\alpha = .89$), Emotional Control ($\alpha = .90$), Self-Monitor ($\alpha = .83$), Initiate ($\alpha = .85$), Working Memory ($\alpha = .92$), Plan/Organize ($\alpha = .82$), Task Monitor ($\alpha = .84$), and Organization of Materials ($\alpha = .93$) (Roth, Isquith, & Gioia, 2005).

Validity of the BRIEF-A was demonstrated in several ways: item content, internal structure, and validity of scores within specific diagnostic groups. For item content, ten experts in executive functioning, with regards to clinical practice and research, assigned each of the items to one of the BRIEF-A scales. Agreement among raters ranged from a mean of 35% to 98%: (a) Inhibit, 86%; (b) Shift, 92%; (c) Emotional Control, 98%; (d) Self-monitor, 35%; (e) Initiate, 81%; (f) Working Memory, 79%; (g) Plan/Organize, 77%; (h) Task Monitor, 88%; (i) Organization of Materials, 85%. An exploratory factor analysis of the normative data was one to show internal structure validity. The two factors of Metacognition and Behavioral Regulation were strongly correlated with one another on both the Self-Report ($r=0.783$, $p<.05$) and the Informant Report ($r=0.799$, $p<.05$). The BRIEF-A also demonstrated sensitivity to the strengths and weaknesses

within executive functioning of populations with medicated and un-medicated ADHD, Alzheimer's Disease, Mild Cognitive Impairment, Multiple Sclerosis, Traumatic Brain Injury, and Epilepsy. The BRIEF-A is not intended to independently diagnose disorders, but is a useful tool for evaluating likelihood of dysfunction (Roth, Isquith, & Gioia, 2005).

Measures of positive psychology.

Grit Scale. The Grit Scale is a 12-item self-report measure that assesses one's perseverance and passion for long-term goals. Responses are based on a one to five point likert scale (1 = not at all like me, 2 = not much like me, 3 = somewhat like me, 4 = mostly like me, 5 = very much like me). Examples of a few items are "I finish whatever I begin" and "I am ambitious" (Duckworth et al., 2007).

Reliability and validity of the Grit Scale was demonstrated with a sample of 1,545 participants aged 25 or older. An alpha coefficient for internal consistency was calculated for reliability, and the overall scale demonstrated high internal consistency ($\alpha = .85$). Grit was found to not correlate with intelligence. It was highly correlated with Big Five conscientiousness and self-control. It demonstrated incremental predictive validity of success by accounting for 4% of the variance in predicting success beyond conscientiousness and self-control. (Duckworth, et al., 2007)

Life Orientation Test-Revised. The Life Orientation Scale-Revised (LOT-R) is a 10-item self-report measure that assesses a person's level of dispositional optimism. Six items are scored (3 are reverse-scored) and four items are fillers. Responses are based on a one to five point likert scale for each item (0 = strongly disagree, 1 = disagree, 2 = neutral, 3 = agree, 4 = strongly agree). A higher score indicates a higher level of

optimism. The LOT-R was revised from the original Life Orientation Test (LOT), which had 12 items (Scheier, Carver, & Bridge, 1994). Two were removed because they dealt more with coping styles (Simmons & Lehmann, 2012). A sample item is “I rarely count on good things happening to me” (Scheier, Carver, & Bridge, 1994).

Reliability of the LOT-R was originally established with a sample of 4,309 undergraduate students from Carnegie Mellon University. Internal consistency was high ($\alpha = .82$), and test-retest reliability over a 28-month time frame was adequate (range of $\alpha = .56$ to $\alpha = .79$). Confirmatory factor analysis supported construct validity of the LOT-R and its recommended one-factor structure. (Scheier et al., 1994) Hirsch, Britton, and Connor (2010) demonstrated strong criterion validity and found the LOT-R was significantly negatively correlated with hopelessness ($r = -.65$) and depression ($r = -.60$).

Positive and Negative Affect Schedule. The Positive and Negative Affect Schedule (PANAS) is a self-report measure that contains a list of 20 feelings and emotion adjectives (e.g., inspired, distressed), where 10 of them are positive and 10 are negative. It measures a person’s self-perception of two different factors; Positive Affect (PA) and Negative Affect (NA). The PANAS offers the flexibility to ask raters to consider different time periods, ranging from this moment to the past year. They can also be instructed to assess their overall general feelings. For this study, participants were asked to rate themselves based on their general feelings. Responses are based on a one to five point likert scale for each adjective (1 = not at all, 2 = a little, 3 = moderately, 4 = quite a bit, 5 = extremely). The scale takes about 2 to 5 minutes to complete. A score is

determined by totaling up the points for each scale. Possible scores for both PA and NA range from 10 to 50 (Watson & Clark, 1984).

Watson and Clark (1988) demonstrated internal consistency of the PANAS with various samples of college students (range $n = 586$ to $n = 1,002$). Cronbach's coefficient alpha was calculated and was high for both scales. For PA, the range was between $\alpha = .86$ to $\alpha = .90$. For NA, alphas ranges were between $\alpha = .84$ to $\alpha = .87$ (Watson & Clark, 1988). Similar results were replicated by Crawford & Henry (2004). The PANAS has also exhibited a significant level of test-retest reliability over time (Watson & Clark, 1984; 1988). The PA scale is shown to be negatively correlated with measures of depression and anxiety, but more so with depression (Crawford & Henry, 2004).

