RELATIONSHIP OF INTERNALIZING BEHAVIOR PROBLEMS TO INTELLIGENCE AND EXECUTIVE FUNCTIONING IN CHILDREN

To

Mom and Dad

I did it.

RELATIONSHIP OF INTERNALIZING BEHAVIOR PROBLEMS TO INTELLIGENCE AND EXECUTIVE FUNCTIONING IN CHILDREN

By

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THESIS

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The current theme of research regarding children has focused greatly on emotional intelligence, Attention Deficit Hyperactivity Disorder (ADHD), and other problems involving emotional disorders. While there is a great amount of research devoted to these topics, there is a lack of consensus on the effects these emotional disorders have on the areas of intelligence and executive functioning in children. This study examined the relationship between internalizing behavior problems (depression, anxiety, and social withdrawal) and intelligence and executive functioning in children. Archival data, from 75 children between the ages of 6 and 14, were used. The sample consisted of children with internalizing behavior problems and children without internalizing or externalizing behavior problems, which was classified using the Child Behavior Checklist (CBCL). Each child was evaluated using the Wechsler Intelligence Scale for Children-Third Edition (WISC-III), Children's Executive Function Scale (CEFS), and the Category Test. Results indicated that children with internalizing behavior problems performed significantly worse in domains of global executive function, problem solving, and initiative. No significant differences were found between the control and internalizing groups in the domain of intellectual functioning. This study

supports the premise that executive function and intelligence are separate domains and should both be assessed in children with internalizing behavior disorders.

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CHAPTER 1

INTRODUCTION

Intelligence (IQ) and behavior are not new phenomena in the realm of psychological research. For years researchers have been contemplating hypotheses, constructing models, and conducting numerous experiments to discover a relation between behavior and intelligence. In addition to IQ, executive functioning (EF) is also being investigated to understand the relationship between behavior and EF. As IQ and EF are separate domains (Denckla, 1996a; Denckla, 1996b), both are necessary to study in order to understand the relationship of behavior to cognitive functioning. The majority of recent studies on behavioral issues (De Luca et al., 2003) have focused on the effects of externalizing behaviors (e.g., aggressiveness, hyperactivity, and delinquency) since many children are being diagnosed with Attention Deficit/Hyperactive Disorder (ADHD). This emphasis on externalizing behaviors has left a gap in the research concerning the relationship between internalizing behavior disorders (e.g., anxious/depressed, withdrawn) and intelligence and executive functioning. (Kazlow & Thompson, 1998).

Internalizing behavior problems, like externalizing behavior problems, are problematic and negatively impact children in many domains including cognitive functioning (Plante & Sykora, 1994), interpersonal and social relationships (Falk, Dunlap, & Kern, 1996), and serve as a risk factor for future psychopathology (Ollendick & King, 1994). While there are a plethora of assessments for internalizing behavior disorders, these assessment tools are not frequently utilized in school settings (Wu et al., 1999). As there is a poor use of available resources, new indicators of internalizing

behavior disorders could be identified in assessment measures that are routinely used in the school setting such as IQ tests. This could aid clinicians to identify and rectify immediate problems in children.

Before reviewing the purpose of this study, it is important to review the literature to understand what past and current studies have shown regarding the constructs of intelligence, internalizing behavior abnormalities, and executive functioning and understand why it is important to measure their relationships.

CHAPTER 2

LITERATURE REVIEW

The Construct of Intelligence

Intelligence (IQ) is a concept that is controversial and open to interpretation. Currently there are three main models of intelligence that are widely accepted. According to Charles Spearman (Vasta, Haith, & Miller, 1995), intelligence consists of two factors, the g and s. The g refers to general intelligence and is found in every form of intellectual processes. The g is uniform in all types of abilities and acts as a base intelligence. Opposite of the g is the s, which refers to specific abilities that one uses on certain tasks. For example, someone who is gifted in musical intelligence has a specific ability in that area and would thus have a stronger s than someone who was not gifted in the musical arts. The hierarchical model of intelligence is a more recent interpretation of intelligence (Vasta et al., 1995). This model states that intelligence is organized in a pyramid formation in which the bottom of the pyramid is broad-based general intelligence, and the top of the pyramid is specific intelligence. The hierarchical model of intelligence is a model that was widely accepted in the 1990s by numerous universities and schools (1995).

For the purpose of this study, Robert Sternberg's (Bernstien, Clarke-Stewart, Roy, Srull, & Wickens, 1994) definition of intelligence was used. Sternberg believes intelligence consists of three characteristics, "the possession of knowledge, the ability to use information processing to reason about the world, and the ability to employ that reasoning adaptively in different environments" (p. 387).

History of Intelligence

E. G. Boring said, “intelligence was whatever an intelligence test measures” (1923, p. 35). This, of course, presumes that IQ tests are read at face value and are not interpreted; however, this is not the norm. Kaufman (2000) offers a valuable history of IQ testing. According to Kaufman, IQ testing began in 1838 by Jean Esquirol who used IQ tests to distinguish between mental retardation and emotional problems. Esquirol’s work is important because it began the formation of the construct of verbal intelligence. Verbal intelligence is an indicator of g and accounts for abilities in the realms of verbal comprehension and working memory. The name that most people will remember with regard to IQ tests is Sir Francis Galton. Galton, a proponent of eugenics, was interested in distinguishing between people who were geniuses and those who were mentally challenged. Although Galton was influential, his work faltered because of a lack of validity in his measures. The first “real” IQ test, the Binet-Simon scale, was created in 1905, and was designed to distinguish between children who were mentally handicapped and those who were not. The United States received the benefits of the Binet-Simon scale in 1917 when Lewis Terman, a professor at Stanford University, translated it into English. Because of this translation the Binet-Simon is now called the Stanford-Binet (2000).

IQ testing took a different path in 1918 when the army incorporated its use to distinguish men who were intelligent from those who were not. Arthur Otis provided the army with the Army Alpha, verbal measures, and Robert Yerkes provided the army with the Army Beta, performance measures. Up to this point the Stanford-Binet was the most credible IQ test and it dominated the school and psychological arena as the test of choice.

However, David Wechsler, who worked under E. G. Boring, and trained earlier by Spearman and Pearson scoring numerous Army Alpha exams, was one of the first trained examiners of the Stanford-Binet. With his knowledge of psychometrics, Wechsler was not content with just giving either a verbal or performance test of intelligence, so in 1939 he created a test that combined both domains. However, introducing new tests can be difficult for the community to accept. Simon and Binet's test was rejected until Galton's reign was over. This same resistance was met by Wechsler since the Stanford-Binet was the popular test of the time. Presently, the Wechsler intelligence tests (e.g., Wechsler Adult Intelligence Scale-Third Ed., 1998; Wechsler Intelligence Scale for Children-Third Ed., 1991) are the most widely used intelligence measures because of their excellent reliability and validity demonstrated through decades of research (Kaufman, 2000; Piedmont, Sokolove, & Fleming, 1989; Rispens et al., 1997; Watkins, Kush, & Glutting, 1997). Recent publications of the WISC-IV (Wechsler, 2003) promises continuing prominence of the Wechsler approach.

The Wechsler tests were different from earlier IQ tests because Wechsler contended that IQ tests should not be interpreted at face value; rather, they need to be examined from a clinical point of view (Kaufman, 2000). That is, Wechsler wanted to understand how a person solved problems and constructed answers rather than just seeing what information a person possessed. Not only can IQ tests estimate how far a student has progressed (Schaefer & McDermott, 1999), but they can also be regarded as an aspect of the personality (Kaufman, 2000). Wechsler is regarded as a pioneer and a leader in the realm of intelligence. Through his tests, researchers and theorists have been able to formulate numerous theories concerning children and intelligence. Pragmatically, his

tests have been used to assess children to pinpoint specific learning deficits that they may have in addition to finding a child's specific strengths and weaknesses when it comes to learning. Sparrow and Davis (2000) support profile strength and weakness analysis by emphasizing the evolving trend away from global IQ analysis towards a multifactorial profile analysis. Thus, it is important to examine and interpret subtest scores in addition to global scores when analyzing IQ tests. The importance of intelligence and IQ testing has been established; now it is necessary to become familiar with executive functioning in children.

