2012

An Examination of the Comorbidity between Externalizing Disorders and Reading Disabilities in School-Age Boys

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AN EXAMINATION OF THE COMORBIDITY BETWEEN EXTERNALIZING DISORDERS AND READING DISABILITIES IN SCHOOL-AGE BOYS

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Submitted in Partial Fulfillment of the Requirements of the Degree of

Doctor of Psychology

August 2012

Acknowledgements

I would like to recognize the guidance and assistance provided to me by all the committee members and greatly acknowledge their outstanding contribution to this research project.

To Dr. Lisa A. Hain. I can't think of anyone else who could have coached me through this better than you. Your kind manner, willingness to share and open-minded nature combined with vast psychological and neuropsychological knowledge and excellent statistical knowledge made working with you a joy.

To Dr. Terri Erbacher, thanks for your salient comments and prompt feedback. You lent a unique and valuable perspective to this project.

To Dr. Edward Kardell, thank you for being my internship supervisor and third committee member. I got to know you quite well over the past year; you were always there if I ever had an issue or needed help with the dissertation. In times of stress, you would usually share a personal scenario or story which would put me at ease. Your integrity and kind and gentle manner was always so reassuring to me.

To my mother, over the years I have learned from you how to adapt, overcome obstacles and achieve goals. I'm glad you have been able to see my accomplishment. To my late father, you always were and always will be my hero, forever offering me encouragement and praise.

To all my dear friends and family who offered their love and encouragement over these past three years, thank you! To Carol Calame, I owe a particular debt of thanks for your daily encouragement.

To Samantha, my step daughter, it was fun being in school with you! You really are the coolest stepdaughter ever! You have enriched my life in ways I never thought possible.

To my husband, Nick, it was only because of your love, encouragement, support and belief in me that I was able to accomplish this goal. I'll never forget the day we met on October 2, 1982 at your birthday party. You've made me so happy, I can't think of anyone I would rather have next to me on the journey of life. I dedicate this to you.

Abstract

Our current education system uses a global method that does very little to address the concurrent cognitive, academic and social-emotional needs of the special education student. By using a single analysis, we fail to address specific deficits, including comorbidity of cognitive, academic, and socio-emotional deficits. Generalized assessments do little to address the source of the student's problems. If these comorbid learning and social-emotional problems are addressed early on, this might reduce the incidence of antisocial and/or delinquent behaviors and lead to greater academic success. In an attempt to further investigate the relationships between academic, (i.e., reading) and emotional/behavioral systems, the current study explored cognitive subtypes through hierarchical cluster analysis of Wechsler Intelligence Scale for Children 4th Edition (WISC-IV) standardized subtests, educational achievement assessed through analysis of the Woodcock Johnson III (WJIII) and emotional and behavioral functioning assessed through Behavior Assessment System for Children 2nd Edition (BASC-2 TRF) teacher ratings. Six cognitive subtypes were identified and differentiated across cognitive, academic, psychosocial, and disciplinary variables. Statistically significant group differences were found.

The Crystallized Language subgroup emerged as having relatively lower Verbal Comprehension Index (VCI) and Word Attack scores with a global psychopathology, including the highest rate of the externalizing behavior of aggression in concert with the lowest anxiety and the highest rates of truancy, suspensions and arrest out of all the subgroups. As for the other subgroups, the Executive/ Working Memory subgroup had lower cognitive and academic ability with increased depression and a slight elevation in truancy and arrests. The Cognitively Impaired and Visual Spatial/Constructional subgroups demonstrated severe cognitive and academic deficits and experienced global emotional/behavior dysfunction, with high rates of truancy and arrest, respectively. The Auditory/Verbal subgroup showed commensurate lower cognitive and

academic deficits with externalizing problems and overall global emotional/behavioral deficits with a history of truancy noted. The High Functioning/Processing Speed subgroup showed no cognitive/academic concerns, but did demonstrate increased anxiety with no positive disciplinary history noted.

