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The Relationship between Self-Awareness and Executive Functioning in Learning Disabled College Students with and without Executive Deficits

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ABSTRACT

The term "executive functioning" is apt in describing that aspect of frontally mediated cortical functioning that has to do with managing, structuring and directing behavior (Stuss & Knight, 2002). Research suggests that individuals who demonstrate impaired executive functioning also exhibit an impaired capacity for self-awareness of competencies (August & Garfinkel, 1990). These findings, however, are almost exclusively based on the investigation of executive dysfunction, a sequelae to traumatic brain injury. Research is less abundant regarding the relationship between executive functioning and developmental diagnoses such as AD/HD and/or learning disabilities, which are also characterized by similar deficiencies in self-awareness. Therefore, the proposed study was designed to examine the relationship between self-awareness and executive functions in learning disabled college students, at several colleges and universities, to further the understanding of executive dysfunction, which in turn may pave the way for intervention methods for this population.

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those who have been an integral part of this process. Thank you from the bottom of my heart.

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Chapter I

INTRODUCTION

The concept of learning disabilities has emerged within the past 40 years, and numerous definitions have been given, depending on the professional training and experience of the person attempting the definition (Gades & Edgell, 1994). According to the National Joint Committee for Learning Disabilities, as cited in Hammill, Leigh, McNutt, & Larson (1981), "these disorders are intrinsic to the individual and presume to be due to central nervous dysfunction" (p.340). They have been characterized as a disorder in basic psychological processes involved in understanding or using language, spoken or written, that may manifest itself in an imperfect ability to listen, think, speak, read, write, spell or use mathematical calculations (Hammill et al., 1981).

In recent years, an increasing number of students with learning disabilities have been studying in institutions of higher education (Thomas, 2000). According to the American Council on Education, as cited in Heiman and Precel (2003), the percentage of all students with disabilities entering college quadrupled between 1978 and 1991, from 2.2% to 8.8% of all students. In 1998, two out of five first year college students who had some kind of disability reported having a learning disability (Heiman & Precel, 2003). It is likely that, the growing number of students attending college with a diagnosed learning disability (Cosden & McNamara, 1997) reflects increased interest in higher education by students with learning disabilities, advocacy by parents and teachers, and the compliance of schools with the American Disabilities Act (ADA), which is a Federal Civil Rights law intended to protect qualified persons with disabilities from discrimination (Strage, 2000).

Although there has been an influx of students with disabilities attending institutions of higher education, according to the American Council on Education, as cited in Murray, Goldstein, Nourse, & Edgar (2000), in 1995, the graduation rate of college students with learning disabilities was only 3.6%, compared with 62.1% for student without disabilities. According to Wolf (2001), many factors, "some intrinsic to the student and others extrinsic to the campus, moderate success in higher education" (p. 385) and thus contribute to the number of obstacles students with disabilities encounter once they are admitted to college. Contributory factors including poor social and interpersonal skills (Vaughn, Hogan, Kouzekanani, & Shapiro, 1990), multiple diagnoses (Seidman, Biederman, Monuteaux, Doyle, & Faraone, 2001), and psychological distress (Heiman & Tali, 2003) have been well documented. Furthermore, research suggests that students with learning disabilities may also manifest neuropsychological deficits in executive functioning, particularly in areas of attention, which may also account for the role in school failure and/or difficulty for these students (Seidman, Biederman, Monuteaux, Doyle, & Faraone, 2001). Since research acknowledges the presence of neuropsychological deficits, Wolf (2001) encourages the exploration of cognitive processes, especially in the area of executive functioning, since it is an important factor that must be understood as institutions of higher education strive to promote access and provide effective support services on their campuses.

Executive Functions. In recent years, there has been a renewal of interest in the frontal lobes of the brain and their associated functions. While the anatomical term, frontal lobes, refers to the anterior one-third of the brain, executive functions refers to the psychological construct of interactive, yet, independent control functions within different

regions of the frontal lobes (Stuss & Alexander, 2000). Recent developments in the conceptualization of executive functions have moved from the concept of a singular executive function to a hierarchical interactive view (Stuss, 1992). Executive functions appear to develop in a hierarchical manner throughout childhood and adolescence and are relatively independent of IQ (Stuss, 1992; Welsh & Pennington, 1988).

Stuss (1992) describes an interactive hierarchical feedback model where a feedback loop monitors incoming information at each of the three levels for analysis and subsequent adjustment, while the feed-forward aspect maintains a readiness state. Sensory and perceptual input is presented at the lowest level of multiple systems, while the executive functions direct lower level systems at the second hierarchical level. At the third and highest level of functions is self-awareness or consciousness (Passler, Isaac, & Hynd, 1985; Stuss, 1992). Every component of executive functioning involves a distinctive set of activity related behaviors and is necessary for appropriate, socially responsible, and effectively self-serving adult conduct (Lezak, Howieson, Loring, 2004). According to Lezak (1982), individuals who have an impaired capacity for self-awareness or self-regulation usually have a cluster of executive function deficiencies.

Self-Awareness. Self-awareness, a term used interchangeably with self-perception, is the highest level described in consciousness: the ability to be aware of oneself and the relation of self to the environment (Stuss, 1992). Freeman and Watts (1948) suggest that hierarchical levels of self-awareness occur throughout childhood and adolescence, similar to the hierarchical development of brain growth and executive functions. Picton and Stuss (1994) postulated a model for self- awareness, similar to the models of brain functioning that have a hierarchical component to them. They suggest that four operational levels

exist, including: arousal-attention, perceptual-motor, executive mediation, and self-awareness. In their description of this model, each operational level feeds forward to higher levels and provides a tentative digest of the analyses and association within each level, as well as feeds backward to lower levels to modulate the analyses and operations that will occur. Direct contact with the external environment is restricted to the perceptual-motor level. The two highest levels, which are located in the frontal lobes, incorporate action planning, inhibition, and facilitation of working memory. It is at this point where self-awareness emerges from convergence of emotional states and memory - not simply explicit remote memory of experience or explicit semantic knowledge, but memory of abstract mental states that allow construction of expectancy and thus memory for the future (Stuss & Benson, 1986). This prefrontal self-consciousness or self-awareness appears to bear some similarity to the concept of metacogntion.

Metacognition. Metacognition refers to the monitoring and control of one's use of cognitive skills (Nelson, 1992). It provides the basis for the transfer and generalization of learned skills to daily living functioning. Awareness is one component of metacogntion which refers to a person's knowledge and regulation of his or her own cognitive processes, and affects the ability to monitor performance (Nelson et al.,1992). Willoghby, King, and Polatajko (1996) suggest that self-awareness refers to a set of judgments and beliefs regarding one's performance capabilities with respect to a task or a series of tasks. They further postulate that awareness and self-monitoring also include the ability to survey task difficulty in relationship to individual strengths and weaknesses, as well as to plan ahead, and to choose suitable strategies. Learning disabled students with inefficient metacognitive skills demonstrate difficulty regulating these cognitive processes, which

may result in poor memory and learning and account for the role in school failure and/or difficulty for these students (Seidman, Biederman, Monuteaux, Doyle, & Faraone, 2001).

Executive function and self-awareness. The development of self-awareness in children is viewed as gradual and appears to correspond with a significant period of rapid development in the frontal lobes (Gallup & Suarez, 1986). Assuming that there are no deficits in executive functioning, Harter's (1983, 1986) work has shown that by middle childhood, children are able to comprehend both a general or global sense of themselves. With increased cognitive capacity, adolescents and college-aged individuals display further differentiation of self-awareness (Shapka & Keating, 2005). Therefore, since the developmental progression of higher levels of self-awareness corresponds with the development in the frontal lobes, Gallup and Suarez (1986) suggest that there are significant implications regarding the relationship between executive abilities and self-awareness in adults who exhibit neuropsychological deficits in executive functioning. However, research related to self-awareness and executive function has focused primarily on the self-awareness of traumatic brain-injured individuals (DeHope & Finegan, 1999; Newman, Garmoe, Beatty, & Ziccardi, 2000; Ownsworth, McFarland, & Young, 2000), as well as a interest in those with attention-deficit hyperactivity disorder (Stuss, 1992).

Hart, Giovannetti, Montgomery, and Schwartz (1998) examined individuals who had severe traumatic brain injuries. They demonstrated that error detection and correction during performance of naturalistic actions was impaired. It appeared as though impairments in awareness and self-monitoring prevented them from being aware of their functional deficits. This finding is particularly important since the awareness of one's

own strengths and weaknesses ultimately influences learning and its generalization to everyday functioning (Belmont, Ferretti, & Mitchel, 1982).

In addition to brain injury, Gerdes et al. (2005) found that children with attention-deficit/hyperactivity disorder were much more likely than comparison children, without ADHD to overestimate their academic competence relative to adult report, regardless of who was used as the criterion rater (teacher, mother, or father). It appeared as though children demonstrating impaired executive functioning, as a byproduct of ADHD, also demonstrated an impaired self-awareness in that they inflated their self-perceptions the most in domains of greatest deficit. Furthermore, a few studies have demonstrated that children with ADHD exhibit sub-average or relatively weak performances on various tasks of executive functioning, that may be related to impaired self-awareness, including inhibition, initiation, and organization in comparison to their non-disabled peers (Barkley, 1997; Pennington, Groisser, & Welsh, 1993).

There is also some overlap between ADHD and various kinds of learning disabilities (Cantwell & Satterfield, 1978; Levine, Busch, & Aufseeser, 1982). Seidman et al. (1995) suggested that persons with ADHD and comorbid learning disabilities have more severe executive deficits than persons without learning disabilities. They suggest that this may be attributed to the additive effect of combining two cognitive disorders that both include attention and memory dysfunctions. Therefore, Seidman et al. (1995) suggest that similar implications, regarding an impaired self-awareness, may also be evidenced in the lives of individuals with learning disabilities who are also exhibiting executive deficits.

Although a subset of individuals with learning disabilities exhibit disordered executive functioning (August & Garfinkel, 1990; Seidman et al., 1995), commonly associated with an impaired self-awareness (Prigatano, 1991), individuals with learning disabilities appeared to be more aware of their struggles in a study which examined the self-perceptions of college students with and without learning disabilities (Cosden & McNamara, 1997). Students were administered the Self-Perception Profile for College Students (Harter, 1986) which demonstrated that learning disabled students had lower perceptions of their scholastic and intellectual abilities than students without disabilities.

Because by definition, learning disabled students have experienced academic failure, a number of researchers have been examining the extent to which learning disabled students feel negatively about themselves. Although inconclusive, a number of studies have revealed that learning disabled students evidenced worse feelings about themselves than do normally achieving students (Alley & Deschler, 1979; Rogers & Saklofske, 1985). For example, in a study headed by Renick and Harter (1989), learning disabled children's self-perceptions were investigated using the Perceived Competence Scale for Children (Harter, 1982). Results indicated that learning disabled students, grades three through eight, perceived themselves as being less academically competent when compared with normally achieving students.

Although self-perception, was examined in students with and without learning disabilities (Cosden & McNamara, 1997; Renick & Harter, 1989), the aforementioned studies did not have a criterion rater to determine whether or not there were discrepancies between their perceived competence and their actual achievements. Also, despite research demonstrating the presence of executive deficits in learning disabled individuals

(Faraone, Biederman, Monuteaux, & Seidman, 2001), these studies did not include objective measures of executive functioning to determine whether or not discrepancies between perceived competency and actual achievements could be attributed to notable deficits in executive functioning. Therefore, implications regarding the relationship between self-awareness and executive functioning in learning disabled students could not be made.

Since self-awareness is the ability to be aware of oneself and the relation of self to the environment (Stuss, 1992), it has significant implications for the interpersonal and academic performances of students with learning disabilities studying in institutions of higher education (Thomas, 2000). Therefore, in light of the absence of research examining self-awareness and executive function in learning disabled college students (McDonald & Flanagan, 2004; Newman, Garmoe, Beatty, & Ziccardi, 2000), the proposed study will compare the accuracy in reporting perceived level of executive ability and actual scores on objective measures of executive functioning among learning disabled college students with and without executive dysfunction.

Statement of the Problem

In recent years, studies of college students with learning disabilities revealed that they had greater difficulty handling academic demands, adjusting to larger class sizes, and adjusting to the less structured university life (Heiman & Precel, 2003). Although many factors contribute to the obstacles students with disabilities encounter once they are admitted to college, research suggests that cognitive deficits, especially in the area of executive functioning, may have significant implications for the interpersonal and

academic performances of students with learning disabilities (Thomas, 2000; Wolf, 2001).

Seidman et al. (2001) suggests that students with learning disabilities who manifest neuropsychological deficits in executive functioning may also account for the role in school failure and/or difficulty, for these students, since individuals who demonstrate deficits in executive functioning often exhibit an impaired capacity for self-awareness of competencies (August & Garfinkel, 1990). Implications of impaired self-awareness may include difficulties with coping, performing tasks, and/or achieving personal goals, which in turn can adversely impact one's self-esteem and self-concept (Gallup & Suarez, 1986). However, dissimilar to investigations of self-awareness in individuals with traumatic brain injury (Newman, Garmoe, Beatty, & Ziccardi, 2000) and attention deficit hyperactivity disorder (Stuss, 1992), there is an absence of studies examining whether or not learning disabled students, exhibiting impairments in executive functioning, demonstrate similar deficits in self-awareness (Seidman et al., 2001).

Although self-perception, a term used interchangeably with self-awareness (Stuss, 1992), has been examined in students with and without learning disabilities (Cosden & McNamara, 1997; Renick & Harter, 1989), these studies did not determine whether or not gaps existed between their level of perceived competency and actual achievements. Furthermore, these studies did not include neuropsychological measures of executive functioning, despite research suggesting the presence of executive deficits in learning disabled students (Seidman et al., 2001). Therefore, implications regarding the association between self-awareness and executive functioning in learning disabled students could not be made.

Statement of Purpose

Much of what is known about prefrontal functioning derives from clinical case studies of adults who have sustained frontal lobe damage (Luria, 1973; Shallice, 1982; Stuss & Benson, 1984) and from experimental brain lesion studies of nonhuman primates (Diamond & Gilbert, 1989; Schwartz, 1983). Since it is believed that the relationship between self-awareness and executive functions have important implications for individuals who have sustained frontal lobe damage, it is probable to suggest that similar implications may be useful for individuals with impaired executive function, but not as a byproduct of a brain injury.

Since self-awareness is the ability to be aware of oneself and the relation of self to the environment (Stuss, 1992), it has significant implications for the interpersonal and academic performances of students with learning disabilities studying in institutions of higher education (Thomas, 2000). However, there is an absence of studies examining whether or not these individuals exhibit similar deficits in self-awareness as those who sustain frontal lobe injury (Hart et al., 1998) or are diagnosed with attention-deficit/hyperactivity disorder (Seidman et al., 2001).

In light of the absence of research examining neuropsychological test performance and self-awareness in adults with learning disabilities (McDonald & Flanagan, 2004; Newman, Garmoe, Beatty, & Ziccardi, 2000), the proposed study intends to examine self-awareness and executive functions in learning disabled college students. More specifically, self-awareness of executive abilities among learning disabled college students with and without impaired executive functioning. The examination of self-awareness and executive functions, in learning disabled college students, presents a

reasonable opportunity to further the understanding of executive dysfunction, which in turn may prevent interpersonal and academic performances from being compromised (Gallup & Suarez, 1986) and pave the way for intervention methods for this population.

