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Effects of Trauma Induced Stress on Attention, Executive Functioning, Processing Speed, and Resilience in Urban Children

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EFFECTS OF TRAUMA INDUCED STRESS ON ATTENTION, EXECUTIVE FUNCTIONING, PROCESSING SPEED, AND RESILIENCE IN URBAN CHILDREN

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Abstract

Brain development, and particularly structures involved in executive functioning, occurs at different rates in children, leading to differential performance in school. Due to neuroanatomical changes secondary to the stress response, children who have experienced stress as a result of poverty and traumatic events may be at increased risk for cognitive difficulties, including attention, executive functioning, and processing speed (Blair, Granger, & Razza, 2005; DeBellis, Hooper, & Sapia, 2005). Prevalence rates among urban children suggest that 70-100% have been exposed to trauma (Dempsey, Overstreet, & Moely, 2000; Macy, Baryry, & Noam, 2003). Some of these children develop posttraumatic stress disorder and some do not, raising the question of resilience (Bonanno & Mancini, 2008). Difficulties with cognitive functioning, as well as the role of protective factors have major implications for school performance (Gathercole, Pickering, Knight, & Stegmann, 2004). The current study examined sustained attention, initiation, working memory, and processing speed and the influence of resilience in 47 underprivileged urban elementary school children, ages 8 through 13, who have experienced stress as a result of poverty and trauma. Data were collected through neuropsychological assessments and participant self-report measures. Results suggested that stronger resilience was associated with fewer difficulties with sustained attention and working memory. These findings have significant implications for resilience training and increased academic supports in the classroom. Suggestions and literature on such programs are provided.

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Chapter I

BACKGROUND

Introduction

The concept of executive functions refers to a set of higher order cognitive skills, which allow purposeful, goal directed activity. Recently, interest in executive functioning as an area of research has re-emerged. Executive functions are of particular interest in children, as the development of these skills parallels the maturational trajectory of the frontal systems (Welsh &, Pennington, 1988). Although the emergence of basic executive skills in infancy has become evident, more complex skills do not fully develop until late adolescence (Mazuka, Jincho, & Oishi, 2009; Bernstein & Waber, 2007). Thus, the variance in development of such functions in children may have significant implications for their performance, behavior, and achievement in school.

While normally developing children may experience difficulties due to an underdeveloped frontal system, children who have experienced stress secondary to traumatic events and poverty may be of even greater risk for problems. A chronic stress response produced by traumatic experiences can affect the neurobiological, emotional, behavioral, cognitive, and interpersonal development of the child (DeBellis, Hooper, & Sapia 2005). Unfortunately, the prevalence rates for trauma are quite high; in a sample of 5,877 Americans, the National Comorbidity Survey (NCS) (as cited in Kessler, Sonnega, Bromet, Hughs, & Nelson, 1995) revealed that 60.7% of men and 51.2% of women had experienced at least one lifetime traumatic event, with many having experienced two or more traumas . It has been suggested that the lifetime prevalence rates of post-traumatic stress disorder (PTSD) in children and adolescents are at least as high or higher than prevalence rates during adulthood (De Bellis, Hall, Boring, Frustaci, & Moritz, 2001).

Unfortunately, chronic stress has deleterious effects on the brain. Neuroanatomical changes have been observed in children who have experienced chronic stress and PTSD, as these negative factors produce harmful sequelae in various brain systems. As a result, impairments have been observed in the cognitive abilities of such individuals. Learning, memory, and concentration have reportedly been affected in adults with PTSD (Vasterling & Brailey, 2005). Early exposure to extreme stress may affect children's neurocognitive development and specifically intellect, verbal abilities, and school performance. The extent of such effects may be a function of the duration and severity of the stressor. Research also suggests that protective factors may help to buffer some of these negative factors leading to resilience in some (Bonanno & Mancini, 2008).

Attention and Executive Functioning

The delineation between attention and executive functioning is quite vague, especially in children whose underlying neurological systems are not fully developed. Some believe that attention and executive functioning are mutually exclusive, but when it comes to measuring these constructs, most agree that they are in fact very difficult to tease apart (e.g. Korkman, 2000). The measurement of one, independent of the other, is not entirely possible as both are required to complete most neuropsychological assessments that seek to measure them. Therefore, these two constructs are frequently discussed together.

William James (1890) said that attention is "the taking possession of the mind in clear and vivid form of one out of what seem several simultaneous objects or trains of thought" (pp. 403-404). Attentional processes involve orienting to a small amount of incoming information and ignoring other input. In this way, an individual can process information by orienting to, selecting, and maintaining focus on information, making it available for cortical processing (Zillmer, Spiers, & Culbertson, 2008).

Attention can refer to many processes including a general level of alertness/ vigilance; a state of arousal; orientation; focused, divided, or sustained mental effort; processing within a specific sensory arena; or capacity (Zillmer et al., 2008). Most researchers now view attention not as a unified system, but as a multifaceted concept including several elements that coordinate to work together systematically to lead to attentive functioning (Mirsky, 1987; Zillmer et al., 2008). Mirsky, Anthony, Duncan, Ahearn, and Kellam, (1991) posited that these elements include the abilities to focus-execute, sustain, encode, and shift.. These elements of attention are supported by distinct brain regions and damage or dysfunction in one of these regions may lead to deficits in a particular aspect of attention (Mirsky et al., 1991). The attentional system implicates multiple behavioral states and cortical processes that are controlled by various cerebral structures (Zillmer et al., 2008).

Interest in the executive functioning of children has increased significantly over the past decade, with particular attention paid to the development of these functions (Bernstein & Waber, 2007). Executive functions are those that include a vast range of abilities such as initiation of behavior, planning in order to complete an activity, self-monitoring and regulation of behavior, and cognitive flexibility (Lezak, 2004).

Executive functioning is a term often used interchangeably with the term *frontal lobe functioning*. The frontal lobes, located in the cerebral cortex, anterior to the central sulcus, are one of the major brain structures that govern these complex functions (Carlson, 2010). The interconnections of the frontal lobes with most other brain regions play a significant role in guiding, directing, integrating, and monitoring behavior that is goal directed (Anderson, Levin, & Jacobs 2002). This can be likened to a conductor of a symphony guiding separate sections of an orchestra to produce an integrated performance.

Processing Speed

Cognitive processing speed is a measure of an individual's mental and motor efficiency in the ability to plan, organize, and develop relevant strategies (Groth-Marnat, 2009). This ability requires both speed and concentration through planning and organization and motor control. Individuals who are strong in this area are likely to be quick readers, dial a telephone number rapidly, and quickly locate something on a shelf. Those who are weaker in this area may be slower at learning, picking out objects, and reading, and they may carefully reflect on their answers before providing them.

Case (1985) indicated that much of the intellectual changes noted as a child matures, is directly related to the child's increasing ability to process more information within a given time period and automaticity. As this maturity is observed, cognitive processing speed appears to be an important mediator that influences skill acquisition (Brigman & Cherry, 2002). Deficits in information processing may even result in impairment in other cognitive functions, specifically memory (Brigman & Cherry, 2002; DeLuca, Johnson, & Natelson, 1994).

Poverty and Stress

One in five children in America grows up in poverty conditions, elevating his or her risk for socioemotional difficulties, which may be a result of substandard housing, noise, crowding, family turmoil, early childhood separation, and community violence (Evans & English, 2002). The World Health Organization (2003) report on mental health indicated, "Mental disorders occur in persons of all genders, ages, and backgrounds. No group is immune to mental disorders, but the risk is higher among the poor, homeless, the unemployed, persons with low education…" (p. 7). As a result of exposure to poverty related issues, children growing up in low-income homes are more likely to experience high levels of stress (Blair, Granger, & Razz, 2005).

Cumulative stressor exposure may increase the risk of developing socioemotional difficulties (Evans & English, 2002). With poverty comes a lack of opportunity, limited availability and accessibility to resources, and an increased likelihood of experiencing difficult events (Kuruvilla & Jacob, 2007). The risk of health issues resulting from poor diet and health habits, inadequate medical care, poor sanitation, exposure to environmental pollutants, and other hazards coincide with poverty as well (Ewart & Suchday, 2002). Poverty is often associated with lower levels of parental availability and supervision and family and community support, as well as alcoholism, and increased levels of crime and violence, abuse, and family desertion (Blair et al., 2005; Kuruvilla & Jacob, 2007).

Distress frequently results from such difficulties and manifests through emotional states and affective disturbances including depressed mood, frustration, and discontent, and through somatic complaints for which there is no organic cause (Kuruvilla & Jacob, 2007). Those living in poverty report higher levels of hopelessness, fatalism, lack of control, present- rather than future- orientation, and ultimately lower levels of life satisfaction (Kuruvilla & Jacob, 2007). All of these factors greatly affect achievement in school and longer duration of exposure to poverty results in the worst achievement levels likely due to chronically elevated physiological stress (Evans & Schamberg, 2009; Kuruvilla & Jacob, 2007). In addition, poverty increases the risk of drug and alcohol use at earlier ages, earlier sexual activity, and mental health problems (Kuruvilla & Jacob, 2007).

Trauma and Stress

Children's exposure to trauma in low-income urban environments can be quite prevalent. The nature of this exposure can be severe, ongoing, and even a fact of normal daily life, leading to traumatic stress reactions at disproportionate rates (Kiser, Medoff, & Black, 2010). Such traumatizing events can include exposure to community violence, incarceration or death of family members, neglect, abuse, and other maltreatment (Black & Krishnakumar, 1998; Coulton, Korbin, & Su, 1999; Perry, 2006). Prevalence rates of children living in these inner-city communities have suggested that 70-100% have been exposed to some sort of trauma (Dempsey, Overstreet, & Moely, 2000; Macy, Barry, & Noam, 2003).

Urban poverty can cause negative changes in family functioning as a result of chronic stress and violence. Families may react to chronic stress and violence with chaos, disorganization, and instability and, therefore, children do not acquire the fundamental developmental experiences required to express their underlying genetic potential to self-regulate, communicate, relate, and think (Kiser et al., 2010; Perry, 2006). Children may begin to internalize their caregivers' consistent failure to provide protection and control over their environment, leading to working models characterized by mistrust (Ackerman, Kogos, Youngstrom, Schoff, & Izard, 1999).

Traumatized children are at great risk for emotional, behavioral, social, cognitive, and physical health problems (Perry, 2006). Trauma induced stress can lead to stress reactions, including post-traumatic stress disorder (PTSD), which is defined by functional impairment and three symptom clusters; reexperiencing, avoiding and numbing, and hyperarousal (American Psychiatric Association [*DSM-IV-TR*], 2000). Multiple trauma exposures and increased duration amplify the likelihood of symptomatic responses, which might include affective and physiological dysregulation and attachment disturbances (Kiser et al., 2010). Most of these children have limited access to therapeutic services and for those who have access to therapy, it is often too little too late. It is quite difficult to heal a child after years of chaos and abuse (Perry, 2006).

Childhood trauma and stress may even be associated with diffuse brain structure differences in relation to peers (Arnsten, 1998). Lupien, McEwan, Gunnar, and Heim, (2009) proposed the neurotoxicity versus the vulnerability hypothesis to address cause and effect. The neurotoxicity hypothesis suggests that prolonged exposure to glucocorticoids, the stress-releasing hormone, reduces neurons' ability to resist insults, increasing their rate of damage by other toxic challenges. Therefore, a reduced hippocampal size is a result of years of PTSD, depressive symptoms or chronic stress. The vulnerability hypothesis suggests that this reduced hippocampal size is not a result, but actually a pre-existing risk factor for stress-related disorders that may be induced by genetics or early exposure to stress. The authors suggest that these two hypotheses are likely not mutually exclusive (Lupien et al., 2009).

Resilience

Psychological resilience can be seen as the capacity to "bounce back" or thrive after a difficult or potentially traumatizing event (Bonanno & Mancini, 2008; Campbell-Sills, Forde, & Stein, 2009). Bonanno and Mancini indicated that resilient individuals also maintain the capacity for generative experiences and positive emotions. They noted that evidence for resilience in children usually requires more careful monitoring across multiple domains, such as peer relations and school performance.

After trauma exposure, although children frequently demonstrate distress initially, many are quite resilient (Kiser et al., 2010). This initial distress might include some transient stress reaction, as well as unhappiness or disturbance about the occurrence of the event. However, their coping skills are strong enough to allow them to continue to meet the demands of daily life (Bonanno & Mancini, 2008). Children who overcome seemingly overwhelming obstacles appear to be competent in coping with every day challenges, developing clear and realistic goals, problem solving, relating well to others and treating them with respect (Goldstein, 2008).

Statement of the Problem

Although children around the country are held to similar standards in terms of meeting certain benchmarks related to standardized testing of abilities, they do not all receive equal quality education. Further, some children are living in environments that almost preclude them from being able to function on an equivalent academic level as their peers in other parts of the county. These children are faced with poverty and increasing rates of abuse, trauma, and community violence, which are all factors impacting their ability to focus and successfully learn in the classroom. These factors are especially prevalent in underprivileged urban areas. According to the National Clearinghouse on Child Abuse and Neglect (2002), in 2000 approximately 879,000 children were discovered to have suffered from maltreatment. In 2007, 6.1% of homicide victims were below the age of 18 (U.S. Department of Justice Bureau of Justice Statistics, 2002). Additionally, a survey of over 1,400 children and adolescents, suggested that one-quarter experienced one high-magnitude traumatic event by age 16 and 6% had experienced this type of event within the past 3 months (U.S. Department of Justice Bureau of Justice Statistics, 2002).

Green (1985) indicated that a continual need to repeat and reenact childhood trauma occurs after the failure to master this trauma in childhood. Additional evidence suggests that childhood trauma is linked to later drug abuse, juvenile delinquency, criminal behavior, and an increased rate of becoming abusive parents (Burgess, Hartman, & McCormack, 1987; Frederick, 1985; Green). Childhood trauma has also been linked to adult anxiety disorders, dissociative experiences, borderline personality disorder, multiple personality disorder, and general adult psychiatric disturbance (Carmen, Rieker, & Mills, 1984; Chu & Dill, 1990; Faravelli, Webb, Ambonetti, Fonnesu, & Sessarego, 1985; Herman, Perry, & van der Kolk, 1989; Kluft, 1985).

With all these events occurring outside of the classroom and minimal to no psychological help and support, it is only natural that students are not able to work and learn at their full potential. Educators have the incredibly challenging task of reaching such students and preparing them for standardized tests to meet national standards, as well as the next grade level.

The extant literature suggests that there may be a disruption to attention, executive functioning, and processing speed as a result of stress and trauma. According to Anderson (2002), developmental models suggest that early disruption to executive functioning during childhood may lead to severe disruption across a range of domains, which may include cognitive, social, and behavioral dimensions. Implications thus exist for the effects of this cognitive disruption to the school environment.

Statement of Purpose

Historically, the frontal lobes have been poorly understood, partially because they were considered "silent" areas, lacking sensorimotor signs after prefrontal lobe damage. It is now understood that the frontal lobes are implicated in intention, planning, and control of responding, contributing to problem solving and adaptability (Malloy, Cohen, Jenkins, & Paul (2005). Dysfunction in these areas has been demonstrated in clinical case studies of frontal lobe damage and lesion studies of nonhuman primates (Luria, 1973; Malloy et al., 2005). Since executive function damage has also been associated with trauma and stress, it is probable to suggest that similar associations may be relevant for individuals with impaired executive functioning, not secondary to brain injury.