This study demonstrates the need for more accurate identification of the special education student as a whole being, incorporating each facet of cognitive, academic and comorbid social/emotional deficits. If specific deficits are identified, more targeted interventions would help practitioners to teach and offer social/emotional supports. Effectively diagnosing a complex and unique cognitive academic and social emotional makeup will certainly provide a springboard for academic success, which may ultimately reduce antisocial and/or criminal behaviors and improve society for future generations. Future research could benefit from investigation using current assessments with more standardized employment and collection of data on disciplinary actions.

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Chapter 1

Introduction

Educational professionals are trained to work with students who present with complicated behaviors, some of which are more difficult to understand and treat. Due to the overwhelming amount of comorbidity that exists in behaviorally based definitions of childhood disorders, educators often feel confused and ill-prepared to work with these more challenging behaviors that negatively affect academic progress. Of particular concern, are those students who present with both learning and emotional-behavioral challenges which result in a complex diagnostic picture. The comorbidity of emotional and academic problems requires clinically sensitive assessment of multi-factorial needs as the symptomatic picture is much more complex than for any single disability alone. Given accurate assessment of this heterogeneity, the intricate interplay of learning and emotional processes can be highlighted with the full clinical profile being considered in determining eligibility for support services under the Individuals with Disabilities Education Act (IDEA). This comprehensive approach requires knowledge of how these two systems operate within the individual with knowledge of brain-behavior relationships being crucial. Ultimately, the knowledge garnered from a comprehensive evaluation is tied to environmentally focused and individualized research-based interventions.

According to the National Center for Education Statistics (U.S. Department of Education, 2011), approximately six million special education students are served under IDEA. Of those students, 38% were eligible for special education and related services as students with specific learning disabilities (SLD), 10% were eligible as students with other health impairments (OHI), and 6% were identified with emotional disturbances (ED). Even though IDEA allows for both primary and secondary diagnoses for these classifications in order to more accurately classify special education students, such students are frequently classified with only one type of

disability. Comorbid conditions are less likely to be determined and are not one of the categories of eligibility dictated by IDEA. Thus, appropriate classification and intervention for the more complex comorbid conditions are less often realized. To illustrate, Brook and Boaz (2005) studied students in whom attention problems that resulted in disordered behavior had been diagnosed and discovered that 94% of those boys also had comorbid learning disorders. Comorbid conditions are more frequent than expected and the final common pathway is associated with poorer neuropsychological, academic, and behavioral outcomes (Germano, Gagliano, & Curatolo, 2010).

A clear example of how comorbid disabilities are typified includes examining children with attention deficit hyperactivity disorder (ADHD). ADHD is the most commonly diagnosed behavioral disorder of childhood with approximately two million children having the disorder (Learning Disabilities Association of America, LDA, 2011). According to the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 2004), between 3% and 7% of school-age children have ADHD with boys much more likely to receive the diagnosis. Further, the Centers for Disease Control and Prevention (CDC) reported that approximately 5% of children with ADHD do not have a learning disability, 5% with ADHD do have a learning disability and 4% have a comorbid condition (CDC, 2011). However, other estimates suggest the percentage is much higher. The LDA suggested that approximately 20% to 30% of those children with ADHD also have a specific learning disability (LDA, 2011).

In addition, according to the National Institute of Mental Health, other disorders that sometimes accompany ADHD are oppositional defiant disorder (affecting as many as one third to one half of all children with ADHD), conduct disorder (about 20 to 40% of children with ADHD), anxiety, depression, and bipolar disorder (Digest of Education Statistics, 2010). The

most frequently encountered developmental problem for students with comorbid learning and attention problems are that they are more typically seen as demonstrating severe behavioral disorders (Mangina, Beuzeron-Mangina, & Grizenko, 2000). This comorbidity of learning disorders and emotional problems continues into adulthood. Unfortunately, as adults, some may continue to experience associated emotions such as shame, fear, environmental and emotional sensitivity, dysregulation, and difficulties with change in much the same way they experienced them as students (Gerber & Reiff, 1994). It is often this associated emotional sequelae that is least identified and least remedied.