Executive Functioning

Executive functioning (EF) is a concept that currently has been receiving a great deal of attention (Kerr & Zelazo, 2004; Carpenter, Just, & Reichle, 2000; Karatekin, Lazareff, & Asarnow, 2000; Sparrow & Davis, 2000). Executive functioning is defined as "the ability to maintain an appropriate problem-solving set for attainment of a future goal" (Welsh & Pennington, 1988, p. 201). Expanding this definition, Welsh, Pennington, and Groisser (1991) added that EF includes the abilities of planning, performing organized searches, and controlling impulses. Moreover, Denckla (1994) asserts that, "executive function is a higher order top-down domain" (p. 118).

Starting in the first year of life, executive functioning begins to develop in infants and proceeds to grow throughout development. Evidence suggests that executive functioning develops in multiple stages and involves the frontal lobes, especially the prefrontal cortex (Karatekin et al, 2000). They further note that by age six, there is an improvement in the prefrontal skills of children in that they have increases in logical thought, verbal mediation, working memory, and selective attention (Welsh et al., 1991).

Although there is no clear consensus as to what constitutes executive functioning, Karatekin et al. (2000) and Carlson et al. (2004) provide the following abilities that EF governs: planning, problem solving, decision making, encoding contextual information about stimuli, working memory, strategic and goal-directed behavior, abstract thought, cognitive flexibility, inhibition, judgement, adaption to novel circumstances, and self-regulation.

An important aspect of EF is that it not only provides the structure to attain a goal but it also provides a map for how to attain the goal (Cripe, 1996). According to Barkley (2000), these executive actions become executive if they involve the "when or whether" and are nonexecutive if they involve the "what and how" (p. 1065). EF allows a child to problem solve and allocates for different solutions. For example, if a child is given two assignments, then EF is involved in the ability to decide which assignment to do first, how to complete it, and then when to do the next assignment. Again, there is an implied concept that EF is future-goal-oriented. Denckla (1996a) eloquently clarified this when she termed EF as "control processes" (p. 265).

Comparison of Intelligence and Executive Functioning

Although there are differences between IQ and EF, they are not mutually exclusive. Both incorporate abilities involving working memory, processing speed, language, and attention (Anderson, 1998). Additionally, EF and IQ overlap with regards to fluid intelligence. Fluid intelligence denotes, in part, the working memory which encompasses EF (Denckla, 1996a). It is in working memory where processing, coding, and analysis take place. A pragmatic example of the similarities between EF and IQ can be shown through the processes required to perform the WISC-III subtests Block Design,

Picture Arrangement, and Similarities. According to Anderson (1998), these subtests measure planning, abstraction analysis, and problem solving, which appear to codify components of both EF and IQ. Even the vocabulary subtest of the WISC-R has been used as a low demanding EF measure of stored information (Denckla, 1996b).

The difference between EF and IQ, as has been suggested, is that EF is the recipe and IQ is the ingredient. EF utilizes intelligence in its goal directed behavior (Pennington, 1991), and in that respect the two are separate. Whereas EF and IQ overlap in fluid intelligence, they differ with regard to crystallized intelligence. Crystallized intelligence involves rote memory, information that has already been processed (i.e., good vocabulary). Thus, without needing to use a recipe, crystallized IQ is separate from EF (Denckla, 1996a). Research by Welsh, Pennington, and Groisser (1991) demonstrated that intelligence was not synonymous with executive function. EF scores from the Tower of Hanoi (TOH; Simon, 1975) and the Wisconsin Card Sorting Test (WCST; Heaton, 1981) did not correlate with measures of intelligence (the Iowa Test of Basic Abilities was used), indicating that EF is a domain of its own, independent of intelligence. Nonetheless, Denckla (1996b) expressed that the "the extent to which EF in children recapitulates the factor found in intelligence tests as opposed to the extent to which EF emerges as a factor not accounted for by IQ is a matter theoretically central to developmental neuropsychology" (p. 13). Thus, the above arguments suggest that there is lack of agreement regarding the degree to which EF and IQ are similar. Given that there are noted differences between EF and IQ, however, it is justifiable to address them separately when examining their relationship with internalizing behavior problems. By

comparing both EF and IQ to internalizing behaviors, there will be greater clarification of the specific relationships of EF and IQ.

Measuring Executive Function

Executive function, like IQ, is a construct that is comprised of many diverse components. Moreover, EF spans a vast range of abilities making it difficult to develop a global score that encompasses all EF domains (Denckla, 1994). Thus, unlike IQ, EF measures do not provide a global assessment of EF; rather, they provide information regarding the sub-components of EF. As Denckla (1994) notes, "the executive function domain must be fractionated not made into a composite" (p. 121). As stated previously, standard IQ tests, such as the Wechsler tests, are not sufficient to test EF. Also, their differences can be attributed to the familiarity of IQ components such as the Performance IQ portion, which makes the individual tests somewhat known to children (1994). For example, although tests such as Object Assembly and Picture Arrangement may pose challenge, nonetheless, children are somewhat familiar with these activities. Object Assembly is somewhat compatible to a puzzle and Picture Arrangement can be compared to a cartoon strip (Denckla, 1994). Conversely, tests of EF have been defined as novel, unfamiliar tasks.

Many tests currently used to measure EF include: Stroop Test (Stroop, 1935), Category Test (Halstead, 1947), Tower of Hanoi (Klahr, 1978), Tower of London (Shallice, 1982), Wisconsin Card Sorting Test (WCST; Heaton, 1981), and Twenty Questions (Denny & Denny, 1973) (Ardila, Pineda, & Rosselli, 2000; Denckla, 1994). An important instrument to mention is the Children's Executive Functions Scale (CEFS; Silver, Kolitz-Russell, Bordini, & Fairbanks, 1993). Although a relatively unfamiliar

measure of executive function, the CEFS has been shown to be significantly correlated with other psychometric tests of EF including the Rey-Osterrieth Complex Figure organization score, the Wisconsin Card Sorting Test (WCST) categories completed, and WCST loss of set (Molho, 1996). Further analysis revealed that the CEFS correlated with the Child Behavior Checklist (CBCL; Achenbach, 1991), supporting the ability of the CEFS to measure specific aspects of behaviors related to EF (Goulden, 1998).

Executive Function and Child Development

Just as intellectual abilities mature as children develop, so does executive functioning. Executive functioning begins in infancy and can be evidenced by abilities such as impulse control and anticipation (Gnys & Willis, 1991). Anderson (1998) expanded upon this and related that EF may gradually increase along with development of language, attention, processing speed, and memory capacity. As children grow, they begin to develop cognitive abilities which interact, and as one matures so may another. Thus, as children are able to communicate and attend at a higher level, so then will they be able to plan and control inhibition more successfully.

While children continually develop their EF abilities, the greatest developmental period occurs between the ages of six and eight (Passler, Isaac, & Hynd, 1985; Riccio, Hall, Morgan, Hynd, Gonzalez, & Marshall, 1994). This appears to be attributed to the development of inhibition, which allows children to be able to control and plan what they will do (1985). Given this information, it appears that middle childhood is a critical period in the development of EF abilities. For example, if a child is not able to develop inhibition between the ages of six and eight, then there might be repercussions later in the development of many abilities. This implies that cognitive development may not mature

to its full potential if the child cannot focus and develop inhibition. Anderson (1998) noted that EF abilities in early childhood are vulnerable to cerebral insult and that growth of EF abilities could be negatively affected as injured children develop. Furthermore, although EF deficits may not be obvious at an early age when a child has developmental difficulties, they could appear later on as the child grows (Barkley, 1996). EF performance is associated with age-related change in that there is improved performance as children age. Thus, older children fare better on certain EF abilities, such as planning and flexibility of thought and action, than do younger children (Weyandt & Willis, 1994).

Childhood Behavior Problems

Children are complex beings. They develop and grow, and throughout their course of maturation acquire an array of knowledge, skills, and abilities to help them in their quest for growth and survival. Sometimes children falter and develop behavior problems which could disrupt their quest for growth. Behavior problems, in most circumstances, have no single etiology. Rather they may be caused by a combination of problems such as a high-risk environment (e.g., abusive home, low socioeconomic status, or transient family), peer rejection, extreme self-doubt, and biological or biochemical differences (Easterbrooks, Davidson, & Chazan, 1993). For example, students in schools separated based upon their IQ (average vs. moderate intelligence) have been found to have significant behavior differences because of the influence of feelings of rejection by peers and teachers (Roberts & Zubrick, 1992).

Children at one time or another may be diagnosed as having a behavior problem. However, there is a difference between a child who truly has a behavior abnormality (e.g., classified through testing and observation) and one who just has an isolated,

transient problem. To constitute a behavior abnormality, the problem must be persistent, have a high frequency and intensity, and should permeate the child's universe (e.g., school and home) (Campbell, 1990).