In general, cognitive abilities such as attention, executive functioning, and processing speed are a large part of life in the classroom and are necessary to succeed in school. However, the success of children who have experienced severe stress may be largely compromised as a result of specific deficits in these areas of cognitive functioning. Sustained attention, initiation, working memory, and processing speed are three major areas suggested by the literature to be affected in this population; specifically, it has been indicated that behavioral initiation, sustained attention, digit repetition, and speed of information processing are reduced (Beers & De Bellis, 2002; Shin, Rauch, & Pitman, 2005; Vasterling, Brailey, Constans, & Sutker, 1998; Vasterling et al., 2002). Working memory in general is affected by a failure to inhibit information that is not directly relevant to the task being performed (Baddeley, 1986; Smith & Jonides, 1996). Perseveration, disinhibition, and commission errors (resulting from an induced state of arousal) may contribute to lower scores as well (Robbins & Everitt, 1996; Vasterling et al., 1998). However, research of these constructs in children who have experienced severe stress and trauma is limited thus far.

In light of the absence of research examining attention, executive functioning, and processing speed ability in children who have undergone severe stress, this study examined these functions, specifically, sustained attention, initiation, working memory, and processing speed in a sample of urban elementary school children who have experienced stress and trauma. In addition, the moderating effect of resilience in the face of these events was examined.

Objectives

The objectives of this study included examining attention, executive functioning, and processing speed ability in urban elementary school children who have experienced one or more events of severe stress or trauma. Sustained attention was measured using Connors Continuous Performance Test (CPT; Conners, 2009); initiation was measured by the Behavior Rating Inventory of Executive Function-Teacher Form (BRIEF-TF; Gioia, Isquith, Guy, & Kenworthy, 2000) Initiation scale; working memory was measured in both auditory and visual domains by the Digit Span subtest of the Wechsler Intelligence Scale for Children- Fourth Edition (WISC-IV; Wechsler, 2003) and the Spatial Span subtest of the Wechsler Nonverbal Scale of Ability (WNV; Wechsler 2006), and processing speed was measured by the Symbol Search subtest of the WISC-IV (Wechsler, 2003). In addition, the study determined the moderating effects of resiliency on abilities in attention and executive functions. Resiliency was measured by the Resiliency Scales for Children and Adolescents (RSCA; Prince-Embury, 2007).

Research Questions

1. Does poverty and trauma-related stress result in lower performance on measures of sustained attention, initiation, working memory, and processing speed compared to the general population?

2. Does resilience (sense of mastery, sense of relatedness, and emotional reactivity) effectively moderate the negative impact of stress on sustained attention, initiation, working memory, and processing speed?

Statement of Hypothesis

Hypothesis 1a. It is expected that poverty and trauma-induced stress will negatively affect performance on a measure of sustained attention, thus leading to a significant inverse relationship between scores on a measure of trauma-induced stress and scores on a measure of sustained attention.

Hypothesis 1b. It is expected that poverty and trauma-induced stress will negatively affect performance on a measure of initiation, thus leading to a significant inverse relationship between scores on a measure of trauma-induced stress and scores on a measure of initiation.

Hypothesis 1c. It is expected that poverty and trauma-induced stress will negatively affect performance on a measure of working memory, thus leading to a significant inverse relationship between scores on a measure of trauma-induced stress and scores on measures of working memory.

Hypothesis 1d. It is expected that poverty and trauma-induced stress will negatively affect performance on a measure of processing speed, thus leading to a significant inverse relationship between scores on a measure of trauma-induced stress and scores on a measure of processing speed.

Hypothesis 2. In children who have experienced stress related to poverty and trauma, it is expected that higher resilience will lessen the negative impact of trauma induced stress and poverty induced stress and be associated with stronger scores on measures of sustained attention, initiation, working memory, and processing speed.

Definition of Terms

Attention. In psychology, the directivity and selectivity of mental processes is usually termed attention (Luria, 1973). In other words, it may be considered the factor responsible for picking out the necessary elements for mental activity. For the purpose of the current study, attention was defined according to Mirsky's model (Mirsky, Anthony, Duncan, Ahearn, & Kellam, 1991) that includes four elements: *focus-execute*: the capacity to focus on specific environmental cues among distracters and appropriately respond; *sustain*: the ability to maintain focused attention or vigilance; *shift*: the ability to change the focus of attention; and *encode*: the ability to register, recall, and manipulate information mentally. This study focused on sustained attention, measured using the Conners' Continuous performance Test-II (CPT-II; Conners', 2009), which measures sustained and selective attention, as well as impulsivity.

Executive Functions. This term is used to describe the "ability to maintain an appropriate problem-solving set for attainment of a future goal" (Welsh & Pennington, 1988, p. 201) and may include "control, supervisory, or self-regulatory functions that organize and direct all cognitive activity, emotional response, and overt behavior" (Isquith, Crawford, Espy, & Gioia, 2005, p. 209). In the current study executive functions were defined as the ability to shift, plan, organize, and inhibit, as well as working memory. Individuals with deficits in executive functioning will experience difficulties in these areas. Definitions by Gioia, Isquith, and Guy (2000) will be used to describe: *shift*: moving from one activity or aspect of a problem to another as the situation demands; *plan*: anticipating future events, goal setting, the development of appropriate steps required to carry out a task systematically; *organize*: establishing and maintaining order and carrying out a task in a systematic manner; *inhibit*: ability to refrain from acting on an impulse and appropriately stopping activity at the appropriate time; *working memory*: mentally holding information for the purpose of completing a related task (as reasoning is taking place, according to Demasio & Anderson, 2003).

The current study focused on working memory as well as initiation, or "getting started," a function that requires other executive functions such as planning and organization. Initiation was defined using the Behavior Rating Inventory of Executive Functioning-Teacher Form (BRIEF-TF; Gioia, Isquith, Guy, and Kenworthy, 2000) Initiate scale. Working memory was defined in both auditory and visual domains, using the Wechsler Intelligence Scale for Children, Fourth Edition (WISC-IV; Wechsler, 2003) Digit Span subtest and the Wechsler Nonverbal Scale of Ability (WNV; Wechsler, 2006) Spatial Span subtest both of which measure attention, concentration, and mental control. It was determined that performance on both of these measures would be important to examine in the current sample due to research demonstrating differential performances in Digit Span and spatial span tasks and multiple processing systems theories of working memory (Baddeley, 1986; Cowan, 1998; Wilde & Strauss, 2002).

Processing Speed. This was defined as the ability to scan and then respond to simple tasks rapidly and efficiently (Sattler, 2008) This can include both mental and motor speed. In addition, processing speed can be seen as a measure of an individual's ability to plan, organize, and develop relevant strategies (Groth-Marnat, 2009). For the purpose of this study, processing speed was defined using the score on the WISC-IV (Wechsler, 2006) Symbol Search subtest, which measures speed of matching symbols to a target. Symbol Search was selected over the Coding subtest to eliminate the stronger motor component and Coding has been shown to be reduced in special samples such as clinical populations (Calhoun & Mayes, 2005; Kaufman, 1994).

Poverty. The term *poverty* has been given a number of definitions. Indicators of poverty will include low income, lack of material possessions, lack of employment, housing difficulties, and low educational levels (Kuruvilla & Jacob, 2007). For the purpose of this study, it was assumed that all participants are experiencing baseline levels of stress related poverty, as 99% are reported to be receiving free lunch, an indicator of poverty in their district.

Trauma. Children who grow up in an underprivileged urban environment are at risk for exposure to ongoing trauma that may even be a part of daily life. Their lives might include exposure to community and domestic violence, incarceration of a caregiver, maltreatment, and/or death of a family member (Kiser et al., 2010). In this study, trauma was defined as one or more of any of the above scenarios for any duration. These events may be severe enough to result in distress, including affective and physiological dysregulation, attachment disturbances, alterations in consciousness and self-perception, and changes in systems of personal meaning and, in some, lead to a psychiatric disorder (e.g. PTSD; Kiser et al.). In this study, stress related to trauma was delineated using the Children's PTSD Symptom Scale (CPSS; Foa, Johnson, Feeny, & Treadwell, 2001).

Resilience. This construct has been defined as hardiness, competence, optimism, self-esteem, achievement, social skill, and the absence of pathology in the face of adversity (Prince-Embury, 2007). In the current study, resilience was defined as the ability to weather adversity and bounce back from a negative experience, as a result of protective factors to include personal qualities of the individual, social environment, and outside environment (Cicchetti, 2010; Prince-Embury, 2007). These are personal attributes that allow some to do better than others when facing adversity and recover from the extremes of trauma and stress (Atkinson, Martin, & Rankin, 2009). The implication is that individuals not only survive adversity, but that they thrive in spite of or because of it, demonstrating some psychological growth (Atkinson, et al. 2009; Polk, 1997). For the purpose of this study, resilience was defined by Sense of Mastery, Sense of Relatedness, and Emotional Reactivity scores on the Resiliency Scales for Children and Adolescents (RSCA; Prince-Embury, 2007).

Delimitations

Limitations of this study included those that are inherent in most studies measuring neurocognitive performance in children. Tasks measuring executive functioning are complex, involving various executive and non-executive processes. As a result, performance represented the collective outcome of these processes and each one was difficult to tease apart. In addition, deficits in these functions may represent the variability in the developmental rates of the frontal lobes in children, rather than individual dysfunction (Bernstein & Waber, 2007; Fuhs & Day, 2011).

A second limitation when assessing executive functioning is the ecological validity of the assessments and the testing environment. While administering neuropsychological tests, the examiner intrinsically imposed structure on a task through clear directions of assessment requirements. Therefore, true deficits may have been masked in a construct that would typically not be structured in normal activity and daily contexts such as home and school (Anderson, 2002). Examiner bias was also introduced when the primary investigator of the study administered the assessments.

Because a self-report measure was used to assess resilience, results may have been subject to distortion, inherent in any self-report tool, reflecting experience through the eyes of the subject. Responses may have been impacted by the respondent's mood, perception of the question, level of insight, response bias, and accuracy of recall. Although there are limitations inherent in self-report measures, the rationale for using self-report resiliency scales is highlighted in Prince-Embury (2007). She notes that research has indicated that, "parents are sometimes not sensitive to the experiences of their children" (Prince-Embury, 2007, p. 9), therefore implying that the report of children provides the most accurate results.

Finally, another limitation is the generalizability of the results. This study examined attention, executive function, processing speed, academic achievement, and resilience in a convenience sample. In addition, selection bias was present, as parents who agreed to allow their children to participate may have raised children with certain characteristics or if there was something traumatic occurring in the home, they may not have allowed their children to participate. Because of these factors, results can only be generalized to this particular population and generalizability to a larger population was limited.

Chapter II

REVIEW OF RELATED LITERATURE

Introduction

The prevalence of poverty and trauma in the United States is quite high. Hundreds of thousands of children each year are terrorized, abused, neglected, or maltreated in some other fashion (Perry, 2006). In a sample of 5,877 Americans, the National Comorbidity Survey (NCS) discovered that 60.7% of men and 51.2% of women had experienced at least one lifetime traumatic event, with many having experienced two or more traumas (Kessler, Sonnega, Bromet, Hughs, & Nelson, 1995). The lifetime prevalence rates of post-traumatic stress disorder (PTSD) in children and adolescents may be at least as high or higher than prevalence rates during adulthood (De Bellis, Hall, Boring, Frustaci, & Moritz, 2001). The results of these issues are children who are under-socialized and at greater risk for emotional, behavioral, social, cognitive, and physical health problems (Perry, 2006)

Chronic stress has deleterious effects on the brain caused by alterations in neural systems (e.g. Perry, 2006). These traumatic experiences cause abnormal organization and function of important neural systems of the brain. This leads to compromised functional capacities that result from these systems. Learning, memory, and concentration have reportedly been affected in adults with PTSD (Vasterling & Brailey, 2005).

Early exposure to extreme stress may affect children's neurocognitive development and specifically intellect, verbal abilities, and school performance. Specifically, although limited, extant research has suggested deficits in the areas of attention, executive functioning, and processing speed. These deficits have significant implications for successful school functioning and performance.

The extent of such effects may be a function of the duration and severity of the stressor. Research also suggests that protective factors may help to buffer some of these negative factors and even allow the victim to thrive in spite of trauma induced stress, leading to resilience in some (Bonanno & Mancini, 2008).

Historical Perspectives: Attention and Executive Functioning

For over a century, controversy and confusion have existed over the functions of the frontal lobes and speculation has included ideas that these structures are silent, that they have solely one function, and that they underlie various classes of behavior (e.g. impulse control, judgment, etc.; Zillmer et al., 2008). As a function of their interconnectedness with other brain structures, the frontal lobes are implicated in goal-directed behavior. Because of this interconnectivity, damage to any of the connecting systems can produce behaviors similar to those exhibited in frontal lobe damage (Zillmer et al., 2008).

Research on the frontal lobes dates back to the 19th century when, in 1848, a 25-year-old foreman named Phineas Gage was impaled with an iron tamping bar during an accidental explosion at a railroad construction site in Cavendish, Vermont (Harlow, 1848). The rod penetrated the head through the frontal lobes, and removed a substantial portion of them. Reportedly, Gage was able to display an accurate recollection of these events, despite this head trauma. After fighting off an infection, he recuperated quickly, except for blurred vision in his left eye and a slight left facial palsy. However, a dramatic change was noted as follows:

> 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 advise when it conflicts with his serious, at times pertinacious obstinate, yet capricious and vacillating, devising many plans of future operation, which are no sooner arranged that they are abandoned in turn for others appearing more feasible. (Harlow, 1868, p. 327)

Subsequent to Gage's death in 1861, repeated reports have documented that substantial damage to the frontal lobes causes dramatic personality changes, while maintaining the integrity of sensation, movement, consciousness, and most cognitive faculties (Mesulam, 2000). This divergence is what has led researchers to remain so curious of and often mystified by the frontal lobes.

Decades after Phineas Gage provided a glimpse of insight into the frontal lobes, Alexander Luria pioneered the field of neuropsychological testing and through assessment of individuals with frontal damage, discovered other personality factors associated with frontal lobe functioning. These included foresight, judgment, insight, the ability to delay gratification, and remorse (Luria, 19973. Other factors associated with frontal lobe functioning have included abstract reasoning, hypothesis generation, creativity, problem solving, and mental flexibility, as well as orderly planning and sequencing of complex behaviors, multitasking, understanding complex situations, inhibition, and the ability to sustain behavioral output without perseveration (Mesulam, 1986).

Development of the frontal lobes happens over many years. They are the last part of the cerebral hemisphere to be formed, obtaining maturity between the ages of 4 and 7 years. Developmental abilities and disabilities in the younger years likely reflect the processes of construction, integration, and establishment of these frontal networks (Bernstein & Waber, 2007). One particular predictor of these frontal abilities is verbal ability (Fuhs & Day, 2011). The size of the frontal lobes increases with the complexity of the species and in humans, they occupy up to one quarter of the total mass of the cerebral hemispheres (Luria, 1973).

The prefrontal zones have important connections to many other parts of the brain, including the reticular formation, which modulates cortical tone, and with formations of the second brain, responsible for reception, analysis, and storage of information, which enables the prefrontal zone to control the course of the fundamental forms of human activity (Luria,1973). These functions allow the frontal lobes to serve as tertiary zones for the limbic system and the motor cortex, allowing the understanding of vigilance and control of goal-linked activities (Luria, 1973). These connections to cortical and subcortical areas comprise the frontal system (Bernstein & Waber, 2007).

The frontal lobes play a role in regulating one’s state of activity to maintain cortical tone (Luria, 1973). Any task associated with an orienting reflex and requiring activation produces autonomic changes that are evidenced through the constriction of the peripheral blood vessels, dilation of those in the head, and a psychogalvanic response which continues until the individual has become accustomed to the stimulus, after which it disappears. In individuals with lesions in the prefrontal zones, this autonomic response becomes unstable or fails to arise. In other words, the frontal lobes play an important role in the regulation of the activation processes underlying voluntary action (Luria, 1973).

The frontal systems also play a role in forming solutions to verbal problems, particularly arithmetical problems requiring switching of operations, and exercises with a complex structure requiring the formation and execution of a program (Luria, 1973). In the latter type of problem, the individual must analyze the elements of the conditions, formulate a strategy for the solution, carry out the operations the strategy requires, and then compare the results with the original conditions (Luria, 1973?).