In accordance with federal guidelines, IDEA delineates 13 classifications for special education eligibility, but at this time, no specific classification category that addresses these comorbid disabilities exists. Even though IDEA allows for both primary and secondary diagnoses for these classifications in order to more accurately classify special education students, such students are frequently classified with only one type of disability. Essentially, only part of each student's "disability" is being identified and addressed. Solely identifying an emotional disturbance without uncovering the "hidden" learning disorder, results in long-term effects on functioning. These long-term harmful effects of comorbidity include juvenile delinquency (Hinshaw, 1992) incarceration (Brier, 1989; Rutherford, 2002) and psychosocial difficulty into adulthood (Gerber & Reiff, 1994).

Statement of the Problem

Under the Title I requirements of the No Child Left Behind Act (NCLB), schools will be identified as needing improvement if they do not make adequate yearly progress (Blackorby & Wagner, 1996). This mandate includes special education students with learning, attention, and emotional problems. Increasingly, high-stakes tests have significant consequences for students,

as they often determine whether they are promoted from one grade to the next, or graduate from high school with a standard diploma (Thurlow & Johnson, 2000). Under this mandate, students who are unable to meet these heightened expectations may feel even more separated from their peers making them much more likely to engage in less desirable behaviors and more likely to drop out of school (Blackorby & Wagner, 1996).

In a cost benefit analysis, Goulding, Chien, and Compton (2011) suggested that students who do not pass these high-stakes tests may decide not to stay in school because either they will not be promoted or may not graduate with a standard diploma. Educational attainment is not only highly correlated with income level and occupational status, but highest level of education earned may have an important influence on health. In fact, a lack of formal education is associated with greater levels of risky health behaviors, including substance abuse and inadequate physical activity and may actually be a predictor of earlier mortality. The average high school student who has dropped out lives 9 years fewer than one who has earned a high school diploma. Higher levels of education promote greater access to resources, engendering a sense of control over one's own life (Goulding, Chien, & Compton, 2011).

The Office of Juvenile Justice and Delinquency Prevention (OJJDP, 1995) reports that boys who drop out of school generally experience negative outcomes, including unemployment, underemployment, and incarceration. Without formal education, rates of dropout, delinquency, depression, suicide, substance abuse, work absenteeism, and other psychosocial complications increase. According to Fine and Zane (1989), high school dropouts report unemployment rates as much as 40% higher than youth with a high school diploma. Arrest rates for youth with disabilities who drop out of school are alarming: 73% have emotional/behavioral disabilities and 62% have learning disabilities. This study revealed that more than 80% of those incarcerated

were high school dropouts. Mental illness also accounts for a significant percentage of high school dropouts (Fine & Zane, 1989; Haynes, 2002). Because psychiatric disability often begins in late adolescence or early adulthood, many who are affected by serious mental illnesses (e.g., schizophrenia and related psychotic disorders) have difficulty completing high school and entering postsecondary education (Haynes, 2000). It is posited that the comorbidity of learning difficulties, emotional issues, and health impairments magnifies maladaptive behaviors, potentially leading to later antisocial behaviors (Willcutt & Pennington, 2000a).

The most identified learning disorder is an inability to read. Because of the high incidence (5%-10%) of learning disabilities in the general population, early identification of affected individuals is crucial to their progress (Reynolds, Elksinan, and Brown, 1996; Shaywitz, Fletcher, & Shaywitz, 1994). It appears from the results obtained from several longitudinal studies that reading deficits are generally stable over time with few exceptions (Shaywitz, Shaywitz, Fletcher, & Escobar, 1990; Spira, Bracken, & Fischel, 2005). Wasick and Slavin (1993) found that few children with severe reading disabilities ever caught up, and this "Matthew Effect" suggests that children with reading difficulties continue to fall farther behind their normally achieving peers in reading achievement (Stanovich, 1986). Furthermore, individuals with reading disabilities generally acquire less basic knowledge because their disability requires them to spend more time with the mechanics of reading than acquiring new information. Unfortunately, the diagnosis of a reading disability typically takes place when the child reaches the second or third grade, at which time most children already demonstrate a significant discrepancy and may have already experienced frustration and failure.