Objectives

Objectives of the proposed study encompass comparing levels of perceived competence amongst learning disabled college students with and without executive dysfunction in areas of scholastic competency. Perception of perceived competency in scholastic ability will be measured using a subscale derived from the Self-Perception Scale for College Students (Harter, 1986). In addition, the proposed study will compare the accuracy in reporting perceived level of executive ability and actual scores on objective measures of executive functioning among learning disabled college students with and without executive dysfunction. Accuracy will be determined by the level of consistency between self-reported scores on the Behavior Rating Inventory of Executive Functioning (BRIEF-A) (Roth, Isquith, Gioia, 2005) and performance on the Neuropsychological Assessment Battery of Executive Functioning (White & Stern, 2001).

Research questions:

#1. Are there differences between learning disabled students, with and without impairments in executive functioning, in their self-reported perception of executive ability, as measured by their Global Executive Composite (GEC) score on the Behavior Rating Inventory of Executive Functions (BRIEF) and on their actual executive functioning as assessed with the Neuropsychological Assessment Battery (NAB), an objective measure of executive functioning?

#2. Do learning disabled students with impairments in executive functioning perceive themselves as less competent in their scholastic abilities in comparison to learning disabled students without impaired executive functioning, as measured by the Self-Perception Profile for College Students (1986)?

#3. Is there a relationship between levels of perceived competency in scholastic abilities, executive functioning status (impaired vs. normal) and perception of executive abilities (i.e., Global Executive Composite score)?

#4. Among students with learning disabilities, is it possible to distinguish between participants with and without impairments in executive functioning on the basis of their perceived abilities in scholastic competency?

Definition of terms

Learning Disabilities: In this current study, learning disabilities will be defined as a varied group of disorders that is manifested as significant difficulties in the acquisition and use of listening, speaking, reading, spelling, writing, reasoning, or mathematical abilities. These disorders are intrinsic to the individual and are presumed to be due to central nervous system dysfunction (Pennington et al., 1993). This does not include individuals who have learning problems which are primarily the result of visual, hearing, or motor handicaps, of mental retardation, of emotional disturbances, or of environmental, cultural, or economic disadvantage. Most, individuals with learning disabilities have average or above average intelligence. Currently, the most accepted approach to defining a learning disability is one in which there is a significant discrepancy between an individual's potential for learning and his/her achievement (Taylor, 1988). Learning problems can be divided into two main groups: a) involvement

of auditory-visual processes, resulting in reading disorders (dyslexia) and other language-based learning problems, and b) involvement of visual and motor processes, resulting in poor handwriting (dysgraphia), problems with mathematics (dyscalculia) and deficits in social skills (Pennington et al., 1993). Learning disabilities are comorbid with other diagnoses including attention-deficit/hyperactivity disorder (ADHD), anxiety, and depression. More specifically, ADHD has been found to co-occur in approximately 20% to 50% of children with reading difficulties, depending on the method of calculating learning disabilities (Semrund-Clikeman, 2004). ADHD has also been found to co-occur with difficulties in mathematics, written language, and social-emotional learning disabilities (Semrund-Clikeman, 2003).

Attention Deficit-Hyperactivity Disorder (ADHD): ADHD is the most common behavioral disorder, afflicting approximately 5%-10% of school-age children (Gerdes et al., 2005). The *Diagnostic and Statistical Manual of Mental Disorders-IV-TR* (American Psychiatric Association, 2000) defines three types of attention deficits: (a) an attention disorder characterized mainly by inattention (ADHD/I); (b) an attention disorder characterized mainly by hyperacivity and impulsive behavior (ADHD/HI); and (c) a combined attention disorder characterized by both inattention and hyperactivity and impulsive behavior (ADHD/COM).

Executive functions: The ability to maintain an appropriate problem set for attainment of future goals (Welsh & Pennington, 1988). Executive functions may include organizational skills, planning, future-oriented behavior, set-maintenance, self-regulation, selective attention, maintenance of attention, vigilance, inhibition, and creativity (Pennington et al., 1993). In this current study, executive functions will be defined as the

ability to inhibit, initiate, shift, plan, organize, self-monitor, emotional control, and working memory. Conversely, individuals with impairments in executive functions experience difficulties in the aforementioned areas. For the purpose of this study, definitions by Gioia, Isquith, and Guy, (2000) of the above functions include: *Sustain:* staying with or sticking to an activity for an age appropriate amount of time; *Inhibit:* the ability to not act on an impulse or appropriately stop one's own activity at the proper time; *Shift:* freely moving from one situation, activity, or aspect of a problem to another as a situation demands; *Plan:* anticipating future events, setting goals, and developing appropriate steps ahead of time to carry out an associated task in a systematic manner; *Organize:* establishing or maintaining order in an activity or place; carrying out a task in a systematic manner; *Self-monitor:* checking on one's own actions during, or shortly after finishing, the task/activity to assure appropriate attainment of a goal; *Emotional Control:* modulating/controlling one's own emotional response appropriate to the situation or stressor; *Working Memory:* the process of holding information in mind for the purpose of completing a specific and related task.

Global Executive Composite (GEC): The *GEC* is a summary score that incorporates all of the clinical scales of the Behavior Rating Inventory of Executive Function (BRIEF-Adult) which is a standardized self-report measure that captures adults' view of their own executive functions in their everyday environment. The BRIEF-A is composed of nine clinical scales that measure different aspects of executive functioning, including: inhibition, shifting, emotional control, self-monitoring, initiation, working memory, planning, task monitoring, and organization. The clinical scales combine to form two broader indexes, the Behavioral Regulation Index (BRI) and the Metacognition

Index (MI), and one summary composite score, the Global Executive Composite (GEC) (Roth, Isquith, & Gioia, 2005). For the purposes of this research, the Global Executive Composite (GEC) score will be used as a summary score which incorporates all of the clinical scales of the BRIEF-A (Inhibit, Shift, Emotional Control, Self-Monitor, Initiate, Working Memory, Plan/Organize, Task Monitor, and Organization of Materials). It is an accurate reflection of the adult's perceived level of executive dysfunction (Roth, Isquith, & Gioia, 2005).

Self-Awareness: Self-awareness is the ability to focus attention on oneself including thoughts, feelings, abilities, and actions. It may be viewed as the ability to self-reflect (Harter, 1986). Self-awareness, is the highest level described in consciousness—the ability to be aware of oneself and the relation of self to the environment (Stuss, 1992). Self-awareness entails social awareness, physical awareness, awareness of oneself as well as to others (Leak & Gibbon, 1995). The proposed study was designed to investigate a single domain of self-awareness, that being perception of executive ability (as described above) and perception of scholastic competency (Harter, 1986). For the purpose of this study, definitions by Harter (1986) of the above domain include: scholastic competence: perception of the individual's capacity in mastering their schoolwork and coursework.

Limitations

There are several factors to consider when utilizing self-report measures as they may be impacted by the respondent's mood, his or her conceptualization of the questions, respondents' insight and level of awareness, response bias, and the respondent's accuracy of recall. Therefore, a major limitation of the present study is the reliance on self-report inventories to assess self-perception of executive ability and scholastic competency. Also,

the study does not include an objective measure to determine whether or not the student qualifies for an AD/HD diagnosis. Since there is a strong relationship between impairments in executive functioning and self-awareness in those with AD/HD, this may confound results. Therefore, there will be no exclusionary criteria for AD/HD. Also, the definition of learning disabled may not capture all reading and math disabilities when operationalized.

In terms of the GEC score of the BRIEF-A, this score may not accurately reflect all of the components of executive functioning. More specifically, the *GEC* is a summary score that incorporates all of the clinical scales of the BRIEF-A which captures an adults' view of their own executive functions in their everyday environment. However, the BRIEF-A is composed of nine clinical scales that measure different aspects of executive functioning. Therefore, combining all nine clinical scales into one score may eliminate valuable information regarding specific details in each of the nine categories.

Another limitation is the generalizability of results. More specifically, since the study is exclusively examining learning disabilities, results can only be generalized to this particular population. Furthermore, generalizability of results may be limited to the small sample size and sample selection.

Chapter II

REVIEW OF RELATED LITERATURE

Introduction

In 2000, the graduation rate of college students with learning disabilities was only 3.6%, compared with 62.1% for students without disabilities (Murray, Goldstein, Nourse, & Edgar, 2000). Studies of college students with learning disabilities revealed that they had greater difficulty handling academic demands, adjusting to larger class sizes, and adjusting to the less structured university life (Heiman & Precel, 2003). In addition to these factors, research suggests that cognitive deficits, especially in the area of executive functioning, may also have significant implications for the interpersonal and academic performances of students with learning disabilities (Thomas, 2000; Wolf, 2001).

According to Seidman et al. (2001), learning disabled students with deficits in executive functioning may experience higher rates of school failure and/or difficulty since research suggests that individuals who demonstrate impaired executive functioning also exhibit an impaired capacity for self-awareness of competencies (August & Garfinkel, 1990). However, unlike investigations of self-awareness in individuals with traumatic brain injury (Newman, Garmoe, Beatty, & Ziccardi, 2000) and attention deficit hyperactivity disorder (Stuss, 1992), there is an absence of studies examining whether or not learning disabled students, exhibiting impairments in executive functioning, demonstrate similar deficits in self-awareness (Seidman et al., 2001). A review of the literature discusses the historical development and relationship between learning disabilities, executive functioning, and self-awareness, as well as reveals a significant

shortcoming regarding the relationship between self-awareness and learning disabled individuals with impaired executive functioning.

Historical Perspectives: Learning Disabilities

Although the federal government's involvement in learning disabilities through task forces, legislation, and funding has only been evident since the 1960s and 1970s, we can trace learning disabilities' roots back to at least the early 1800s. Despite learning disabilities being one of the newest categories officially recognized by the U.S. Department of Education, the origins of its conceptual foundation are as longstanding as many of the other disability categories (Hallahan & Mercer, 2005). Rather, the origins of brain development and its relationship with learning disabilities can be traced back to the scholarly works of classical Greeks who wrote the first accounts of brain-behavior relationships (Zillmer & Spiers, 2001).

Early Contributions

Heraclitus, a philosopher of the sixth century B.C., called the mind an enormous space whose boundaries we could never reach (Hunt, 1993). A geometer Pythagoras (about 580-500 B.C.), was one of the first to suggest that the brain is at the center of human reasoning and plays a crucial role in the soul's life (Zillmer & Spiers, 2001). Hippocrates (460-377 B.C.), a Greek physician honored as the founder of modern medicine, also believed that the brain controlled all senses and movements (Hunt, 1993). Hippocrates suggested that pleasure, merriment, laughter, and amusement, as well as grief, pain, anxiety, and tears, all arise from the brain (Haeger, 1988). He suggested that "men ought to know that from the brain, and the brain only, arise our pleasures, joys, laughter, and jests, as well as our sorrows, pains, grief, and tears" as cited in Allport,

1965 (p. 353). In all his efforts, his greatest contribution was to divorce medicine from religion and superstition. Although these were bold propositions at a time when people thought behavior was mostly under divine control, Hippocrates and his associates could not, however, discuss exactly how such brain-behavior relationships arose (Allport, 1965).

Along with Hippocrates, Galen (A.D. 130-201), a Roman anatomist and physician, advanced the anatomic knowledge of the brain. Galen believed that all physical function, including the brain as well as the rest of the body, depends on the balances of bodily fluids or humors, specifically blood, mucus, and yellow and black bile, which he related to the four basic elements, air, water, fire, and earth (Hunt, 1993; Haeger, 1988). It was not until the 13th century when Andreas Vesalius (1514-1564) corrected Galen's anatomic mistakes of the brain. Through continual dissections and careful scientific observations, Vesalius demonstrated that Galen's views were inaccurate. He revolutionized medicine through precise drawings of the human anatomy.

By the 17th century, Rene Descartes (1596-1650) proposed the idea that the mind and body were separate. This idea was further differentiated during the 18th century when more precise models of the brain became possible through the works of anatomists like Thomas Willis (1621-1675) and Giovanni Lancisi (1654-1720). It was not until the 19th century that modern neuropsychological theories regarding brain functions began to evolve (Zillmer & Spiers, 2001).

Austrian anatomist Franz Gall (1758-1828), is credited as the first major figure to explore the relationship between brain injury and mental impairment. Gall based much of his theorizing on observations he made of brain-injured soldiers. He conjectured that

three separate parts of the brain are each responsible for what he termed: vital source, moral qualities, and intellectual qualities (Head, 1926). Of particular relevance to learning disabilities, Gall is known for noting the effect of brain damage on what today would be termed Broca's aphasia. Gall's contribution in linking brain injury and aphasia, however, were largely overshadowed by his association with the phrenology school of thought, the belief that skull shape determines mental and personality attributes (Hunt, 1993).

In the 1860's, Pierre Paul Broca is generally known for being the one who did the most to promote the idea that speech functions primarily reside in the left side of the brain. He based his case on autopsies of several patients who had impaired speech while alive. He concluded that a small section of the left side of the brain was responsible for speech. This area, which is located in the interior left frontal lobe, has come to be called Broca's area. Individuals who have a particular constellation of speech problems involving slow laborious speech are referred to as having Broca's aphasia (Hallahan & Mercer, 2005).

Carl Wernicke, a Polish-born physician, was another major figure who explored brain localization during this period. In 1874, he published a book describing ten case studies of brain-injured patients with language problems. However, the language disorders they possessed were different from those of Broca's patients (Wernicke, 1874). In contrast to Broca's patients, Wernicke's patients had fluent and unlabored speech, but the sentences spoken were often meaningless and had difficulties in recognizing and comprehending words. This particular area of the brain is called Wernicke's area which consists of a section of the left temporal lobe.

Research on reading disabilities can be dated back to Sir William Broadbent, in 1872, who reported on the case of an intelligent adult patient who:

> After head symptoms, completely lost the power of reading either printed or written characters, while he could write readily and correctly from dictation or spontaneously. His conversation was good and his vocabulary extensive, but at times he was at a loss for a name, and he was quite unable, when asked, to name the simplest and most familiar object presented to his notice, (Broadbent, 1872, p.26)

Approximately 5 years later, Adolph Kussmaul reported on the case of an adult patient with no apparent disabilities other than a severe reading deficit. He asserted that "a complete text-blindness may exist, although the power of sight, the intellect, and the powers of speech are intact." Kussmaul gave birth to the idea of *specific* reading disability, however, he labeled the condition *word deafness* and *word blindness* (Kussmaul, 1877, p.770).

A reciprocal academic relationship between two physicians, John Hinshelwood and W. Pringle Morgan, was the catalyst for extending this work on acquired word-blindness. Hinshelwood's first breakthrough into research, in this area, was with an adult whom he saw in 1894 and followed until his death in 1903. An autopsy revealed the section of the brain affected was the left angular gyrus, which is immediately posterior to Wernicke's area. From the late 1890s into the early 20th century, Hinshelwood gathered data on several cases of acquired and congenital word-blindness and was one of the first to note at least two important aspects of reading disability in children. First, he noted the preponderance of males with the condition, and secondly, the potential inherited aspect of

the disability. As a result of further researching this area, he postulated that the primary disability these children had was in visual memory for words and letters (Hinshelwood, 1917).

By about the 1920s, clinicians and researchers in the United States began to take an interest in the work of the Europeans who had already been studying brain-behavior relationships in children and adults with learning difficulties. In the United States, researchers focused their study on language and reading disabilities, perceptual and perceptual motor disabilities, and attention disabilities (Hallahan & Mercer, 2005). Several key figures, including Samuel Orton, Grace Fernald, Marion Monroe, and Samuel Kirk used the research of Hinshelwood and other Europeans as a foundation for their own work.