The above skills involve working memory, which resides in the prefrontal cortex, but is also likely influenced by hippocampal and amygdala interactions with the prefrontal cortex (Evans & Shamberg, 2009). Therefore, lesions to this region create impairment in these functions (Luria, 1973). Baddeley (1986, 1996) suggested that working memory is comprised of three components: the central executive, the phonological loop, and the visuospatial sketchpad. The central executive is responsible for coordinating processing and storage demands between the phonological loop and the visuospatial sketchpad, as well as selecting and manipulating information in long-term storage.

One promising concept related to frontal lobe damage is that these lobes are the least differentiated part of the cerebral cortex and their individual areas are capable of replacing one another. Damage in one area can be compensated for by adjacent areas (Luria, 1973). Further, in children, neuroplasticity is more promising and, even after damage to these systems, some recovery of function is more likely (Mundkar, 2005).

Executive functioning develops post-natally and is one of the last systems to be fully completed. Executive capacities were described by Bernstein and Waber (2007) as “the interface between the child and the social and physical world within which he or she interacts” (p.46). Research has suggested that basic executive functions develop early and follow a multistep trajectory until full maturity in adulthood. As mentioned previously, this trajectory parallels the development of the prefrontal cortex (Zillmer et al., 2008). Isquith, Crawford, Andrews Espy, and Gioia (2005) noted that if adult oriented measures are applied to school-aged children, the children “do not possess the linguistic, motor, or sustained attention skills necessary to achieve rudimentary success on such tasks", which is informative to the field (Isquith et al., 2005, p.2). For this reason, it is important that child appropriate measures be selected when measuring these abilities.

The ability to inhibit reflexive reactions to contact and to combine more than one action into a behavioral sequence develops between 5 and 9 months of life when the supplementary motor cortex (SMC) matures (Zillmer et al., 2008). The ability to inhibit a response and to relate information over time delays develops between 8 and 12 months. Between 7 and 12 years, children's executive planning ability typically shows a steady improvement (Zillmer et al., 2008).

One study suggested that attention control significantly matures during infancy and early childhood, with adult levels reached by middle childhood (Zillmer et al. 2008). Information processing, cognitive flexibility, and goal-setting usually achieve maturation towards the end of middle childhood, however, these continue to be refined through adolescence and early adulthood. A meta-analysis reported that planning, verbal fluency, and inhibition abilities increase between 5 and 8 years old. Planning and verbal fluency continue to develop through adolescence and early adulthood. The maturation of other brain regions and neural systems that support attention, language, emotions, and memory also play a role in the timing of the development of executive functions. It has been suggested that some executive functions develop in a gradually progressive manner, whereas others mature in a stepwise or staged fashion (Zillmer et al., 2008).

Brocki and Bohline (2004) discussed the lack of distinction between the processes underlying normal and abnormal executive functioning. They determined that the processes actually occur on a continuum, so any dysfunction in children can be seen as a product of a particular function not being fully developed. Typically, the development relies on the cognitive processes of inhibition and working memory (Brocki & Bohline, 2004).

Barkley (1997) suggested that inhibitory functions are central to effective executive functioning as a whole. He noted that behavioral inhibition, including inhibition of responses, ceasing of responses, and controlling interference, contributes to the functioning of other executive functions, including working memory, regulation of affect, motivation, arousal, and analysis and synthesis of information. Barkley's theory is relevant in understanding normal development and he speculated that the development of the inhibitory function parallels the development of the prefrontal regions. In addition, executive functions are dependent on the development of behavioral inhibition (Brocki & Bohlin, 2004).

Historically, attention has been confusing because of the many types of attentional processing and definitions. Attention can refer to a general level of alertness, arousal, orientation to a stimulus, the ability to focus, divide, or sustain mental effort, ability to processes a specific sensory arena, or a measure of capacity (Zillmer et al., 2008).

Luria (1973) deemed attention as the factor that is responsible for selecting the essential elements for mental activity, or the process which keeps a closer watch on the specific and organized course of mental activity". Attention can first be noted in a young child, in the first few weeks of life, with the turning of the eyes and then the head towards a stimulus (Luria,1973). Other irrelevant activities cease and a group of respiratory, cardiovascular, and psychogalvanic responses occur, which Pavlov called the "orienting reflex." With repetition of the stimulus causing this reaction, most individuals demonstrate habituation, reducing the reactive response. The orienting reaction may also be highly directive and selective. Sokolov (1960) concluded that habituation (extinction of the orienting reaction) is selective. Lesions in the superior part of the brain stem and limbic system may disturb the orienting reaction, which may cease to be suppressed by habituation factors. The frontal lobes play a major role in increasing vigilance in an individual and thus partake in higher forms of attention (Luria, 1973).

Attention is said to operate as a gateway for information processing, allowing an individual to orient to, select, and maintain focus on information, making it available for cortical processing. Historically, several models of attention have been proposed. One such model, referred to as the Mirsky model (Mirsky, Anthony, Dunca, Ahearn, & Kellam, 1991) describes attention as containing four elements: (a) focus-execute, the capacity to focus on specific environmental cues among distracters and appropriately respond; (b) sustain, the ability to maintain focused attention or vigilance; (c) shift, the ability to change the focus of attention; and (d) encode, the ability to register, recall, and manipulate information mentally. Fernandez-Duque and Posner (2001) presented another model of attention, that included three major functions: (a) orienting to events and their locations in visual space; (b) achieving and maintaining an alert state; and (c) orchestrating voluntary actions. Another model of attention, presented by Mesulam (2000), posed that the frontal, parietal, and cingulate cortices are involved in a neuronal network that supports spatial attention to the extra personal world.

There is evidence that different parts of the brain have some degree of specialization for different functions (Mirsky et al., 1991). Structures that have been implicated in attention include the reticular activating system (RAS), which plays a role in cortical arousal; the subcortical and limbic system structures, specifically the cingulate gyrus, in regulation of information; the posterior parietal lobe system to focus conscious attention, and finally, the frontal lobes in directing attentional resources (Mirsky et al., 1991; Zillmer et al., 2008). The hippocampus and amygdala are likely involved in the mnemonic aspects of attention to support memory functions (Mirsky et al.,1991)

Historical Perspectives: Processing Speed

Processing speed, referred to in early literature as "mental speed," has not been studied extensively in childhood. Luria (1932) indicated that, in adults, the reaction to a signal is a product of very complex development, which arises on top of other more primitive processes. He noted that the improvement of this process from childhood to adulthood occurs through a qualitative change in structure and becoming a new, functional, organized structure of reaction. Simple primitive impulses have mostly disappeared by the age of 7 or 8 years and have been replaced by an integrated reaction characteristic of adults (Goodenough, 1935; Luria, 1932).

Two early studies (Goodenough, 1935; Philip, 1934, as cited in Kail, 1991), demonstrated that response times (RTs) were shown to significantly change between age 3 years and adulthood. However, for the next two decades, there was little attention paid to processing speed. In the 1960s and 1970s the influence of information-processing perspective on cognitive developmental psychology gradually increased. Studies on processing speed subsequently became more prevalent and differences in this ability were demonstrated on a range of cognitive tasks (Kail,1991).

Often used to measure speed of processing during early studies were name retrieval tasks (Bisanz, Danner, & Resnick, 1979). During these tasks, subjects determined whether picture pairs were identical physically or just in name. Since subjects judged name similarity slower than physical similarity, the difference in times was used to estimate the time required to retrieve the name of the stimulus. In Bisanz et al.'s study, 19-year-olds retrieved the names of common objects in less than half of the time needed by 8-year-olds.

The term *limited processing resources*, sometimes referred to as *attentional resources* or *mental effort* (Kail & Bisanz, 1982, as cited in Kail, 1991) refers to the idea that, although many cognitive activities require a person's deliberate efforts, people are limited in the amount of effort they can allocate. In this instance, the speed of processing determines how rapidly limited resources can be reallocated to other cognitive activities (Kail, 1991).

Due to developmental differences, children are not able to reallocate resources as quickly as adults. Processing speed changes throughout the lifespan with speed increasing throughout childhood and adolescence, reaching a peak in young adulthood, and then declining slowly thereafter (Kail, 1991). These age-related differences may be attributed to the fact that adults are more likely to have extensive task-relevant experience and, thus should have more strategies and more elaborate representations that could result in retrieval of responses (Logan, 1988)

Bull and Johnston (1997) observed a strong relationship between processing speed and arithmetic ability, even after factoring out reading ability. As participants' mathematics ability increased, time to complete the processing speed tasks decreased. It was suggested that familiarity of the stimuli and strength of memory representations influence short-term memory since these factors allow for faster retrieval from long-term memory. Therefore, speed of item identification was significantly correlated with short-term memory span. The major problem for children with arithmetical difficulties may be associated with slow execution of operations, possibly due to slowed long-term memory access (Geary, 1993).

Attention, Executive Functioning, and Processing Speed Related to School Achievement

Correlations have been established between specific scholastic achievement and executive functions such as shifting, updating, and inhibiting, suggesting that executive functioning plays an important role in learning and the development of social and academic competence during childhood (Blair et al. 2005; St. Clair-Thomas & Gathercole, 2006). Isquith et al. (2005) discussed the increasing attention paid to ecological validity in the assessment context, which refers to the "functional and predictive relation between the patient's behavior on a set of neuropsychological tests and the patient's behavior in a variety of real-world settings" (Sbordone, 1996; p 16). Deficits detected in neuropsychological testing have significant implications for the classroom.

Working memory, problem solving, planning, set-maintenance, reasoning, and flexibility make significant contributions to school performance (Muller, Liebermann, Frye, & Zelazo, 2008; Welsh & Pennington, 1988). Empirical evidence suggests working memory is linked to scholastic achievement in subjects such as English, second language, mathematics, science, and geography (Muller et al., 2008). Reduced working memory measures tied with executive skills have been associated with performance below expected standards in national curriculum assessments of these subjects (Gathercole, Brown, & Pickering, 2004; Gathercole & Pickering, 2000a, 2000b; Gathercole, Pickering, Knight, & Stegmann, 2004; Jarvis & Gathercole, 2003).

Other studies have demonstrated a relationship between working memory performance and reading (e.g. De Jong, 1998), comprehension (e.g. Daneman & Carpenter, 1980), and arithmetic (DeStefano & LeFevre, 2004). St Clair-Thomas and Gathercole (2006) discussed the implications of inhibitory processes in reading, comprehension, vocabulary learning, and mathematics and of shifting abilities in writing skills and arithmetic. Reasoning occurs later, beginning around age 7, and allows the child to be able to reflect on abstract notions, facilitating other executive functions, such as planning and self-monitoring (Welsh & Pennington, 1988).

Attention plays a major role in school performance as well. Individuals with impairments in attention are usually unable to allocate their cognitive resources effectively to a task. As a result, the flow of information and processing within other cognitive domains is inhibited (Cohen, Malloy, Jenkins, & Paul 2005). This has significant implications in the classroom setting. If a student is not properly attending to information being presented, the information is not being sufficiently stored for further processing and the student is at risk for not remembering the information accurately, if at all.

Whereas school performance is assumed to be heavily influenced by cultural and personality factors, measures of speed of information processing represent a relatively pure form of cognitive ability in that they are less influenced by cultural and learning factors than typical psychometric intelligence tests (Rindermann & Neubauer, 2001). The speed of information processing is considered an important basis of cognitive abilities in mental speed theory. Since higher cognitive abilities influence cognitive performance in the real world, such as in school, processing speed is implicated in school-based abilities (Rindermann & Neubauer, 2004).

Rindermann and Neubauer (2004) found that processing speed has little direct effect on school performance, but rather has significant indirect effects on school performance due to its influence on most other cognitive domains. For example, on tasks requiring working memory, such as mental arithmetic, processing speed has been shown to be directly related to performance (Bull & Johnston, 1997).

Since working memory requires the temporary storage of information while new information is being processed and other cognitive tasks are being performed, the speed at which one can complete this processing will influence the outcome (Bull & Johnston, 1997). In children with difficulties in this area, there is likely a deficiency in automating basic arithmetic facts, stemming from a general speed of processing deficit (Bull & Johnston, 1997). A child may not be able to demonstrate all of the knowledge that he or she possesses in the same amount of time as another child, and thus, may be assumed to be an underachiever. In addition, children with processing speed difficulties may have problems with rate of learning, comprehension of new information, speed of performance, and mental fatigue (Calhoun & Mayes, 2005). Processing speed can therefore be at least partially responsible for individual differences in school performance and achievement.

In summary, all the above cognitive functions are important for the processing and consolidation of the information presented in school and, therefore, school achievement. In addition, the functions are necessary within social interactions (Blair et al., 2005). Executive functioning plays a role in behavioral regulation while processing speed can impact whether a child is able to pick up on social cues. These functions may be impacted by aspects of early experience that are detrimental to the stress response system (e.g. poverty, trauma), resulting in a negative impact to social and cognitive competence (Blair et al., 2005).

The Brain's Response to Stress

In the study of poverty, stress is frequently considered a resulting factor. Physiological stress responses in children from low-income homes may help to elucidate outcomes in children facing such adversity (Blair et al. 2005). Although related stressors are pervasive, not all children are affected equally and some demonstrate remarkable resilience, termed *stress resistance*. Stress resistance is considered to be an outcome of attributes related to developmental processes. It has even been specifically related to the function of the hypothalamic-pituitary-adrenal (HPA) axis described below (Blair et al., 2005).

A stressor is anything that threatens to disrupt the homeostasis or optimal biological functioning of an organism (Sapolsky, 1992). The stress response is a cascade of hormonal and biochemical events that occur to promote survival by restoring homeostasis. When a person is exposed to any form of stress, the stress response comes into play (Blair et al., 2005). After a traumatic event, the experience is perceived through the senses in the form of intense fear, activating the stress response (De Bellis, Hooper, and Sapia, 2005; Sapolsky, 2000). Chronic activation of the stress response has been shown to adversely affect the development of brain structures and neural systems important for regulation of the stress response, as well as executive functions (Blair et al., 2005)

Several brain systems and specific neurotransmitters have been implicated in this process. The main systems are the norepinephrine-sympathetic adrenomedullary (NE-SAM) system and the hypothalamic-pituitary-adrenocortical (HPA) systems. The NE-SAM system produces the neurotransmitters epinephrine and norepinephrine, released by nerve endings. Through the HPA system, glucocorticoids (mainly cortisol in humans) are produced from the cortex and adrenal glands (De Bellis, Hooper, & Sapia, 2005). Both of these systems work to restore homeostasis by increasing heart rate, metabolizing fat and protein stores, inhibiting digestion, inhibiting the immune system, and inhibiting the growth system to increase energy resources (Gunnar & Cheatham, 2003). The HPA system has been more often studied because it can be easily measured through salivary cortisol samples (Gunnar & Cheatham, 2003).

In the HPA system, signals from the body and brain centers converge in the hypothalamus to begin production of the corticotropin-releasing hormone (CRH), which travels through the blood to the anterior pituitary gland. Here, the CRG begins the breakdown of adrenocorticotropic hormone (ACTH), which travels through the blood stream to the adrenal glands, where it stimulates the outside layers to produce cortisol. This whole process takes approximately 20 minutes (Gunnar & Cheatham, 2003).

The function of the HPA system is to facilitate the survival of an organism facing extremes in the environment. Energy is directed away from processes unnecessary to immediate survival and toward the metabolism of fats and proteins in an attempt to increase available energy. Cardiopulmonary activity increases to speed glucose and oxygen to skeletal muscles and cognition is altered to ensure that the details of the emergency are stored in memory (Gunnar & Cheatham, 2003).