It is crucial for educational practitioners to properly identify comorbid conditions in students in order to effectively intervene and treat each one of the disabilities so that these

students can be afforded the same opportunities customarily attributed to more educated individuals. Effective treatment of learning and emotional disorders may alter the usual trajectory towards a lifetime of poverty or crime. Research suggests the disabled learner will struggle throughout his lifetime. It is time that educational professionals in public schools, return to the classroom and learn to teach these disordered learners how to succeed before they engage in unhealthy or illicit behaviors, placing a drain on all of society.

Purpose of the study

The current study examined how the comorbidity of learning disorders, emotional disturbances or other health impairments, contributed to the development of antisocial behaviors, juvenile delinquency, or psychopathology in school-age boys. This study explored connections between the learning and emotional-behavioral systems in school-age boys and examined how specific cognitive abilities result in a complex pattern of learning and behavioral challenges as rated by teachers. The aim of the study was to highlight the multifactorial nature of comorbid conditions in children and determine patterns of performance by examining the role of cognitive, academic, and emotional-behavioral variables.

Chapter 2

Literature Review

Genetic heritability of a reading disability

Previous studies demonstrate unequivocally that reading difficulties can be genetic in nature (see DeFries & Decker, 1982; DeFries, Vogler, & LaBuda, 1986; Pennington et al., 1991; Willcutt, Pennington, Olson, Chhabildas, & Huslander, 2005). In fact, the risk for reading disability (RD) is four to eight times higher in first-degree relatives with a reading disability than in relatives of individuals without one (Gilger, Pennington, & DeFries, 1991; Pennington & Lefly, 2001). A clear example are the results obtained through the Colorado longitudinal twin studies of reading disability, in which twins with a history of reading difficulties who shared genetic influences accounted for over 86% of the variance in reading (Wadsworth, DeFries, Olson, & Willcutt, 2007). Being able to identify these children who are at risk for potential reading disorders based on familial history may lead ultimately to interventions being delivered at an earlier age, thereby preventing further comorbid conditions.

Deficits in word reading are linked to genetic influences on the oral language system with the development of phonemic awareness. Poor development of phonemic awareness is regarded by many as the proximal cause of most cases of RD (Wagner, Torgenson, & Rashotte, 1994). Although deficits in groups with RD are most pronounced on measures of phoneme awareness and other facets of phonological processing, recent studies suggest that individuals with RD also have weaknesses in several other neurocognitive domains such as slower verbal naming speed and weaknesses in executive domains such as verbal working memory, set shifting, planning, and response inhibition (Semrud-Clikeman, Guy, Griffin, & Hynd, 1992; Willcutt & Pennington, 2000a; Willcutt, Pennington, & DeFries, 2000). Similarly, results obtained from recent studies have provided compelling evidence regarding the genetic and environmental etiologies and

comorbidity with other conditions such as ADHD and antisocial behavior (Gayan, Willcutt, & Fisher, 2005; Stevenson, Pennington, Gilger, DeFries & Gillis, 2005; Willcutt & Pennington, 2000b; Willcutt & Pennington, 2003). Genetic heritability may play a role in comorbid learning disabilities, emotional disabilities, and maladaptive behaviors (Pennington et al., 2008).