Satisfaction with Life Scale. The Satisfaction with Life Scale (SWLS) is a self-report measure that assesses global satisfaction. It contains five statements (e.g., "The conditions of my life are excellent.") where raters give a score ranging from 1 to 7 (1 = strongly agree, 2 = agree, 3 = slightly agree, 4 = neither agree nor disagree, 5 = slightly disagree, 6 = disagree, 7 = strongly disagree). The SWLS takes about five minutes to complete. Points for each statement are added up and scores range from 5 to 35, where 5 is extremely dissatisfied and 35 is extremely satisfied. A sample test item is "the conditions of my life are excellent" (Diener, Emmons, Larsen, & Griffin, 1985).

In a study that included 173 undergraduate students, Diener, Emmons, Larsen & Griffin (1985) demonstrated internal consistency ($\alpha = .87$) of the Satisfaction With Life Scale. Test-retest reliability ($\alpha = .82$) at two-months was also demonstrated in the same study (Diener et al., 1985). Similar results were replicated in other studies (Diener, Sandvik, Siedlitz, & Diener, 1993). The SWLS also shows adequate correlation with

other measures of life satisfaction, both self-report and other collection methods (Diener et al., 1985, 1993). A negative correlation with the SWLS and depression, negative affect, anxiety, and distress has been shown (Diener et al., 1993).

Planned Analysis

Several predictions were made about the data gathered in this study. They are each listed below, along with the planned statistical analysis for each.

1. It is hypothesized that EF inhibition, as measured by the BRIEF-A Behavioral Regulation Index (BRI), will be a significant predictor of grit, as measured by the Grit Scale. A multiple regression was calculated to compare scores on the Grit Scale to scores on the BRIEF-A.
2. It is hypothesized that EF working memory, as measured by the BRIEF-A Metacognitive Index (MI), will be a significant predictor of optimism, as measured by the Life Orientation Test-Revised. A multiple regression was calculated to compare scores on the LOT-R and the BRIEF-A.
3. It is hypothesized that EF inhibition, as measured by the BRIEF-A Behavioral Regulation Index (BRI), will be a significant predictor of positive affect, as measured by the Positive and Negative Affect Schedule (PANAS). A multiple regression was calculated to compare scores on the PANAS and the BRIEF-A.
4. It is hypothesized that EF working memory, as measured by the BRIEF-A Metacognitive Index (MI), will be a significant predictor of life satisfaction, as measured by the Satisfaction with Life Scale (SWLS). A multiple regression was calculated to compare scores on the SWLS and the BRIEF-A.

CHAPTER III

Results

Table 1

Means, Standard Deviations, and Intercorrelations for Predictor and Outcome Variables (N=78)

Variable	M	SD	1.	2.	3.	4.	5.	6.
1. BRIEF-A EF Behavioral Regulation	50.090	9.936	--					
2. EF BRIEF-A Metacognitive	66.910	12.367	.653**	--				
3. Grit	41.808	6.684	-.559**	-.541**	--			
4. LOT-R Optimism	14.392	4.550	-.301**	-.266*	.385**	--		
5. PANAS Positive Affect	26.228	7.053	-.056	-.145	.227*	.453**	--	
6. SWLS Life Satisfaction	23.038	6.537	-.127	-.207	.188	.396**	.255*	--

Note. * $p < .05$. ** $p < .01$. All scores based on raw scores. Higher EF rating scores indicate increased EF dysfunction.

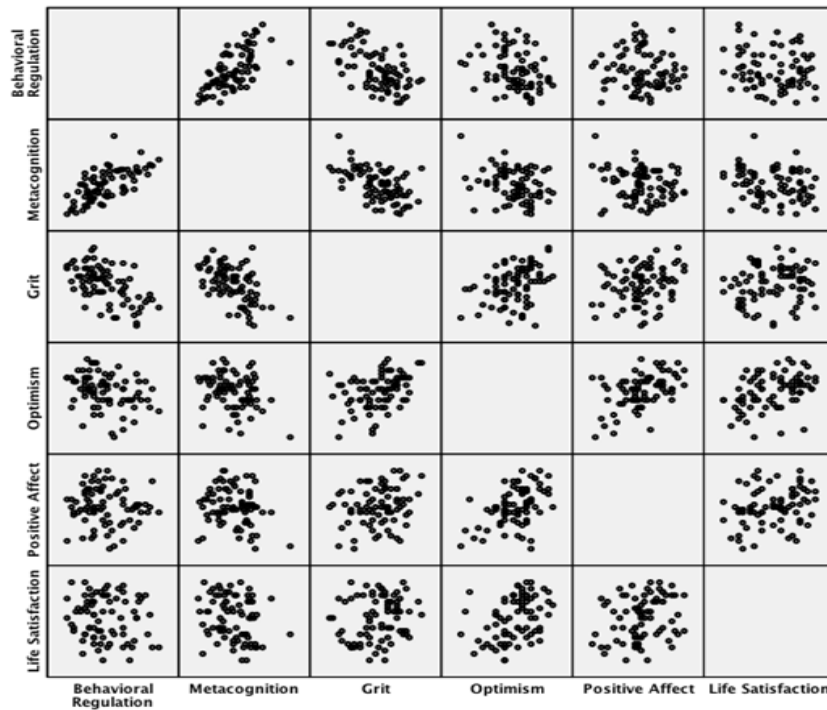


Figure 1

Scatterplot of Predictor and Outcome Variables

This study addresses four hypothesis comparing EF measures with one of four positive psychology measures. Each is reviewed below and the corresponding correlations and multiple regression results are presented.