In 1925, Orton set up an experiment with students who were considered to be "defective or who were retarded or failing in their school work" (Orton, 1925, p. 582). He found that many of these students scored in the near average, average, or above average range on the Stanford-Binet IQ test. This verified Hinshelwood's notion that his cases of congenital word blindness were intelligent. Although Orton agreed with some of Hinshelwood's works, he differed in at least two important respects. First, Orton had a more liberal view of the prevalence of reading disabilities, as opposed to Hinshelwood's proposition that one per thousand of students in elementary schools might have word-blindness. Secondly, although they both thought reading disabilities were often inherited, Hinshelwood pointed to the angular gyrus in the dominant hemisphere as the site of the problem. Although Orton considered this an essential area for normal reading abilities, he viewed reading as a complex activity involving several areas of the brain. Therefore, he

recommended the idea of multisensory training in the realm of remediation techniques. In particular, he stressed the use of the kinesthetic function by having students trace letters while sounding them out (Orton, 1937). Today, practitioners still use this method which is phonics-based using the visual, auditory, and kinesthetic modalities for reading-decoding and spelling instruction.

Grace Fernald was another prominent figure associated with a multisensory approach to learning disabilities. However, she also emphasized reading and writing words as a whole (Fernald, 1943). Marion Monroe, having served as Orton's research associate, tried out Orton's methods along with the methods of Fernald. She developed diagnostic tests and used the results to guide instruction. Using a combination of kinesthetic tracing techniques and sound blending, she reported success with 29 children with reading disabilities (Monroe, 1928).

As with the studies on language and reading disabilities, the early research on perceptual, perceptual-motor, and attention disabilities was focused on adults with brain injuries. Kurt Goldstein studied many cases of brain injury over several years. He reported that they tended to display a consistent constellation of behaviors: hyperactivity, forced responsiveness to stimuli, figure background confusion, concrete thinking, perseveration, and catastrophic reaction (Goldstein, 1936). Forced responsiveness to stimuli was characterized by the soldiers indiscriminant reactions to stimuli in that they could not distinguish essential from inessential. His patients also had a tendency to repeat behaviors repeatedly, both verbal and motor. He also noted that these individual were unsuccessful in dealing with over stimulation and disorganization. It appeared as though

many of these cases, today, would be considered learning disabled and/or learning disabled with comorbid attention-deficit/hyperactivity disorder.

Goldstein's findings served as the basis for the research of Heinz Werner and Alfred Strauss who argued that the kind of perceptual-motor and cognitive and behavior problems they found among mentally retarded children were also found in children of normal intelligence caused by brain damage. Although they could not prove brain damage in these individuals, the idea became more popular. The term, "brain damage," was mitigated to "minimal brain dysfunction," and later replaced with the term "learning disability" (Strauss & Werner, 1942).

Current Perspectives on Learning Disabilities

In the United States, from about 1960 to 1975, learning disabilities began its emergence as a formal category. It was during this period that (a) the term learning disability was introduce; (b) the federal government included learning disabilities on its agenda; (c) parents and professionals founded organizations for learning disabilities; and (d) educational programming for students with learning disabilities blossomed (Hallahan & Mercer, 2005). The period from about 1975-1985 was a period of relative stability as the field moved toward consensus on the definition of learning disabilities as well as methods of identifying students with learning disabilities.

Since the 1960s, most definitions of learning disabilities have made reference to a neurological basis. However, it was not until the 1980s, and especially the 1990s, that evidence began to accumulate to support a biological basis for learning disabilities. Through the use of postmortem studies and neuroimaging studies, evidence has begun to mount that hereditary factors are implicated in many cases of learning disabilities

(Hallahan & Mercer, 2005). Although learning disabilities have been defined in various ways over time, it is a term that refers to a varied group of disorders that is manifested as significant difficulties in the acquisition and use of listening, speaking, reading, spelling, writing, reasoning, or mathematical abilities. These disorders are intrinsic to the individual and are considered to be due to central nervous system dysfunction (Hammill, Leigh, McNutt, & Larsen, 1981). The term does not include individuals who have learning problems which are primarily the result of visual, hearing, or motor handicaps, of mental retardation, of emotional disturbance, or of environmental, cultural, or economic disadvantage. Those with learning disabilities have average or above average intelligence, but there is a significant discrepancy between the person's potential for learning and his/her achievement (Clikeman, 2005).

During the most recent period of learning disabilities history, from 1976-1977 to 1998-1999, the number of students identified as leaning disabled has doubled. In 2000, more than 2.8 million students were identified as learning disabled, which represented just over half of all students with disabilities (UDOE, 2000). In recent years, an increasing number of students with learning disabilities have been studying in institutions of higher education (Thomas, 2000). According to the American Council on Education, as cited in Heiman and Precel (2003), the percentage of all students with disabilities entering college quadrupled between 1978 and 1991, from 2.2% to 8.8% of all students. In 1998, two out of five first year students who had some kind of disability reported having a learning disability (Heiman & Precel, 2003).

Colleges and universities have made their programs more accessible, however, only modest progress was made between 1973, with the passage of Section 504 of the

Rehabilitation Act, and 1990, with the passage of the Americans with Disabilities Act. More specifically, Section 504 stipulates that no otherwise qualified person due to disability may be denied the participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance (Thomas, 2000). Since nearly all public and most private colleges are recipients of federal aid, the entire institution is required to comply with the act's provision. In order to demonstrate compliance, the college must file an assurance of compliance, provide notice to participants that the recipient's program does not discriminate based on disability, identify a specific employee to coordinate compliance, conduct a self-evaluation, engage in voluntary action to correct those circumstances that may have limited the participation of students with disabilities, adopt grievance procedures, and remediate violations of the act (Hallahan & Mercer, 2005).

In addition to Section 504, Title II of the American with Disabilities Act prohibits public entities (e.g., state government, public schools, public colleges) from denying qualified persons with disabilities the right to participate in or benefit from the services, programs, or activities that they provide, and from subjecting such individuals to discrimination if the exclusion or discrimination is due to the person having a disability. Title III of the act further prohibits entities that operate places of public accommodation from discriminating against persons with disabilities by denying them full and equal enjoyment of the goods, services, facilities, privileges, advantages, or accommodations they provide (Thomas, 2000).

After the implementation of the American with Disabilites Act, institutions that had previously made little or no progress in making accommodations for students with

disabilities began to increase their efforts. This is largely attributed to the publicity surrounding the passage of the ADA, as well as an increase in the number of administrative appeals and lawsuits, and the growth in the number of students requesting accommodations. The greater demand for accommodations can be attributed to the fact that many current college students received either an Individualized Education Program, as is required by the Individuals with Disabilities Education Act of 1990, or a service plan, which is required by Section 504, while in elementary and secondary schools. Furthermore, these students have also become increasingly aware of their rights to accommodation while in higher education (Thomas, 2000).

Most recently, the Individuals with Disabilities Education Act (IDEA), was rewritten and signed into law in 2004. This Act changes many sections of the statute to reflect new ideas around learning disabilities and the concept of a pre-identification strategy called response to intervention (RTI). The emphasis of RTI is to focus on providing more effective instruction by encouraging earlier intervention for students experiencing difficulty in learning to read. The implementation of this revision is that this will prevent some students from being identified as LD by providing interventions as concerns emerge. The Act states:

> …almost 30 years of research and experience has demonstrated that the education of children with disabilities can be made more effective by providing incentives for whole-school approaches (NJDOE, 2006).

However, despite these revisions and attempts towards early intervention, studies have revealed that the increasing number of students with disabilities entering college reported persistent feelings of lower self-efficacy and reported large gaps between their

competence and their actual achievements (Hoy et al., 1997). In addition to a negative perception of competency, research also suggests the students with learning disabilities can manifest neuropsychological deficits in executive functioning, particularly in areas of attention and memory, which may also account for the role in school failure and/or difficulty for these students (Seidman, Biederman, Monuteaux, Doyle, & Faraone, 2001). Difficulties for students with learning disabilities are further exacerbated when they are also diagnosed with attention-deficit/hyperactivity disorder (August & Garfinkel, 1990).

Research suggests that persons with ADHD and comorbid learning disabilities have more severe executive deficits because of the additive effect of combining two cognitive disorders that both include attention and memory dysfunctions (August & Garfinkel, 1990). Faraone et al. (2001) purport that learning disabilities, when combined with ADHD, have a specific role in school failure since executive functions are intrinsic to the ability to respond in an adaptive manner to novel situations and are also the basis of many cognitive, emotional, and social skills. It is defined broadly as the aspect of cortical functioning that has to do with managing, structuring, and directing behavior (Stuss, 1992). It deals with planning, flexible problem solving and, at the highest levels, self-awareness which includes the self-monitoring and self-assessment of behavior (Lezak, 1995; Wecker, Kramer, Wisniewski, & Delis, 2000; Zillmer & Spiers, 2001).

Historical Perspectives: Executive Functions

In recent years, there has been a renewal of interest in the frontal lobes and their associated functions. While the anatomical term, frontal lobes, refers to the anterior one-third of the brain, executive functions refers to the psychological construct of interactive, yet, independent control functions within different regions of the frontal lobes (Stuss &

Alexander, 2000). Historically, the study of executive functions and the frontal lobes revealed inadequacies and inconsistencies with regards to definitions (Salthouse, 2005). For example, Stuss and Benson (1986) characterized executive functions as problem-solving encompassing anticipation, goal selection, planning, monitoring, use of feedback, and self-awareness. Lezak (1995) described four components of executive functions, including volition, planning, purposive action, and effective performance. Temple (1997) characterized executive functions as involving planning, decision making, directed goal selection, and monitoring of on-going behavior, as well as self-awareness, empathy, and social sensitivity.

Although there are several variations in the definition of executive functions, some agreement exists regarding the patterns and abilities associated with the executive system. More specifically, the term executive functioning is apt in describing that aspect of cortical functioning that has to do with managing, structuring, and directing behavior (Stuss, 1992). It deals with planning, flexible problem solving, and at the highest levels, the self-monitoring and self-assessment of behavior (Lezak, 1995; Wecker et. al., 2000; Zillmer & Spiers, 2001).

Before the 19th century, people knew little about the cortex of the brain. Rather, contemporary research on the frontal lobes can be dated back to 1848, when there was an accidental explosion at a railroad construction site in Cavendish, Vermont. An iron tamping bar was accidentally hurled through the head of a 25-year-old foreman named Phineas Gage (Harlow, 1848). The tapered end of the rod penetrated the head, piercing and carrying away a substantial part of the frontal lobes. It was reported that Gage remained quite rational, and displayed an accurate recollection of the events related to the

explosion despite the trauma to his head. He rapidly recuperated, after falling ill to an infection, with the exception of blurred vision in the left eye and a slight left facial palsy. Although he was deemed rehabilitated, this conclusion appeared to be premature in that his injury led to a dramatic change, described in a passage that is now a classic in the annals of behavioral neurology:

> His contractors, who regarded him as the most efficient and capable foreman in their employ previous to his injury, considered the change in his mind so marked that they could not give him his place again. The equilibrium or balance, so to speak, between his intellectual faculties and animal propensities, seems to have been destroyed. He is fitful, irreverent, indulging at times in the grossest profanity (which was not previously his custom), manifesting but little deference for his fellows, impatient of restrain or advice when it conflicts with his series, at times pertinacious obstinate, yet capricious and vacillating, devising many plans of future operation, which are no sooner arranged than they are abandoned in turn for others appearing more feasible. (Harlow, 1868, p.327)

After his death, in 1861, dozens of reports have repeatedly confirmed that massive damage to the frontal lobes caused dramatic changes in personality while keeping sensation, movement, consciousness, and most cognitive faculties intact (Mesulam, 2002). It is this dissociation that is largely responsible for the sense of enigma that has permeated research on the human frontal lobes.

Since the time of Phineas Gage, a number of major achievements and influential concepts led to the evolution of neuropsychology as a discipline, which is a subspecialty of psychology examining the complex properties of the brain and behavior (Zillmer &

Spiers, 2001). It was during the first half of the twentieth century that the dilemma of the frontal lobes unfolded in the form of those who considered it the seat of the highest integrative functions of the human mind (Ackerly, 1935; Brickner, 1936; Goldstein, 1936) and those who commented on the paucity of deficits associated with substantial frontal damage (Hebb, 1949). However, this controversy gradually dissipated through the emergence of insightful clinical assessment methods and sophisticated neuropsychological instruments to acknowledge the neurological basis of emotion and personality (Hunt, 1993; Mesulam, 1986). In fact, evidence began to show that many patients with frontal lobe lesions became associated with an erosion of foresight, judgment, and insight, and an inability to delay gratification or experience remorse (Luria 1996). Some patients tended to display difficulty with abstract reasoning, hypothesis generation, creativity, problem solving, and mental flexibility. It appeared as though the orderly planning and sequencing of complex behaviors, the ability to multitask, the capacity for grasping a complex situation, the inhibition of immediate but inappropriate response tendencies, and the ability to sustain behavioral output without preservation could each become markedly disrupted following frontal lobe injury (Mesulam, 1986)

Neuropsychological testing of patients with prefrontal damage began to exhibit quantifiable deficits in tasks of concentration, sustained information retrieval, and inhibition of inappropriate responses (Mesulam, 1986). Whereas, tests of mental flexibility and hypotheses formation were also frequently impaired (Luria 1966; Milner, 1963, 1982; Stuss & Benson, 1984; Weintraub & Mesulam, 1985), most tests of perception, construction, language, and spatial attention remained intact (Mesalum, 1986). This discrepancy was addressed through scientific evidence supporting a

localization position, which was made available in 1861, when Paul Broca (1824-1880) announced to the medical community that motor speech was specifically located in the posterior region of the left frontal lobe. His discovery led to numerous investigations regarding localizations of higher cognitive functions which suggested that specific brain functions exist in particular locales in the brain. These areas of the brain were noted to have a precise cognitive function to a specific anatomic section of the brain which may or may not affect other areas of cognitive functioning (Zillmer & Spiers, 2001).

Brain Development: The Role of the Frontal Lobes

Current literature suggests that biological maturation of the brain appears to occur, for the most part, in a hierarchical model of development. Development of the brain appears to start at the posterior regions and progresses to the anterior or frontal regions of the brain. Specifically, cortical development of the brain begins with the primary motor and sensory areas, moves on to secondary regions, and lastly the prefrontal or tertiary association areas. Although prefrontal circuitry appears to continue into adolescence and adulthood, prefrontal maturation appears to occur by puberty (Stuss, 1992).

Over the last several decades, it has become clear that the prefrontal cortex plays a pivotal role in neural control over cognition. However, for a long time neuropsychologists only knew what the frontal lobes did not do since the functions of the temporal, parietal, and occipital lobes follow straightforward principles of organization built around sensory system processing (Miller & Cummings, 1999). The frontal lobes are the most recently evolved parts of the brain, and in man, make up about one third to one fourth of the mass of the cerebral hemispheres (Passler, Isaac, & Hynd, 1985).

However, despite decades of research regarding the neuroanatomical and behavioral nature of the frontal cortex, it appears that they have remained one of the least understood regions of the cerebral cortex (Nauta, 1971).