A number of tests have been created that assess for behavior problems. The one used most frequently in pediatric psychology literature is the Child Behavior Checklist (Achenbach ,1991). The CBCL consists of behavior problem and social competence items to be answered by the parent of the child. These questions are factored into three groups: social competence, adaptive functioning, and syndrome scales. The syndrome scales are classified into the Internalizing and Externalizing scales. The CBCL is able to discern between internalizing (depression, anxiety, social withdrawal) and externalizing (hyperactive, aggressive, delinquent) behavior abnormalities (Greenbaum & Dedrick, 1998). Research has shown that the elevations on different scales may have prognostic implications for comorbid problems (e.g., depression combined with conduct disorder) (Mattison & Spitznagel, 1999). Scale elevations indicative of comorbid problems were further substantiated by the work of Greenbaum and Dedrick (1998, p. 149) who stated that the scales provide an "appropriate measure of global problem behavior." Global problem behavior refers to overall behavior of the child including both internalizing and externalizing behavior disorders. The CBCL is a strong tool to use because it has a multifunctional scale system and a high correspondence with the Diagnostic and Statistical Manual of Mental Disorders, 4th ed. (DSM-IV; APA, 1994) as reported by Wadsworth, Hudziak, Heath, and Achenbach (2001). Furthermore, it has been shown to have predictive validity over a five-year span (Mattison & Spitznagel, 1999).

Internalizing Behavior Problems

Most behavior problems can be classified as either externalizing or internalizing. Externalizing behaviors are ones in which the child is socially troublesome, and are typified by verbal aggression, oppositional defiance, and conduct problems. Internalizing behaviors are ones in which the child is inwardly troublesome, and are typified by social withdrawal, somatic complaints, loneliness, and depression. Kovacs and Devlin (1998) define internalizing disorders as "conditions whose central feature is disordered mood or emotion" (p. 47). Previous research has shown that children as early as the second grade can begin to develop internalizing behavior problems (Hymel, Rubin, Rowden, & LeMare, 1990). The focus of this study will be internalizing behaviors, and the following section will describe the construct of internalizing behaviors and the effects on children.

Internalizing behavior problems affect both the child's social and academic life. Research has demonstrated that level of self-esteem is positively correlated with academic ability (Kugle, Clements, & Powell, 1983). The research further stipulated that academic ability was more attributed to self-esteem than to ethnicity and socioeconomic status (1983). Self-esteem and self worth are not unfamiliar concepts. For decades the cognitive-behavioral arena has commented on how self-perception can affect many areas of a person's life. What seems to happen is that a child with low self-esteem will be more preoccupied with his identity than with academics; thus, attempting to compensate for one area causes failure in another (Kugle, Clements, & Powell, 1983).

Learning is integral to intelligence because children need to be motivated to incorporate new information and new problem solving abilities into their current intellectual functioning. For example, a component of verbal portions of intellectual tests

measure the child's social acculturation, ability to comprehend information, and the manipulation of number operations (Glasser & Zimmerman, 1967). Furthermore, "negative beliefs will reduce relevant motivation and learning behavior" (Chapman, Silva, & Williams, 1984, p. 290). This is a simple statement, yet effective in showing that negative self-esteem and self-perception do cause a hindrance in learning and thus may inhibit growth of one's intelligence. Two important areas of internalizing behavior disorders that this study will focus on are depression and anxiety.

Depression

The idea that children can become depressed was not widely accepted until the 1970s and 1980s because it was thought that children did not posses the cognitive correlates necessary for depression (Solnit, Cohen, & Schowalter, 1986). Since that time it has been reported that the incidence of childhood depression in the overall population is between 0.2% and 1.8% (Ford et al., 2003; Sorensen et al. 2005) and more specifically in males is approximately 4.1 percent and in females is roughly 4.7 percent (Kent, Vostanis, & Freehan, 1995). Childhood depression is thought to result from complications in development , such as poor self-esteem and rejection among peers (Cole, Martin, & Powers, 1997), biological defects (Segrin, 2000; Wicks-Nelson & Israel, 1997), and loss (Eley & Stevenson, 2000). Essential features of depression include low self-esteem, sadness, (Blumberg & Izard, 1985), guilt, and diurnal variation of mood (Hamilton, 1980). Depressed children have social and interpersonal difficulties in that they suffer poor peer relations, go into self-isolation, and concentrate on negative cognitions (Kaslow, Rehm, & Siegel, 1984; Kovacs, 1997; Renouf, Kovacs, & Mukerji, 1997; Timbremont, Braet, & Dreessen, 2004). A dangerous factor for some depressed children

is that they attempt suicide. Kovacs (1997) noted that 84% of all suicide attempts occur in depressed individuals. Moreover, given the episodic and chronic nature of depression, it is a leading cause of morbidity and mortality in children (Emslie & Mayes, 2001; Rushton, Forcier, & Schectman, 2002).

Depression also can further disrupt cognitive growth by causing sensory distortion. Depression can interfere with the interpretation and processing of external stimuli. Children with depression are not able to identify "congruent and incongruent affective prosody" (Emerson, Harrison, & Everhart, 1999, p. 107). Prosody is the ability to create or interpret nonverbal information in communication, such as pitch, tempo, and voice inflection. Without this ability, children lack the ability to properly and accurately interact with their environment. The study by Emerson et al. (1999) consisted of 38 boys, aged nine to eleven, and showed that children with depression exhibit the same decrease in prosody recognition as do children with nonverbal learning disabilities. The research even claimed that the children with depression could exhibit the same functional impairments as seen in persons with right hemisphere lesions (1999). This point is further substantiated by Segrin (2000), who noted that depressed children have limited paralinguistic behaviors (nonverbal portion of language such as rate, pitch, and pause duration). Typically children who are depressed speak at a slower rate, talk less, pause excessively, and have longer response time. Resulting from this, children with depression, boys more so than girls, have trouble decoding nonverbal information and cues related to verbal interpretation (2000). Given this deterrent to verbal development, it might be expected that depressed children would have lower verbal skills than non-depressed children. With regard to academic consequences, research has yielded

conflicting results. Some research suggests that depression can lead to academic failure, whereas others proclaim that there is no relation between depression and academics (Hamilton, Asarnow, & Tompson, 1997).

Childhood depression is hard to detect since some symptoms might be displayed by non-depressed children. Symptoms usually include social reclusion and isolation, anger outbursts, and disturbances in eating and sleeping (Brumback, & Weinberg, 1977; Emslie, & Mayes, 1999; Emslie, Mayes, & Hughes, 2000; Carlson, 2000). It is possible that these symptoms could occur in a child for multiple reasons. Typically, children with depression will express their feelings in a nonverbal manner (e.g., withdrawing, hitting or kicking objects) because they may not know how to articulate how they are feeling or they may be ashamed for feeling that way (Poznanski, 1985). Therefore, additional signs which identify depression should be investigated in order to distinguish between children who are displaying minor problems and children who are showing symptoms of depression. Early detection is imperative because depression left untreated could have long term deleterious effects (Kovacs, 1997; Rudolph & Clark, 2001).

Anxiety

Anxiety is one of the most prevalent disorders seen in children (Jalenques & Coudert, 1993) and has a prevalence rate of ten to twenty percent (Manassis, 2000). Whereas sadness is the essential feature in depression, fear, worry, and apprehension play the key roles in anxiety (Brady & Kendall, 1992; Crook, Beaver, & Bell, 1998). Children with anxiety disorders are characterized as being less assertive, shyer, and more withdrawn, when compared to non-anxious children (Ginsburg, La Greca, & Silverman, 1998). Furthermore, children with anxiety are more prone to develop depression than are

non-anxious children (Brady & Kendall, 1992). Anxious children tend to have more impairments in their social and emotional functioning (1992), speech and communication abilities, and learning processes (Manassis, 2000). Specifically with regard to learning, Ruisel (2000) noted that anxiety "can affect cognitive performance at any level of information processing" (p. 9). He further noted that anxiety causes a decrease in a person's attention and concentration and negatively affects the encoding of new information (2000).