Behavioral Regulation Index and Metacognitive Index Predicting Grit

(Hypothesis One)

The first hypothesis concerned combining the two composite scores on the BRIEF, namely the Behavioral Regulation Index (i.e., inhibition) and the Metacognitive Index (i.e., working memory), in order to determine if they predict grit scores. Findings confirmed that the linear combination of these unordered predictors was indeed significantly related to grit scores, $R^2 = .365$, adjusted $R^2 = .348$, $F(2,75) = 21.592$, $p = .000$ (see Table 2). The self-ratings of the EF scores accounted for approximately 35% of the variance of grit scores in the sample. Regarding EF predictors' individual contributions, the Behavior Regulation Index was significantly correlated with grit scores ($r = -.559$, $p = .000$) and the Metacognitive Index was significantly correlated with grit scores ($r = -.541$, $p = .000$). After partialing out the effects of the Metacognitive Index, the Behavior Regulation Index was still a significant predictor (zero order $r = -.559$; partial r after controlling for BRIEF MI = $-.320$; $p = .005$). The Metacognitive Index was also a significant predictor after partialing out the effects of the Behavioral Regulation Index in the sample (zero order $r = -.541$; partial r controlling for ratings of BRIEF BRI = $-.279$; $p = .014$).

Table 2

Regression Analysis Summaries for Hypotheses One (N = 78)

BRIEF Behavior Regulation Index Self-Rating and BRIEF Metacognition Index Self-Rating Predicting Grit Score								
Variable	<i>B</i>	<i>SEB</i>	<i>B</i>	<i>T</i>	<i>p</i>	Zero-Order	Partial	Part
BRIEF Behavior Regulation Index	-.247	.084	-.357	-2.928	.005	-.559	-.320	-.269
BRIEF Metacognition Index	-.170	.068	-.306	-2.512	.014	-.541	-.279	-.231

*Behavioral Regulation Index and Metacognitive Index Predicting Optimism**(Hypothesis Two)*

The second hypothesis involved combining the two composite scores on the BRIEF, namely the Behavioral Regulation Index (i.e., inhibition) and the Metacognitive Index (i.e., working memory), in order to determine if they predict Life Orientation Test-Revised scores (i.e., optimism). Findings from a multiple regression confirmed that the linear combination of these unordered predictors was significantly related significantly related to optimism scores, $R^2 = .099$, adjusted $R^2 = .075$, $F(2,76) = 4.172$, $p = .019$ (see Table 3). The EF self-rating scores together accounted for approximately 7.5% of the variance of optimism scores in the sample. However, after partialing out the effects of the BRIEF Metacognitive Index, the BRIEF Behavioral Regulation Index was no longer significant (zero order = $-.301$; partial r controlling for effects of BRIEF MI = $-.174$; $p = .127$). Individually, the Behavior Regulation Index was significantly correlated with optimism scores ($r = -.301$, $p = .004$). The Metacognitive Index was also significantly correlated with optimism scores ($r = -.266$, $p = .009$).

Table 3

Regression Analysis Summaries for Hypotheses Two (N = 79)

BRIEF Behavior Regulation Index Self-Rating and BRIEF Metacognition Index Self-Rating Predicting LOT-R Optimism Scores								
Variable	<i>B</i>	<i>SEB</i>	<i>B</i>	<i>T</i>	<i>p</i>	Zero-Order	Partial	Part
BRIEF Behavior Regulation Index	-.102	.066	-.222	-1.542	.127	-.301	-.174	-.168
BRIEF Metacognitive Index	-.045	.053	-.121	-.844	.401	-.266	-.096	-.092

*Behavioral Regulation Index and Metacognitive Index Predicting Positive Affect
(Hypothesis Three)*

The third hypothesis involved combining the two composite scores on the BRIEF, namely the Behavioral Regulation Index (i.e., inhibition) and the Metacognitive Index (i.e., working memory), in order to predict positive affect scores on the Positive and Negative Affect Scale. Findings from a multiple regression confirmed that the linear combination of these unordered predictors was not significantly related to positive affect scores, $R^2 = .047$, adjusted $R^2 = .022$, $F(2,76) = 1.872$, $p = .161$ (see Table 4). The EF self-ratings scores together only accounted for approximately 2% of the variance of positive affect scores in the sample. After partialing out the effects of the BRIEF Metacognitive Index, the BRIEF Behavioral Regulation Index still not significant (zero order = $-.056$; partial r controlling for effects of BRIEF MI = $.096$; $p = .404$). Individually, the Behavior Regulation Index was not significantly correlated with positive affect scores ($r = -.056$, $p = .311$). In contrast, the Metacognitive Index was found to be significantly correlated with positive affect scores ($r = -.195$, $p = .042$).