Neurophysiologists presume that the prefrontal cortex is central in formulating goals, intentionality, selecting goal appropriate cognitive routines, providing sequential access to these routines, and evaluating the outcome of the actions (Zillmer & Spiers, 2001). It is often said that the frontal lobes act as a conductor of the brain (Goldberg, 2001). In an effort to describe the contribution of the frontal lobes, to our everyday functioning, Carter (1998) suggests that the:

> The frontal lobes are where ideas are created, plans constructed, thoughts joined with their associates to form new memories, and fleeting perceptions held in mind until they are dispatched to long-term memory or to oblivion. This brain region is the home of consciousness....Self-awareness arises here, and emotions are transformed in this place from physical survival systems to subjective feelings..... for it is here, too, that mystics have traditionally placed the *Third Eye* – the gateway to highest point of awareness. (Carter, 1998, p. 180)

The term "executive functioning" is apt in describing that aspect of cortical functioning, in the frontal lobes, that has to do with managing, structuring and directing behavior (Stuss & Knight, 2002). It deals with planning, selectively problem solving, and at the highest levels, the self-monitoring and self-assessment of behavior. Executive functioning is not a single behavior but a category of behavior that is orchestrated primarily by different aspects of the frontal systems on the rest of the brain (Carter, 1998; Zillmer & Spiers, 2001). The frontal lobes are connected by numerous neural pathways to

almost all the other cortical areas. These paths are two ways in that they carry in information from the buried parts of the brain and they also carry signals back (Carter, 1998; Miller & Cummings, 1999; Nauta, 1971).

Stuss and Benson (1986) have proposed a useful model of executive functioning in relation to general brain functioning. They suggest that a basic level of brain functioning, operations such as memory, language, sensory, and motor functions, operate according to well-defined and automatic programs, in that they can function without much conscious attention. However, to be executed at the right time and in the right place, higher levels of behavior require planning and integration of these functions. Unless organized by higher-order executive functions, problem-solving behavior becomes chaotic, sometimes failing to initiate, sometimes having to logical sequence, or sometimes perseverating on the first problem-solving strategy that comes to mind (Milner, 1982). The ability to organize stimuli and input from the environment is largely attributed to the role of the frontal lobes and is particularly important when an organism is facing a novel situation. Conversely, when an individual encounters a routine situation, the role of the frontal lobes is less prominent (Goldberg, 2001).

Studies examining the relationship between deficits in higher cerebral functioning, associated with attention-deficit/hyperactivity disorder, have provided significant advances in our understanding of the neuropsychological dimensions of executive functioning (Barkley, 1997; Pennington, Groisser, & Welsh, 1993). For example, a study conducted by Wu, Anderson, and Castiello (2002) investigated multiple aspects of executive functioning in children with attention deficit/hyperactivity disorder, specifically targeting areas of attentional components, impulsiveness, planning, and

problem solving. Since frontal lobe functioning is related to abilities in executive control, ADHD was hypothesized to be associated with deficits in various areas of executive functioning. According to their findings, children with ADHD had slower verbal responses and sustained attention deficit, as well as deficits in selective attention.

Russell Barkley, as cited in Zillmer and Spiers (2001), a prominent theorist who has researched the relationship between executive abilities and disinhibition with learning disabilities and ADHD populations, has proposed a three-tiered executive model of ADHD. The first tier, behavioral inhibition, involves three interrelated processes: (a) the inhibition of a pre-potent response, (b) stopping an ongoing response, and (c) protecting an ongoing mental operation from disruption by competing external or internal events. More specifically, these inhibitory processes are necessary for the effective operation of the four executive functions of the second tier: working memory; internalization of speech; regulation of arousal, emotions, and motivations; and the process of recombining behavioral elements to create new behaviors. The second tier, in turn, affects the control, organization, and flexibility of the behavioral output of the third tier.

When inhibitory and executive processes interact, a child will begin to develop the capacity to regulate behavior by using internal representations of events in thoughts and images. That is, these internal representations allow the child to link past learning and experience with both present demands and future consequences of actions. This internal capacity to manipulate and guide behavior allows for the regulation of emotion and motivation, as well as the generation of new behavioral patterns to augment goal-oriented behavior. However, in ADHD, an impaired inhibitory control process disrupts the operation of the executive processes. It is the cascading effect of this impairment

which results in a host of behavioral excesses and deficits, including poor impulse control, inattention, and hyperactivity (Zillmer & Spiers, 2001).

Executive functions appear to develop in a hierarchical manner throughout childhood and adolescence (Stuss, 1992; Welsh & Pennington, 1988). Temple (1997) reported, "By the age of six years, adult levels of performance were reached on simple planning and organized visual searching. By the age of 10 years, adult levels were attained on set maintenance, hypothesis testing, and impulse control…Adult levels of complex planning, motor sequencing, and verbal fluency were not reached until adolescence" (p. 291). This model of development appears consistent with other proposed models of brain maturation and psychological development (Miller & Cummings, 1999; Stuss, 1992).

Donald T. Stuss (1991) proposed three levels of function for the frontal cortex wherein the first level refers to brain activities designed to maintain and organize information in meaningful sequences and the ability to initiate and drive behavior. The second level of function for frontal cortex is an executive or control function which is defined as the conscious direction toward a selected goal in novel or non-routine situations. The final level of frontal function is consciousness itself, the ability to be aware of oneself and the relation of self to the environment.

Development of Self-Awareness/Self-Monitoring

Self-awareness, is the highest level described in consciousness: the ability to be aware of oneself and the relation of self to the environment (Stuss, 1992). According to Shapka and Keating (2005), as children's minds become increasingly flexible with each developmental milestone, their perceptions of themselves become increasingly

differentiated and comprehensive. It appears that very young children are capable only of evaluating themselves in terms of five domains: physical competence, physical appearance, peer acceptance, cognitive competence, and behavioral conduct. In contrast, older children and adults rate themselves along a continuum, for example, from very well to very bad. Harter's (1983, 1986) work has shown that by middle childhood, children are able to comprehend both a general or global sense of themselves along with domain-specific evaluations in the five areas noted above. With increased cognitive capacity, adolescents and college-aged individuals display further differentiation of the five initial areas of self-perceived competence (Shapka & Keating, 2005).

Freeman and Watts (1948) suggest that hierarchic levels of self-awareness occur throughout childhood and adolescence, similar to the hierarchical development of brain growth and executive functions. Picton and Stuss (1994) postulated a model for self-awareness, similar to the models of brain functioning that have a hierarchical component to them. They suggest that four operational levels exist, including: arousal-attention, perceptual-motor, executive mediation, and self-awareness. In their description of this model, each operational level feeds forward to higher levels and provides a tentative digest of the analyses and association within each level, as well as feeds backward to lower levels to modulate the analyses and operations that will occur. Direct contact with the external environment is restricted to the perceptual-motor level. The two highest levels, which are located in the frontal lobes, incorporate action planning, inhibition and facilitation of working memory. It is at this point where self-awareness emerges from convergence of emotional states and memory - not simply explicit remote memory of experience or explicit semantic knowledge - but memory of abstract mental states that

allow construction of expectancy and thus memory for the future (Stuss & Benson, 1986). This prefrontal self-consciousness or self-awareness appears to bear some similarity to the concept of metacogntion.

Metacognition refers to the monitoring and control of one's use of cognitive skills (Nelson et al., 1992). It provides the basis for the transfer and generalization of learned skills to daily living functioning. Awareness is one component of metacogntion which refers to a person's knowledge and regulation of their own cognitive processes, and affects the ability to monitor performance (Nelson et al., 1992). Willoghby, King, and Polatajko (1996) suggest that self-awareness refers to a set of judgments and beliefs regarding one's performance capabilities with respect to a task or a series of tasks. They further postulate that awareness and self-monitoring also include the ability to survey task difficulty in relationship to individual strengths and weaknesses, as well as to plan ahead, and to choose suitable strategies.

The concept of self-awareness differs from self-esteem or self-concept in that the latter terms may be viewed as how an individual feels and thinks about one's self (self-approval). As mentioned previously, self-awareness (highest level of the feedback-feedfoward model of the brain) is represented by the prefrontal cortex, but is also dependent upon lower levels functions. According to Stuss and Alexander (2000), "Indeed, the most important role of the frontal lobe may not be for executive cognitive processes, but for affective responsiveness, social and personality development, and self-awareness and consciousness" (p. 291).

It has been hypothesized that self-awareness is the product of affective states and memory (emotion and experience) in that integrated activity is assumed between

affective state and the lower and higher system levels within the frontal lobes. Moreover, self-awareness is the product of memory of abstract mental states that form expectations for the future. The development of self-awareness in children is viewed as gradual and appears to correspond with a significant period of rapid development in the frontal lobes (Gallup & Suarez, 1986). Therefore, executive functions, in relation to self-awareness, is intrinsic to the ability to respond on an adaptive manner to novel situations and are also the basis of many cognitive, emotional, and social skills. Every component of executive functioning involves a distinctive set of activity related behaviors and is necessary for appropriate, socially responsible, and effectively self-serving adult conduct (Lezak, Howieson, & Loring, 2004).

Self-awareness is multifaceted as it includes physical awareness, awareness of self and of other persons, and social awareness (Strauss & Goethals, 1991). A mature self-awareness requires an integrated appreciation of one's physical status and ongoing physical relationship with the immediate external environment, an appreciation of being a distinctive person in a world which mainly exists outside of one's immediate awareness and is inhibited by many other distinctive individuals, and appreciation of oneself as an interactive part of the network of social relationships (Lezak, 1995). According to Lezak (1982), individuals who have an impaired capacity for self-awareness or self-regulation, usually have a cluster of executive function deficiencies. However, research related to self-awareness and executive function has focused primarily on the self-awareness of traumatic brain-injured and acquired brain injured individuals (DeHope & Finegan, 1999; Newman, Garmoe, Beatty, & Ziccardi, 2000; Ownsworth, McFarland, & Young, 2000).

Self-Awareness and Executive Functioning after Brain Injury

Developmental disorders of executive functions, as well as traumatic and acquired brain injury produces a variety of neurobehavioral difficulties, including impairment of attention and memory, executive functioning, judgment, language, and motor skills, which are extremely disruptive to those who live with these deficits and their families (Newman, Garmoe, Beatty, & Ziccardi, 2000). It appears as though much of what is known about prefrontal functioning and self-awareness derives from clinical cases studies of adults who have sustained frontal lobe damage (Luria, 1973; Shallice, 1982; Stuss & Benson, 1984) and from experimental brain lesion studies of nonhuman primates (Diamond, 1989; Schwartz, 1983). Although damage to the frontal lobes may effect specific behaviors within the realm of executive functions (awareness, goal setting, planning, self-initiation, self-inhibition, self-monitoring, etc.), it is important to note that not all individuals with frontal lobe damage exhibit the same behaviors and/or difficulties with self-awareness (Lezak, 1982; Pollens, McBratnie, & Burton, 1988).

The capacity for understanding one's strengths and limitations has been labeled "self-awareness" and is often compromised after trauma to the brain in that these individuals do not adequately perceive significant changes in their higher cerebral functioning (Prigtano, 1991). Such a lack of understanding their competency places the person at risk for poor judgment decision, difficulties adjusting to change, and interpersonal problems arising from the loss of appreciation of the impact of one's behavior on others (Newman et. al., 2000). Moreover, social awareness difficulties, experienced by those with frontal lobe damage, impede efforts to re-enter the social community. It appears as though impulsivity, actions, and gestures resulting from

disinhibition makes successful, daily interactions outside a therapeutic setting difficult to attain (DeHope & Finegan, 1999).

According to Bandura's Social Cognitive Theory (1986), there are a variety of internal and external factors that combine in an effort to formulate an individual's thoughts, feelings, and social behaviors necessary for effective human functioning. The theory further postulates that such processes incorporate the ability to adapt to environmental demands, formulate direction or behavior in pursuit of personal goals, and most importantly, the ability to evaluate one's behavior outcomes (i.e. self-assessment of competence). Morton and Wehman (1995) suggest that the inability to monitor one's own performance may lead to difficulty in coping, as well as performing tasks or achieving personal goals. In turn, this affects self-identity and self-worth. They propose that this is frequently associated with frontal lobe injury.

One of the most common methods of assessing self-awareness in individuals with executive system dysfunction has been to compare the ratings of a person with a brain injury to those of family member or staff who know the individual. The study of these individuals is imperative in understanding the relationship between self-awareness and executive dysfunction because traumatic brain injury produces a variety of neurobehavioral deficits, including impairment of attention and memory, executive functioning, judgment, language, and motor skills (Brooks, 1987).

For example, Hart et al. (1998) examined individuals who had severe traumatic brain injuries. They demonstrated that error detection and correction during performance of naturalistic actions was impaired. It appeared as though impairments in awareness and self-monitoring prevented them from being aware of their functional deficits. This

finding is particularly important since the awareness of one's own strengths and weaknesses ultimately influences learning and its generalization to everyday functioning (Belmont, Ferretti, & Mitchel, 1982).

In 2001, Mukherjee, Heller, & Alper reported that approximately 5.3 million American children and adults currently live with disabilities resulting from traumatic brain injury and commonly present with an impaired sense of self (i.e., unawareness of deficits), which is ultimately attributed to executive dysfunction. This is consistent with previous findings according to Prigatano et al. (1986) who found that traumatic brain injured patients, in the post-acute rehabilitation setting, tended to overestimate their abilities relative to ratings from relatives and staff members. Berquist and Jacket (1993) found that patients who experience a good outcome following brain injury are typically those who recognize and appreciate their limitations, set realistic goals, and actively participate in rehabilitation. However, since an impaired self-awareness is commonly seen in individuals with brain injury, poor psychosocial outcomes occur very often (Fleming, 1996; Ownsworth, McFarland, & Young, 2000). It appears as though, as a result of injury, the lack of self-awareness (Prigatano et al., 1986) and difficulty judging most facets of social information (McDonald & Flanagan, 2004) make participation in social and recreational activities for these individuals difficult. Common psychosocial problems among this population are associated with depression, social anxiety, loneliness, and low self-esteem (Tyerman & Humphrey, 1984).

Since concerns about the degree of association between self-awareness and cognitive dysfunction during the early stages after injury and later on in the recovery process, Ranseen, Bohaska, and Schmitt (1990) measured self- awareness in traumatic

brain injured patients using patient and staff rating within the first week of admission to an inpatient rehabilitation unit and again at discharge. Their findings suggested that patients initially exhibited very poor self-awareness, and did not change significantly over a 1 month period. In another study, Prigatano, Fordyce, Zeiner, Roueche, Pepping, and Wood (1986) note that when brain injured patients were asked, during neuropsychological interviews, to rate severity of their behavioral problems, they often underestimated the severity of the problem compared to relatives' report. This finding suggests that impaired self-awareness after brain injury has important diagnostic and rehabilitation implications. They further postulate that "it often appears that severely brain-injured patients do not adequately perceive significant changes in their higher cerebral functioning" (p.111). Similarly, Fordyce and Roueche (1986), using the Patient Competency Rating Scale, compared behavioral ratings made by patients, relatives, and rehabilitation staff over the course of an intensive rehabilitation program for three groups of 28 seriously brain-damaged patients (aged 19-44 yrs). Group one included patients with perspectives similar to those of their social environment in that they had more initial emotional distress and showed non-significantly less neuropsychological impairment than did participants in groups two and three, who greatly underestimated their impairments compared to staff and relative ratings. Ratings of group two participants became better aligned with staff members and relatives' perspectives at discharge, while group three demonstrated increased divergence from staff and relative ratings. By discharge, group one had reduced emotional distress, while distress increased for groups two and three. Their results suggested that patients typically rated themselves "higher" (more competent) than did their relatives and rehabilitation staff.