Since anxiety can affect all components of information processing in children, Ruisel (2000) emphasized a need to examine "individual components of psychometric intelligence" (p. 11). This point is further substantiated by Onwuegbuzie, Bailey, and Daley (1999) who reported that high anxiety impedes the amount of information retained in the memory of children for processing. Without this information, learning is decreased because there is no new material to process. Hodges and Plow (1990) further showed that children with anxiety had a lower level of intelligence than children without anxiety based on examination of the Full Scale IQ from the WISC-R. The deficit in intelligence involved tests that require learning new concepts and concentration. Additionally, the research showed that three of the twenty children with anxiety exhibited a verbal deficit, in that their Performance IQ (PIQ) was higher than their Verbal IQ (VIQ) by 19 points or more (1990). This implies that anxiety limits intellectual performance because an anxious child will have difficulty encoding and processing relevant and necessary material.

Internalizing Behavior Problems and Intelligence

Children with internalizing behavior problems tend to have problems in academics (Stipek & Mac Iver, 1989). If a child believes that he is not able to do well on tests or that he is incapable of learning new material, then those thoughts can inhibit him from learning (1989). Children early in their youth (preschool through third grade) blend their thoughts on academic and social abilities. For example, if a child believes that he is rejected and he becomes depressed and withdrawn, then he may also attribute those same feelings to his academic abilities and believe he is a failure there. Unfortunately, these two abilities (social and academic) are not seen as separate entities until the child reaches late elementary school, and even then they are not completely looked upon as being separate (Stipek & Mac Iver, 1989).

While many problems in school can be attributed to externalizing problems (anger, non-compliance), research is showing that internalizing problems do affect children's ability to learn (Hodges & Plow, 1990). There are data suggesting that depression is associated with Learning Disabilities (LDs) (Prior, Smart, Sanson, & Oberklaid, 1999). In fact, children with a single LD were more likely to be diagnosed with an internalizing behavior problem instead of an externalizing behavior problem (1999). Emslie, Kennard, and Kowatch (1995) reported that "chronic mood disorders can over time cause learning disabilities" (p. S42). Their review of literature noted that children with internalizing behavior disorders, as a whole, perform more poorly on measures of intelligence than children without internalizing behavior disorders. However, the studies they cite examined not only children with depression, but also children with other psychiatric disorders (1995). Because it is hard to claim depression

as the cause of neuropsychological and intellectual impairment seen in the mixed sample, it is important to have a pure sample of depressed children to measure the possible neuropsychological and intellectual impairment associated with internalizing behavior problems alone. For example, in a small group of children (n=12) with internalizing behavior problems, Matson and Fischer (1991) found that the Freedom From Distractibility Index (FFD) was significantly lower than the Verbal Comprehension Index (VCI) and Perceptual Organization Index (POI) of the WISC-III. Moreover, the POI was significantly higher than the VCI for the internalizing group (1991).

Behavior Problems and Learning

When examining the interaction of behavior and learning it is somewhat difficult to decide whether the behavior caused the learning problem or vice versa. To help decipher this conundrum, extensive studies in the area of reading have been undertaken. Studies suggest that poor school adjustment is associated with poor reading ability, and a child with behavior problems will have a harder time learning how to read due to poor concentration and attention (McGee, Williams, Share, Anderson, & Silva, 1986). What appears to happen is that the child has the behavior problem, for instance an externalizing problem of hyperactive-aggressive behavior, the behavior problem limits the child in his ability to learn which then exacerbates the behavior problem the child had in the beginning (1986). Thus, there is a circular effect of the behavior problem causing the academic difficulty which in turn causes the child to have more problems.

The idea that behavior abnormalities cause learning problems can be supported by the research of Smart, Sanson, and Prior (1996). Their research demonstrated that behavior problems can lead to delays in reading. As in prior studies, their research

focused on externalizing problems (attention-distractibility) and the effects on learning. While this longitudinal study (Smart et al., 1996) could not pinpoint the exact mechanism or the exact time the behavior problem created the learning problem, there was support to show that that is how the circle begins.

Executive Function and Behavior Problems

Problems in EF typically result from damage to frontal lobe circuits and involve deficits including poor planning ability and disinhibiton (Weyandt & Willis, 1994). While research has demonstrated that behavior problems in children negatively correlate with intellectual ability (Stipek & Mac Iver, 1989; Hodges & Plow, 1990), a focus needs to be placed on the correlation between behavior problems and executive function. Research conducted by Riccio et al. (1994) compared the WCST, CBCL, and the Teacher Report Form (TRF; Achenbach & Edelbrock, 1986), and showed that impaired performance on the WCST may be indicative of either Internalizing, Externalizing, or both types of behavior problems. Matson and Fischer (1991) further support the assertion that children with internalizing and externalizing behavior problems process information differently from each other and from children without behavior problems.

Additional research regarding subtypes of behavior problems and neurological disorders has shown that EF deficits can be found in these different disorders: children with ADHD have been found to display deficits in EF abilities including inhibiting responses, planning (Weyandt & Willis, 1994), reconstitution, operation of working memory, and internalizing of self-directed speech (Houghton et al., 1999). Ozonoff and Jensen (1999) studied children with autism, Tourette Syndrome (TS), and ADHD, and

found that while children with autism displayed problems with flexibility and planning, children with ADHD and TS showed problems with inhibition.

The above studies mainly focus on Externalizing behaviors and few researchers have looked at correlating Internalizing behavior problems with EF. However, research with young adults, ages 18-45, demonstrated that there are EF impairments in patients with depression, mainly in complex integration and concept formation, and initiation ability (Fossati, Amar, Raoux, Ergis, & Alilaire, 1999). This study is limited in showing a direct correlation between EF and Internalizing behavior problems because all subjects were diagnosed with depression and some of the subjects had a comorbid diagnosis of schizophrenia. However, it does allude to potential EF deficits associated within the Internalizing domain. Other research has shown that depression is associated with other types of executive dysfunction including impaired cognitive flexibility, psychomotor speed, and attentiveness (Brumback, & Staton, 1980; Kaslow, Rehm, & Siegel, 1984; Staton, Wilson, & Brumback, 1981). The studies demonstrated that after a group of children with endogenous depression were treated, the depression decreased, and the children displayed less impulsive thinking, made fewer errors, and had improved psychomotor functioning (1981).

In addition to studies focusing on the relationship between depression and executive function, research has examined the role anxiety plays in EF. Anxiety is associated with deficits in cognitive flexibility, processing and sequencing of information, and incorporating and encoding linguistic information (Kusche, Cook, & Greenberg, 1993; Toren et al., 2000). It seems apparent that anxious children have a rigidity of thought and thus are not able to process information in a constructive manner.

These studies indeed are relevant in showing that internalizing behavior disorders do impact EF in a negative way. Given this insight, it is imperative to see the relationship between internalizing behavior disorders and other areas of EF that have yet to be examined.

WISC-III and subtest scatter

The Wechsler Intelligence Scale for Children-Third Edition (WISC-III; Wechsler, 1991) is one of the most widely used tests of children's intelligence (Piedmont et al., 1989; Rispens et al., 1997; Watkins et al., 1997). Wechsler claimed he wanted his intelligence test to be constructed so that researchers could interpret clinical information. Clinical information meant understanding how children solve problems, interpret and relay information, and how they react behaviorally to the intelligence test (Glasser & Zimmerman, 1967).

One way to clinically interpret the WISC-III profile is to examine subtest scatter. Subtest scatter on the WISC-III of seven points or more from the highest to the lowest verbal subtest scaled score and nine points or more from the highest to the lowest performance subtest scaled score is not typical and only occurs in 15% of children (Greenway & Milne, 1999). According to these authors, when interpreting the WISC-III, the ACID (Arithmetic, Coding, Information, and Digit Span) profile was typically used to determine if a child possibly had a learning disability (1999). If the child had scatter among subtests, such that these four subtests were the lowest tests, then that could be indicative of a learning disability (1999). However, Kaufman (1994) has suggested that a SCAD (Symbol Search, Coding, Arithmetic, and Digit Span) profile would be a better indicator if a child had a learning disability as opposed to the ACID profile. He

suggested this because the subtests in the SCAD profile place more emphasis on the child's ability to "encode information for subsequent mental processing," (p.223).