Table 4

Regression Analysis Summaries for Hypotheses Three (N = 79)

BRIEF Behavior Regulation Index Self-Rating and BRIEF Metacognition Index Self-Rating Predicting PANAS Positive Affect Scores								
Variable	<i>B</i>	<i>SEB</i>	<i>B</i>	<i>T</i>	<i>p</i>	Zero-Order	Partial	Part
BRIEF Behavior Regulation Index	.089	.105	.124	.839	.404	-.056	.096	.094
BRIEF Metacognitive Index	-.158	.085	-.276	-1.869	.066	-.195	-.210	-.209

*Behavioral Regulation Index and Metacognitive Index Predicting Life Satisfaction**(Hypothesis Four)*

The fourth hypothesis involved combining the two composite scores on the BRIEF, namely the Behavioral Regulation Index (i.e., inhibition) and the Metacognitive Index (i.e., working memory), in order to predict life satisfaction scores on the Satisfaction with Life Scale. Findings from a multiple regression confirmed that the linear combination of these unordered predictors was not significantly related to life satisfaction scores, $R^2 = .043$, adjusted $R^2 = .018$, $F(2,76) = 1.703$, $p = .189$ (see Table 5). The EF self-ratings scores together only accounted for approximately 2% of the variance of life satisfaction scores in the sample. After partialling out the effects of the BRIEF Behavioral Regulation Index, the BRIEF Metacognitive Index was not significant (zero order = $-.207$; partial r controlling for effects of BRIEF BRI = $-.165$; $p = .149$). Individually, the Behavior Regulation Index was not significantly correlated with life satisfaction scores ($r = -.127$, $p = .132$). In contrast, the Metacognitive Index was significantly correlated with life satisfaction scores ($r = -.207$, $p = .032$).

Table 5

Regression Analysis Summaries for Hypotheses Four (N =79)

BRIEF Behavior Regulation Index Self-Rating and BRIEF Metacognition Index Self-Rating Predicting SWLS Life Satisfaction Scores								
Variable	<i>B</i>	<i>SEB</i>	<i>B</i>	<i>T</i>	<i>p</i>	Zero-Order	Partial	Part
BRIEF Behavior Regulation Index	.009	.098	.014	.092	.927	-.127	.011	.010
BRIEF Metacognitive Index	-.115	.079	-.216	-1.456	.149	-.207	-.165	-.163

CHAPTER IV

Discussion

The purpose of this study was to examine how, and to what extent, EF dimensions, specifically behavior regulation skills (i.e., inhibition) and metacognition skills (i.e., working memory), predict four positive psychology traits, namely grit, optimism, positive affect, and life satisfaction.

EF and Grit

As hypothesized, self-ratings of EF behavioral regulation and metacognition predicted college students' grit scores. One potential explanation of this is that individuals with increased EF skills are better able to follow through and stick to planned courses of actions in day-to-day activities. Regarding EF behavioral regulation skills, the ability to inhibit motivated impulses indeed predicted grit scores. It is feasible that increased inhibitory control allows an individual to sustain goal-directed behavior without influence from distractions. Regarding EF metacognitive skills, the ability to plan, organize, and hold information in mind also predicted the propensity to persevere through time to achieve goals. Conceptually, it is feasible that increased metacognitive skills allow an individual to better structure, initiate, organize, and maintain goal-directed behavior through time.

Moreover, in this study, behavioral regulation skills better predicted grit when compared to metacognitive skills. This may imply that an individual's ability to inhibit prepotent responses and shift attention is more connected to the ability to persevere through time. To a lesser degree, the ability to plan, organize, and initiate predicted grit.

This is an important finding in that previous research has not analyzed how these particular EF dimensions contribute to grit.

Overall, findings from the present study lend credence to previous research that links EF functioning to problem solving and goal attainment skills related to grit. For example, Stuss & Alexander (2000) found that, during complex problem solving, many areas of the frontal lobes associated with EF skills are activated. Casey, et al (2011) found that individuals with increased inhibitory control demonstrated increased delayed response choices. In other words, they inhibit responses to immediate small rewards in exchange for long-term greater pay off. Ruthsatz & Urbach (2012) also reported that working memory skills was a key component of the cognitive profiles of high performing individuals. In general, the frontal lobes have long been recognized as playing an important role in coordinating behavioral responses that require inhibitory control and planning (Fuster, 2001).

EF and Optimism

As hypothesized, EF behavioral regulation and metacognition skills predicted college students' optimism scores. One potential explanation of this finding is that increased EF skills allows an individual to more successfully think through time, strategize for the future, and overcome obstacles. These abilities may contribute to a more positive outlook. Also feasible is a bidirectional association where a positive outlook also impacts EF functioning. For example, it is feasible that a more optimistic state of mind is conducive to improved EF behavioral regulation.

Regarding EF behavioral regulation, the ability to inhibit motivated impulses indeed predicted optimism scores. One potential explanation is that increased self-regulation skills allow an individual to more effectively inhibit pessimistic thinking and focus more on positive aspects of a situation. Regarding EF metacognitive skills such as working memory, findings from this study suggested that the ability to plan, organize, and hold information in mind predicted optimism. Conceptually, it is feasible that increased metacognitive skills allow an individual to think through time and maintain focus on positive events, leading to a more optimistic view of life. Moreover, in this study, behavioral regulation better predicted optimism in comparison to metacognitive skills. This may imply that an individual's ability to inhibit and shift attention is more connected to a positive outlook. To a lesser degree, the ability to plan, organize, and initiate predicted optimism.