Oddy, Coughlan, Tyerman, and Jenkins (1985) revealed the importance of an impaired awareness of behavioral limitations after traumatic brain injury in their study where they asked patient and their families to describe the behavioral problems they encountered seven years after traumatic brain injury. In addition to difficulties with memory, they also reported that 40% of the patients refused to admit to difficulties. Prigatano (1991) suggests that such refusal may be more than psychological denial, but may reflect what might broadly be called "organic" unawareness. Their difficulty with accurately perceiving themselves within the context of the external environment may affect their interpersonal relationships and have catastrophic social consequences (Fordyce & Roueche, 1986; Ranseen, Bohaska, & Schmitt, 1990; Zillmer & Spiers, 2001).

In addition to faulty perceptions within the context of the external environment, social participation is also compromised following injury, primarily because of cognitive and emotional/behavioral changes (Finest, Dyrnes, Krogstad, & Berstad, 1996), as well as the difficulty judging most facets of social information (McDonald & Flanagan, 2004). Global social indicators usually reveal difficulties in many areas of community functioning following traumatic brain injury, in comparison to their lives before injury (Rath, Hennessy, & Diller, 2003).

In a study conducted by Brown, Gordon, and Spielman (2003), individuals with traumatic brain injury were compared to their non-disabled counterparts within the context of engaging in social-recreational activity. Consistent with prior reports (Mukherjee, Heller, & Alper, 2001; Schretlen et al., 2000), the non-disabled group was more active than the brain-injured group. Similarly, according to a study conducted by

McDonald and Flanagan (2004), in comparison to their non-injured counterparts, those with traumatic brain injury had marked difficulty in social perception in terms of emotion recognition and social communication. These findings may provide additional implications related to the difficulty this groups encounters when trying to participate in social settings.

Self-Awareness in ADHD and/or Learning Disabilities

Similar to research citing the relationship between executive dysfunction and impaired self-awareness in clinical cases studies of children and adults who have sustained frontal lobe damage (Luria, 1973; Shallice, 1982; Stuss & Benson, 1984), Gerdes et al. (2005) found comparable results in a population of children with attention deficit hyperactivity disorder. In their study, children with attention deficit hyperactivity disorder were much more likely than comparison children to overestimate their competence relative to adult report, regardless of who was used as the criterion rater (teacher, mother, or father). It appeared as though children with this disorder inflated their self-perceptions the most in domains of greatest deficit.

There is also some overlap between ADHD and various kinds of learning disabilities (Cantwell & Satterfield, 1978; Levine, Busch, & Aufseeser, 1982). Seidman et al., (1995) have suggested that persons with ADHD and comorbid learning disabilities have more severe executive deficits than persons without learning disabilities. They suggest that this may be attributed to the additive effect of combining two cognitive disorders that both include attentional and memory dysfunctions. August and Garfinkel (1990), in a study comparing ADHD children with and without accompanying reading disabilities on a range of neuropsychological measures, stated that their combined ADHD

and reading disabled group performed significantly worse than the ADHD group alone on a range of measures in the areas of executive abilities. In a similar study, Tarnowski, Prinz, and Nay (1986) found that the ADHD and learning disabled group was significantly worse on perceptual discrimination on test of continuous performance when compared to those who were diagnosed with ADHD alone (Continuous Performance Test; Weintraub & Mesulam, 1985). Furthermore, Willicutt et al. (2001) found that children diagnosed with both ADHD and reading disabled were more impaired almost entirely on all measures of neuropsychological function compared with individuals with ADHD without a learning disability in reading.

Although a subset of individuals with learning disabilities exhibit disordered executive functioning (August & Garfinkel, 1990; Seidman et al., 1995), which is commonly associated with an impaired self-awareness (Prigtano, 1991), individuals with learning disabilities appeared to be more aware of their struggles in a study which examined the self-perceptions of college students with and without learning disabilities (Cosden & McNamara, 1997). Students were administered the *Self-Perception Profile for College Students* (Neeman & Harter, 1986) which demonstrated that learning disabled students had lower perceptions of their scholastic and intellectual abilities than students without disabilities. Accordingly, students with learning disabilities had lower grades and test scores than their non-disabled counterparts, but reported more social acceptance and support from campus organizations than their non-disabled counterparts. Although individuals with learning disabilities in this sample reported no difference in their perceptions, it is important to consider that those individuals with learning disabilities, who attend college, are a subset of all adults with learning disabilities, and are expected

to differ from the broader population in significant ways (Skinner & Schenck, 1992). For the most part, these students were most likely those who had done well in school, despite their disability.

Although self-awareness was examined in students with and without learning disabilities (Cosden & McNamara, 1997; Renick & Harter, 1989), the aforementioned studies did not have a criterion rater (mother, father, teacher) to determine whether or not there were gaps between their perceived competence and their actual achievements. Also, despite research demonstrating the presence of executive deficits in learning disabled individuals (Faraone et al., 2001), these studies did not include objective measures of executive functioning to determine whether or not potential gaps between perceived competency and actual achievements could be attributed to notable deficits in executive functioning. Therefore, implications regarding the association between self-awareness and executive functioning in learning disabled students could not be made.

As a result of impaired executive functioning, self-awareness has been implicated as a core deficit specific to attention-deficit/hyperactivity disorder (Stuss, 1992), as well as brain injury (Hart et al., 1998). However, despite research implicating the presence of executive impairments in individuals with learning disabilities, there is an absence of studies examining whether or not these individuals exhibit similar deficits in self-awareness as those who are diagnosed with attention-deficit/hyperactivity disorder (Seidman et al., 2001). Therefore, examination of self-awareness and executive functions, in learning disabled college aged adults, presents a reasonable opportunity to further the understanding of executive dysfunction in this population. In turn, this may prevent

interpersonal and academic performances from being compromised and pave the way for intervention methods for this population (Gallup & Suarez, 1986).

A review of the literature demonstrates the association between executive function and self-awareness as cited in clinical cases studies of children and adults who have sustained frontal lobe damage (Luria, 1973; Shallice, 1982; Stuss & Benson, 1984), as well as studies of children and adults with attention deficit/hyperactivity disorder (Cantwell & Satterfield, 1978; Levine, Busch, & Aufseeser, 1982; Seidman et al., 1995). Although self-awareness has been examined in students with and without learning disabilities (Cosden & McNamara, 1997; Renick & Harter, 1989), these studies did not determine whether or not gaps existed between their level of perceived competency and actual achievements. Furthermore, these studies did not include neuropsychological measures of executive functioning, despite research suggesting the presence of executive deficits in learning disabled individuals (Seidman et al., 2001). Implications regarding the association between self-awareness and executive functioning in learning disabled students could not be made. Therefore, this study was designed to further assess the relationship between executive functioning and self-awareness in learning disabled adults with and without executive impairments.

Summary

A review of the literature demonstrates an underlining similarity between the neuropsychological study of brain injury, attention-deficit/hyperactivity disorder, and ADHD with comorbid learning disabilities (Rourke & Grant, 1999). More specifically, there appears to be a direct correlation between an impaired self-awareness and executive dysfunction in individuals with traumatic or acquired brain injury, as well as those free

from insults to the brain (Gerdes et al. 2005; Ownsworth, McFarland, & Young, 2000; Renick & Harter, 1989; Seidman, Diederman, Monuteaux, Doyle, & Faraone, 2001).

However, current research has focused primarily on the self-awareness of traumatic/acquired brain injured individuals (DeHope & Finegan, 1999; Ownsworth, McFarland, & Young, 2000; Newman, Garmoe, Baetty, & Ziccardi, 2000; Prigatano & Klonoff, 1998), as well as those diagnosed with attention-deficit/hyperactivity disorder (Stuss, 1992). More specifically, there is a lack of research examining the relationship between self-awareness and executive functioning among learning disabled adults with and without impaired executive functioning (Cosden & McNamara, 1997; Seidman et al., 2001).

The proposed study is designed to measure the self-awareness of learning disabled college students with and without executive impairment, ages 18 and older. Self-awareness of scholastic competencies will be measured using the Perceived Competence Scale for College Students (Harter, 1986), which taps participants' perceptions of scholastic competency. It is anticipated that differences will exist between learning disabled college students with and without impairments in executive functioning in terms of their perceived scholastic competency. This assumption is based on the research presented by August and Garfinkel (1990), suggesting that having a cognitive disorder influences our levels of perceived competency (Faraone et al., 2001).

The relationship between self-awareness of executive abilities and actual performance on neuropsychological measures will also be assessed. Self-awareness of executive abilities will measured using the Behavior Rating Inventory of Executive Function for Adults (Isquith, Guy, & Gioia, 2005). This self-report questionnaire

produces a Global Executive Composite score which measures the participants' overall perceived level of executive ability in areas of planning ability, organization, sustained attention, working memory, inhibition, set shifting, and self-monitoring. Furthermore, executive deficits will be assessed based on performances on an objective measure of executive functioning (White & Stern, 2001).

Chapter III

METHODOLOGY

Design

The current study used a causal comparative research design, which focused on making group comparisons. This design excluded experimental manipulation of the treatment variables, and therefore, the results could not be used as proof of a cause-and-effect relationship. Rather, this design was used to study phenomenon involving the inherent characteristics of learning disabled college students. This study examined the difference between learning disabled students, with and without impairments in executive functioning, in their self-reported perception of executive ability, as measured by their Global Executive Composite (GEC) score on the Behavior Rating Inventory of Executive Functions (BRIEF) and on their actual executive functioning as assessed with the Neuropsychological Assessment Battery (NAB), an objective measure of executive functioning. Furthermore, this study also examined whether learning disabled students, with impairments in executive functioning, perceived themselves as less competent in their scholastic abilities in comparison to learning disabled students without impaired executive functioning, as measured by the Self-Perception Profile for College Students (Neeman & Harter, 1986).

Participants

The target population, for this study, was learning disabled college students from three private four-year institutions and one 2-year community college. All participants were at least 18-years-old and had been identified through the Office of Disability Support Services as having a specific learning disability in Reading and/or Math. The Office of Disability Support Services posted notice of the research recruitment request to

participate in the office area to recruit for the sample. Once participants were recruited, the research project was introduced by myself, the principal researcher. Students who were willing to participate signed an informed consent that fully explained the study and each participant's rights (see Appendix A & B). Considering this is a "protected population," each participant had to sign consent form signed in order for him/her to take part in the research. Once agreed, each participant was administered the following measures: a) Neuropsychological Assessment Battery-Executive Function Module; b) Behavior Rating Inventory of Executive Functioning; and c) The Self-Perception Profile for College Students. In order to preserve the anonymity and confidentiality of the participant's data, all identifiable information was recorded by administering a number from 1 to 52 to each participant's protocol. Therefore, participants were not be publicly identified.

Despite being identified through the Office of Disability Support Services as having a learning disability, as part of the screening process, the participants were administered additional measures to provide further clarification of the presence of a learning disability. All participants were administered two subtests (Vocabulary and Matrices Reasoning) from the Wechsler Abbreviated Scales of Intelligence (WASI) to obtain an estimated intelligence quotient (IQ) and achievement tests (Word Reading and Numerical Operations subtests) from the Wechsler Individual Achievement Test 2nd edition (WIAT-II) to verify LD/non-LD status using a predicted achievement formula. Therefore, the combined information allowed the researcher to be certain of the participant's qualification status for this particular study, as well as assessing for word

reading capability, which was important for self-report measures. There was no exclusionary criteria for and AD/HD diagnosis.

Method of Sampling

The method of sampling in this study was purposive sampling of students who had been diagnosed with a learning disability. Since the focus was not on drawing a representative sample, but one serving the interest of this research, students who were willing to participate, and had been diagnosed with a learning disability, were recruited from the Office of Disability Support Services to comprise the pool of participants.

Hypotheses

#1. It was expected that there would be statistically significant differences in the Global Executive Composite (GEC) score and overall executive functioning (Neuropsychological Assessment Battery) between learning disabled students with and without impairment in executive functioning.

#2. It was expected that scores on the Self-Perception Profile for College Students would be significantly lower for learning disabled individuals, classified as having impairment in executive function, on levels of perceived competence in scholastic abilities in comparison to learning disabled students without impaired executive functioning.

#3. Among students with learning disabilities, it was expected that significant positive relationships would be observed between perception of competency in scholastic abilities, executive function status (impaired vs. normal), and perception of executive abilities (i.e. Global Executive Composite score). More specifically, perceived

competency would be predicted by executive function status and perception of executive abilities.

#4. It was expected that levels of perceived competence in scholastic abilities would serve as a significant predictor that could accurately distinguish between learning disabled students with and without impairments in executive functioning.

Instrumentation (see Appendix C)

The measurement devices that were used in this study were the Self-Perception Profile for College Students (Harter, 1986), Behavior Rating Inventory of Executive Functions-Adult (Gioia, Isquith, & Guy, 2000), and the Neuropsychological Assessment Battery-Executive Functions Module (White & Stern, 2001). The Self-Perception Profile for College Students (Harter, 1986) was used to measure the self-perception of scholastic competency. The Behavior Rating Inventory of Executive Functions-Adult (BRIEF) was a standardized self-report measure that captured the adults' view of their own executive functions, or self-regulation, in their everyday environment. Lastly, the Neuropsychological Assessment Battery-Executive Functions Module (NAB) was used to objectively measure the participant's performance in executive functioning, including: planning, judgment, conceptualization, cognitive response set, mental flexibility, verbal fluency, and generativity.

Behavior Rating Inventory of Executive Functions-Adult. The BRIEF was a standardized self-report measure that captured the adults' view of their own executive functions, or self-regulation, in their everyday environment. It was designed to be completed by adults between the ages of 18 and 90 years with a minimum fifth-grade reading level, including those with a wide variety of developmental disorders and

systemic neurological and psychiatric illnesses such as attention disorders, learning disabilities, autism spectrum disorders, traumatic brain injury, multiple sclerosis, depression, and schizophrenia.

The BRIEF-A was composed of 75 items, with nine overlapping theoretically empirically derived clinical scales that measure different aspects of executive functioning, including: inhibition, shifting, emotional control, self-monitoring, initiation, working memory, planning, task monitoring, and organization. The clinical scales combined to form two broader indexes, the Behavioral Regulation Index (BRI) and the Metacognition Index (MI), and one summary composite score, the Global Executive Composite (GEC) (Roth, Isquith, & Gioia, 2005). For the purposes of this research, the Global Executive Composite (GEC) score was used as a summary score that incorporated all of the clinical scales of the BRIEF-A (Inhibit, Shift, Emotional Control, Self-Monitor, Initiate, Working Memory, Plan/Organize, Task Monitor, and Organization of Materials). It was an accurate reflection of the adult's perceived level of executive dysfunction (Roth, Isquith, & Gioia, 2005). The BRIEF-A also included three validity scales: Negativity, Infrequency, and Inconsistency.