A negative feedback mechanism activates when sufficient levels of cortisol are detected in the hippocampus and a message is sent to the hypothalamus to stop production of CRH. With the frequent use of cortisol receptors in the hippocampus, they become down regulated, resulting in fewer receptors (Sapolsky, 1992), causing a decreased ability of the system to self-regulate and an increase in the system's ability to become sensitized, over reactive, and dysfunctional (Perry, 2006). As a result, even mild stressors may produce prolonged elevations in cortisol. Elevations in CRH have been identified in traumatized individuals in response to acute and chronic stress (Southwick, Yehuda, & Wang, 1998). Although with removal of a stressor, the HPA system can demonstrate plasticity and normal function may be at least partially recovered, this depends on duration and intensity of the stressor (Gunnar & Cheatham, 2003; Perry 2006).

Another way to look at the above processes is through allostasis theory. Allostasis theory indicates that the body continuously adjusts its normal operating range in response to any external requirements and when this equilibrium is constantly needing to be mobilized, the allostatic load increases (Evans & Schamberg, 2009). Overexposure to these bodily response systems alters the body's ability to respond efficiently to environmental demands and accelerates wear and tear (Evans & Schamberg, 2009). Chronically elevated allostatic load may influence neurological processes, including those in the hippocampus and prefrontal cortex, leading to cognitive dysfunction (Evans & Schamberg, 2009).

It has been suggested that early exposure to stressful and even traumatizing situations may lead to enhanced stress responsiveness (De Bellis, Hooper, & Sapia, 2005). Elevated levels of catecholamines and cortisol will affect brain development in a variety of ways. Catecholamines play a role in the dilation of the pupils, decrease in peripheral blood flow, diaphoresis, and renal inhibition. Animal studies have shown that activation of this system may induce behaviors consistent with anxiety, hyperarousal, and hypervigilance. Other research has shown that the locus coeruleus-sympathetic nervous system-catecholamine system is dysregulated in traumatized children suffering from depressive and PTSD symptoms (with or without a diagnosis of PTSD; De Bellis, Hooper, & Sapia, 2005). The dysregulation of serotonin may also play a major role in the development of PTSD symptoms, as well as increase the risk of major depression and aggression. (De Bellis, Hooper, & Sapia, 2005).

The Brain's Response to Trauma Induced Stress

While stress in general leads to deregulation in the brain, traumatic stress may lead to additional responses over and above those resulting from other types of stress. Childhood traumatic and neglectful experiences cause abnormal organization and function of important neural systems in the brain, compromising functional capacities mediated by these systems (Perry, 2006). These diffuse brain structural differences may be responsible for the development of PTSD (Arnsten, 1998). Anatomically, the medial prefrontal cortex and the amygdala have been shown to be hyporesponsive and hyperresponsive, respectively, during exposure to mild to moderate stress (Arnsten, 1998).

Little is known about functional neuroanatomical stress patterns in children, as imaging studies, such as positron emission tomography (PET) and functional magnetic resonance imaging (fMRI), are difficult or not feasible with this population. It has been suggested that elevated levels of catecholamines and cortisol may lead to adverse brain developments by increasing the loss of neurons (Edwards, Harkins, Wright, & Menn, 1990; Sapolsky, 2000; Simantov et al., 1996; Smythies, 1997), delaying myelination (Dunlop, Archer, Quinlivan, Beazley, & Newnham, 1997), affecting the pruning process (Lauder, 1988; Todd, 1992), inhibiting neurogenesis (Gould, McEwen, Tanapat, Galea, & Fuchs, 1997; Gould Tanapat, & Cameron, 1997; Gould, Tanapat, McEwen, Flugge, & Fuchs, 1998; Tanapat, Galea, & Gould, 1998), and decreasing neurotrophic factor expression (Smith, Makino, Kvetnansky, & Post, 1995).

Structural MRI studies have indicated that myelinated areas of the brain may be particularly susceptible to early exposure to elevated levels of stress hormones. Teicher et al. (1997) discovered that early childhood trauma may have deleterious effects on corpus callosum development with greater reduction in males. These findings were verified by De Bellis, Keshavan, et al. (1999) and extended to include enlarged right, left, and total lateral ventricles in subjects with PTSD, as well as reduced intracranial volume compared to controls. Specifically, a reduced midsaggital area of the corpus callosum was observed. This later findings were associated with longer duration of abuse, suggesting that recurrent and chronic abuse may have a cumulative, harmful effect on the developing brain (De Bellis et al, 1999).

Effects on the frontal systems, primarily responsible for executive functions have been demonstrated as well. Frontal lobe asymmetry, increased frontal lobe cerebrospinal fluid (CSF) volumes, and reduced size of the prefrontal cortex and prefrontal cortical white matter have been detected in subjects with PTSD (De Bellis, Keshavan, Clark, et al., 1999; De Bellis, Keshavan, Shifflett, Iyengar, Beers, et al., 2002). Magnetic Resonance Spectroscopy (MRS) studies have suggested that there may be a loss of neuronal integrity in the anterior cingulate region of the medial prefrontal cortex, but that PTSD remission (by removal of the stressor and treatment of PTSD) may be associated with enhanced medial prefrontal neurogenesis and reductions of cortisol and catecholamines (De Bellis, Keshavan, et al., 2000).

The Effects of Trauma Induced Stress on Attention, Executive Functions, and Processing Speed

Research studies have documented the deleterious effects of early exposure to extreme stress on the neurocognitive development of children, which includes intellectual and verbal impairments and poor school performance (Beers & De Bellis, 2002). Children raised in chronically poor families even demonstrate reduced cognitive performance (Kuruvilla & Jacob, 2007). However, the literature is limited on the neuropsychological sequelae of trauma and stress in children.

Extant literature does indicate modest findings, most in individuals who have developed PTSD. In one study performed in this area, Beers and De Bellis (2002) detected deficits in attention and abstract reasoning/executive functions in children with maltreatment-related PTSD as compared to demographically matched peers. Specifically, frontal deficits were discovered on tasks such as card sorting and word-list generation. In addition, these children showed higher rates of distractibility, impulsivity, and difficulty with sustained attention. These findings are consistent with CNS changes in the frontal cortex seen in individuals with PTSD on imaging studies mentioned above (Beers & De Bellis, 2002).

Impairments in attention and executive functioning have been observed in adults with PTSD. Difficulties with concentration are common and constitute a symptom of PTSD in the

Diagnostic and Statistical Manual (DSM-IV TR; Vasterling & Brailey, 2005). Research has shown that certain aspects of attention may be more affected than others. Among military veterans, those with a PTSD diagnosis performed more poorly than those without the diagnosis on tasks requiring sustained attention and encoding capacity, but not on focus/execute or shifting tasks (Vasterling, Brailey, Constans, & Sutker, 1998; Vasterling et al., 2002). Specific measures detecting difficulties included continuous performance tasks and digit repetition and mental arithmetic tasks. Cancellation, Stroop, and card sorting tasks were intact.

Children from disadvantaged backgrounds have demonstrated particular neurocognitive difficulties in the area of executive functioning (Noble, Norman, & Farah, 2005, as cited in Fuhs & Day, 2011). Working memory deficits have been seen in individuals with PTSD as well and are thought to be strongly related to prefrontal dysfunction in humans (Baddeley, 1986; Evans & Schamberg, 2009; Shin, Rauch, & Pitman, 2005; Smith & Jonides, 1996). Working memory deficits may be the result of a failure to inhibit information that is not directly relevant to the task (Shimamura, 1996). This failure to inhibit information may be associated with reexperiencing symptoms or a failure to inhibit unsolicited emotional memories (Vasterling et al., 1998).

Perseveration and disinhibition are behaviors in a traumatized population that may contribute to low scores on neuropsychological tasks as well. Vasterling et al. (1998) found that the tendency to make intrusion errors on emotionally neutral tasks was positively correlated with reexperiencing symptoms and was negatively correlated with avoidance/numbing symptoms. Perseverative responses may be associated with PTSD, indicating dysfunction of the prefrontal cortex and specifically the ventromedial prefrontal region.

Posttraumatic Stress Disorder may be associated with reduced prefrontal inhibitory functions, which might lead to difficulty avoiding distraction from extraneous stimuli.

Vasterling et al. (1998) detected a tendency for individuals with PTSD to make more commission errors across tasks, which is a finding consistent with induced arousal states in animals (Robbins & Everitt, 1996).

Trauma induced stress has been shown to decrease speed of information processing as well, however research on these effects is very limited. Field, Classen, Butler, Koopman, Zarcone, and Spiegel (2001) demonstrated that a sample of childhood sexual abuse survivors performed significantly slower on a Stroop task in which they named the colors of sexual/victimization words as compared to controls. This might be attributed to intrusion symptoms and selective attention to trauma-related, leaving less processing resources available for color-naming.

Neuroanatomical underpinnings are likely responsible for these observed deficits and represent bilateral cerebral impairment (Vasterling & Brailey, 2005). Much of the cognitive impairment detected in PTSD is likely attributable to dysfunction in regions, such as the prefrontal cortex, that are more sensitive to defects in neurotransmitter systems that are implicated in the regulation of arousal. Koenen et al.'s (2001) findings indicated that there may be disruption in both dorsolateral and ventral prefrontal regions in PTSD. The orbitofrontal region is deeply connected with the hippocampus and amygdala and, therefore, may be particularly relevant to dysfunction in PTSD (Koenen et al., 2001).

A major issue and something for clinicians and researchers to keep in mind during the neuropsychological evaluation of individuals with trauma related stress is motivation. Individuals may not be sufficiently engaged in tasks to perform at their highest potential. This decrease in motivation may be a result of poor concentration secondary to psychological distress or intentional low performance associated with secondary gain (Vasterling & Brailey, 2005).

However, Vasterling and Brailey note that in cases of suboptimal effort, there is usually a global reduction in scores, as compared to specific isolated deficits observed in PTSD. In addition, neuropsychological deficits should coincide with known neurological findings and results should be similar to non-treatment and non-compensation-seeking samples (Vasterling & Brailey, 2005).

Finally, it is important to note that when it comes to the neurobiological abnormalities and the neuropsychological findings in traumatized individuals, it is known that these are simply correlated with each other. Whether the abnormalities are a consequence of trauma, a risk-resilience related factor for PTSD, or both, it still largely unknown (Vasterling & Brailey, 2005). Animal research seems to point in the way of stress exposure leading to neurobiological and behavioral alterations. However, investigations have detected all sides and findings do not point in any one direction (Vasterling & Brailey, year?).

Historical Perspectives: Resilience

The concept of resilience has become of increasing relevance to both mental and physical health domains. In 1914, following the start of World War I, Ernest Shackleton and a team of explorers were shipwrecked in polar ice on their way to the Antarctic. Despite dangers and being 1,200 miles from help, every man returned alive 2 years later (Atkinson, Martin, & Rankin, 2008). In recent years, this achievement has been deemed a demonstration of resilience under extreme and prolonged threat, propelling Shackleton to become a role model for successful managers (Atkinson et al., 2008). There have been several similar accounts in the last several decades, including survivors of concentration camps, that have led to a recent increase in the use of the term resilience to reframe past events (Atkinson et al., 2008).

Resilience has taken on many definitions by several researchers over the years. It has been described as the ability to thrive or bounce back after a potentially traumatic event (Bonanno & Mancini, 2008; Campbell-Sills, Forde, & Stein, 2009). Other phrases such as hardiness, invulnerability, stress-buffering, and stress-related growth have all been used to describe this construct (Atkinson et al., 2008). In addition, the psychological growth following adversity has been emphasized (Aldwin, 2007; Polk, 1997) as well as an individual's ability to re-establish equilibrium, rather than a hardening to stress (Wagnild & Young, 1990). There are even suggestions of resilience of a personality trait (Atkinson et al., 2008), but others argue that people can only become resilient in the face of adversity (Rutter, 2007).

Until recently, the assumption was that the absence of psychopathology after exposure to a traumatic event occurred only in individuals with extraordinary emotional strength. However, evidence now suggests that resilience to these events is not as rare as previously thought, but rather, is a primary feature of standard coping skills (Goldstein, 2008).

Resilience is encompassed within a framework of positive adaptation and therefore a lack of symptoms should not be associated with resilience. Research on resilience seeks to examine individual assets, rather than deficits, as well as successful outcomes, rather than negative ones (Atkinson et al., 2008). The insulating factors that seem to protect children from overwhelming risks may be good predictors of positive adult outcome (Goldstein, 2008).

Developmental psychologists and psychiatrists of the 1970s pioneered the documentation of resilience research of children who exhibited healthy developmental trajectories despite being raised in poor socioeconomic conditions. These studies suggested that resilience results from normal mechanisms of adaptation (Bonanno & Mancini, 2008). Cicchetti (2010) described resilience as not something an individual "has," but it is a process that is multiply determined and is not fixed or absolute.

Historically, research on the causes and course of psychopathology has focused on a deficit model. The course of individuals faced with adversity was portrayed as inevitably resulting in maladaptive outcomes (Cicchetti, 2010). However, as researchers began to notice that not all high-risk children elicited the dismal responses that were previously predicted, the process through which these children did not develop psychopathology was suddenly viewed as important for informing theories on the development of maladaptation and pathology. This evidence of adaptive behavior was not yet labeled as resilience (Cicchetti, 2010).

Early research on resilience was conducted on individuals with schizophrenia and persons exposed to parental mental illness, extreme stress and poverty, and who experienced traumatic occurrences earlier in life (Cicchetti, 2010). Werner and Smith (1982, 1992) systematically searched for protective forces that differentiated children with healthy adaptation from those who were less well adjusted. Thriving of some of the children despite adversity led to increased empirical efforts to understand this individual variation (Werner & Smith, 1982, 1992).

Initial research on resilience in children dates back about 50 years and suggested biological, psychological, and social protective factors that might serve to buffer against adversity and how these factors were influential (Goldstein, 2008; Mancini & Bonanno, 2006). These might include person-centered variables, such as personality, and sociocontextual factors, such as supportive relationships and family (Cicchetti, 2010; Mancini & Bonanno, 2006). In addition, early research focused on children who were determined to be *at risk* for later difficulties because of adverse life circumstances including poverty, loss of family cohesion, and parental mental illness. Subsequently, resilience was used to describe those children who had lower rates of psychopathology later in life (Hoge, Austin, & Pollack, 2007).

More current evidence indicates that protective factors exist that lead to resilient functioning. The question has been raised as to whether these protective factors are actually the converse of risk factors (e.g. lack of social support is a risk factor, but adequate social support could represent resiliency; Hoge et al., 2007). Protective factors might be found in the child's personal qualities, family environment, and outside environment, including school (Prince-Embury, 2007). These include close relationships with competent family members and adults, ability to self-regulate, positive views of self, motivation to function effectively in the environment, and attachments with well-regulated peers (Masten, 2007). Trauma resilience has even been associated with male gender, older age, and greater education (Mancini & Bonanno, 2006).

Other protective factors might include personal qualities, such as intellectual ability, easy temperament, autonomy, self-reliance, sociability, effective coping strategies, and communication skills (Prince-Embury, 2007). Skills linked to executive functions, such as problem-solving, foresight in planning, and a future orientation have also been associated with resilient functioning (Luthar, 2006; Masten, 2007). Understanding the positive adaptations to stress is important to prevention and intervention efforts for individuals who have experienced stressful events.

Early studies focused on high-risk youth who demonstrated the ability to overcome emotional, developmental, medical, environmental, or economic challenges. However, investigations have more recently expanded to look at a broader range of young populations. Research has also shifted in a direction to examine the mechanisms underlying resilient functioning rather than identifying only the factors, allowing researchers to design prevention and intervention strategies designed to promote resilience (Cicchetti, 2010; Luthar, Cicchetti, & Becker, 2000). The neuroplasticity of the brain combined with the capacity for experiences to change the human brain, lead to possible influences of genetic, neurobiological, and endocrine bases of resilience (Atkinson, 2008; Gunnar & Cheatham, 2003).