Overall, findings from the present study support previous EF and optimism studies. For example, Kruger (2011) administered the Executive Function Index (EFI; Spinella, 2005) and the Life Orientation Test (LOT; Scheier, Carver, & Bridge, 1994) to 113 college students. Results indicated a significant correlation between EF and optimism. However, the researchers combined hope and optimism together as predictors of EF. The current study parses out the two constructs and provides additional evidence that EF is a predictor of optimism alone.

EF and Positive Affect

Contrary to the hypothesis, EF metacognition and behavioral regulation scores together did not predict positive affect in the sample. However, EF metacognition skills alone predicted positive affect. This may suggest that the ability to hold

information in mind is more important in predicting a person's positive affect when compared to inhibitory control skills. Previous research has investigated EF and level of engagement with life. For example, Phillips, Bull, Adams, & Fraser (2002) reported that increased positive mood/affect was associated with decreased EF performance on switching and inhibition tasks. In other words, a happy mood may actually impair EF skills. Findings from the current study did find such a relationship. However, EF metacognitive skills, such as planning, organizing, and initiating, were indeed linked to positive affect. This is an important finding that extends the EF and positive affect literature.

EF and Life Satisfaction

Contrary to the hypothesis, EF metacognitive and EF behavioral regulation skills together did not predict life satisfaction. However, metacognitive skills alone did. This appears to support that notion that one's ability to plan for the future and organize material and means is more important in predicting a person's global assessment of their life when compared to inhibitory regulation skills. Overall, this finding corresponds with Miley and Spinella's (2006) research that indicated a positive correlation between EF and satisfaction with life. These researchers administer the Executive Function Index (EFI; Spinella, 2005), a self-report measure of EF, and the Satisfaction With Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985), which was also used in the current study ($n=173$). More specifically, motivation and planning skills were significantly correlated with life satisfaction. However, impulse control was not. Similarly, the current study found that metacognitive skills, rather than inhibitory control skills, predicted life satisfaction.

Limitations and Future Directions

This study has noteworthy limitations. First, EF is a multidimensional construct (Miyake, et al, 2000). This study only focused on two broad domains of EF, behavior regulation and metacognition skills. However, there are potentially many other EF components that were not investigated. Future research might further incorporate other EF skills such as planning, motivational drive, or mental flexibility.

In addition, there are multiple ways to measure EF and positive psychology traits. Self-report, the primary method used in this study, is just one way to measure constructs of interest. For example, many EF studies combine self-report questionnaires with clinical/laboratory measures to increase construct validity (Chaytor, Schmitter-Edgecombe, & Burr, 2006). Also, positive psychology studies have incorporated interviewing and problem solving tasks to further assess and understand attributes (Duckworth, Steen, & Seligman, 2005). Additionally, self-report can have potential validity problems as it is difficult to determine if responses are accurate and rooted in reality.

A third limitation concerns the sample. Results for this study were based on a sample of college students and may lack generalizability to a certain degree. In the future, it would be important to examine the relationship between EF and positive psychology traits in older adults and children. In addition, this study did not include a clinical sample of individuals. It might be useful for future studies to include a group of individuals that have been formally diagnosed with EF difficulties. EF outcomes of this group could then be compared to a control group, fundamentally addressing EF skills and positive

psychology traits more thoroughly. In addition, the majority of EF and nutrition research is correlational. More experimental studies are needed that establish cause and effect.

Another limitation of this study was that the sample of college students was predominately female. Studies have noted that college students can be limited in the amount and/or intensity of life experiences, both positive and negative (Peterson, 2001). Essentially, this may impact self-awareness and life perspective. Future studies may consider investigating EF and positive psychology attributes in individuals at a variety of points along the lifespan. For example, grit and life satisfaction attributes might differ considerably in older adults when compared to younger. Likewise, research has noted the EF skills change to some extent during late adulthood (Kramer, Humphrey, Larish, Logan, & Strayer, 1994). It would be interesting to investigate how age influences the relationship between EF and positive psychology traits. Essentially, each of the constructs in this study are fluid and may change over the course of a person's life

Summary

The purpose of this study was to investigate how, and to what extent, EF behavioral regulation (e.g., inhibition) and metacognition (e.g., working memory) successfully predicted positive psychology attributes. Self-reported EF skills successfully predicted many positive psychology traits. Regarding grit, inhibition and metacognition skills together were a significant predictor. This suggests that increased inhibitory control and the ability to plan and organize allows an individual to sustain focus on goal-directed behavior while resisting distractions. Regarding optimism inhibition and metacognition skills together were a significant predictor. This may

indicate that an optimistic person is better able to draw on EF abilities to maintain a positive outlook. Regarding positive affect, EF inhibition and metacognition skills together were not a significant predictor, but positive affect was correlated with metacognition. This seems to suggest that working memory contributes to the ability to stay engaged and focused in life. Regarding life satisfaction, EF inhibition and metacognition skills together were not a significant predictor, but life satisfaction was correlated with metacognition. This suggests that the ability to control thoughts and emotions in the mind contributes to the ability to make a more positive global assessment of one's life. Overall, the findings from this study extend previous EF and positive psychology research by highlighting the dimensions of EF that contribute to life well-being factors.