For the self-report form normative sample, internal consistency was moderate to high, with alpha coefficients ranging from .73 to .90 for the clinical scales and from .93 to .96 for the indexes and the Global Executive Composite score. A similar but higher pattern of statistics was found for the self-report form mixed clinical and healthy adult sample, with alpha coefficients ranging from .80 to .94 for the clinical scales and from .96 to .98 for the indexes and the Global Executive Composite. Test-retest was examined for a subset of healthy adults for the self-report form (n = 50; 22 males, 28 females; age

range = 20 to 72 years). Test-retest correlations across the clinical scales ranged from .82 to .93 over an average interval of 4.22 weeks. The test-retest correlations were .93 for both the Behavioral Regulation Index and the Metacognition Index, and .94 for the

Regarding administration, I provided a pencil and verbal instructions to the respondent, emphasizing the importance of responding to all items on the form. I explained that the BRIEF-A was composed of 75 items and would take approximately 15 minutes to complete. Once the form was completed and collected, I reviewed it for blanks or multiple responses. If some were found, the participant was asked to go back and respond to the skipped items or to clarify any ambiguous responses. Upon completion, I used the Scoring Sheet to calculate the scale raw score for each of the nine clinical scales, the two indexes, and the overall composite. The respondent's item responses were reproduced as circled item scores on the Scoring Sheet, with 1 corresponding to *Never (N)*, 2 corresponding to *Sometimes (S)*, and 3 corresponding to *Often (O)*. The circled score for each item was summed for each column and entered in the box at the bottom of the page.

On the Scoring Summary/Profile Form, I recorded the respondent's demographic information in the spaces provided and transferred the total scale raw scores from the Scoring Sheet to the Raw score column in the Scoring Summary Table. To calculate the Behavioral Regulation Index (BRI) raw score, I summed the raw scores obtained for the Inhibit, Shift, Emotional Control, and Self-Monitor scales. To calculate the Metacognition Index (MI) raw score, I summed the raw scores obtained for the Initiate, Working Memory, Plan/Organize, Task Monitor, and Organization of Materials scale. Finally, to calculate the Global Executive composite (GEC) raw score, I summed the BRI

and MI raw scores or the sum scores for all nine clinical scales (Inhibit, Shift, Emotional Control, Self-Monitor, Initiate, Working Memory, Plan/Organize, Task Monitor, and Organization of Materials).

In an effort to convert raw scores to T scores, normative conversion tables were provided in the BRIEF-A manual. T-scores provided information about an individual's scores relative to the scores obtained by respondents in the normative sample. For example, a T-score of 70 indicated that the individual's score was two standard deviations above the normative sample mean and equals or exceeds the scores of approximately 95% of the respondents in the normative sample. Higher raw scores, percentiles, and T scores indicated greater degrees of executive dysfunction. Traditionally, T scores at or greater than 65 are considered clinically significant.

Self-Perception Profile for College Students. This questionnaire was designed to investigate 13 domains of self-awareness in terms of competencies and abilities. They include: creativity, intellectual ability, scholastic competence, job competence, athletic competence, appearance, romantic relationships, social acceptance, close friendships, parent relationships, finding humor in one's life, morality, and global self-worth. Each of these content domains had four items per subscale and each subscale could have been administered independently of the others. For the purposes of this study, only the scholastic competency scale was used.

In order to offset the tendency to give socially desirable answers, a question format was used that asks the student to indicate which of two types of students they are most like (i.e., some students like the kind of person they are but other students wish that they were different). The format implies that while some students share one type of self-

perception, other students may feel quite differently, thus students were asked to identify with the reference group that was appropriate for them. With this format, the student was first asked which kind of student he or she is most like; the student then decided whether that description was "sort of true" or "really true" for him or her. Each item was scored from 1 to 4, where a score of 1 indicated low perceived competence, and a score of 4 reflected high competence. Reliabilities of the four item Self-Perception subscales were assessed by coefficient alpha, an index of internal consistency. Across subscale, these values ranged from .76 to .92 (Harter, 1986).

Neuropsychological Assessment Battery (NAB). The Neuropsychological Assessment Battery (NAB) is a comprehensive, modular battery of neuropsychological tests developed for the assessment of a wide array of cognitive skills and functions in adults aged 18 years to 97 years. The NAB consisted of six modules: a Screening Module and five domain-specific modules: Attention, Language, Memory, Spatial, and Executive Functions. Each NAB module had two equivalent/parallel forms (Form 1 and Form 2) created with identical task/content specifications and development methods.

For each domain-specific module, a module index score was calculated as the sum of selected primary T scores in that module, summarizing the examinee's performance on that module. All of the modules were co-normed on the same individuals, therefore examiners can choose to administer the entire NAB or administer only specific modules, based on clinical or research needs. For the purposes of this research, the Executive Function battery was the only module administered. The Executive Functions Index was based on the primary scores of the Mazes (MAZ), Judgment (JDG), Categories (CAT), and Word Generation (WGN) tests. Executive

Functions Indexes below 85 were indicative of impaired overall executive functioning, and scores of 85 or higher were indicative of non-impaired overall executive functioning. The Executive Function Index score was interpreted as an overall marker of planning, judgment, conceptualization, cognitive response set, mental flexibility, verbal fluency, and generativity.

The NAB was created over a 7-year period of time. The reliability of selected NAB tests was estimated from the item scores or subsets of item scores from a single administration. The internal consistency was examined using alpha coefficients. The range of alpha coefficients is quite diverse for the six modules, when averaged or both forms across age groups. For the Executive Functions Module, the alpha coefficients ranged from .45 for Judgment (JDG) to .77 for Mazes (MAZ). The stability of NAB scores was assessed by using both Form 1 and Form 2 and sampling across a wide age range. The test-retest sample consisted of 95 individuals who were tested twice, with an average test-retest interval that exceeded 6 months. The Executive Function Module coefficients range is from .43 for Judgment (JDG) to .64 for Word Generation (WGN).

The intercorrelations for the NAB demographically corrected standardized scores range from .16 to .45. The Total Screening Index correlated very strongly with the Screening Domain scores, ranging form .53 to .70. A similar pattern was found for the module index score intercorrelations. The correlations were all positive and all range from the .40s to .50s. For the Executive Functions primary scores, the intercorrelations were all positive and most were in the moderate range. Each Executive Functions Module primary score correlated more strongly with the Executive Functions Index score than with the other module index scores. In summary, the intercorrelations among the

Screening Domain scores, module index scores, and module primary scores generally showed a consistent pattern of convergent and divergent validity. In all cases, the module primary sores correlate most highly with the module index score that subsumes them (White & Stern, 2003).

Regarding administration, the participants were asked to complete the Mazes (MAZ), Judgment (JDG), Categories (CAT), and Word Generation (WGN) tests. On the Mazes subtest, the participant was instructed to complete mazes within a specified amount of time. There were a total of seven mazes, however, the participants' performance determined whether or not the subtest would be discontinued. For example, discontinuation criteria would have been met after three consecutive scores of zero. Scores from 0-2 are given based upon how quickly the respondent finished the maze and whether or not it was correct. The Judgment task required the participant to answer questions such as, "Why should you blow out candles before going to bed?" Similar to the first test, a score between 0-2 was be given based upon the thoroughness and relevance of the answer provided. There were no discontinuation rules therefore, the entire subtest was to be administered. Categories was a subtest that exposed the participant to a page with six boxes with pictures of people in them, as well as information about each person. Using all the information on the page, the participant was instructed to divide the six people into two groups, with each group having at least two people in it. For example, one way to divide the people was by gender, so one group would be men and the other group would be women. The participant was given 240 seconds to come up with as many different two-group categories. These responses are recorded verbatim and were scored from 0-2 based upon the quality of the response. This

subtest was repeated again but with a different group of pictures. The last subtest was Word Generation. Participants were given 120 seconds to make as many 3-letter words as possible using the letters *a, o g, k, m, n, r, t.* For example, you could use the *t* the *o* and the *y* to create the word *toy*. For each three-letter word that met criteria, the participant earned one point.

Each subtest produced a total raw score that was converted to z-scores, then finally to t-scores/percentiles. T-scores were used to determine an Index Score. Executive Functions Indexes below 85 were indicative of impaired overall executive functioning, and scores of 85 or higher were indicative of non-impaired overall executive functioning. However, assessment of the participant's strengths and weaknesses in the specific areas of executive functioning tested in the NAB was based on the individual test scores from the Executive Functions Module.

In terms of performances, an Executive Function Index score below 85 resulted in an impaired performance on the four administered subtests. For example, on the Mazes (MAZ) subtest, an interpretation of impaired performance may have included difficulties with planning and foresight, but may have also been associated with reduced impulse control and decreased psychomotor speed. On the Judgment (JDG) subtest, an impaired performance is likely a result of poor problem solving, poor knowledge of important aspects of home safety and health/medical issues, and possibly reduced decisional capacity in these areas. An impaired performance on the Categories (CAT) subtest could be the result of poor concept formation, cognitive response set, mental flexibility, and generativity. Lastly, on the Word Generation (WGN) subtest, an impaired performance

would likely result in reduced generativity or verbal fluency, poor self-monitoring, and perseverative tendencies.

Data Collection Methods

All students participated in a one-hour administration session where they completed two self-report questionnaires and participated in the administration of objective measures of executive functioning. The first self-report measure, the Self-Perception Profile for College Students (Harter, 1986), was designed to investigate the participant's perception of scholastic competency. This took the participant approximately 10 minutes to complete. The second self-report measure, the Behavior Rating Inventory of Executive Functions-Adults (BRIEF-A), was then administered. This was a standardized self-report measure that captured the adults' view of their own executive functions, or self-regulation, in their everyday environment and took the participant approximately 15 minutes to complete.

Upon completing the questionnaires, I administered four subtests measuring executive functioning, derived from the Neuropsychological Assessment Battery, which objectively examined executive function abilities. This portion of the administration took approximately 30 minutes, depending on the severity of impairment. After testing administration was completed, students were given a token of appreciation for their participation in the study.

Data Analyses

For the purposes of analyzing self-awareness and executive functions in learning disabled college students, several statistical methods were implemented. In order to determine whether differences existed between learning disabled students, with and

without impairments in executive functioning, in their self-reported perception of executive ability and on their actual executive functioning, a multivariate analysis of variance (MANOVA) was implemented. If the MANOVA was significant, follow-up analyses could assess whether there were differences among groups on the population means for certain dependent variables and for particular linear combinations of the dependent variables. This would then require analyses of variances (ANOVA) on each dependent variable. Post hoc analyses to significant univariate ANOVA's would then be conducted.

A one-way analysis of variance was used to determine whether learning disabled participants with impairment in executive functioning perceived themselves as less competent in the area of scholastic competency, in comparison to learning disabled participants without executive impairment, as measured by the Self-Perception Profile for College Students (1992).

A multiple regression analysis would determine if level of perceived scholastic competency could be predicted by executive function status (impaired vs. normal) and perception of executive abilities (i.e., Global Executive Composite score) regardless of impairment status in executive functioning.

A discriminant function analysis was used to determine whether perceived ability in scholastic competency could predict the participant's status as learning disabled/executively impaired or learning disabled/no impairment in executive functioning. Alpha was set at the traditional $p \leq .05$ level of significance for all analyses in this study.

Power Analysis

In order to determine the appropriate sample size for this present study and to have meaningful outcomes, four power analyses were conducted. This study's power analysis used the computer program G*Power (Faul & Buchner, 1992) and employed Cohen's (Cohen, 1988) criteria for effect size. The first hypothesis, comparing learning disabled students with and without executive dysfunction in their ability to accurately perceive levels of executive ability was tested using an F-Test. Assuming the traditional value of alpha = 0.05 and power = .80, with a large effect size, the required total sample size was 52. The second hypothesis, comparing levels of perceived competence in learning disabled students with and without executive dysfunction, was tested using an F-Test. Assuming the traditional value of $a = 0.05$ and power = .80, with a large effect size, the required sample size was 52. The third hypothesis, examining the relationship between levels of perceived scholastic competency, executive status and perception of executive abilities, was tested using an F-test for Multiple Regression. Assuming the traditional value of $a = 0.05$ and power = .80, with a large effect size, the required sample size was 40. The fourth hypothesis, distinguishing learning disabled participants with and without executive impairment on the basis of their perceived academic competency was tested using an F-Test for Multiple Regression. Assuming the traditional value of $a = 0.05$ and power = .80, with a large effect size, the required sample size was 25.

Chapter IV

ANALYSIS OF THE DATA

Demographics

The present study examined $n = 52$ participants, ranging in age from 18 to 52 years ($M = 21.2$, $SD = 6.1$). A closer look at the data indicated that despite being labeled as a "non-traditional" student (e.g., two students in their early fifties), the scores obtained from these individuals were not considered outliers and, therefore, were included in data collection. Gender was closely split with 51.9% ($n = 27$) female and 48.1% ($n = 25$) male participants. Ethnicity of the sample was 38.5% ($n = 20$) Hispanic, 28.8% ($n = 15$) Caucasian, 21.2% ($n = 11$) African American, 7.7 % ($n = 4$) "other", and 3.8% ($n = 2$) Asian. Table 1 summarizes these demographic variables aggregated by executive functioning group.

Descriptive Statistics

Participants were classified with regard to the nature of their learning disability (LD), with 46.2% ($n = 24$) classified with word reading, 40.4% ($n = 21$) with word reading and numerical operation, and 13.5% ($n = 7$) with only numerical operation (LD). Prior to conducting inferential statistical analyses to examine study hypotheses, descriptive statistics for key study variables and neuropsychological instruments administered were estimated and are summarized in Table 2. As observed within the Table, estimated psychometric intelligence was variable with Full Scale scores ranging from 90 (Average) to 130 (Very Superior), however, the mean score of 112 places the sample, overall, within the high average range. Other table values suggest a similar performance in overall neuropsychological performance.

Table 1

Overall Demographic Characteristics (n = 52)

	Executive Functioning +		Executive Functioning -	
	F	%	F	%
Gender				
Female	15	55.6	12	44.4
Male	11	44.0	14	56.0
Ethnicity				
Hispanic	7	35.0	13	65.0
Caucasian	11	73.3	4	26.7
African American	7	63.6	4	36.4
Other	1	25.0	3	75.0

Note. No significant differences were observed for gender ($p = 0.41$) or ethnicity ($p = 0.06$) using chi-square analyses of observed vs. expected cell frequency counts; Mean age = 21.2, ($SD = 6.1$).

Table 2

Descriptive Statistics for Primary Outcome Variables (n = 52)

	M	*SD*	Minimum Score	Maximum Score
Global Executive Composite	54.5	10.5	35	86
WASI Scores				
Vocabulary	56.7	7.9	38	72
Matrix Reasoning	56.8	6.0	39	67
FSIQ	112.1	9.4	90	130
WIAT Scores				
Word Reading	92.8	11.0	68	121
Numerical operations	102.0	15.8	15	128
NAB Scores				
Mazes	40.9	10.2	23	58
Judgment	46.7	9.0	29	68
Categories	43.4	4.9	32	53
Word Generation	48.8	8.8	33	66
Executive Functioning Overall	88.0	13.2	69	114
Self Perception	2.5	0.9	1	4

Note. GEC score based on Behavior Rating Inventory of Executive Functions-Adult (BRIEF); WASI = Wechsler Abbreviated Scale of Intelligence; WIAT = Wechsler Individual Achievement Test; NAB = Neuropsychological Assessment Battery; Self Perception based on Self-Perception Profile for College Students.

Study Hypotheses

Hypothesis 1

The first study hypothesis posited that there would be statistically significant differences in the Global Executive Composite (GEC) score and the overall executive functioning (Neuropsychological Assessment Battery, NAB) between learning disabled students with and without impairment in executive functioning. The initial statistical analysis plan called for the use of a multivariate analysis of variance (MANOVA) to test this hypothesis. However, given that executive functioning status was determined by scores on the NAB, it was determined that allowing the NAB score to serves as both an independent and a dependent factor within the same analysis would be inappropriate. Therefore, given that GEC was the only dependent variable within this model, a t-test was employed to compare the mean scores.