Summary

A review of the literature suggests some relationship between attention, executive functioning, processing speed, and stress related to poverty and traumatic experiences in children (e.g. Leskin & White, 2007). More specifically, there appear to be correlations between impairments in sustained attention, initiation, working memory, and speed of information processing, and trauma induced stress (Beers & De Bellis, 2002; Shin, Rauch, & Pitman, 2005; Vasterling, Brailey, Constans, & Sutker, 1998; Vasterling & Brailey, 2005; Vasterling et al., 2002). However, little research has been done in the area thus far and this type of research with pediatric populations is particularly scant.

This study contributed to the literature by providing information on how stress affects cognitive functioning and ultimately classroom performance, which provides rationale for building resilience. This study was designed to measure sustained attention, initiation, working memory, and processing speed as in children who have experienced stress related to poverty and one or more traumatic event. In addition, resilience was examined as a moderator of these cognitive abilities.

Chapter III

METHODOLOGY

Design

The current study employed a descriptive design, which made inferences about data that had been collected. In addition, a correlational design was used to examine the relationship of attention, executive functioning, processing speed, academic achievement, and resilience. The study excluded experimental manipulation of the treatment variables, and therefore, the results cannot be used to describe a cause-and-effect relationship. Rather, this design was used to study phenomena involving characteristics of children exposed to trauma induced stress.

The independent variables in this study were stress as a result of poverty alone and additional trauma induced stress as determined by scores on the Children's PTSD Symptom Scale (CPSS; Foa et al., 2001). Dependent variables included sustained attention, as measured by the Connors' Continuous Performance Test-II (CPT-II; Conners, 2009); initiation, as measured by the Behavior Rating Inventory of Executive Functioning-Teacher Form (BRIEF-TF; Isquith, Guy, & Gioia, 2005); working memory, as measured by the Wechsler Intelligence Scale for Children, Fourth Edition (WISC-IV; Wechsler, 2003) Digit Span subtest and the Wechsler Nonverbal Scale of Ability (WNV; Wechsler, 2006) Spatial Span subtest; processing speed, as measured by the WISC-IV (Wechsler, 2003) Symbol Search subtest; and resilience, as measured by the Resiliency Scales for Children and Adolescents (RSCA; Prince-Embury, 2007).

Participants

The target population for this study was children exposed to stress as a result of poverty alone with some having symptoms related to trauma induced stress. Participants were 8 to 13 year-old students at an urban preK-8 public school. The research project was introduced by me. It was emphasized that participation in the study was voluntary and that participants were free to withdraw at any time. Parents of students who were willing to participate signed an informed consent and students signed an oral assent, both of which explained the study and each participant's rights. Because this was considered a protected population, each participant had to sign the consent in order for him/her to partake in the research.

Method of Sampling

The method of sampling in this study was purposive sampling of students who had likely been exposed to poverty and/or trauma induced stress. Since the focus was not on drawing a representative sample, but one serving the interest of this research, students who were willing to participate from this particular urban school were recruited to comprise the pool of participants. Therefore, this was a nonrandomized convenience sample.

Instrumentation

The measurement devices that were used in this study were the Connors' Continuous Performance Test (CPT-II; Conners, 2009), Behavior Rating Inventory of Executive Function-Teacher Form (BRIEF-TF; Isquith, Guy, & Gioia, 2005), Wechsler Intelligence Scale for Children (WISC-IV; Wechsler, 2003) Digit Span and Symbol Search, Wechsler Nonverbal Scale of Ability (WNV; Wechsler 2006) Spatial Span subtest, Resiliency Scales for Children and Adolescents (RSCA; Prince-Embury, 2007), and Child PTSD Symptom Scale (CPSS; Foa et al., 2001).

Connors' CPT-II was used to measure sustained attention. Working memory was measured through both auditory and visual domains with the WISC-IV Digit Span and the WNV Spatial Span respectively. The WISC-IV Symbol Search subtest was used to measure processing speed. Initiation was measured using the BRIEF-TF. The RSCA was used to measure resilience in the participants and the presence of trauma-induced stress was measured with the CPSS.

Connors' Continuous Performance Test, Second Edition (CPT-II)

Connors' CPT-II (Conners, 2009) is a computerized assessment tool used to assess attention problems and to measure treatment effectiveness. It was designed as an evaluation tool for attention, impulsivity, or activity control problems, as well as difficulties related to executive functioning and is meant to be completed by individuals six and older. The primary categories of distinction on this test are inattention, impulsivity, and vigilance. This study will examine attentiveness, which is how well the individual discriminates between targets and non-targets, and vigilance, determined by a slowing of reaction time (Klecker & Wesley, 2003).

The Connors' CPT is administered in about 14 minutes and scored on the computer. During this task, white letters appear on a black screen at varying intervals of 1, 2, or 4 seconds and are displayed for 250 milliseconds. The intervals vary over six blocks, each with three sub-blocks containing 20-letters. The examinee is told to push the spacebar or click the mouse when any letter except the letter X appears on the screen. Administration steps are further delineated to obtain informed consent, assure confidentiality, administer a practice test, and then administer the CPT-II protocol. The administrator should be unobtrusively present while the test is administered (Klecker & Wesley, 2003).

The computer program records response times, speed and consistency of reaction, perseveration, response accuracy, omission errors, and commission errors. Scores are calculated using block results, which provides the changes in reaction time speed and consistency as the test progresses. Scores are provided upon completion of the test and are provided in the form of *T* scores and percentile calculations based on comparisons to individuals matched for age and gender. For the purpose of this study, the Confidence Index (CI) was interpreted. This gives a percentage for likelihood of attention problems compared to a clinical sample. Higher percentages indicate more difficulty sustaining attention.

Normative data for the CPT-II include a clinical sample of 378 diagnosed ADHD cases and 223 adult individuals with neurological impairment. The non-clinician sample was made up of 1,920 individuals from the general population. Age and gender are reported as follows: 52.5% males and 47.5% females under 18; 28.8% males and 71.2% females over 18. In the ADHD clinical sample of 378, there were 75.3% males and 24.7% females under 18 and 54.2% males and 45.8% females over 18 (Klecker & Wesley, 2003).

Test-retest reliability (3 months between tests on average) for the CPT-II is based on 10 participants from the nonclinical group and 13 participants with other clinical diagnoses. Test-retest reliability ratings ranged from a low of .05 (Hit SE SIS Change) to a high .92 (Confidence Index). Validity evidence is described as strong on research of ADHD populations, accurately differentiating between clinical and nonclinical groups (Klecker & Wesley, 2003).

In terms of administration, demographic information was recorded in the computer program. Instructions were provided at the beginning of the task to press the spacebar or mouse every time a letter appeared on the screen, except for the letter X. If the examinee asked any questions during the task, he/she was told that the question would be answered when the task was complete and he/she was encouraged to continue (Klecker & Wesley, 2003).

Behavior Rating Inventory of Executive Function (BRIEF)

The BRIEF (Isquith, Guy, & Gioia, 2005) is designed to assess impairment of executive function behaviors in children ages 5 to 18 in the home and school environments using parent and teacher questionnaires. It is designed to include children with learning disabilities, attentional disorders, traumatic brain injuries, lead exposure, pervasive developmental disorders, depression, and other developmental, neurological, psychiatric, and medical conditions. The BRIEF includes a teacher form and a parent form, each with 86 items and eight clinical scales measuring different aspects of executive function: Inhibit, Shift, Emotional Control, Initiate, Working Memory, Plan/Organize, Organization of Materials, and Monitor. These scales form the Behavioral Regulation and Metacognition indexes and an overall score that is the sum of the two indexes, the Global Executive Composite. For the purpose of this study, only the Initiate scale on the teacher form (BRIEF-TF) was used (Fitzpatrick & Schraw, 2003).

Scores on the BRIEF-TF are given as *T*-scores and percentiles based on either an overall national norm group or by gender in the norm group. The BRIEF-TF can be completed by any adult who has had a considerable amount of contact with the child in an academic setting. The form takes about 10-15 minutes to complete. Scoring contains a negativity scale and an inconsistency scale to measure validity (Fitzpatrick & Schraw, 2003).

The items on the BRIEF were derived from a literature review and clinical experience. The clinical scales each have established constructs and items with high content validity. Internal consistency reliability is reported to be quite good, ranging from .80 to .98. Using Cronbach's alpha, the reliability of the composite scales almost all have alpha coefficients falling in the mid to upper .90s. Test-retest reliabilities were measured over a period of 3.5 weeks for the teacher form normative sample. The correlations were strong with alpha coefficients falling at .91 for the Global Executive Composite and in the mid to upper .80s for the individual scales. Interrater reliabilities for the parent and teacher raters were moderate (overall mean $r = .32$) for the normative group, but low for the scales Initiate ($r = .18$) and Organization of Materials ($r = .15$; Fitzpatrick & Schraw, 2003).

Construct validity was assessed by performing an exploratory factor analysis of the full scale using an oblique rotation, which yielded two factors explaining 75% of the variance. These factors corresponded to the Behavior Regulation and Metacognition Indices. A correlation of .65 between the factors was indicated by the factors analysis (Fitzpatrick & Schraw, 2003).

Convergent validity was established with other measures of inattention, impulsivity, and learning skills. Correlations between the BRIEF and Achenbach's Child Behavior Checklist ranged from .73 (Inhibit scale with aggressive behavior scales) to .11 (BRIEF Scales and the CBCL somatic scales). Working Memory on the BRIEF strongly correlated with the CBCL Attention Problems scale. ($r = .64$). Moderate correlations were shown between the BRIEF and the Conners' Rating Scales. The strongest were between the BRIEF Behavior Regulation Index and its underlying scales, and the CRS Restless-Disorganized ($r = .71$), Conduct Disorder ($r = .77$), and Hyperactive-Immature ($r = .57$) scales (Fitzpatrick & Schraw, 2003).

Wechsler Intelligence Scale for Children (WISC-IV)

The WISC-IV (Wechsler, 2003) is the most recent revision of Wechsler's intelligence tests for children and adolescents. It is an individually administered intelligence test designed for examinees between the ages of 6 years 0 months and 16 years 11 months. The test yields a Full Scale IQ (FSIQ) and four Index scores: Verbal Comprehension Index (VCI), Perceptual Reasoning Index (PRI), Working Memory Index (WMI), and Processing Speed Index (PSI). Fifteen subtests (10 core and 5 supplemental) comprise the WISC-IV. They include Similarities, Vocabulary, Comprehension, Information, and Word Reasoning (VCI); Block Design, Picture Concepts, Matrix Reasoning, and Picture Completion (PRI); Digit Span, Letter-Number Sequencing, and Arithmetic (WMI); Coding, Symbol Search, and Cancellation (PSI) . Scores on each subtest can be compared with the normative sample and converted into scaled scores. For the purposes of this study, only the WISC-IV Digit Span and Symbol Search subtests were used. The WISC-IV Digit Span and Symbol Search subtests require approximately 5 and 3 minutes respectively to administer (Maller & Thompson, 2005).

The standardization sample for the WISC-IV included 2,200 examinees, representative of the March 2000 U.S. Bureau of the Census data in terms of age, gender, race, ethnicity, parent education level, and four geographical regions. Internal consistency reliability for all subtests and composite scales was obtained using the split-half method with Spearman-Brown correction. Test-retest reliability coefficients were reported for speeded subtests. Average coefficients across age groups ranged from .79 to .90 for core subtests and .78-.88 for supplemental subtests. All Index coefficients with the exception of the PSI were at or above .90 at all ages. Coefficients on FSIQ were greater than or equal to .96 for every age (Maller & Thompson, 2005).

Content validity was based on reviews of the literature, input from panels, consultants, and various psychologists. The WISC-IV internal structure was investigated via exploratory (EFA) and confirmatory (CFA) factor analyses on core subtests scores for the entire standardization sample and both core and supplemental subtest scores of 1,525 children from the standardization sample. Principal axis EFA with oblique rotation results indicated most loadings occurred on expected factors. Confirmatory factor analyses tested competing one, two, three, four, and five factor models and the four factor model corresponding to WISC-IV Index scores was determined to be the best fitting model (Maller & Thompson, 2005).

Based on 244 examinees whose demographic characteristics varied a bit from the WISC-IV standardization sample, the WISC-IV and WISC-III were correlated (.89). Correlations between the WISC-IV FSIQ or Index scores and the Wechsler Individual Achievement Test-Second Edition (WIAT-II) were moderate to high (all $r \leq .18$), but Cancellation was a poor predictor of achievement subtest scores. Correlations between the WMI and the Children's Memory Scale (CMS) subtests were low to moderate, except for the CMS Attention/Concentration subtest (.74; Maller & Thompson, 2005).

Wechsler Nonverbal Scale of Ability (WNV)

The WNV (Wechsler, 2006) is an individually administered test of general cognitive ability that eliminates or minimizes verbal content. It is designed for use with examinees between the ages of 4 years, 0 months and 21 years, 11 months who are diverse in terms of linguistic, educational, cultural, and socioeconomic backgrounds, as well as conditions such as language disabilities and hearing loss. The test minimizes the need for receptive language skills and eliminates the effects of varying expressive language and mathematical skills on examinee scores. In addition, directions are pictorial, using little or no verbal instructions and tasks do not require the examinee to speak (Maddux & Tindal, in press).

The WNV includes six subtests, four of which can be given for a full four-subtest battery or brief two-subtest battery for each of two age groups: 4 years, 0 months through 7 years, 11 months and 8 years, 0 months through 21 years, 11 months. Each battery yields a full scale score. The subtests are Matrices, Coding, Object Assembly, Recognition, Spatial Span, and Picture Arrangement. Four optional scores include Spatial Span-Forward, Spatial Span-Backward, longest Spatial Span-Forward, and longest Spatial Span-Backward (Maddux & Tindal, in press). For the purposes of this study, only the WNV Spatial Span subtest was used.

Subtest raw scores on the WNV are converted to *T* scores with a mean of 50 and a standard deviation of 10 points. The sum of *T* scores are then converted to a full scale standard score with a mean of 100 and a standard deviation of 15. Age equivalents and percentile ranks can also be determined. Test development included a series of reviews by an international panel, a panel review of the pictorial directions, a series of three pilot studies, and a national tryout (Maddux &Tindal, in press).

Standardization of the WNV occurred concurrently in the United States and Canada. In the US, normative data included a sample of 1,323 examinees ages 4 years, 0 months, through 21 years, 11 months stratified by age, sex, race/ethnicity, education level, and geographic region. The sample was divided into 15 age groups (Maddux & Tindal, in press).

Internal consistency is adequate, as none of the subtest coefficients are below about .70 for any of the 15 age groups. The subtest coefficients averaged across the age groups ranged from .74 (Picture Arrangement) to .91 (Matrices). The average coefficient across age groups is .91for full scale scores. Coefficients for optional scores average .76 across age groups for Spatial Span-Forward, and .82 across age groups for Spatial Span-Backward. Coefficients provided for US special groups, including gifted, mild and moderate mental retardation, reading and written expression learning disorders, language disorder, English language learners, deaf, and hard of hearing, were reportedly adequate. Test-retest reliability is reported to be moderate for subtests and adequate for the full scale score. Interscorer agreement ranges from .88 to .94 for cases in the normative sample (Maddux & Tindal, in press).

In terms of validity, an intercorrelational study was used to determine the relationships among subtest and composite scores. The correlation between full scale scores for the two-subtest and four-subtest batteries was found to be .88 for both age groups and all subtests were found to be significantly correlated with each other. Confirmatory factor-analytic studies using a single-factor model produced specificities for the younger age group ranging from .43 to .63 and for the older age group ranging from .32 to .66 (Maddux & Tindal, in press).