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APPENDICES

APPENDIX 1

BRIEF-A

Name of Rated Individual _____ Gender Male Female Age _____

Your Name _____ Today's Date ____/____/____

Your relationship to him/her: Parent Spouse Sibling Friend Other _____

How well do you know him/her? Not well Moderately well Very well You have known him/her for ____ years.

During the past month, how often has each of the following behaviors been a *problem*?

N = Never S = Sometimes O = Often

1. Has angry outbursts	N	S	O
2. Makes careless errors when completing tasks	N	S	O
3. Is disorganized	N	S	O
4. Has trouble concentrating on tasks (such as chores, reading or work)	N	S	O
5. Taps fingers or bounces legs	N	S	O
6. Needs to be reminded to begin a task even when willing	N	S	O
7. Has a messy closet	N	S	O
8. Has trouble changing from one activity or task to another	N	S	O
9. Gets overwhelmed by large tasks	N	S	O
10. Forgets his/her name	N	S	O
11. Has trouble with jobs or tasks that have more than one step	N	S	O
12. Overreacts emotionally	N	S	O
13. Doesn't notice when he/she causes others to feel bad or get mad until it is too late	N	S	O
14. Has trouble getting ready for the day	N	S	O
15. Has trouble prioritizing activities	N	S	O
16. Has trouble sitting still	N	S	O
17. Forgets what he/she is doing in the middle of things	N	S	O
18. Does't check work for mistakes	N	S	O
19. Has emotional outbursts for little reason	N	S	O
20. Lies around the house a lot	N	S	O
21. Starts tasks (such as cooking, projects) without the right materials	N	S	O
22. Has trouble accepting different ways to solve problems with work, friends, or tasks	N	S	O
23. Talks at the wrong time	N	S	O
24. Misjudges how difficult or easy tasks will be	N	S	O
25. Has problems getting started on his/her own	N	S	O
26. Has trouble staying on the same topic when talking	N	S	O
27. Gets fired	N	S	O
28. Reacts more emotionally to situations than his/her friends	N	S	O
29. Has problems waiting his/her turn	N	S	O
30. People say that he/she is disorganized	N	S	O
31. Loses things (such as keys, money, wallet, homework, etc.)	N	S	O
32. Has trouble thinking of a different way to solve a problem when stuck	N	S	O
33. Overreacts to small problems	N	S	O
34. Doesn't plan ahead for future activities	N	S	O
35. Has a short attention span	N	S	O
36. Makes inappropriate sexual comments	N	S	O
37. When people seem upset with him/her, doesn't understand why	N	S	O
38. Has trouble counting to three	N	S	O

During the past month, how often has each of the following behaviors been a problem?

	N = Never	S = Sometimes	O = Often
39. Has unrealistic goals	N	S	O
40. Leaves the bathroom a mess	N	S	O
41. Makes careless mistakes	N	S	O
42. Gets emotionally upset easily	N	S	O
43. Makes decisions that get him/her into trouble (legally, financially, socially)	N	S	O
44. Is bothered by having to deal with changes	N	S	O
45. Has difficulty getting excited about things	N	S	O
46. Forgets instructions easily	N	S	O
47. Has good ideas but cannot get them on paper	N	S	O
48. Makes mistakes	N	S	O
49. Has trouble getting started on tasks	N	S	O
50. Says things without thinking	N	S	O
51. His/her anger is intense but ends quickly	N	S	O
52. Has trouble finishing tasks (such as chores, work)	N	S	O
53. Starts things at the last minute (such as assignments, chores, tasks)	N	S	O
54. Has difficulty finishing a task on his/her own	N	S	O
55. People say that he/she is easily distracted	N	S	O
56. Has trouble remembering things, even for a few minutes (such as directions, phone numbers)	N	S	O
57. People say that he/she is too emotional	N	S	O
58. Rushes through things	N	S	O
59. Gets annoyed	N	S	O
60. Leaves room or home a mess	N	S	O
61. Gets disturbed by unexpected changes in daily routine	N	S	O
62. Has trouble coming up with ideas for what to do with free time	N	S	O
63. Doesn't plan ahead for tasks	N	S	O
64. People say that he/she doesn't think before acting	N	S	O
65. Has trouble finding things in room, closet, or desk	N	S	O
66. Has problems organizing activities	N	S	O
67. After having a problem, does not get over it easily	N	S	O
68. Has trouble doing more than one thing at a time	N	S	O
69. Mood changes frequently	N	S	O
70. Doesn't think about consequences before doing something	N	S	O
71. Has trouble organizing work	N	S	O
72. Gets upset quickly or easily over little things	N	S	O
73. Is impulsive	N	S	O
74. Doesn't pick up after self	N	S	O
75. Has problems completing his/her work	N	S	O

Roth, R., Isquith, P. & Gioia, G. (2005). BRIEF-A Behavior Rating Inventory of Executive Functioning-Adult Version: Professional Manual. Lutz, FL: Psychological Assessment Resources, Inc.