Results of the t-test indicated that there were no significant differences between learning disabled students in their GEC score and overall executive functioning, either with ($M = 56.8$, $SD = 9.7$) or without ($M = 52.2$, $SD = 11.0$) impairments, $F(1, 50) = 2.6$, $p = 0.12$).

It was further postulated that these findings may be do, in part, to the presence of confounding variables that did not allow for the most appropriate distribution of variance, thereby limiting the chance for statistical significance. In order to examine this possibility, Hypothesis I was re-examined using analysis of covariance (ANCOVA), in which age, estimated psychometric intelligence, word reading, and numerical operations were each entered as covariates across four, independent ANCOVAS with GEC as the dependent measure of executive functioning.

The results are summarized in Table 3. As observed within the table, no significant group differences emerged when covariates were incorporated into the model. There were, however, trends toward significance when FSIQ ($p = 0.07$), Word Reading ($p = 0.07$), or Numerical Operations ($p = 0.08$) served as covariates (see Table 3).

Table 3

Source Values for Hypothesis I Exploratory ANCOVAS

Source	*SS*	*Df*	*MS*	*F*	*p*
Covariate: Age	49.1	1.0	49.1	0.5	0.5
GEC	267.1	1.0	267.1	2.5	0.12
Error	5279.6	49.0	107.7		
Covariate: FSIQ	146.0	1.0	146.0	1.4	0.25
GEC	372.8	1.0	372.8	3.5	0.07*
Error	5182.6	49.0	105.8		
Covariate: Word Reading	392.3	1.0	392.3	3.9	0.05
GEC	353.2	1.0	353.2	3.5	0.07*
Error	4936.3	49.0	100.7		
Covariate: Numerical Operations	182.2	1.0	182.2	1.7	0.19
GEC	334.4	1.0	334.4	3.2	0.08*
Error	5146.5	49.0	105.0		

Note. Dependent variable = Global Executive Composite (GEC). *p-value trending toward statistical significance.

Hypothesis 2

The second study hypothesis suggested that scores on the Self-Perception Profile for College Students would be significantly lower for learning disabled students classified as having impairment in executive function than learning disabled students without impaired executive functioning. This hypothesis was tested using ANOVA with group (executive function vs. executive dysfunction) entered as the independent variable and Self-Perception Profile for College Students scores entered as the dependent variable.

The results indicated that, as expected, participants without impairment in executive functioning ($M = 3.0$, $SD = 0.62$) scored significantly higher on the Self-Perception Profile for College Students than participants with impairment in executive functioning ($M = 2.1$, $SD = 0.9$); $F(1, 50) = 19.1$, $p < 0.001$.

Hypothesis 3

The third hypothesis posited that perceived scholastic competency would be predicted by both actual executive function status (NAB) and by *perception* of executive abilities (GEC). This hypothesis was tested using standard linear multiple regression analysis with competency entered as the dependent variable and actual and perceived executive functioning entered as predictor variables.

The results revealed a significant model, $F(2, 49) = 7.0$, $p = 0.002$, that accounted for 22.2% ($R = 0.47$) of the variance in competency. Notably, among the entered predictors only the NAB executive functioning overall score emerged as significant, indicating that *actual* executive functioning predicted competency, but *perceived* (GEC) scores did not (See Table 4).

Table 4

Standard Coefficients for Scholastic Competency Multiple Regression Analysis

	Beta	*t*	*P*	Partial
(Constant)		-0.48	0.64	
Actual: NAB Overall	0.48	3.70	0.00	0.47
Perceived: GEC	0.05	0.41	0.68	0.06

Hypothesis 4

The fourth study hypothesis expected that levels of perceived competence in scholastic abilities would serve as a significant predictor that accurately distinguishes learning disabled students with impairments in executive functioning from learning disabled students without impairments in executive functioning. This hypothesis was examined using a discriminant function analysis (DFA) with scholastic ability entered as the predictor and group (LD with executive functioning impairment vs. LD without executive functioning impairment) entered as the criterion.

The results indicated that a significant, predictive, classification model emerged, $X^2 = 16.0, p < 0.001$) that classified 76.9% ($n = 40$ accurately identified and validated) correctly (Wilks' Lambda = 0.723). Further examination of this hypothesis using a bivariate correlation (self perception of abilities in scholastic competency and NAB overall score), revealed a significant relationship between these two variables, $r(50) = 0.47, p < 0.001$), thereby supporting the predictive value of the proposed discriminant model and the shared variance between self-perception of abilities in scholastic competency and executive functioning.

Chapter V

DISCUSSION

Summary and Conclusions of Research

The present study examined the relationship between executive function and self-awareness of cognitive ability in college students diagnosed with learning disability and known executive dysfunction. As it has been well established that individuals with frontal lobe sequelae often have a limited awareness of deficits, this study was believed to be an important addition to the scientific literature that ultimately may enhance our understanding regarding the implications of executive dysfunction among students with learning disabilities. The current study required a causal comparative research design used to examine phenomenon involving the inherent characteristics of college students with learning disabilities. This target population was recruited from the Office of Disability Support Services from three private 4-year institutions and one 2-year community college. In light of the research focus, the study required purposive sampling of students who have been diagnosed with a learning disability.

As mentioned previously, the term *executive functioning* adequately describes that aspect of frontally mediated cortical functioning that has to do with managing, structuring and directing behavior (Stuss & Knight, 2002). Research suggesting that individuals who demonstrate impaired executive functioning also exhibit an impaired capacity for self-awareness of competencies (August & Garfinkel, 1990) has been derived largely from clinical case studies involving patients who have sustained head injuries. Hart et al. (1998), for example, examined individuals with severe brain injuries and found that impairments in executive functioning that included lack of awareness and self-

monitoring, prevented participants from demonstrating awareness of their functional deficits on neuropsychological measures. Again, the results of this study and other similar studies (Barkley, 1997; Gerdes et al., 2005; Pennington et al., 1993), was a crucial part of the scientific literature that establishes the relationship between executive functioning and self-awareness. However, these studies mostly investigated executive dysfunction, a sequelae common in many traumatic brain injuries (Luria, 1973; Shallice, 1982; Stuss & Benson, 1984). There is a paucity of research, however, investigating the relationship between executive functioning and developmental diagnoses such as AD/HD and/or learning disabilities, which are also characterized by similar deficiencies in self-awareness (August & Garfinkel, 1990; Stuss & Knight, 2002).

Although there have been a number of recent studies examining students with learning disabilities, studies conducted within institutions of higher education, are still quite limited, as it primarily does not go beyond the scope of contributory factors predicting college success. Contributory factors including poor social and interpersonal skills (Vaughn et al., 1990), multiple diagnoses (Seidman et al., 2001), and psychological distress (Heiman & Precel, 2003) have been well documented. However, deficits in executive functioning, particularly in areas of attention and awareness, as being one of the potential contributory factors, was only recently introduced into the literature (Seidman et al., 2001).

More specifically, since executive functioning is responsible for the management of behavior and capacity for self-awareness, students with a deficiency in this area may have difficulty with coping, performing tasks, and/or achieving personal goals, and thus contribute to school failure (Gallup & Suarez, 1986). This prompted an interest in

exploring how deficits in executive functioning influence learning and its generalization to everyday functioning (Belmont, Ferretti, & Mitchel, 1982), especially within the context of an academic environment where neuropsychological impairments in executive functioning could possibly account for school difficulty and have significant implications for these students' interpersonal and academic performances (August & Garfinkel, 1990; Seidman et al., 2001).

Therefore, the primary hypothesis tested was that college students with learning disabilities and known executive dysfunction would have both a poorer perceived expectation and a poorer actual performance on neurocognitive tests of executive function. While the results of this primary hypothesis did not find support in the sample of participants assessed, a number of important findings did emerge that enable a better understanding of students with learning disability and executive dysfunction. The ensuing discussion shall summarize and explain key study findings with an eye towards identifying clinical implications and areas for future study.

Hypothesis 1

The basic objective of the first hypothesis was to determine if there were differences between participants with and without executive dysfunction in accuracy of reporting perceived level of executive ability (BREIF) and actual level of executive functioning (NAB) among college students with learning disabilities. Contrary to expectation, no significant differences were obtained and the results revealed that learning disabled students, with or without impairments in executive functioning, did not demonstrate differences in perceived or actual executive functioning. As this finding is inconsistent with the established scientific literature, the link between impaired executive

functioning and self-awareness was examined further in a *post-hoc* analysis that attempted to control for the presence of potential study confounds that may have impacted the results obtained. However, despite statistical control of age, estimated psychometric intelligence, and academic performance, there continued to be no significant group differences. These results suggest that even with executive deficits, students with learning disabilities were found to be just as accurate in reporting their perceived level of executive abilities in comparison to learning disabled students without such impairments.

Although this finding is not consistent with a wide body of work indicating the relationship between executive functioning and self-awareness, several possible explanations should be considered. First, it is difficult to make a direct comparison between the results of this study and the current established literature. This is primarily due to potential population differences, as much of what is known about prefrontal functioning derived from clinical case studies of adults who have sustained traumatic brain injury (Luria, 1973; Shallice, 1982; Stuss & Benson, 1984). More specifically, these TBI case studies might not be readily generalized to the learning disability population. Indeed, deficits in executive functioning demonstrated among the participants in this current study, in general, are likely to be substantially less severe than clinical samples of patients with traumatic brain injury. Given this, a direct generalization of findings from the empirical literature might not be readily expected.

In addition, it is important to consider the possibility of other unaccounted variables that may have impacted results. One such consideration, for example, is the amount of remediation and/or knowledge, regarding their disability, these participants

have gained throughout their academic careers. That is, they could have learned compensatory strategies which are methods used compensate for weaknesses through exercise and practice to circumvent their cognitive difficulties. For example, the use of external aids (e.g. memory notebook systems, alarms, calendars, labeled shelving, etc.) and internal aids (e.g. rehearsing information, mnemonic devices, visual imagery, verbal pegs, etc.) can often be useful in helping students with learning disabilities meet the demands of higher learning. This is especially important to consider since participants were recruited from the Office of Disability Support Services associated with their respective college/university. Therefore, it is possible that these students may be somewhat familiar with their disability and have some level of awareness regarding their weaknesses, limitations, and needs.

This explanation is supported by a study that examined the self-perceptions of college students with and without learning disabilities, which revealed that students diagnosed with a learning disability appeared to be more aware of their struggles (Cosden & McNamara, 1997). Therefore, similar to Cosden and McNamara's (1997) findings, it may not be unusual that the participants in this study were found to be accurate reporters, if we consider the possibility that they have, most likely, encountered academic difficulty and are subsequently aware of their limitations, despite having impaired skills in executive functioning.

Hypothesis 2

The second question proposed in this study sought to explore whether learning disabled students, with impairments in executive functioning, perceived themselves as less competent in their scholastic abilities in comparison to their learning disabled

counterparts without impairments in executive functioning. This question was prompted by previous research examining the extent to which students with learning disabilities feel negatively about themselves, since by definition these students have experienced academic failure and/or difficulty. Previous research revealed that students with learning disabilities evidenced worse feelings about themselves than do students without learning disability (Rogers & Saklofske, 1985). For example, in a study headed by Renick and Harter (1989), learning disabled children's self-perceptions were investigated using the Perceived Competence Scale for Children (Harter, 1982). Results indicated that learning disabled students, grades three through eight, perceived themselves as being less academically competent when compared with students without learning disabilities. As previously mentioned, in a study conducted by Cosden and McNamara (1997) examining the self-perceptions of college students with and without learning disabilities, it was found that individuals with learning disabilities appeared to be more aware of their struggles. These students were administered the Self-Perception Profile for College Students (Neeman & Harter, 1986) which demonstrated that learning disabled students had lower perceptions of their scholastic and intellectual abilities than students without disabilities.

In light of this relevant literature, this study hypothesized that scores on the Self-Perception Profile for College Students (Harter, 1986) would be significantly lower for students with learning disability, classified as having impairment in executive functioning, on levels of perceived competence in scholastic abilities, in comparison to learning disabled students without impaired executive functioning. As anticipated, students with learning disabilities and impairments in executive functioning perceived

themselves as less competent in the area of scholastic ability in comparison to those students without executive deficits. This finding is not only consistent with the current literature, but it also has important clinical implications relevant to working with students with disabilities. Specifically, students with learning disabilities often have greater difficulty managing academic demands, adjusting to larger class sizes, and to the less structured university life (Heiman & Precel, 2003). From a clinical perspective, these challenges may provoke and/or exacerbate feelings of inadequacy and low self-esteem, which in turn, may significantly impact the interpersonal and academic growth of these students and subsequently prevent them from attaining personal and academic success (Thomas, 2000; Wolf, 2001). Thus, when working clinically with these students, practitioners should be sensitive to the inherent struggles these student's encounter, as well as encourage peer groups where students enduring similar academic struggles may help normalize feelings of frustration and foster interpersonal and academic growth.

Hypothesis 3

The third study hypothesis posited that perceived scholastic competency would be predicted by both *actual* executive function status (NAB) and by *perception* of executive abilities (GEC). As it is important to have a clear understanding for the various factors that might predict scholastic competency in students with learning disability, this third study hypothesis posited that perceived scholastic competency would be predicted by both actual executive function status (NAB) and by perception of executive abilities (GEC). The results revealed that, of the two variables, only actual executive functioning emerged as a significant predictor of scholastic competency.

Although previous studies have established that learning disabled students had lower perceptions of their scholastic and intellectual abilities than students without disabilities (Neeman & Harter, 1986), other predictors of scholastic competency, to include actual function status, is a unique addition to the empirical literature provided by this current study. This is an important finding with significant implications for how professionals can address feelings of inadequacy within this population. While the results of this study suggest that one's perceived performance on measures of executive functioning did not predict scholastic competency, it remains important to consider how these results generalize to the larger population of students with disabilities, as well as students who may be unidentified.

First, actual performance on tests of executive functioning may have had important implications for how the participants in this study internalized scholastic competency. Specifically, in the second hypothesis it was learned that learning disabled students with deficits in executive functioning perceived themselves as less competent in the area of scholastic ability, one might consider that the outcome of this third hypothesis indicated that a poorer performance on measures of executive functioning predicted a lower level of perceived scholastic competency. On the contrary, a stronger performance on these measures would predict a higher level of perceived scholastic competency. Thus, having evidence of how these students internalize their scholastic competency may help inform treatment and academic planning.

More specifically, from a clinical perspective, this is an important finding, as remediating deficits and strengthening skills in problematic areas, in general, will have significant implications for these students' interpersonal and academic performances.

However, since the development of self-awareness in children is viewed as gradual, and by middle childhood, children are able to comprehend both a general or global sense of themselves (Harter, 1983, 1986), it is crucial to begin the process of remediation earlier. That is, with increased cognitive capacity adolescents and college-aged individuals display further differentiation of self-awareness and have had more time to internalize negativistic perceptions of their abilities (Shapka & Keating, 2005).