Components of successful reading

In order to identify early reading problems, a framework for developing instruction to teach children to read was required. In 1997, the National Reading Panel (NRP) identified five components of reading instruction that are essential for developing the underlying processing skills that lead to successful reading. These components are phonemic awareness, phonics, reading fluency, comprehension, and vocabulary. Children with specific learning disabilities in reading often exhibit a deficit in one or more of these core areas of balanced literacy. Phonemic awareness means knowing that spoken words are made up of smaller parts called phonemes; whereas, phonics instruction teaches students about the relationship between phonemes and printed letters, and explains how to use this knowledge to read and spell. When these basic decoding skills are intact, children are able to decode unknown words and continue to develop their sight word lexicons. As children mature in the reading process, an age appropriate level of vocabulary is necessary in order to recognize words and associate meaning at an automatic level. Finally, comprehension is necessary in order to understand extended text. Comprehension is ultimately the goal of reading and this process calls upon the integration of other successful components of the reading process (NRP, 1997). At any one of these levels, children could experience difficulties learning to read, and for them, reading may become a frustrating and ultimately unsuccessful activity.

The Phonological Processor

Studies of individuals with and without reading difficulties suggest that phonological decoding, defined as the ability to translate sequences of printed letters into the corresponding sounds, plays a central role in both normal and abnormal reading development (e.g., Pennington, 2002; Wagner & Torgesen, 1987). In addition to poor phonemic awareness, poor readers seem to understand the syntactic structure of a sentence but cannot maintain it in working memory long enough to comprehend meaning (Mann, 1994). Working memory processes are crucial to holding and manipulating sounds. According to Baddeley and Hitch (1974), the reading brain calls upon the phonological loop, which helps to hold and encode sounds and to manipulate sounds within words. There is evidence to suggest that reading disabilities may in part be secondary to deficits in phonological processing or phonemic awareness. For instance, Badian (1990) and colleagues found that the best predictors of future reading could be found through assessment of sound-letter associations. The first sign of a reading disability was discovered in those children who at 3 years of age had a weakness in their receptive vocabulary and object naming abilities. In addition, at five years of age, these children maintained a weakness in object-naming, letter sound knowledge and phonemic awareness. Lastly, children with reading disabilities had had a history of weakness in grapheme-phonemic association in storage and retrieval of phonological information in long-term memory in kindergarten, which was associated with later weaknesses in comprehension (Badian, 1990).

Phonemic awareness is necessary to be able to read, as reading involves a mixture of sensory and language-based functions. Three sensory systems involved are the auditory, visual and vestibular senses. The auditory sense is involved because of its role in speech perception, the visual sense due to its ability to identify patterns, and finally, the vestibular sense regulates eye

movement necessary for the kinesthetic motion involved in reading (Berninger & Richards, 2002). This development of coordinating multiple processes related to reading follows a typical developmental trajectory. Reading is an intricate skill that begins with audition. In fact, preschool children with frequent ear infections can have trouble when they begin to learn reading becausethey may have had distorted hearing; hearing is necessary for the initial intake of the sound-symbol relationship necessary for good reading. Severe or recurrent ear infections can cause a delay in the development of receptive and expressive communication skills. These deficits can then cause learning problems that result in reduced academic achievement (Berninger & Richards, 2002). Specific reading disabilities appear to derive from these types of language based disorders (Badian, 1990; Shapiro & Levine, 1990; Felton, 1992).

The Orthographic Processor

Given that reading involves both a phonological aspect as well as a visual aspect, it is not surprising that the extant research suggests that lack of exposure to the written word can affect reading fluency. Reading fluency ability is often used as a good indication of overall reading ability and comprehension. Problems with reading fluency can be easily detected at a young age by a deficit in the fluid retrieval of familiar names and numbers (Feifer & DellaToffalo, 2008). Good readers demonstrate fluency with the association of sounds, letters, and words. Such fluency begins with an orthographical understanding. Orthography refers to the writing system in a particular language. English orthography consists of regular reading and spelling words, regular reading words, rule based words, and irregular words. Good readers will automatically recognize all four types of words, though they will not read each individual word; rather, they will focus their attention on the letter patterns (Berninger & Richards, 2004; Hook & Jones, 2002).