Greenway and Milne's (1999) research compared WISC-III subtest scatter with MMPI-A (Archer, 1992) codetypes and discovered that there is a relationship between psychological disturbance and subtest scatter in male adolescents. Significant scatter on the Processing Speed index was associated with a MMPI-A codetype of 4-2 (Psychopathic Deviate-Depression) or 2-4 (Depression-Psychopathic Deviate). The 2-4 or 4-2 codetype is indicative of individuals who have problems with authority figures and impulse control. Additionally, these individuals do not follow accepted social standards and typically manifest antisocial behaviors (Archer, 1992). The authors suggest that the children with an elevation on scale four do poorly on certain tests (e.g., Picture Completion and Symbol Search) because they do not listen to the examiner because of problems with authority (Greenway & Milne, 1999). Moreover, Milne and Greenway (1999) showed that depressed children had performance subtest scatter and that verbal subtest scatter could be seen in children who had social withdrawal. The research suggests that Performance scatter can be indicative of psychopathology (i.e., Psychopathic Deviate) and can be used as a screening device to detect psychopathology in boys who may be prone to failure in school (Greenway & Milne, 1999). A limitation to Greenway and Milne's (1999) study is that the subjects are from a normal population, aged 14-16 years, and were not screened for clinical features (i.e., psychopathology) and/or learning disabilities (1999).

The University of Rochester Child and Family Study also showed that on the original version of the WISC, subtest scatter could be indicative of future

psychopathology (1982). While the study showed that there is a possible relationship of subtest scatter to schizophrenic tendencies, it concluded that overall subtest scatter showed a possibility of indicating abnormal emotional behavior (1982). A construct of the WISC-III is the Freedom From Distractability Index (FFD). The FFD index has created some controversy given that there is disagreement regarding what the factor measures. The FFD factor has been typically associated with ADHD and other attention related problems (Riccio, Cohen, Hall, & Ross, 1997). However, Riccio et al. (1997) showed that the FFD factor was additionally correlated with anxiety, withdrawal, and depression. Although not statistically significant, when comparing the FFD to the Revised Behavior Problem Checklist (RBPC; Quay & Peterson, 1987), the highest correlations were found on the Anxiety and Withdrawal factor (1997).

The possibilities for interpretation of the WISC-III subtests could be further developed (e.g., freedom from distractibility) and more research is needed in the direction of combining psychometric and clinical analysis to allow for diagnostic formulations (Rispens et al., 1997; Watkins et al., 1997). Given the above utility of using WISC-III interpretation in clarifying diagnoses, it would be beneficial to use WISC-III interpretation as an indicator to warrant further testing of children who may have internalizing problems.

Current Problem

Currently, studies examining childhood psychopathology focus mainly on externalizing problems while internalizing problems are receiving less attention (Kazdin & Weisz, 1998; Kazlow & Thompson, 1998). This paucity in research is attributed to many factors, but mainly that internalizing behaviors are less disruptive than

externalizing behaviors (Kaslow & Thompson, 1998; Ryan, 2001). Although internalizing behaviors are less disruptive, this does not necessitate that externalizing behaviors warrant more attention than internalizing behaviors. On the contrary, this paucity in research demonstrates the importance of conducting further research in the area of internalizing behavior (Ryan, 2001).

Internalizing behavior problems negatively impact children. Although not conclusively shown, it is believed that anxiety and depression interfere with cognitive processes in that the child is not fully able to concentrate on what he or she is trying to learn (Plante & Sykora 1994). Pragmatically, it makes sense. If a child is not able to concentrate on a task then it will be hard for him/her to learn new tasks. Moreover, children with internalizing behavior problems usually have difficulties with peer interactions (Falk, Dunlap, & Kern, 1996). These difficulties, if not ameliorated, could lead to further social skill deficiencies in addition to later life adjustment problems (1996). Painting a bleaker picture, Ollendick and King (1994) suggest that internalizing behavior disorders at an early age serve as a risk factor for the future development of psychopathology.

There are limiting identifying factors to show if a child is experiencing internalizing emotional problems. Although there are tests of emotional functioning for that purpose, they are frequently not utilized unless a child “appears” to be suffering from an emotional crisis (Rubin & Mills, 1991; Wicks-Nelson & Israel, 1997; Wu et al., 1999). Kazdin and Weisz note, internalizing or emotional problems (e.g., depression, anxiety, and withdrawal) are more likely to be overlooked by those who refer children to treatment (1998, p. 20). Moreover, Reynolds (1990) noted that internalizing disorders are

hard to detect because they tend to be covert in nature and have subtle signs. Given this poor use of available resources and underdetection of internalizing problems, it seems apparent that new indicators be found in the measures that are routinely given, such as IQ tests. By doing so, it would help clinicians and investigators to clarify and understand immediate problems in children for the purpose of generating useful information and efficacious treatment.

Purpose of the Current Study

The purpose of the study is to examine whether or not (a) internalizing behavior problems are associated with subcomponents of intelligence as measured by the WISC-III indices and subtests (b) internalizing behavior problems are associated with executive function, as measured by the CEFS and the Category Test (Reitan & Wolfson, 1992).

CHAPTER 3

METHOD

Participants

Seventy-five participants between the ages of 6 and 14 years who were referred from 1997 to 2001 for an evaluation of learning difficulties were selected from an archival database collected at a child neuropsychology evaluation center at the University of Texas Southwestern Medical Center. Typical diagnoses include learning disabilities (LD) and Attention Deficit/Hyperactivity Disorder (ADHD). Children with injury to the central nervous system were excluded. All files contained a consent form signed by the child's parent for this Institutional Review Board approved study (IRB File# 1003-615).

Materials

Child Behavior Checklist for Ages 4-18 (CBCL; Achenbach, 1991).

The CBCL is a 118 item behavioral checklist designed to "provide an empirical foundation for identifying syndromes from which to construct a taxonomy of childhood disorders," (1991, p. 31). The questions are factored into three groups: social competence, adaptive functioning, and problem scales. The CBCL problem scale items are rated on a 3 point Likert scale which ranges from "not true" to "often true" to "very true". These points are converted into a T-score that has a mean of 50 and a standard deviation of 10. The CBCL is a standardized rating form that can be filled out by parents who have at least a 5th grade reading level (Achenbach & McConaughy, 1987). The CBCL assesses many different child behavior abnormalities, including the following: withdrawn, somatic complaints, anxious/depressed, social problems, thought problems, attention problems, delinquent behavior, and aggressive behavior. These problem scales

are then grouped into the Internalizing scale (withdrawn, somatic complaints, and anxious/depressed) and the Externalizing scale (delinquent behavior and aggressive behavior). The total behavior problem scale provides a measure of global psychopathology. Norms for the CBCL, for ages 4 through 18, were established by comparing clinical and nonclinical samples across all factors of age, gender, ethnicity, and socioeconomic status. In the test manual, Achenbach (1991) reports that there is good reliability and validity, with intraclass correlations in the .90s, .87 for test-retest reliability of competence scales and .89 for problem scales. The mean reliability for intraparent agreement ranged from .74 to .75 for the competence scales and from .65 to .75 for the problem scales (1991). The Internalizing and Externalizing scales have been found to be positively correlated (mean Pearson r=.54). While this suggests that the two scales are not mutually exclusive, Achenbach points out that some children can be "primarily" Internalizing while others can be "primarily" Externalizing (1991).

Children's Executive Functions Scale (CEFS; Silver et al., 1993).

The CEFS is a 99 item parent-report scale designed to measure executive function in children. The CEFS is rated on a 3-point Likert scale which indicates the presence or absence of symptoms (0= almost never, 1 = sometimes, 2 = very much). The questions are combined to form a total sum (range= 0-198) and are also divided into five subscales: Social Appropriateness (range= 0-30), Inhibition (range= 0-50), Problem Solving (range= 0-68), Initiative (range= 0-30), and Motor Planning (range= 0-20). Research by Molho (1996) showed that the CEFS demonstrated adequate construct validity in a child ADHD population. Analysis of data with the CEFS revealed the following test-retest reliability

coefficients: total score (.92), social appropriateness (.85), inhibition (.90), problem-solving (.85), initiative (.81), and motor planning (.81) (unpublished data, 1996).

Halstead Category Test (HCT; Reitan & Wolfson, 1992; Halstead, 1947). The HCT is an individually administered test of abstracting ability. By altering the child's performance based on negative and positive feedback, the HCT measures concept formation. Six subtests together make up the older children's version of the HCT (Reitan & Wolfson, 1992); the first five sets are organized based on different principles and the sixth set is comprised of all five principles. The first group requires matching of Roman numerals and the second group requires the child to identify the total number of objects on the screen. The third group is based on the concept of uniqueness where the child identifies the one figure that differs from the others. The fourth and fifth groups are based on identifying the proportion of the figure that is solid. The sixth group measures recall and is a review of the previous five. A total of 168 stimulus figures on a 10" x 8" screen are shown and answers are given from a panel containing four levers numbered one through four. If a child answers correctly, a bell sounds (positive feedback). If a child answers incorrectly, then a buzzer sounds (negative feedback). A child can make only one response per item. The test produces a single score reflecting the number of errors made. The maximum possible errors is 168. The raw scores can be converted into T-scores. For the purposes of this research, both raw and T-scores were used. The HCT was normed as part of Halstead Reitan Neuropsychological test battery and was able to discriminate between children with and without brain impairment (Baron, 2004).