APPENDIX 2

Grit Scale

Directions for taking the Grit Scale: Please respond to the following 17 items. Be honest – there are no right or wrong answers!

1. I aim to be the best in the world at what I do.
 - Very much like me
 - Mostly like me
 - Somewhat like me
 - Not much like me
 - Not like me at all

2. I have overcome setbacks to conquer an important challenge.
 - Very much like me
 - Mostly like me
 - Somewhat like me
 - Not much like me
 - Not like me at all

3. New ideas and projects sometimes distract me from previous ones.
 - Very much like me
 - Mostly like me
 - Somewhat like me
 - Not much like me
 - Not like me at all

4. I am ambitious.
 - Very much like me
 - Mostly like me
 - Somewhat like me
 - Not much like me
 - Not like me at all

5. My interests change from year to year.
 - Very much like me
 - Mostly like me
 - Somewhat like me
 - Not much like me
 - Not like me at all

6. Setbacks don't discourage me.
 - Very much like me
 - Mostly like me
 - Somewhat like me
 - Not much like me
 - Not like me at all

7. I have been obsessed with a certain idea or project for a short time but later lost interest.
- Very much like me
 - Mostly like me
 - Somewhat like me
 - Not much like me
 - Not like me at all
8. I am a hard worker.
- Very much like me
 - Mostly like me
 - Somewhat like me
 - Not much like me
 - Not like me at all
9. I often set a goal but later choose to pursue a different one.
- Very much like me
 - Mostly like me
 - Somewhat like me
 - Not much like me
 - Not like me at all
10. I have difficulty maintaining my focus on projects that take more than a few months to complete.
- Very much like me
 - Mostly like me
 - Somewhat like me
 - Not much like me
 - Not like me at all
11. I finish whatever I begin.
- Very much like me
 - Mostly like me
 - Somewhat like me
 - Not much like me
 - Not like me at all
12. Achieving something of lasting importance is the highest goal in life.
- Very much like me
 - Mostly like me
 - Somewhat like me
 - Not much like me
 - Not like me at all

13. I think achievement is overrated.
- Very much like me
 - Mostly like me
 - Somewhat like me
 - Not much like me
 - Not like me at all
14. I have achieved a goal that took years of work.
- Very much like me
 - Mostly like me
 - Somewhat like me
 - Not much like me
 - Not like me at all
15. I am driven to succeed.
- Very much like me
 - Mostly like me
 - Somewhat like me
 - Not much like me
 - Not like me at all
16. I become interested in new pursuits every few months.
- Very much like me
 - Mostly like me
 - Somewhat like me
 - Not much like me
 - Not like me at all
17. I am diligent.
- Very much like me
 - Mostly like me
 - Somewhat like me
 - Not much like me
 - Not like me at all

Directions for scoring the Grit Scale

For questions 1, 2, 4, 6, 8, 11, 12, 14, 15, and 17, assign the following points:

- 5 = Very much like me
- 4 = Mostly like me
- 3 = Somewhat like me
- 2 = Not much at all like me
- 1 = Not like me at all

For questions 3, 5, 7, 9, 10, 13, and 16, assign the following points:

- 1 = Very much like me
- 2 = Mostly like me
- 3 = Somewhat like me
- 4 = Not much at all like me
- 5 = Not like me at all

Grit is calculated as the average score for items 2, 3, 5, 6, 7, 8, 9, 10, 11, 14, 16, and 17. The Consistency of Interest subscale is calculated as the average score for items 3, 5, 7, 9, 10, and 16. The Perseverance of Effort subscale is calculated as the average score for items 2, 6, 8, 11, 14, and 17.

The Brief Grit Scale score is calculated as the average score for items 3, 6, 7, 8, 9, 10, 11, and 17.

Ambition is calculated as the average score for items 1, 4, 12, 13, and 15.

Grit Scale citation

Duckworth, A.L., & Quinn, P.D. (2009). Development and validation of the Short Grit Scale (Grit-S). *Journal of Personality Assessment*, 91, 166-174.

<http://www.sas.upenn.edu/~duckwort/images/Duckworth%20and%20Quinn.pdf>

Duckworth, A.L., Peterson, C., Matthews, M.D., & Kelly, D.R. (2007). Grit: Perseverance and passion for long-term goals. *Journal of Personality and Social Psychology*, 9, 1087-1101.

APPENDIX 3

Revised Life Orientation Test (LOT-R)

Instructions:

Please answer the following questions about yourself by indicating the extent of your agreement using the following scale:

- |0| = strongly disagree
- |1| = disagree
- |2| = neutral
- |3| = agree
- |4| = strongly agree

Be as honest as you can throughout, and try not to let your responses to one question influence your response to other questions. There are no right or wrong answers.

- _____ 1. In uncertain times, I usually expect the best.
- _____ 2. It's easy for me to relax.
- _____ 3. If something can go wrong for me, it will.
- _____ 4. I'm always optimistic about my future.
- _____ 5. I enjoy my friends a lot.
- _____ 6. It's important for me to keep busy.
- _____ 7. I hardly ever expect things to go my way.
- _____ 8. I don't get upset too easily.
- _____ 9. I rarely count on good things happening to me.
- _____ 10. Overall, I expect more good things to happen to me than bad.