Although the results of this study suggest that actual performance served as a predictor of perceived scholastic ability, we cannot begin to remediate learning deficits, and in turn, improve overall perception of competency, if learning disabled students are not being classified. Therefore, the second point of reference includes a discussion about students with unidentified learning disabilities who navigate through the school system without the proper supports and remediation, and the resultant interpersonal repercussions associated with continuous school failure and difficulty. Furthermore, even with classification, statistics suggest that the graduation rate among college students with learning disabilities is much lower than those without disabilities (Murray, Goldstein, Nourse, & Edgar, 2000). From this perspective, it becomes apparent that the primary objective is to, first, identify learning difficulties early in a student's academic career, and secondly, remediate deficits by teaching compensatory strategies. As mentioned previously, strategies such as the use of external (e.g. memory notebook systems, alarms, calendars, labeled shelving, etc. and internal aids (e.g. rehearsing information, mnemonic devices, visual imagery, verbal pegs, etc.) can often be useful in helping students with learning disabilities circumvent the demands of higher learning. The end result should

help improve academic performance and subsequently the students' perception of competency and overall self-esteem.

Hypothesis 4

The fourth study hypothesis expected that levels of perceived competency in scholastic abilities would serve as a significant predictor that accurately distinguishes learning disabled students with impairments in executive functioning from learning disabled students without these impairments. The results indicated that a significant, predictive, classification model emerged, to include a shared variance between self-perception of abilities in scholastic competency and executive functioning. That is, approximately 77% of the time, based on the participant's self-perception of scholastic competency score, the model could predict whether they belonged to the group with or without impairments in executive functioning. Although this finding continues to emphasize the overall relationship between perception of scholastic competency and executive functioning, a further examination of this hypothesis, using a bivariate correlation, revealed that a higher score in perceived scholastic competency was associated with a higher executive functioning score. Again, there is evidence of a relationship between students with learning disabilities, and impairments in executive functioning, perceiving themselves as less competent in the area of scholastic ability in comparison to those students without executive deficits. The results of this study provide important empirical information regarding contributory factors predicting students' perception of scholastic competency which, in turn, may help clinicians working with this population, as well as pave the way for intervention methods and prevent interpersonal and academic performances from being compromised (Gallup & Suarez, 1986).

Limitations

Although the outcomes of this study revealed significant implications for students with disabilities studying in institutions of higher education, it is important to consider several methodological limitations. First and foremost, the utilization of self-report measures, to include the Behavior Rating Inventory of Executive Functions and the Self-Perception Profile for College Students, may be impacted by the respondent's mood, his or her conceptualization of the questions, respondents' insight and level of awareness, response bias, and the respondent's accuracy of recall. Therefore, an important, but common limitation of the present study is the reliance on self-report inventories to assess self-perception of executive ability and scholastic competency.

In addition to the self-report nature of the BRIEF, this instrument may not accurately reflect all of the components of executive functioning. More specifically, although typically used as a diagnostic measure, the *GEC* is a summary score that incorporates all of the clinical scales of the BRIEF-A which captures an adults' view of their own executive functions in their everyday environment. However, the BRIEF-A is composed of nine clinical scales that measure different aspects of executive functioning. Therefore, combining all nine clinical scales into one score (GEC) may have eliminated valuable data regarding specific details in each of the nine categories.

Another potential study limitation is that the present study did not assess comorbid diagnoses. Although the students were recruited from the Office of Disability Support Services associated with their respective campuses, in an effort to preserve confidentiality, the parameters of the study did not require the students to reveal whether or not they had been diagnosed with a comorbid ADHD diagnosis. However, given that

there is also some overlap between ADHD and various kinds of learning disabilities (Cantwell & Satterfield, 1978; Levine, Busch, & Aufseeser, 1982), such data may have impacted findings and provided valuable information. More specifically, Seidman et al. (1995) suggested that persons with ADHD and comorbid learning disabilities have more severe executive deficits than persons without learning disabilities. They suggest that this may be attributed to the additive effect of combining two cognitive disorders that both include attention and memory dysfunctions. Therefore, having this information may have provided the opportunity for further analysis regarding the severity of executive deficits, and subsequent impaired self-awareness, evidenced in the lives of individuals with learning disabilities who are also diagnosed with ADHD. Future studies would be advised to incorporate this factor.

Furthermore, the parameters of this study did not require the data collection sites to provide information regarding the level of support services they provide for students registered through their office. This is especially important to consider since participants were recruited from the Office of Disability Support Services associated with their respective college/university. Therefore, it is possible that these students may have been somewhat familiar with their disability and had some level of awareness regarding their weaknesses, limitations, and needs. This information could have provided more insight into the lack of significant findings between participants with and without executive dysfunction in accuracy of reporting perceived level of executive ability among college students with learning disabilities.

Another limitation of this research includes the lack of research assistants. That is, I served as the primary investigator, as well as the individual responsible for the

administration and scoring of data. In future research, it will be important to train several qualified research assistants to share this responsibility in an effort to ensure inter-rater reliability and prevent researcher bias tendencies.

Finally, sample size may have been a methodological factor within this sample. The size of the sample collected can have a basic influence on statistical significance. While this study was adequately powered to reject null hypotheses, recruiting a larger sample within a traditionally heterogenous subpopulation may have afforded a better opportunity to obtain statistical significance. This may have been particularly an issue with the primary study hypothesis in which relatively large variances were observed in comparison to mean scores. Thus, a larger sample size may have reduced observed heterogeneity and also afforded better opportunity for generalizability outside of the recruited sample.

Another limitation is the generalizability of results. More specifically, since the study is exclusively examining students with learning disabilities, results can only be generalized to this particular population. Future studies might seek to replicate this study but also include a comparative group of students without learning disabilities. This would allow the researcher to make more general implications. Although generalizability of results may be limited to the small sample size of learning disabled students, the demographics of the sample were diverse which is an important factor regarding the studies external validity. However, even though the sample was diverse, when working with racial and ethnic minority groups or people with disabilities, it is important to be cognizant of within-group variation (Mertens, 1998). Lastly, this study used a causal comparative research design, which focuses on making group comparisons. Therefore,

this design excludes experimental manipulation of the treatment variables and subsequently cannot be used as proof of a cause-and-effect relationship. It is important to note that the nature of the populations assessed precludes randomization, true-experimentation for cause and effect.

Implications for Future Research

Future studies must continue to examine whether there are differences between learning disabled students, with or without impairments in executive functioning, in their ability to accurately report their perceived level of executive abilities. The goal would be to firmly establish the link between impaired executive functioning and poor self-awareness in students with learning disabilities. Doing so will provide useful information for professionals working with these students who can then work towards remediating these deficits and pave the way for intervention methods for this population. When replicating this study, it may be useful to include measures evaluating the participants actual and objective measures of academic performance (i.e. GPA) to determine whether or not it is consistent with their accuracy of reporting perceived level of executive ability and actual level of executive functioning. In addition, it may also be interesting to consider cross-sectional designs examining the effects of executive dysfunction at one point in time across several groups, or in this case grades (e.g. fifth- and ninth-grade students). Since the development of self-awareness in children is viewed as gradual, and by middle childhood, children are able to comprehend both a general or global sense of themselves (Harter, 1983, 1986), a cross-sectional design may provide information regarding when these individuals begin to internalize negativistic perceptions of their abilities (Shapka & Keating, 2005).

Conclusion

Despite these considerations, the premise of this study was to follow-up where previous research fell short in examining neurocognitive test performance in executive functioning and self-awareness with a learning disabled population. The results of this study demonstrate the relationship between self-awareness and executive functions in college students with learning disabilities, and in particular, how executive dysfunction manifests itself and plays a role in one's perception of scholastic competency. These current findings, in conjunction with the established scientific literature regarding students with learning disabilities, perception of competency, and development of self-awareness, demonstrates the importance of beginning the process of remediation earlier in one's academic career (Harter, 1983, 1986). Moreover, based on the outcomes of this study, there is a strong indication that remediating deficits and strengthening skills in problematic areas will likely improve academic performance, and in turn, may have significant implications for these students' interpersonal functioning, as they will most likely feel better about themselves and feel more confident in their abilities. At the very least, the results of this study further establishes the role of executive dysfunction in students with learning disabilities, thus providing important implications for professionals working with this population regarding academic planning.

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Appendix A

INFORMED CONSENT FORM

TITLE OF STUDY: The Relationship between Self-Awareness and Executive Functioning in Learning Disabled College Students with and without Executive Deficits.

RESEARCH STUDY: I _____ have been asked to participate in a research study under the direction of Melissa Fiorito, Ed.S., and her faculty advisor Dr. Laura K. Palmer. Other individuals working as study assistants may assist in this research study.

RESEARCHERS' AFFILIATION: The primary researcher, Melissa Fiorito, Ed.S, is a doctoral candidate of the Counseling Psychology Program in the Department of Professional Psychology and Family Therapy in the College of Education and Human Services at Seton Hall University, South Orange, New Jersey.

PURPOSE OF RESEARCH: The overall purpose of this study is to advance the scientific understanding of the underlying cognitive processes in learning disabilities and how these processes may be affected by impairments of executive functioning.

RESEARCH PROCEDURES: The procedure will last approximately one hour and will consist of a brief neuropsychological assessment battery and questionnaires. The session will take place at Seton Hall University in the Department of Professional Psychology and Family Therapy. Test measurements include standardized self-report questionnaires and objective measures of executive functioning. Once agreed, each participant will be administered the following measures: 1) Neuropsychological Assessment Battery-Executive Function Module; 2) Behavior Rating Inventory of Executive Functioning; 3) The Self-Perception Profile for College Students.

INSTRUMENTS: The first self-report measure, the Self-Perception Profile for College Students (Harter, 1986), is designed to investigate an individual's perception of scholastic competency. This should take approximately 10 minutes to complete. The second self-report measure, the Behavior Rating Inventory of Executive Functions-Adults (BRIEF-A), will be administered. This is a standardized self-report measure that captures adults' view of their own executive functions, or self-regulation, in their everyday environment and should take approximately 15 minutes to complete. Upon completing the questionnaires, the examiner will administer four subtests measuring executive functioning, derived from the Neuropsychological Assessment Battery, which will objectively examine executive function abilities. This portion of the administration will take approximately 30 minutes, depending on the severity of impairment. After testing administration is completed, students will be given a token of appreciation for their participation in the study.

VOLUNTARY NATURE OF THE PROJECT: I understand that I may choose not to participate in the study at any time and may withdraw from the study, without penalty at any time.

PRESERVATION OF ANONYMITY: Each participant's identifiable information will be assigned a random number code for the purpose of preserving the anonymity and confidentiality of each participant's data.

CONFIDENTIALITY: All participant information is confidential.

ACCESS: To assure confidentiality of my study records, each participant's test data will be kept in a locked drawer of which only Melissa Fiorito, Ed.S., and her faculty advisor Dr. Laura K. Palmer, will have access.

RISKS OR DISCOMFORTS: It is not expected that participation in this study will involve significant risk or discomfort. The task may be effortful but there are no significant risks or discomforts likely to be associated with it.

DESCRIPTION OF EXPECTED BENEFITS: There are no expected individual benefits. However, this study is to advance the scientific understanding of the underlying cognitive processes in learning disabilities and how these processes may be affected by impairments of executive functioning. In turn, this study may pave the way for intervention methods for this population. Furthermore, participants will be given a token of appreciation for their participation.

REMUNERATION: An expected benefit of participating in the study is a gift certificate.

COMPENSATION: There will be no compensation for participation since this research does not involve more than minimal risk.

ALTERNATIVE PROCEDURES: There are no alternative procedures that might be advantageous to the participants as there is minimal risk for participation.

CONTACT INFORMATION: If you have any questions regarding the research process please contact Melissa Fiorito at 201-463-1552 or by email at fioritme@shu.edu. Dr. Laura K. Palmer can be contacted at (973) 275-2740. If you have questions regarding your rights as a research participant, you may contact the Institutional Review Board of Seton Hall University at 973-313-6314.

USE OF VIDEO- AND AUDIOTAPE: Neither video-nor-audio tape will be used in this study.

I have read the material above, and any questions I asked have been answered to my satisfaction. I agree to participate in this activity, realizing that I may withdraw without prejudice at any time.

Participant:

*Name:*_____ *Signature:* _____

Date: _____

SIGNATURE OF INVESTIGATOR OR RESPONSIBLE INDIVIDUAL: To the best of my knowledge the participant whose name is entered above has understood the above consent form and the participant's questions have been accurately answered to his/her complete satisfaction.

Investigator:

Name: _____ *Signature:* _____

Date: _____

Appendix B

LETTER OF SOLICITATION

Dear Student,

You are being asked to participate in a research study being conducted through the Department of Professional Psychology and Family Therapy by Melissa Fiorito, Ed.S., a doctoral candidate, and her faculty advisor, Dr. Laura K. Palmer. The primary researcher, Melissa Fiorito, Ed.S., is a doctoral candidate of the Counseling Psychology Program in the Department of Professional Psychology and Family Therapy in the College of Education and Human Services at Seton Hall University, South Orange, New Jersey.

The title of the study is: The Relationship between Self-Awareness and Executive Functioning in Learning Disabled College Students with and without Executive Deficits The term "executive functioning" is apt in describing that aspect of cortical functioning, in the frontal lobes, that has to do with managing, structuring and directing behavior (Stuss & Knight, 2002). Research suggests that individuals who demonstrate impaired executive functioning also exhibit an impaired capacity for self-awareness of competencies (August & Garfinkel, 1990). Therefore, the proposed study is designed to examine the relationship between self-awareness and executive functions in learning disabled college students to further the understanding of this potential relationship. It is believed that studying executive functioning in learning disabled students may pave the way for intervention methods for this population.

The estimated time of participation for each student is approximately one hour and will consist of a brief neuropsychological assessment battery and questionnaires: Self-Perception Profile for College Students (Harter, 1986), Behavior Rating Inventory of Executive Functions-Adult (Gioia, Isquith, & Guy, 2000), and the Neuropsychological Assessment Battery-Executive Functions Module (White & Stern, 2001).

The Self-Perception Profile for College Students (Harter, 1986) will be used to measure the self-perception of scholastic competency. This should take approximately 10 minutes to complete. The Behavior Rating Inventory of Executive Functions-Adult (BRIEF) is a standardized self-report measure that captures adults' view of their own executive functions, or self-regulation, in their everyday environment. This should take approximately 15 minutes to complete. Lastly, the Neuropsychological Assessment Battery-Executive Functions Module (NAB) will be used to objectively measure participant's performance in executive functioning, including: planning, judgment, conceptualization, cognitive response set, mental flexibility, verbal fluency, and generativity. This should take approximately 30 minutes to complete, depending on the severity of impairment. After testing administration is completed, students will be given a token of appreciation for their participation in the study.

Your participation in this study is completely voluntary and you may choose not to participate in the study at any time and may withdraw from the study, without penalty at any time.

Each participant's identifiable information will be assigned a random number code for the purpose of preserving the anonymity and confidentiality of each participant's data. All participant information is confidential.

To assure confidentiality of student records, each participant's test data will be kept in a locked drawer of which only the researchers, Melissa Fiorito, Ed.S. and her faculty advisor Dr. Laura Palmer, will have access.

The primary researcher, Melissa Fiorito, doctoral candidate at Seton Hall University, may be contacted about the research and research participants by phone at 201-463-1552, or email fioritme@shu.edu. Also, her faculty advisor, Dr. Laura K. Palmer, Director of Training at Seton Hall University may be contacted about the research and research participants by phone at Seton Hall University's Department of Professional Psychology and Family Therapy, (973) 275-2740. If you have questions regarding your rights as a research participant, you may contact the Institutional Review Board of Seton Hall University at 973-313-6314.

Thank you for your consideration to participate in this study.

Melissa Fiorito, Ed.S.

Principle Investigator

Laura Palmer, Ph.D.

Faculty Advisor

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