Wechsler Intelligence Scale for Children-Third Edition (WISC-III; Wechsler, 1991). The WISC-III is an individually administered test of intelligence which consists

of two domains, Verbal and Performance. Six subtests comprise the Verbal Scale: Information, Similarities, Arithmetic, Vocabulary, Comprehension, and Digit Span. Seven subtests comprise the Performance Scale: Picture Completion, Coding, Picture Arrangement, Block Design, Object Assembly, Symbol Search, and Mazes (the Mazes subtests was not used for this study). The subtest scaled scores have a mean of 10 and a standard deviation of 3. There are three IQ Scores: Verbal IQ (VIQ), Performance IQ (PIQ), and Full Scale IQ (FSIQ). Additionally, four factor-based Index Scores can be calculated: Verbal Comprehension (VCI), Perceptual Organization (POI), Freedom from Distractibility (FDI), and Processing Speed (PSI). Both the IQ scores and the factor-based indexes have a mean of 100 and a standard deviation of 15 (1991). The WISC-III was normed on a sample of 2200 children between ages of 6 and 16 (100 males and 100 females in each age group) that was representative of the United States population (1991). In the test manual, Wechsler reports good reliability and validity standards. The average reliability coefficients for VIQ, PIQ, and FSIQ were .95, .91, and .96, respectively. For VCI, POI, FDI, and PS, the average reliability coefficients were .94, .90, .87, and .85, and the average reliability coefficients for the subtests ranged from .69 to .87 (1991). The WISC-III has been found to have high internal, construct, concurrent, and predictive validity. A full review of reliability and validity information is provided in the WISC-III manual (1991).

Procedure

A total of 75 children's files were selected from a clinical database in a successive order, starting with 1997 and going to the most recent file (2001) to limit researcher bias.

All files that contained a WISC-III (excluding the Mazes subtest) and CBCL were eligible for inclusion.

The children were assigned to one of four groups, a group without behavior problems (defined by CBCL T score below 60 on the internalizing and externalizing scales) serving as a comparison group, the second selected for having internalizing behavior problems (depression/anxiety, social withdrawal, and somatic complaints) defined by a CBCL T score equal to or greater than 60 on the internalizing scale and a T score less than 60 on the externalizing scale, the third selected for having externalizing behavior problems defined by a CBCL T score equal to or greater than 60 on the externalizing scale and a T score of less than 60 on the internalizing scale, and the last group including those participants having both internalizing and externalizing behavior problems defined by a CBCL T score equal to or greater than 60 on both the internalizing and externalizing scales. Information was collected from all eligible files. However, the hypotheses of this study pertain only to the internalizing and control group. Classifying children into these four groups based on a T score of 60 is supported by Achenbach (1991) and has been validated in a previous study (Eisenberg, Cumberland, Spinrad, et al., 2001).

Statistical Analysis

The following hypotheses were tested to examine the relationship of internalizing behavior disorders in children to intelligence and executive functioning (due to the large number of comparisons, a more stringent alpha level of .01 was used to determine significance):

Hypothesis 1: FFD, on the WISC-III, will be significantly lower for the internalizing group compared to the comparison group. Hypothesis 1 will compare FFD, between the comparison and internalizing group, in the context of ANOVA for all four groups.

Hypothesis 2: No significant difference will be found on POI, VCI, and PSI, on the WISC-III, between the internalizing group and the comparison group. Hypothesis 2 will compare the POI, VCI, and PSI, of the WISC-III between the internalizing and comparison group in the context of ANOVA for all four groups for each dependent variable.

Hypothesis 3: The internalizing group will have significantly lower scores than children in the comparison group on selected subtests of the WISC-III that are related to attention and concentration. Hypothesis 3 will compare all the subtests of the WISC-III (excluding Mazes) between the internalizing and comparison group using an ANOVA for each dependent variable.

Hypothesis 4: The internalizing group will have significantly higher scores than children in the comparison group on measures of EF, indicating poorer performance. Hypothesis 4 will examine CEFS global score using an ANOVA. Additionally, an ANOVA will be conducted with the subgroup of participants who have Category Test scores.

Hypothesis 5: The internalizing group will show significantly higher scores on subcomponents (Social Appropriateness, Inhibition, Problem Solving, and Initiative) of EF when compared to the comparison group. Hypothesis 5 will compare the individual subscores of the CEFS between the internalizing and comparison group using ANOVAs.

CHAPTER 4

RESULTS

Overview of Statistical Analyses

Data were collected and twice entered into Microsoft Excel and then were imported into and managed by SPSS version 12.0. A power analysis showed the effect size (f) to be 0.25, which yielded a power of 0.13 based on a sample size of 75. In order to achieve a power equal to 0.81, a sample size of 256 would be required. First, descriptive statistics were calculated for clinical and sociodemographic variables including age, gender, ethnicity, education level, handedness, psychiatric diagnoses and learning disability diagnoses.

To test the hypotheses, one way analyses of variance (ANOVA) were conducted between all groups to determine if there were differences on WISC-III index and subtest scores, CEFS total and subscale scores, and the Category Test total score. For those significant differences found, post hoc analyses were conducted. Due to the large number of analyses conducted in this study, a more stringent alpha level of .01 was chosen in order to lessen the probability of making a Type I error.

Descriptive Statistics

Tables 1, 2, and 3 display the clinical and sociodemographic characteristics of the groups categorized by psychiatric classification. Overall, the average age of the sample was 10.0 years (SD=3.1), with more than half being male (65.3%). No significant difference was found between groups on the variables of age and gender ($F(3, 71)=.370$, $p=.775$; X^2 (3, N=75) =.807, $p=.807$, respectively). The majority of the sample was found to be Caucasian (89%) with the remainder being Hispanic (6.8%) and African-American

(4.1%). Analyses were not conducted to determine if the groups differed on ethnicity due to limited cell size. However, ethnicity has not been identified to be a determining variable in executive function. Most of the participants were found to be right handed (86.5%), have one or more psychiatric diagnosis (i.e., MDD, ADHD) (56%), and have no learning disability (79%). Although the focus of the study was the internalizing group, all groups' test scores were examined for variables of interest.

Hypothesis One

The results of the ANOVA for FFD between groups are reported below and can be found in Table 4. The hypothesis that FFD would be significantly lower for the internalizing group compared to the comparison group was not supported, F (3, 67)=.455, p=.715). The mean of the internalizing group (M=94.3, SD=22.2) was not found to be different from the mean of the comparison group (M=93.3, SD=16.5).

Hypothesis Two

The results of the ANOVAs for POI, VCI, and PSI are reported below and can be found in Table 4. The hypothesis that no significant difference will be found between the internalizing and comparison groups on POI, VCI, and PSI was supported. The ANOVA between the groups on POI showed no main effect, F (3, 68)=2.40, p=.076. For VCI, the ANOVA between groups showed no main effect, F (3, 68)=.379, p=.768; similarly no main effect was found for PSI, F (3, 62)=1.43, p=.244.

Hypothesis Three

The ANOVAs for the individual WISC-III subtests can be found on Tables 5 (verbal subtests) and 6 (performance subtests). The hypotheses that the internalizing group will have significantly lower WISC-III subtest scores compared to the comparison

group was not supported. No verbal subtests showed significant group differences. The ANOVAs between groups on WISC-III verbal subtests showed no main effect including Information, F (3, 67)=1.07, p=.370, Similarities, F (3, 67)=.46, p=.715, Arithmetic, F (3, 66)=1.57, p=.204. Similarly, no main effect was found for Vocabulary, F (3, 67)=.66, p=.578, Comprehension, F (3, 67)=1.26, p=.297, and Digit Span, F (3, 66)=.206, p=.892.