Correlations of WNV scores with other Wechsler instruments and other nonverbal ability tests were performed to study criterion-related validity. When the WNV and the WISC-IV were compared, the two-subtest and four-subtest WNV full scale scores produced correlations with the WISC-IV full scale IQ of .58 and .76 respectively. For the two-subtest and four subtest WNV, correlations between the WNV and the WISC-IV Perceptual Reasoning Index were .57 and .66 respectively. Correlations between the WNV and the Naglieri Nonverbal Ability Test-Individual (NNAT-I; Naglieri, 2003) were .71 and .73 for the two and four-subtest batteries respectively. Correlations between the WNV and the Universal Nonverbal Intelligence Test (UNIT; Bracken & McCallum, 1998) were .62 and .73. Correlations with the WIAT-II produced coefficients of .43 and .60 (Maddux & Tindal, in press).

Concurrent validity was explored by comparing mean scores of special groups with mean scores of a control group matched for age, race/ethnicity, and education level. Significant differences were shown between the control group mean and the special group mean in studies of the gifted, both levels of mental retardation, and language disorders. Nonsignificant findings occurred in the remainder of the special groups (Maddux & Tindal, in press).

Resiliency Scales for Children and Adolescents (RSCA)

The RSCA (Prince-Embury, 2007) are composed of three self-report questionnaires (Sense of Mastery [MAS], Sense of Relatedness [REL], and Emotional Reactivity [REA]) and designed to identify resiliency factors in children ages 9 through 18. The current study included three participants who were 8 years-old and almost 9, so, although not ideal, the norms for a 9 year-old were used to assign standard scores. These participants were paid closer attention with regard to understanding item content. The MAS has 20 items and is comprised of three subscales: Adaptability, Optimism, and Self-Efficacy. The REL has 24 items and is comprised of four subscales: Comfort, Support, Tolerance, and Sense of Trust. The REA scale has 20 items and is comprised of three subscales: Impairment, Recover, and Sensitivity. Each item uses a 5-point Likert scale and requires an elementary-age reading proficiency (Sink & Mvududu, in press).

Item scores for each scale are summed to yield a raw score, which is then converted into a *T* score and compared with the relevant norm group. Higher MAS and REL and lower REA *T* scores suggest that the examinee has more resiliency resources and less vulnerability. Two overall indices, Resource Index (RI) and Vulnerability Index (VI) are calculated. Because of variance in development, the MAS Adaptability subscale is not interpreted for 9 to11 year olds and 12 to14 year olds and the REL Tolerance subscale is not interpreted for 9 to11 year olds. *T* scores and scaled scores (*ss*) are classified as high, above average, average, below average, and low (Sink & Mvududu, in press).

Scores on the RSCA may aid in developing intervention plans that focus on personal strengths and vulnerabilities. Scales can be utilized for prevention screening when administered in a group setting. The items can be read aloud for younger children. For the purpose of this study, the RSCA was administered individually and the items were read aloud by the examiner only if the participant required assistance (Sink & Mvududu, in press).

The scales' theoretical foundation draws from social learning theory, psychosocial theory, and developmental psychopathology. The constructs of the scales reportedly relate to the personal attributes that contribute to a child or adolescent's resiliency to adversity and the underlying protective factors (Sink & Mvududu, in press).

The scales were standardized with nine norm groups (total sample, females, males, and respondents divided into four age groups). Children (n = 450) and adolescents (n = 200) were purposively drawn from community sources and included participants (5%) with clinical diagnoses, but not in treatment. Participants were matched to the general population on race/ethnicity and caregiver education level (Sink & Mvududu, in press).

For each group, the three scales and two indices were internally consistent with alpha coefficients ranging from .83 to .93. For the 9 to 11 year-old group, three subscales (Adaptability, $\alpha = .56$; Optimism, $\alpha = .69$; Tolerance, $\alpha = .68$) were a bit lower. This was also the case with the Adaptability scale (12-14 age group) when disaggregated by gender ($\alpha = .61$). Both genders in the older group revealed alphas ranging from .79 to .97. Test-retest reliability revealed low-moderate scores for Adaptability ($r = .62$), Optimism ($r = .68$), and Support ($r = .69$). For females (Tolerance, $r = .60$; Support, $r = .64$) and males (Adaptability, $r = .65$; Sensitivity, $r = .57$), scores were also lower. For the 15 to 18 year-old group, resiliency scores ranged from .74 to .88. Coefficients for the late adolescent female group ranged from .71 to .94 and male group from .70 to .91 (Sink & Mvududu, in press).

Convergent and divergent validity were determined by correlating the RSCA with other similar instruments. The Reynolds Bully Victimization Scale (Reynolds, 2004) was significantly correlated to several RSCA subscales (male Sensitivity and Impairment subscale scores ranged from .48 to .64; female Adaptability, Self-Efficacy, Comfort, Trust, and Support scores ranged from -.58 to -.77). The Brown ADD Scales for Children (Brown, 2001) was significantly correlated with Adaptability and Tolerance on the RSCA. On the Beck Youth Inventories (BYI-II; Beck, Beck, Jolly, & Steer, 2005) Negative Affect and Behavior subscales, excluding Anxiety, were significantly correlated with MAS and REL (9-14 year age group, $r = -.31$ to -.38). MAS, REL, and RI scores were significantly correlated with the BYI-IIs Self-Concept scale ($r = .74, .70, .78$ respectively). REA was correlated with the BYI-IIs scales of Disruptive

Behavior, Anger, Depression, and Anxiety (r = .43 to .70) and the RSCA VI was significantly correlated with BYI-IIs Anxiety (r = .36) and Disruptive Behavior (r = .71) scales (Sink & Mvududu, in press).

Criterion validity for the RSCA was established by comparing various clinical samples to matched nonclinical groups with *t* tests. The two samples were significantly different across all resiliency scores for the 9 to 13 year old group, which produced relatively large effect sizes (d = .67 to -1.84). When comparing 14 individuals with bipolar disorder with the nonclinical sample, nonsignificant differences in REL scale and subscale scores were detected. For the 15 to 18 year age group, the clinical and matched nonclinical groups differed across all scales and subscales (d = .44 to 2.27). For the 15 to 18 year old group, clinical versus nonclinial respondents produced nonsignificant differences on resiliency subscales (Sink & Mvududu, in press).

Child PTSD Symptom Scale (CPSS)

The Child PTSD Symptom Scale was developed to measure the severity of post-traumatic stress symptoms in children and adolescents and may be used to make a diagnosis of Posttraumatic Stress Disorder (PTSD) based on the DSM-IV criteria. This self-report measure takes approximately 10 minutes to administer and is keyed to the DSM criteria for PTSD. The measure includes two event items, 17 items to ascertain the symptom frequency in the past month, and seven items evaluating whether the symptoms interfere with various types of functioning. Symptom frequency items are answered on a 4-point Likert-type scale: 0 (*not at all*), 1 (*once a week or less*), 2 (*2 to 4 times a week*), and 3 (*5 or more times a week*). They produce a total symptom severity score ranging from 0 to 51 and scores for each of the three symptom clusters: Reexperiencing, Avoidance, and Arousal. These can also be scored dichotomously to yield diagnostic status (cutoff greater than 11). Items regarding functioning are answered dichotomously as either *absent* (0) or *present* (1) and yield a total severity-of-impairment score between 0 and 7 (Foa, Johnson, Feeny, & Treadwell, 2001).

The normative sample included 75 children and adolescents ages 8 through 15 (mean = 11.8 years; 59% girls, and 41% boys) who had experienced a devastating earthquake in Northridge, California about two years prior. To examine age differences, children were split into a younger (8-11 years) and an older group (12-15 years) group, but no significant differences were noted. Gender differences were, however, noted as girls reported significantly greater total CPSS scores as well as subscores of each symptom cluster than did boys. Mean CPSS scores for the entire sample were 7.6 (SD = 8.1) for the total scores, 1.9 (SD = 2.7) on the reexperiencing subscale, 2.7 (SD = 3.4) on the avoidance subscale, and 2.7 (SD = 2.7) on the arousal subscale. According to the DSM-IV diagnostic criteria for PTSD, 24% of the sample reported symptoms consistent with this diagnosis (Foa, Johnson, Feeny,& Treadwell, 2001).

High internal consistency of the CPSS symptom severity was demonstrated by alpha coefficients of .89 for total score, .80 for reexperiencing, .73 for avoidance, and .70 for arousal. Subscale intercorrelations and the total CPSS score were high: .89 for reexperiencing, .91 for avoidance, and .90 for arousal. The intercorrelations among the three subscales ranged from .70 to .89. Low internal consistency was demonstrated on the functional impairment scale (alpha = .35). When one item that was not related to any other impairment items was removed, internal consistency improved to .89 (Foa, Johnson, Feeny, & Treadwell, 2001).

Test-retest reliability of the PTSD symptom diagnosis was moderate with 65 children on retest (kappa = .55). Percentage agreement of diagnosis was moderately high at 84%. Test-retest reliability of PTSD symptom severity total scale and cluster scores were moderate to excellent. (total score = .84; reexperiencing = .85; avoidance = .63; arousal = .76). Finally, test-retest reliability of the functional impairment score was very good ($r = .70$; Foa, Johnson, Feeny, & Treadwell, 2001).

To assess convergent validity the CPSS was compared with the CPTSD-RI severity rating to obtain a Pearson product-moment correlation coefficient of .80 ($p < .001$). Divergent validity was examined by correlating the CPSS total and subscale scores with depression (DSRSC) and anxiety (MASC) scores. These correlations were lower than the correlation with the CPTSD-RI, indicating that the CPSS appears to be measuring a construct different from depression and anxiety (Foa, Johnson, Feeny, & Treadwell, 2001).

A discriminant function analysis indicated that a linear combination of the three subscales was able to significantly discriminate between children high and low on CPTSD-RI scores. The CPSS subscales correctly classified 95% of the cases. Through inspection of the total scaled score distribution for children high and low for PTSD symptoms, a cutoff score of greater than or equal to 11 was established as the criterion for diagnosing PTSD (Foa, Johnson, Feeny, & Treadwell, 2001).

Procedure

I or a research assistant who was properly trained by the program director of the Counseling Psychology Ph.D. program administered the assessments. Each of 67 participants participated in an approximately 60-minute administration session at his or her school during a free period when the participant completed all tasks. Administration time was largely determined by the performance of each individual child and if a short break was needed, it was provided at the examiners discretion. Each participant was administered the following measures: (a) WISC-IV Symbol Search (Wechsler, 2003);(b) WISC-IV Digit Span (Wechsler, 2003); (c) WNV Spatial Span (Wechsler, 2006); (d) Connors' CPT-II (Conners, 2009); (e) CPSS (Foa et al., 2001); and (f) RSCA (Prince-Embury, 2007). Measures a through d were counterbalanced to eliminate any effects that may be due to the order of the measures given. The CPSS and RSCA were given last, so that any feelings or stress surrounding the questionnaires did not affect performance on other measures. If it appeared that a student was having emotional difficulty as a result of the questions, the plan was to refer him or her to the school social worker; however this was not necessary with any of the participants. In addition, the participants' teachers completed the initiation scale on the BRIEF-TF (Isquith, Guy, & Gioia, 2005) at a time that was convenient for them and returned it when complete.

In order to preserve the anonymity and confidentiality of the participants' data, all identifiable information was recorded by administering a participant code to each participant's protocol. Therefore, participants were not publicly identified. Data were securely locked and only the primary investigator had the key.

Hypotheses and Data Analysis Plan

Hypothesis 1a. It was expected that poverty and trauma-induced stress would negatively affect performance on a measure of sustained attention, thus leading to an inverse relationship between scores on a measure of trauma induced stress and scores on a measure of sustained attention. To establish the strength of the relationship between these variables, a bivariate correlation was conducted in which scores of trauma-induced stress were analyzed with scores of sustained attention.

Hypothesis 1b. It was expected that poverty and trauma-induced stress would negatively affect performance on a measure of initiation, thus leading to an inverse relationship between scores on a measure of trauma-induced stress and scores on a measure of initiation. To establish the strength of the relationship between these variables, a bivariate correlation was conducted in which scores of trauma-induced stress were analyzed with initiation scores.

Hypothesis 1c. It was expected that poverty and trauma induced stress would negatively affect performance on a measure of working memory, thus leading to an inverse relationship between scores on a measure of trauma induced stress and scores on measures of working memory. To establish the strength of the relationship between these variables, a bivariate correlation was conducted in which scores of trauma-induced stress were analyzed with working memory scores.

Hypothesis 1d. It was expected that poverty and trauma induced stress would negatively affect performance on a measure of processing speed, thus leading to an inverse relationship between scores on a measure of trauma-induced stress and scores on a measure of processing speed. To establish the strength of the relationship between these variables, a bivariate correlation was conducted in which scores of trauma-induced stress were analyzed with processing speed scores.

Hypothesis 2. In children who have experienced stress related to poverty and trauma, it was expected that higher resilience would lessen the negative impact of trauma induced stress and poverty induced stress and be associated with stronger scores on measures of sustained attention, initiation, working memory, and processing speed. To establish the strength of the relationship between these variables, bivariate correlations were conducted between sense of mastery, sense of relatedness, and emotional reactivity scores and scores of sustained attention, initiation, working memory, and processing speed.

Power Analysis

In order to determine the appropriate sample size for the present study and to have meaningful outcomes, power analyses were conducted. The power of a statistical analysis refers to the likelihood that the test would produce a statistically significant result, given that the variable outcome being tested is in fact present (Cohen, 1988). Witte and Witte (2007) defined statistical power of a hypothesis as the probability of detecting a particular effect or rejecting the null hypothesis. Power analyses conducted prior to data collection help to determine an appropriate sample size for meaningful outcomes. This power analysis conducted for this study used the computer program G*Power (Erdfelder, Faul, & Buchner, 1996) and employed Cohen's (1988) criteria for effect size.

In order to explore the relationships between trauma induced stress, neuropsychological variables, and resiliency, bivariate correlations were conducted. Alpha was set at the traditional level of significance ($p \leq .05$) for all analyses in this study. A medium effect size of .30 was chosen based on Cohen's (1988) rule of thumb for determining effect size for a correlation. A medium effect is conservative enough without introducing unnecessary error due to imperfect psychometric properties of the assessments leading to findings that lack importance. In addition, the literature in the area supports this choice (e.g. DeBellis et al., 2009; DePrince et al., 2009).

Hypothesis 1a. To establish the strength of the relationship between these variables, a bivariate correlation was conducted in which scores of trauma-induced stress were analyzed with sustained attention scores to determine if there was a significant relationship. With an alpha level of 0.05, the required sample size was 67 with a medium effect size of 0.30 and power at 0.80.

Hypothesis 1b. To establish the strength of the relationship between these variables, a bivariate correlation was conducted in which scores of trauma-induced stress were analyzed with initiation scores to determine if there was a significant relationship. With an alpha level of 0.05, the required sample size was 67 with a medium effect size of 0.30 and power at 0.80.

Hypothesis 1c. To establish the strength of the relationship between these variables, a bivariate correlation was conducted in which scores of trauma-induced stress were analyzed with working memory scores to determine if there was a significant relationship. With an alpha level of 0.05, the required sample size was 67 with a medium effect size of 0.30 and power at 0.80.

Hypothesis 1d. To establish the strength of the relationship between these variables, a bivariate correlation was conducted in which scores of trauma-induced stress were analyzed with processing speed scores to determine if there was a significant relationship. With an alpha level of 0.05, the required sample size was 67 with a medium effect size of 0.30 and power at 0.80.

Hypothesis 2. To establish the strength of the relationship between these variables, bivariate correlations were conducted in which resilience (sense of mastery, sense of relatedness, and emotional reactivity) scores analyzed with sustained attention, initiation, working memory, and processing speed scores to determine if there was a significant relationship. With an alpha level of 0.05, the required sample size was 67 with a medium effect size of 0.30 and power at 0.80.

Based on power analyses, 67 participants were needed to achieve adequate power in this study. However, only 47 participants were actually obtained. This will be further addressed in Chapter V. The hypotheses were tested after the data were collected and analyzed using SPSS version 17.0.