Scoring:

1. Reverse code items 3, 7, and 9 prior to scoring (0=4) (1=3) (2=2) (3=1) (4=0).
2. Sum items 1, 3, 4, 7, 9, and 10 to obtain an overall score.

Note Items 2, 5, 6, and 8 are filler items only. They are not scored as part of the revised scale.

The revised scale was constructed in order to eliminate two items from the original scale, which dealt more with coping style than with positive expectations for future outcomes. The correlation between the revised scale and the original scale is .95.

Reference:

Scheier, M.F., Carver C.S., and Bridges, M.W. (1994). Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): A re-evaluation of the Life Orientation Test. *Journal of Personality and Social Psychology*, **67**, 1063-1078.

APPENDIX 4

PANAS

Worksheet 3.1 The Positive and Negative Affect Schedule (PANAS; Watson et al., 1988)**PANAS Questionnaire**

This scale consists of a number of words that describe different feelings and emotions. Read each item and then list the number from the scale below next to each word. **Indicate to what extent you feel this way right now, that is, at the present moment OR indicate the extent you have felt this way over the past week (circle the instructions you followed when taking this measure)**

1	2	3	4	5
Very Slightly or Not at All	A Little	Moderately	Quite a Bit	Extremely

_____ 1. Interested	_____ 11. Irritable
_____ 2. Distressed	_____ 12. Alert
_____ 3. Excited	_____ 13. Ashamed
_____ 4. Upset	_____ 14. Inspired
_____ 5. Strong	_____ 15. Nervous
_____ 6. Guilty	_____ 16. Determined
_____ 7. Scared	_____ 17. Attentive
_____ 8. Hostile	_____ 18. Jittery
_____ 9. Enthusiastic	_____ 19. Active
_____ 10. Proud	_____ 20. Afraid

Scoring Instructions:

Positive Affect Score: Add the scores on items 1, 3, 5, 9, 10, 12, 14, 16, 17, and 19. Scores can range from 10 – 50, with higher scores representing higher levels of positive affect. Mean Scores: Momentary = 29.7 ($SD = 7.9$); Weekly = 33.3 ($SD = 7.2$)

Negative Affect Score: Add the scores on items 2, 4, 6, 7, 8, 11, 13, 15, 18, and 20. Scores can range from 10 – 50, with lower scores representing lower levels of negative affect. Mean Score: Momentary = 14.8 ($SD = 5.4$); Weekly = 17.4 ($SD = 6.2$)

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APPENDIX 5

SWLS

Below are five statements that you may agree or disagree with. Using the 1 - 7 scale below, indicate your agreement with each item by placing the appropriate number on the line preceding that item. Please be open and honest in your responding.

- 7 - Strongly agree
- 6 - Agree
- 5 - Slightly agree
- 4 - Neither agree nor disagree
- 3 - Slightly disagree
- 2 - Disagree
- 1 - Strongly disagree

___ In most ways my life is close to my ideal.

___ The conditions of my life are excellent.

___ I am satisfied with my life.

___ So far I have gotten the important things I want in life.

___ If I could live my life over, I would change almost nothing.

- 31 - 35 Extremely satisfied
- 26 - 30 Satisfied
- 21 - 25 Slightly satisfied
- 20 Neutral
- 15 - 19 Slightly dissatisfied
- 10 - 14 Dissatisfied
- 5 - 9 Extremely dissatisfied
-

Diener, E., Emmons, R., Larsen, R., & Griffin, S. (1985). The satisfaction with life scale. *Journal of Personality Assessment*, 49, 71-75. doi: 10.1207/s15327752jpa4901_13

APPENDIX 6

IRB Approval

10/7/2013

Names: Seth Marshall and Hanni Watson
 Protocol Title: Relationship Between Executive Functioning and Positive Psychology Attributes in College Students
 Protocol Number: 14-089
 Seth.Marshall@mtsu.edu

Dear Investigator,

The MTSU Institutional Review Board, or a representative of the IRB, has reviewed the research proposal identified above. The MTSU IRB or its representative has determined that the study poses minimal risk to participants and qualifies for an expedited review under 45 CFR 46.110 and 21 CFR 56.110.

Approval is granted for one (1) year from the date of this letter for 200 participants.

According to MTSU Policy, a researcher is defined as anyone who works with data or has contact with participants. Anyone meeting this definition needs to be listed on the protocol and needs to provide a certificate of training to the Office of Compliance. **If you add researchers to an approved project, please forward an updated list of researchers and their certificates of training to the Office of Compliance (c/o Andrew Jones, Box 134) before they begin to work on the project.** Any change to the protocol must be submitted to the IRB before implementing this change.

Please note that any unanticipated harms to participants or adverse events must be reported to the Office of Compliance at (615) 494-8918.

You will need to submit an end-of-project report to the Office of Compliance upon completion of your research. Complete research means that you have finished collecting and analyzing data. **Should you not finish your research within the one (1) year period, you must submit a Progress Report and request a continuation prior to the expiration date.** Please allow time for review and requested revisions.

Also, all research materials must be retained by the PI or faculty advisor (if the PI is a student) for at least three (3) years after study completion. Should you have any questions or need additional information, please do not hesitate to contact me.

Sincerely,

William H. Leggett
 MTSU Institutional Review Board