Regarding the WISC-III performance subtests, there were no significant differences between the groups at the .01 level; however, the differences for two performance subtests reached significance at the .05 level. Those two performance subtests were Block Design, F (3, 67)=3.24, p=.027, and Object Assembly, F (3, 67)=3.63, p=.017. However, post hoc analyses revealed no significant differencesbetween the comparison and internalizing groups on these subtests (p=1.00 for Block Design and Object Assembly). Approaching significance in the ANOVA was Symbol Search, F (3, 61)=2.36, p=.08. The remainder of the performance subtests that did not reach or approach significance were Picture Completion, F (3,67)=1.78, p=.160, Coding, F (3, 67)=.108, p=.955, and Picture Arrangement, F (3, 67)=.752, p=.525.

Hypothesis Four

The results of analyses for the Category raw and T-scores and the CEFS Total Score can be found in Tables 7 and 8, respectively. The hypothesis that the internalizing group will have significantly higher scores (meaning poorer performance) on measures of EF was supported by the CEFS but not the Category Test data. Regarding the Category error raw score, F (3, 37)=.661, p=.581 and the Category error T-score, F (3, 32)=1.55, p=.221, no significant differences were found between groups. A significant difference was found between the groups on the CEFS Total score, F (3, 35)=12.15, p=.000, and

between the internalizing and the comparison groups specifically as shown by the post hoc analysis (p=.034).

Hypothesis Five

The results of the ANOVAs for the CEFS subscores are reported below and can be found in Table 8. The hypothesis that the internalizing group will show significantly higher subscores (meaning poorer performance) on the CEFS was supported for specific subscores. Significant differences were found between groups on subscores included Social Appropriateness, F (3, 35)=4.52, p=.009, Inhibition, F (3, 35)=9.34, p=.000, Problem Solving, F (3, 35)=11.91, p=.000, and Initiative, F (3, 35)=7.12, p=.001. A main effect was not found between groups on Motor Planning, F (3, 35)=2.64, p=.065. Specifically regarding the differences between the comparison and internalizing groups, only Problem Solving (p=.007) and Initiative (p=.005)showed significant differences according to post hoc analyses.

CHAPTER 6

DISCUSSION

Children with internalizing behavior problems were more likely to show difficulties in global executive functions and in specified domains of executive functions including problem solving and initiative, as reported by parents, but not on standardized testing of executive functions. No specific difficulties in global intelligence or in specific domains of intelligence were found specifically for children with internalizing behavior problems.

The results of this study are consistent with other published reports of executive dysfunction related to anxiety and depression (Ardila et al., 2000; Emerson et al., 2004). Emerson and colleagues (2004) found that anxious-depressed boys showed deficits in executive function domains of problem solving, concept formation, and sequencing. Additionally, Shenal and colleagues (2003) stated that individuals with depression show impairments in global executive function due to decreased frontal lobe activity resulting from depression. Steingard (2000) reported the implications of the frontal lobes in the pathogenesis of depression, which supports this study showing elements of executive dysfunction in children with internalizing behavior problems.

While this study showed no difference between groups in the domain of motor planning, Emerson and colleagues (2001) found that motor asymmetry and grip strength differed between children with and without depression. They showed that children with depression demonstrated motor dissymmetry with more rapid decline in right hand grip strength. A reason for this difference may be related to the way motor planning was assessed. The CEFS is based on parent report whereas Emerson's study used an

objective measure (child hand dynamometer, model 78011; Lafayette Instruments, Lafayette, Indiana).

A significant difference was found on the CEFS (parent rated measure) but not on the Category Test (objective measure). This is an important finding and an explanation of this may be due to the subjective biases of the parental responses (Boyle & Pickles, 1997) on the CEFS. Also, the CEFS and the Category Test measure different EF abilities and thus could be tapping into different EF domains (see materials under Method Section).

Contrary to other studies (i.e., Matson & Fischer, 1991) showing that internalizing behavior problems are related to decreased intellectual scores, this study provided no support for that adverse relationship. Consequently, this study is consistent with other reports showing no adverse relationship between internalizing behavior problems and intelligence scores. For example, Ardila and colleagues (2000) noted that frontal lobe deficits are not profound on intelligence tests whereas frontal deficits can be revealed on tests of executive function. This adds further support for the separation of intelligence and executive function, as well as providing evidence that children can show impairments on measures of executive function while simultaneously showing no impairments on intelligence tests (Ardila et al., 1998).

Denckla (1994) asserts that EF should not be assessed as a composite but rather as sub-domains. However, this study showed significant differences in both a global measures of EF (CEFS total score) as well as subdomains of EF (CEFS subscale scores). This implies that it is important to assess both global EF and sub-domains of EF just as IQ is assessed on a global and sub-domain level.

Although there is clear evidence for the distinction of executive function and intelligence (Denckla, 1994), significant trends were found on the WISC-III subtests of Block Design and Object Assembly. Why did these two subtests show differences and no other differences were found on the WISC-III? One answer might be that these two subtests rely on the use of executive functions more than the other subtests. Kaufman (1994) noted that Block Design and Object Assembly both require problem solving, nonverbal concept formation, and attentiveness to complete the tasks. As these tests are both timed, the child must also have initiative to complete the tasks within a specified time. Thus, while executive function and intelligence represent two different domains, Block Design and Object Assembly are two subtests that may tap into the executive function domains of problem solving and initiative. For instance, although the internalizing and comparison group showed no significant difference on Object Assembly, the difference between the scores is clinically meaningful as the comparison group mean score (8.2) is in the Low Average range and the internalizing group mean score (6.8) is in the Borderline range.

This study was not able to specify factors in IQ or EF measures that could identify children with internalizing behavior disorders; however, it did show that children with internalizing behavior disorders do exhibit difficulties on certain IQ and EF components. Thus, if these cognitive difficulties are identified in a school setting it could imply that the child may have internalizing behavior problems that are contributing to the cognitive difficulties.

Limitations

This study has several limitations. Two significant limitations involve the number of participants and the assigning of group classification. Each group had a limited number of participants, with the largest group being the comparison group (n=36), then the mixed and internalizing groups (n=20 and 13, respectively) and the smallest being the externalizing group (n=6). Out of these participants, a significant number were missing evaluative data including the Category Test (comparison n=20, internalizing n=5, externalizing n=2, mix n=7) and the CEFS (comparison n=21, internalizing n=6, externalizing n=2, mix n=7). Having a small sample size decreases the power of a statistical test which decreases the ability to find statistical significance and can increase the standard error.

The groups were not classified utilizing a standardized structural clinical interview (such as the Structured Clinical Interview for DSM-IV, Child Edition, KID-SCID; Hien et al., 1994). The groups were classified according to a standardized method using the CBCL, supported by Achenbach (1991) and validated by Eisenberg and colleagues (2001), according to a parent rating of problem behaviors. This is a limitation as the behaviors were subjectively rated as opposed to objectively measured, thus allowing for parental bias to influence the assessment (Youngstrom, Loeber, & Stouthamer-Loeber, 2000).

While a comparison group was created according to the above CBCL classification method (Eisenberg et al., 2001), it was not free of psychiatric and learning disorders. Approximately half (44.4%) of the comparison group carried a psychiatric diagnosis which included ADHD and Post Traumatic Stress Disorder (PTSD), and almost a third (31.4%) were diagnosed with a learning disability (i.e., math, reading, writing).

The confound of PTSD has adverse implications as it has been associated with executive dysfunction (Beers & De Bellis, 2002). These psychiatric and learning disorder diagnoses were based on the patients' available medical record. Another limitation is that the majority of the sample (89%) was mostly Caucasian which limits the generalizability of the results.

Conclusion

This study found significant differences between the comparison and internalizing groups in terms of global executive functioning, problem solving, and initiative as reported by parents, with the internalizing group showing more executive dysfunction. While no significant differences were found between the comparison and internalizing groups in terms of intellectual functioning, a clinically meaningful difference was found on the Object Assembly subtest of the WISC-III, with the internalizing group showing poorer performance. This study supports the premise that intelligence and executive function are discrete, separate domains. Thus, assessing children with internalizing behavior problems should include both intelligence and executive functioning measures as performance on one may not necessarily reflect performance on the other.