Chapter IV

RESULTS

Analysis of the Data

This chapter provides the descriptive statistics for the sample, results of the hyposthesis tests, supplemental analyses, and summary of the findings of this study. The purpose of this study was to determine the effects of poverty induced stress and trauma induced stress on sustained attention, initiation, working memory, and processing speed and examine the moderating effects of resilience. It is known that children raised in low-income homes are more likely to experience high levels of stress (Blair, Granger, & Razza, 2005). In addition, stress related to poverty and traumatic events may increase the risk for cognitive difficulties (DeBellis, Hooper, & Sapia, 2005). With prevalence rates of trauma exposure in children suggested to be between 70-100%, these children are at risk for difficulties in attention, executive functioning, and processing speed, which are supported by brain regions affected by stress (Dempsey, Overstreet, & Moely, 2000; Macy, Baryry, & Noam, 2003). However, the presence of protective factors may lessen the negative effects of stress.

Demographics

The present study examined 47 participants, ranging in age from 8 to 13 years (M = 10.26, SD = 1.41). The sample was made up of 53.2% males (n = 25) and 46.8% females (n = 22). Table 1 summarizes demographic variables for sex and grade.

Table 1

Overall Demographic Characteristics (n = 47)

	n	Percent
Sex		
Male	25	53.2
Female	22	46.8
Grade		
3rd	16	34.0
4th	14	29.8
5th	5	10.6
6th	8	17.0
7th	4	8.5
8th	0	0

Descriptive Statistics

To determine if there were any significant relationships between the demographic variables and the key variables (i.e. sustained attention, initiation, working memory, processing speed, trauma symptoms, and resilience) a correlation matrix was performed and is summarized in Table 2. As observed within the table, a significant relationship was detected between sex and CPT CI and, more specifically, males tended to have more problems with sustained attention (r = -.302, $p < 0.05$). In addition, there was a significant negative correlation between grade and CPT CI (r = -.260, $p < 0.05$), indicating that children in lower grades had more problems with attention. Grade level was coded with third and fourth grades under one code and fifth through eighth under another, which provided the most even split. Finally, there was a significant positive correlation between grade and RSCA Mastery (r = .266, $p < 0.05$), indicating that children in higher grades had a higher sense of mastery. Descriptive statistics for key study variables and neuropsychological instruments administered were estimated and are summarized in Table 3.

Table 2

Correlation Matrix between Key Study Variables and Demographic Variables.

		SS	DSp	SSp	CPT	BRIEF	Age	Grade	Sex	CPSS	RSCA MAS	RSCA REL	RSCA REA
Sym Srch	Pearson Cor.	1	.269*	.521**	-.440**	-0.300	-0.093	-0.146	0.225	-0.208	0.159	0.212	-0.162
	Sig. (1-tailed)		0.035	0.000	0.002	0.121	0.268	0.167	0.067	0.099	0.148	0.081	0.146
	N	46	46	46	42	19	46	46	46	40	45	45	44
Digit Span	Pearson Cor.	.269*	1	.570**	-.284*	-0.089	-0.055	-0.126	0.057	-0.088	-0.183	0.015	-.445**
	Sig. (1-tailed)	0.035		0.000	0.033	0.363	0.356	0.199	0.351	0.291	0.112	0.461	0.001
	N	46	47	47	43	20	47	47	47	41	46	46	45
Spat Span	Pearson Cor.	.521**	.570**	1	-.328*	-0.312	0.074	0.091	0.075	-0.168	0.201	0.219	-0.211
	Sig. (1-tailed)	0.000	0.000		0.016	0.104	0.309	0.271	0.308	0.147	0.091	0.072	0.082
	N	46	47	47	43	20	47	47	47	41	46	46	45
CPT	Pearson Cor.	-.440**	-.284*	-.328*	1	0.147	-0.196	-.260*	-.302*	0.260	-0.179	-.286*	.368**
	Sig. (1-tailed)	0.002	0.033	0.016		0.301	0.104	0.046	0.024	0.058	0.128	0.033	0.009
	N	42	43	43	43	17	43	43	43	38	42	42	41
BRIEF	Pearson Cor.	-0.300	-0.089	-0.312	0.147	1	0.246	-0.19	-0.092	0.113	-0.179	-0.181	-0.290
	Sig. (1-tailed)	0.121	0.363	0.104	0.301		0.162	0.209	0.358	0.333	0.238	0.236	0.121
	N	19	20	20	17	20	20	20	20	19	20	20	20

		SS	DSp	SSp	CPT	BRIEF	Age	Grade	Sex	CPSS	RSCA MAS	RSCA REL	RSCA REA
Age	Pearson Cor.	-0.093	-0.055	0.074	-0.196	0.246	1	.895**	-0.142	-0.007	0.072	-0.021	0.099
	Sig. (1-tailed)	0.268	0.356	0.309	0.104	0.162		0.000	0.171	0.484	0.317	0.444	0.258
	N	46	47	47	43	18	47	47	47	41	46	46	45
Grade	Pearson Cor.	-0.146	-0.126	0.091	-.302*	-0.092	.895**	1	-0.085	-0.002	0.266*	0.215	0.153
	Sig. (1-tailed)	0.167	0.199	0.271	0.024	0.358	0.000		0.285	0.495	0.037	0.076	0.158
	N	46	47	47	43	20	47	47	47	41	46	46	45
Sex	Pearson Cor.	0.225	0.057	0.075	-.302*	-0.092	-0.142	-0.085	1	-0.057	-0.058	0.136	-0.070
	Sig. (1-tailed)	0.067	0.351	0.308	0.024	0.358	0.171	0.285		0.361	0.350	0.183	0.323
	N	46	47	47	43	20	47	47	47	41	46	46	45
CPSS	Pearson Cor.	-0.208	-0.088	-0.168	0.260	0.113	-0.007	-0.002	-0.057	1	-.267*	-0.040	.465**
	Sig. (1-tailed)	0.099	0.291	0.147	0.058	0.333	0.484	0.495	0.361		0.045	0.403	0.001
	N	40	41	41	38	19	41	41	41	41	41	41	40
RSCA MAS	Pearson Cor.	0.159	-0.183	0.201	-0.179	-0.179	0.072	0.266*	-0.058	-.267*	1	.618**	-0.049
	Sig. (1-tailed)	0.148	0.112	0.091	0.128	0.238	0.317	0.037	0.350	0.045		0.000	0.374
	N	45	46	46	42	20	46	46	46	41	46	46	45
RSCA REL	Pearson Cor.	0.212	0.015	0.219	-.286*	-0.181	-0.021	0.215	0.136	-0.040	.618**	1	-0.186
	Sig. (1-tailed)	0.081	0.461	0.072	0.033	0.236	0.444	0.076	0.183	0.403	0.000		0.111
	N	45	46	46	42	20	46	46	46	41	46	46	45
RSCA REA	Pearson Cor.	-0.162	-.445**	-0.211	.368**	-0.290	0.099	0.153	-0.070	.465**	-0.049	-0.186	1

	SS	DSp	SSp	CPT	BRIEF	Age	Grade	Sex	CPSS	RSCA MAS	RSCA REL	RSCA REA
Sig. (1-tailed)	0.146	0.001	0.082	0.009	0.121	0.258	0.158	0.323	0.001	0.374	0.111	
N	44	45	45	41	20	45	45	45	40	45	45	45

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed).

Table 3

Descriptive Statistics for Key Study Variables and Neuropsychological Instruments.

	M	*SD*	*Minimum Score*	*Maximum Score*
CPSS	19.07	9.90	0	38
RSCA				
Mastery	48.04	13.76	25	71
Relatedness	55.5	21.47	24	98
Reactivity	28.89	17.01	2	62
WISC-IV				
Digit Span	15.04	4.02	9	26
Symbol Search	20.63	8.96	4	43
WNV Spatial Span	12.17	3.91	9	22
Connors' CPT	62.82	25.72	0	50
BRIEF-TF Inititate	11.44	3.01	7	17

Note. CPSS = Child PTSD Symptom Scale; RSCA = Resiliency Scale for Children and Adolescents; WISC-IV = Wechsler Intelligence Scale for Children, Fourth Edition; WNV = Wechsler Nonverbal Scale of Intelligence; CPT = Continuous Performance Test; BRIEF-TF = Behavior Rating Inventory of Executive Functions- Teacher Form.

PTSD versus Non-PTSD on Neurocognitive Functioning

Foa et al. (2001) suggested a cutoff score of 11 on the CPSS to differentiate between individuals who meet criteria for Post Traumatic Stress Disorder (scores >= 11) and those who do not (scores < 11). To this end, a a *t*-test was performed to examine whether there were significant differences between these two groups on neurocognitive functioning. No significant differences were detected.

Verbal Working Memory versus Non-Verbal Working Memory

To determine whether the format (verbal versus nonverbal) of the working memory task influenced results, a *t*- test was performed comparing the distribution means of verbal working memory (WISC-IV Digit Span) and non-verbal working memory (WNV Spatial Span). No significant differences were detected.

Primary Analyses

Hypothesis 1

The first set of hypotheses posited that there would be statistically significant relationships between traumatic stress and neuropsychological functions. Specifically, it was predicted that higher scores on the CPSS would be associated with lower scaled scores on the WAIS-IV Symbol Search, WAIS-IV Digit Span, and WNV Spatial Span; higher CPT Confidence Indeces (CI); and higher T-scores on the BRIEF-TF Initiate scale. One-tailed bivariate correlations revealed no significant correlations and, therefore, this hypothesis was not supported. A trend did exist towards a positive correlation between scores on the CPSS and the CPT ($r = .260$, $p = .058$), suggesting that participants with more symptoms of traumatic stress may show increased difficulties with sustained attention. Again, this is not a significant finding, but one to note for future focus.

Hypothesis 2

The second hypothesis posited that stronger scores on the RSCA would be significantly correlated with stronger scores on the neuropsychological measures. Specifically, it was predicted that higher *T*-scores on the RSCA MAS and REL scales and lower scores on the RSCA

REA scale would be associated with higher scaled scores on the WAIS-IV Symbol Search, WAIS-IV Digit Span, and WNV Spatial Span; a lower CPT CI; and lower *T*-scores on the BRIEF-TF Initiate scale.

Results of the one-tailed bivariate correlations indicated that there were several significant findings. First, there was a significant negative correlation between RSCA REL and CPT CI ($r = -.286$, $p < .05$), suggesting that participants with a higher sense of relatedness had less difficulty with sustained attention. Second, RSCA REA was negatively correlated with WAIS-IV Digit Span ($r = -.445$, $p = .001$), indicating that individuals with less emotional reactivity performed better on a task of working memory. RSCA REA was positively correlated with CPT CI ($r = .368$, $p < .01$), suggesting that individuals with lower emotional reactivity had less difficulty with sustained attention. These findings supported this hypothesis and results are summarized in Table 4.

Table 4

Correlations of Resilience and Neuropsychological Variables.

		SS ss	Dsp ss	SSp T	CPT CI	BRIEF T	RSCA MAS T	RSCA REL T	RSCA REA T
Symbol Search ss	Pearson Correlation	1	.269*	.521**	-.440**	-0.300	0.159	0.212	-0.162
	Sig. (1-tailed)		0.035	0.000	0.002	0.121	0.148	0.081	0.146
	N	46	46	46	42	17	45	45	44
Digit Span ss	Pearson Correlation	.269*	1	.570**	-.284*	-0.089	-0.183	0.015	-.445**
	Sig. (1-tailed)	0.035		0.000	0.033	0.363	0.112	0.461	0.001
	N	46	47	47	43	18	46	46	45
Spatial Span T	Pearson Correlation	.521**	.570**	1	-.328*	-0.312	0.201	0.219	-0.211
	Sig. (1-tailed)	0.000	0.000		0.016	0.104	0.091	0.072	0.082

		SS ss	Dsp ss	SSp T	CPT CI	BRIEF T	RSCA MAS T	RSCA REL T	RSCA REA T
	N	46	47	47	43	18	46	46	45
CPT CI	Pearson Correlation	-.440**	-.284*	-.328*	1	0.147	-0.179	-.286*	.368**
	Sig. (1-tailed)	0.002	0.033	0.016		0.301	0.128	0.033	0.009
	N	42	43	43	43	15	42	42	41
BRIEF T	Pearson Correlation	-0.300	-0.089	-0.312	0.147	1	-0.179	-0.181	-0.290
	Sig. (1-tailed)	0.121	0.363	0.104	0.301		0.238	0.236	0.121
	N	17	18	18	15	18	18	18	18
RSCA MAS T	Pearson Correlation	0.159	-0.183	0.201	-0.179	-0.179	1	.618**	-0.049
	Sig. (1-tailed)	0.148	0.112	0.091	0.128	0.238		0.000	0.374
	N	45	46	46	42	18	46	46	45
RSCA REL T	Pearson Correlation	0.212	0.015	0.219	-.286*	-0.181	.618**	1	-0.186
	Sig. (1-tailed)	0.081	0.461	0.072	0.033	0.236	0.000		0.111
	N	45	46	46	42	18	46	46	45
RSCA REA T	Pearson Correlation	-0.162	-.445**	-0.211	.368**	-0.290	-0.049	-0.186	1
	Sig. (1-tailed)	0.146	0.001	0.082	0.009	0.121	0.374	0.111	
	N	44	45	45	41	18	45	45	45

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed).

Conclusions

The results suggest partial support for the hypotheses of this study. For the first hypothesis, it was expected that there would be statistically significant relationships between trauma symptoms and neuropsychological functions; however, none were found and hypothesis one was rejected. Next, it was predicted that stronger scores on measures of resilience would be significantly correlated with stronger scores on the neuropsychological measures. There were significant correlations between sense of reliability and sustained attention, sense of reactivity and working memory, and sense of reactivity and sustained attention. Therefore, this hypothesis was partially supported. No additional significant relationships were found.

Overall, symptoms of traumatic stress were not found to be associated with reduced neurocognitive functioning as predicted. However, it appears that resilience may be associated with stronger neuropsychological functioning. Specifically, the RSCA Emotional Reactivity scale was the most sensitive parameter to measure the effects of resilience on neurocognitive functioning. This finding is based on results of the bivariate correlations performed among key variables.

Chapter V

DISCUSSION

Summary and Conclusions of Research

This study sought to determine the effects of poverty induced stress and trauma induced stress on sustained attention, initiation, working memory, and processing speed and to examine the moderating effects of resilience. A neurocognitive approach to psychological stress was utilized in order to clarify the impact of traumatic stress on cognitive functioning and achievement. This target population was recruited from an underprivileged urban school. This chapter discusses the statistical findings associated with each research hypothesis, compares the current findings with previously conducted empirical research studies, and explores implications and future directions for research.

Although children in the United States are held to similar standards in terms of meeting academic benchmarks, some live in environments that pose significant barriers to them functioning on an equivalent academic level as their peers in other parts of the country. Research findings from the National Comorbidity Survey (NCS) suggest that 60.7% of men and 51.2% of women had experienced at least one lifetime traumatic event (Kessler, Sonnega, Bromet, Hughs, & Nelson, 1995). In urban children, this number has been predicted to be between 70 and 100%. Children growing up in low-income homes are also more likely to experience high levels of stress. The lifetime prevalence rates of post-traumatic stress disorder (PTSD) in children and adolescents are at least as high or higher than prevalence rates during adulthood (De Bellis, Hall, Boring, Frustaci, & Moritz, 2001). A chronic stress response produced by traumatic experiences has been shown to negatively affect sustained attention, initiation, working memory (specifically digit repetition), and processing speed (Beers & De

Bellis, 2002; Shin, Rauch, & Pitman, 2005; Vasterling, Brailey, Constans, & Sutker, 1998; Vasterling et al., 2002) and protective factors may help to buffer some of the negative effects (Bonanno & Mancini, 2008).