CHAPTER 6

TABLES

Table 1 Clinical Characteristics by Group

Variable	Group					p-value
	Total N=75	Comparison N=36	Internalizing N=13	Externalizing N=6	Mix N=20	
Age	10.0 (±3.1)	10.3 (±3.1)	10.5 (±3.3)	9.0 (±3.7)	10.2 (±2.4)	.775
Gender						.807
Female	34.7%	30.6%	38.5%	50.0%	35.0%	
Male	65.3%	69.4%	61.5%	50.0%	65.0%	
Ethnicity						----
Caucasian	89%	86.1%	84.6%	100.0%	94.4%	
African-American	4.1%	5.6%	7.7%	0.0%	0.0%	
Hispanic	6.8%	8.3%	7.7%	0.0%	5.6%	
Education						----
Grade 0-2	38.6%	41.7%	38.5%	66.7%	25.0%	
Grade 3-5	30.7%	25.0%	30.8%	0.0%	50%	
Grade 6-8	18.7%	22.2%	15.4%	16.7%	15.0%	
Grade 9-10	12.0%	11.1%	15.4%	16.7%	10.0%	
Hand						----
Right	86.5%	82.9%	84.6%	83.3%	95.0%	
Left	13.5%	17.1%	15.4%	16.7%	5.0%	
LD						----
None	79.9%	68.6%	100.0%	83.3%	85.0%	
Math	4.1%	5.7%	0.0%	0.0%	5.0%	
Reading	2.7%	5.7%	0.0%	0.0%	0.0%	
Writing	6.8%	11.4%	0.0%	0.0%	5.0%	
M/R	1.4%	0.0%	0.0%	0.0%	5.0%	
R/W	4.1%	5.7%	0.0%	16.7%	0.0%	
M/R/W	1.4%	2.9%	0.0%	0.0%	0.0%	

LD=Learning Disability M/R=Math and Reading LD
R/W=Reading And Writing LD M/R/W=Math and Reading and Writing LD

Table 2 Clinical Psychiatric Diagnoses by Group[1]

Variable	Group					p-value[2]
	Total N=75	Comparison N=36	Internalizing N=13	Externalizing N=6	Mix N=20	
Mood Disorder	4%	0.0%	0.0%	0.0%	15.0%	
Disruptive Disorder	45.3%	41.7%	46.2%	50.0%	50.0%	
Mixed Disorder	6.7%	2.8%	23.1%	0.0%	5.0%	
None	44.0%	55.5%	30.7%	50.0%	30.0%	

[1]Psychiatric diagnosis based on review of medical record [Mood Disorder (major depressive disorder, bipolar disorder, generalized anxiety disorder, post traumatic stress disorder), Disruptive Disorder (attention deficit hyperactive disorder, obsessive compulsive disorder), Mixed Disorder includes a combination of Mood and Disruptive Disorder]
[2]Unable to calculate significant difference due to limited cell size

Table 3 Sociodemographic Characteristics by Group

Variable	Group				
	Total N=75	Comparison N=36	Internalizing N=13	Externalizing N=6	Mix N=20
Parental Marital Status					
Married	78.7%	77.8%	76.9%	100.0%	75.0%
Divorced	12.0%	13.9%	15.4%	0.0%	10.0%
Separated	4.0%	5.6%	0.0%	0.0%	5.0%
Never Married	5.3%	2.8%	7.7%	0.0%	10.0%
Child Living Status					
Both Parents	75.0%	77.8%	76.9%	100.0%	75.0%
Father	0.0%	2.8%	0.0%	0.0%	0.0%
Mother	10.0%	8.3%	7.7%	0.0%	10.0%
Other	15.0%	11.1%	15.4%	0.0%	15.0%
Mother's Employment Status					
Employed	60.0%	66.7%	46.2%	50.0%	60.0%
Unemployed	2.7%	2.8%	0.0%	0.0%	5.0%
Retired	1.3%	0.0%	0.0%	0.0%	5.0%
Housewife	34.7%	30.6%	46.2%	50.0%	30.0%
Other	1.3%	0.0%	7.7%	0.0%	0.0%
Mother's Education					
Grade $\leq$ 12	4.0%	2.8%	0.0%	0.0%	10.0%
High School	9.3%	8.3%	23.1%	0.0%	5.0%
College	62.6%	63.9%	69.3%	83.3%	50.0%
Post Graduate	24.0%	25.0%	7.7%	16.7%	35.0%
Father's Employment Status					
Employed	95.9%	94.3%	100.0%	100.0%	94.7%
Unemployed	1.4%	2.9%	0.0%	0.0%	0.0%
Retired	1.4%	0.0%	0.0%	0.0%	5.3%
Other	1.4%	2.9%	0.0%	0.0%	0.0%
Father's Education					
Grade $\leq$ 12	1.4%	0.0%	0.0%	0.0%	5.3%
High School	19.4%	20.0%	16.7%	16.7%	21.1%
College	37.5%	40.0%	50.0%	33.4%	26.3%
Post Graduate	41.7%	40.0%	33.3%	50.0%	47.4%

Table 4 WISC-III Index Scores by Group

Index Score	Group				p-value
	Comparison	Internalizing	Externalizing	Mix	
VCI	98.3 (±15.7)	98.7 (±15.1)	94.0 (±28.3)	102.2 (±18.8)	.768
POI	94.3 (±20.4)	90.0 (±16.2)	101.0 (±6.5)	105.5 (±16.2)	.076
FFD	93.3 (±16.5)	94.3 (±22.2)	89.6 (±17.5)	98.1 (±15.1)	.715
PSI	95.1 (±13.6)	91.6 (±17.9)	107.3 (±24.2)	100.1 (±15.4)	.244

VCI=Verbal Comprehension Index
POI=Perceptual Organization Index
FFD=Freedom From Distractibility Index
PSI=Processing Speed Index

Table 5 WISC-III Verbal Subtests by Group

Verbal Subtest	Group				p-value
	Comparison	Internalizing	Externalizing	Mix	
Information	9.1 (±3.1)	10.5 (±3.1)	10.0 (±5.6)	10.7 (+3.5)	.370
Similarities	10.2 (±3.1)	11.1 (±2.8)	9.4 (+5.9)	10.9 (±3.7)	.715
Arithmetic	8.5 (±3.5)	7.8 (±3.8)	6.2 (±2.6)	9.5 (±2.9)	.204
Vocabulary	9.7 (±3.4)	8.5 (±3.1)	8.2 (±5.6)	10.2 (±4.7)	.578
Comprehension	9.5 (±3.7)	7.3 (±3.5)	7.6 (+4.6)	9.5 (±4.1)	.297
Digit Span	8.9 (±2.9)	9.5 (±4.8)	9.8 (±3.6)	9.5 (±3.0)	.892

Table 6 WISC-III Performance Subtest by Group

Performance Subtest	Group				p-value
	Comparison	Internalizing	Externalizing	Mix	
Picture Completion	9.2 (±3.7)	10.9 (±2.7)	11.2 (±2.2)	11.1 (±3.2)	.160
Coding	8.5 (±3.6)	8.6 (±3.7)	9.2 (±5.2)	9.0 (±3.3)	.955
Picture Arrangement	9.4 (±4.9)	7.5 (±2.8)	9.6 (±2.2)	9.7 (±3.9)	.525
Block Design	8.7 (±3.7)	8.1 (±3.8)	10.4 (±2.4)	11.45 (±3.3)	.027
Object Assembly	8.2 (±3.5)	6.8 (±4.3)	9.0 (±1.6)	10.9 (±3.8)	.017
Symbol Search	9.5 (±3.2)	7.6 (±4.0)	12.0 (±4.8)	10.6 (±3.1)	.080

Table 7 Category Test by Group

Variable	Group				p-value
	Comparison N=12	Internalizing N=8	Externalizing N=4	Mix N=12	
Raw Score	38.0 (±25.7)	30.1 (±24.5)	21.0 (±16.8)	30.1 (±22.7)	.581
T-Score	50.2 (±14.5)	53.6 (±12.9)	43.8 (±12.7)	41.7 (±13.1)	.221

Table 8 CEFS Total and Subscale Scores by Group

CEFS Scores	Group				p-value
	Comparison N=15	Internalizing N=7	Externalizing N=4	Mix N=13	
Total Score	46.1 (±23.9)	78.0 (±31.6)	99.3 (±25.3)	95.6 (±17.5)	.000
Social Appropriateness	6.3 (±5.2)	7.1 (±3.3)	10.3 (±5.0)	12.5 (±4.6)	.009
Inhibition	16.1 (±9.6)	20.0 (±9.0)	28.8 (±8.3)	32.5 (±7.2)	.000
Problem Solving	13.3 (±7.0)	29.9 (±16.7)	36.3 (±12.3)	33.6 (±8.1)	.000
Initiative	4.9 (±3.2)	13.7 (±8.1)	13.3 (±2.9)	12.2 (±5.8)	.001
Motor Planning	5.5 (±4.6)	7.3 (±4.9)	10.8 (±2.9)	4.9 (±2.5)	.065

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VITA

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