In general, cognitive abilities, such as attention, executive functioning, and processing speed are a large part of life in the classroom and are necessary to succeed in school. Attention is the directivity and selectivity of mental processes (Luria, 1973) and is modulated through focus-execution, sustaining, shifting, and encoding. Executive functioning describes the "ability to maintain an appropriate problem-solving set for attainment of a future goal" (Welsh & Pennington, 1988, p. 201) and involves the organizing and directing of cognitive activity, emotional responses, and behavior (Isquith, Crawford, Espy, & Gioia, 2005). Working memory, the holding of information mentally for the purpose of completing a related task, and initiation or the ability to get started were most relevant to the goals of this study. Processing speed is the ability to rapidly scan and react to simple tasks (Sattler, 2008). Early disruption to the executive functioning system may lead to severe disruption across a range of domains, including cognitive, social, and behavioral dimensions, leading to a disruption in the school environment.

Protective factors that exist in certain individuals may be associated with the ability to bounce back and grow psychologically following adversity (Aldwin, 2007; Bonanno & Mancini, 2008; Campbell-Sills, Forde, & Stein, 2009; Polk, 1997). Resilience has been thought of as hardiness, competence, optimism, high self-esteem, achievement, social skills, and the absence of pathology in the face of adversity. In other words, it can been seen as the ability to weather adversity and bounce back from a negative experience, as a result of protective factors, which include personal qualities, social environment, and outside environment (Cicchette, 2010; Prince-Embury, 2007).

This study provides information about how stress affects neurocognitive functions relevant to school achievement, which provides rationale for building resilience. Therefore, the primary hypotheses tested were that increased trauma symptoms would be associated with weaker cognitive functions and that resilience would be correlated with stronger cognitive functions. There was some support of these hypotheses and these key study findings will be detailed below with a discussion of clinical implications and areas for future study.

Discussion of the Results of the Hypotheses

The first research question examined whether poverty and trauma-induced stress resulted in lower performance on measures of sustained attention, initiation, working memory, and processing speed. The first set of hypotheses predicted that trauma induced stress would negatively affect performance on measures of sustained attention, working memory, initiation, and processing speed. This hypothesis was not supported in the present study. However, there was a trend towards a positive correlation between traumatic stress symptoms and abilities of sustained attention. Although the finding was not significant in the current study, it is an area to focus on in the future and may be bolstered in a study with more participants.

Extant research demonstrates a link between trauma/ PTSD and attention, specifically sustained attention. Studies of military veterans found that veterans with PTSD performed worse than those without PTSD on a continuous performance test, requiring sustained attention (Vasterling, Brailey, Constans, & Sutker, 1998; Vasterling & Brailey, 2005). Difficulty with sustained attention was also seen in children with maltreatment-related PTSD (Beers & De Bellis, 2002).

The second research question examined whether resilience effectively moderated the negative impact of stress on sustained attention, initiation, working memory, and processing speed. This hypothesis predicted that higher resilience would be associated with stronger scores on measures of sustained attention, initiation, working memory, and processing speed. This hypothesis was partially supported.

Results demonstrated that a higher sense of relatedness was associated with less sustained attention difficulties. As research on resilience has only recently begun, there are few studies linking resilience to specific neuropsychological functions such as sustained attention. Luthar (2006) and Masten (2007) found that skills linked to executive functions, such as problem solving, foresight in planning, and a future orientation are associated with resilient functioning.

In this study, lower emotional reactivity was correlated with less sustained attention difficulties, which supported this hypothesis. One would speculate that if a child is more emotionally reactive, it is less likely that he would be able to sustain focus over a period time. This might be due to emotionally stimulating events in the classroom with peers or teachers. Sustained attention difficulties would make it challenging to engage in the learning process, so resilient functioning, evidenced by lower emotional reactivity, has strong implications for academic performance.

Results also showed that lower emotional reactivity was associated with stronger working memory, which is consistent with this hypothesis. It makes sense that a child who is less emotionally reactive would be able to use the attention, planning, and mental manipulation to formulate a strategy to successfully execute a working memory task. Research shows that resilient youths have been found to have better self-regulatory skills (i.e. executive functions; Buckner, Mezzacappa, & Beardslee, 2003) and stronger intellectual functioning (Masten, Hubbard, Gest, Tellegen, Garmezy, & Ramirez, 1999) than non-resilient youths.

After discussing specific results, it is important to consider how these findings may generalize to a larger population of students who have experienced or are currently experiencing the effects of poverty and trauma induced stress. The results of this study bring to light the challenges that students in similar settings may be facing. Children who live in underprivileged urban areas appear to be experiencing disproportionately high rates of trauma exposure (Dempsey, Overstreet, & Moely, 2000; Macy, Barry, & Noam, 2003). As a result, levels of traumatic stress are high and are affecting students' classroom functioning. Specifically, this study detected problems in sustained attention that were potentially related to trauma. In addition, stronger resilience characteristics were related to stronger working memory and sustained attention. Therefore, children in equivalent settings who share similar experiences should be monitored for the risks of trauma-induced stress and would likely benefit from programs that build resilience, some of which will be discussed below.

Clinical and Practical Implications

The results of this study have implications for better understanding (a) the effects of psychological stress on neurocognitive functioning and academic performance, (b) the moderating effects of resilience, and (c) the importance of programs with the potential to increase resilience. Given the findings of the current study, psychologists and educators will play a vital role in disseminating to the larger community the impact of these factors and providing rationale for structuring programs to meet students' psychological and academic needs.

Counseling psychologists have a responsibility to advocate for such disadvantaged populations and tailor treatments to support them. Extant literature on trauma-focused cognitive behavioral therapy provides information on treating these individuals in therapy (Cohen, Mannarino, & Deblinger 2006; Murray, Cohen, & Mannarino, 2013). Trauma-focused cognitive behavioral therapy is an evidence-based approach for traumatized children and their families to help build core skills in areas such as safety affect regulation. Strategies in this work include prioritizing safety, enhancing engagement of a support system, differentiating between real danger and hypervigilance of trauma reminders, and providing advocacy for the receipt of other community services (Murray et al., 2013). Research has also shown beneficial effects of its use by psychologists in the school environment, as school has been identified as the main entry portals for children's access to mental health services (Fitzgerald & Cohen, 2012)

Relational play therapy is another approach that has been identified as an effective treatment to help traumatized children to reconnect to others in healthy ways (Vicario, Tucker, Adcock, & Hudgins-Mitchell, 2013). Here, play therapy can help to build the foundation of a safe and trusting relationship, which can hold the therapeutic work of trauma resolution. The overarching goal is to help the child to expand the capacity for connection, with the assumption that his or her ability to connect with others has diminished after a traumatic event.

Educators have a responsibility to provide the best education possible, which may mean incorporating specific strategies or programs, such as resilience training, to promote learning. This is of particular importance given the findings in the present study and trends in the extant literature that various neurocognitive functions and academic achievement are negatively affected by stress exposure, but may be moderated by the presence of resilience.

With results suggesting that resilience is an important characteristic in moderating the effects of trauma induced stress, interventions for building resilience will be discussed. Interventions should be strength-based and, in younger children, might involve positive selfexpectation, breaking down and conquering tasks in steps, and recognizing and rewarding individuals when someone is accomplished (Prince-Embury, 2007).

For individuals who scored low on the Sense of Mastery scale, it can be helpful to have a discussion about how they conceptualize competence through exploring what they can recall having done well. Counseling may help cultivate this process and introduce more mastery experiences by "mining for mastery." Once these areas are identified, therapeutic work can be directed to further identify, elaborate, enhance, and generalize strengths. For example, a clinician may help a child to be able generalize strengths in one arena to an area in which he has been less successful. Enhancing these strengths will often require the support of teachers and parents as well. Barriers to strengths should also be identified and clinicians can help to explore strategies to diffuse them. Prince-Embury (2007) provides further recommendations for utilizing the information provided by the scales and more detail on building certain resilient characteristics.

Research has suggested that an individual's perception that social support is available and accessible, regardless of whether or not it is enacted, is predictive of psychological well-being. (Hogan, Linden, & Najarian, 2002). This highlights the need to explore the support systems of children and adolescents so that, in times of crises, they know how to ask for help. A clinician may help a child to identify who and how they may ask for help in a variety of scenarios (Prince-Embury, 2007).

For youth who have higher than average emotional reactivity, as many in the current study did, vulnerability management may be a primary intervention. Emotional reactivity may be broken down into the components of sensitivity, recovery, and impairment and self-management can be discussed by the clinician. The clinician may need to normalize the behavior and help teach the individual to identify triggers, learn to anticipate them, and learn more effective strategies for calming down. Group settings can be valuable to managing vulnerability as well. Techniques focus on identifying triggers for emotional reactivity and helping participants to have a discussion about the difficulty they have in a variety of situations. These techniques are based in behaviorism and lead to an increase in self-awareness (Prince-Embury, 2007).

The results of this study should aid in making mental health providers aware, not only of the cognitive deficits that may be present in their work with patients experiencing trauma induced stress, but of their important role in helping to build resilience in such individuals. Prince-Embury (2007) stresses the importance of developing resilient classrooms at school, supplemented with the development of structured mental health programs. These programs may utilize the therapies mentioned above that have been shown to be effective with this population.

With respect to sense of mastery, environments should provide somewhat challenging tasks in circumstances that are rewarding and accepting despite the outcome. Circumstances, feelings, thoughts, and behaviors that allow successful functioning under challenging conditions should be combined. Children can be reinforced by rewards offered for resiliency attitudes, feelings, and behaviors, whether or not successful outcomes have been achieved. Modeling is an important component too as others help to model resilient attitudes and behaviors in mildly challenging, as well as extraordinary circumstances. This all requires an awareness on the part of the providers, as they need to be able to reward the process underlying specific behaviors, as well as reacting to the outcome with non-punitive, accurate feedback. For example, children may be rewarded for taking a risk on a new activity (Prince-Embury, 2007).

While there are several strength-based resiliency enhancing programs, the Penn Resiliency Program provides a good example of the types of interventions offered. This program sponsors school-based interventions targeting adolescents to increase well-being and prevent depressive symptoms. The Penn Optimism Program (POP) teaches students cognitive therapy techniques, including identifying negative beliefs, evaluating evidence for and against negative beliefs, and generating alternative hypotheses. In addition, they improve assertiveness, negotiation, relaxation, and decision making. In the Penn Enhancement Program (PEP), students discuss topics relevant to interpersonal relationships during middle and high school years, including goal-setting, value identification, self-esteem, friendships, and peer pressure. These programs typically run in groups of eight to ten and last for 12 two-hour sessions (Reivich, Gillham, Chaplin, & Seligman, 2005).

Doll, Zucker, and Brehm (2004) recommend specific principles and techniques for fostering resiliency in the classroom. The first is to help students to believe that they have the ability to learn and be successful in the classroom (academic efficacy). Those with a high sense of academic efficacy increase their efforts until they are successful on challenging tasks, as opposed to giving up, as those with a low academic efficacy might do. The second principle is to train students to have personal goals for their own learning, identifying and solving problems that are barriers to these goals, and selecting and implementing appropriate actions. The third principle is to train students how to self-monitor and make decisions about how to behave appropriately (Doll et al., 2004).

Limitations

The outcomes of this study revealed significant implications for building resilience in students experiencing trauma-induced stress. However, it is important to consider several methodological limitations. First, the utilization of self-report measures, including the Resiliency Scales for Children and Adolescents and Child PTSD Symptom Scale, may be impacted by several factors including mood of the respondent, his or her own understanding of the questions, respondent's insight and level of awareness, response bias, and accuracy of recall. Although there are limitations inherent in self-report measures, the rationale for using self-report resiliency scales is highlighted in Prince-Embury (2007). She notes that research has indicated that "parents are sometimes not sensitive to the experiences of their children" (Prince-Embury, 2007, p. 9), therefore implying that the report of children provides the most accurate results.

Another limitation is sample size, which can have an influence on statistical significance. An a priori power analysis determined that 67 participants would be necessary to provide sufficient power. However, after recruitment of participants seemed to hit a point of saturation, when no additional parents were responding to requests for their children to participate, it was agreed upon by the primary investigator and her dissertation committee that data collection could be ceased at that point. The final number of participants collected provided adequate power to achieve several statistically significant results. In the future, recruiting a larger sample, may afford a better opportunity to obtain more significant results and generalize results to a larger population.

This raises another limitation involving difficulty with participant recruitment. Parents and guardians in this population often have other more pressing needs or may be skeptical of investigator motivations, leading to difficulty acquiring their consent for their child's participation. One factor that may have influenced skepticism was the difference in demographics of the researcher. The students were primarily African American from low-income homes with presumably less educated parents. The parents may have had difficulty trusting an educated Caucasian researcher stepping into their environment. In addition, half way through the study the school experienced a complete change in personnel, so parents may have already been rebuilding trust in the educators. Sending letters of solicitation home to the parents also involved help from the teachers, but they themselves were likely overwhelmed in a new and difficult environment and the research was less of a priority.

The above factors also relate to selection bias. Parents who are aware of trauma and stress in the home may have been less likely to allow their children to participate in this study for fear or being exposed. Unfortunately, these are children who would have provided the most valuable data for this study and who may benefit most from resiliency interventions. To increase response rates, additional incentives for parents may be necessary in the future to solicit the participation of more students. In addition, a broader inclusion of schools in a similar environment may have been helpful.

There are some limitations involved in any measurement of executive functioning. Performance on these measures represented the collective outcome of various executive and non-executive processes and each one was difficult to tease apart. In addition, deficits in these functions may have represented the variability in the developmental rates of the frontal lobes in children, rather than individual dysfunction (Bernstein & Waber, 2007; Fuhs & Day, 2011). Another issue when assessing executive functioning is the ecological validity of the assessments and the testing environment. While administering such tasks, the examiner intrinsically imposes structure on a task through clear directions of assessment requirements. In addition, a great deal of structure is present in the classroom, so teacher report may have been affected by a similar phenomenon. Therefore, true deficits may have been masked in a construct that would typically not be structured in daily contexts at home and in school (Anderson, 2002).

Another limitation is the generalizability of results. Data were collected at one school in one particular district. While results may be representative of what others in the district are facing, it may be difficult to generalize these results outside of this particular district. Future studies should include additional schools, which may involve children facing different types of traumatic stress. In addition, a comparative group might allow the researcher to make more general implications.

Because bivariate correlations were used for data analysis, resilience could not be examined as a moderating variable, but rather, could only be separately compared to traumatic stress and to the neuropsychological variables. Therefore, no causal inferences could be made. Correlations were chosen for some of the analyses to first explore whether relationships existed in the absence of much previous research. In addition, knowing in advance that recruitment of a large number of participants would be difficult, correlations produced the highest power possible with a lower sample size. Since the complexity of the analyses were compromised, a future study might use a more sophisticated analysis to examine resilience as a moderating variable. It would be helpful to see if, in the face of traumatic stress, resiliency leads to less of a a detriment on cognitive functioning and, thus, less functional difficulty in the classroom. The other possibility is that, if neuropsychological functioning is strengthened, children might demonstrate increased resilience.

Future Directions

The present study impacts significantly on the field of counseling psychology by providing a rationale for advocacy and therapy for individuals who experience stress as a result of poverty and trauma. Specific therapies and programs have been delineated above. Future studies should continue to examine the connections between stress related to poverty and trauma and neuropsychological and academic functioning. In addition, moderating effects of resilience on other cognitive functions may be explored. It is important to explore the significance of resilience in this area and establish a link, as it is a characteristic that may serve as a strong protective factor against negative phenomena. In addition, programs to build resilience have become more prevalent and have been shown to be effective.

When replicating this study, it would be helpful to have a comparison group of participants who are demographically matched, but have not experienced traumatic stress. In addition, more participants and an increased complexity in the analyses to better test research questions would be ideal. Analyses may be further deconstructed to examine the effects of gender since it was shown to be associated with one of the neuropsychological variables.

The next step in this research will be to acquire a measure of academic functioning for participants in order to examine the functional outcome of cognitive difficulties. Later studies may examine the effects of resilience programs on building resilience in children with traumatic stress.

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