Just as phonological awareness is critical to sound-letter association, orthographic awareness is critical to fluent reading. The fluent reader is easily and automatically able to detect nonsense words from legitimate words and demonstrate good prosody when reading aloud (Spear-Swerling, 2006). Good readers are easily able to learn word attack strategies, such as prefix, stem, and suffix (morphemic structures) through multisensory and/or rote teaching techniques. In contrast, the poor reader demonstrates poor fluency in conjunction with orthographic, phonological, morphological, rapid automatic naming deficits and receptive/expressive language deficits (Berninger, 2001). An oral reading fluency screening can easily identify at-risk students for early reading intervention in order to avoid remedial assistance. Assessments such as the Process Assessment of the Learner (PAL) (Berninger, 2001a), the Test of Rapid Automatic Naming (RAN) (Wolf & Denckla, 2004) and the Delis-Kaplan Executive Function System (DKEFS) (Delis, Kaplan, & Kramer, 2003) could be instrumental in the early identification of at-risk students for reading.

Identification of reading disabilities

Three main areas of development that place a child at risk for RD are language (pre-academic skills), attention, and behavior (Reynolds, et al., 1996). In order to identify a reading disability, school psychologists are called upon to evaluate students according to the standards set forth by IDEA (2004). IDEA defines a specific learning disability in Title 20 United States Code Section 1401(30) [cited as 20 USC 1401§ (30)] as follows:

(30) Specific learning disability.

(A) In General. The team ‘specific learning disability’ means a disorder in 1 or more of the basic psychological processes involved in understanding or in using language,

spoken or written, which disorder may manifest itself in the imperfect ability to listen, think, speak, read, write, spell, or do mathematical calculations.

(B) Disorders included. Such term includes conditions such as perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia.

In addition, IDEA 2004 regulations stipulate that the school team must determine if the child is not achieving adequately for his/her age or does not meet state-approved grade-level standards when provided with learning experiences and instruction appropriate for the child's age and grade-level standards. The academic areas for SLD eligibility include oral expression, listening comprehension, written expression, basic reading skills, reading fluency skills, reading comprehension, mathematics calculation, or mathematics problem solving [see 34 CFR 300.309(a)(1)].

Several studies have substantiated direct relationships between basic psychological processes and deficient reading skills. Historically, SLD has been seen as a learning deficit in a specific academic area, although in reality, cognitive deficits likely lead to a variety of learning difficulties across multiple academic domains. Recent research has contributed a wealth of information that pinpoints some of the neuroarchitecture and processing demands that are involved in performing academic tasks. This has led to the delineation of SLD subtypes within academic areas (Hain, Hale, & Kendorski , 2009).

Reading disability subtypes

A disorder in reading can be considered a developmental disorder characterized by significant underachievement on standardized tests of single-word reading, reading fluency, and reading comprehension, usually resulting from impaired phonological processing (Hynd,

Marshall, & Semrud-Clikeman, 1991; Pennington, Van Orden, Smith, Green, & Haith, 1990; Shaywitz, et al., 1995; Willcutt & Pennington, 2000b; Palacios & Semrud-Clikeman 2005).

Basic reading skills. Learning to read is not like learning to speak. The human brain is hardwired to learn spoken language; therefore, it is a naturally occurring process (Shaywitz, 2003). Typically, simply exposing hearing children to spoken language allows them to acquire and produce speech. Learning to read, however, is not "natural" for children. It has to be explicitly taught; exposure to text and print is not enough for the majority of the population. Neurobiological advances in research suggest that the posterior left hemisphere is disrupted in poor readers (Shaywitz, 2003). To illustrate, although the right hemisphere can accommodate for poor phonological skills, specifically, the posterior occipitotemporal area of the brain is used for skilled reading (Shaywitz & Shaywitz, 2005). Moreover, according to the Council for Exceptional Children (2011), gaps in basic reading skills may develop in decoding, word recognition, and attention without proper sound recognition. Without effective sound-letter association, children are likely to experience fluency and comprehension problems, as most of their focus of energy will be spent on reading, with little comprehension of the material (Shaywitz & Shaywitz, 2005).

Reading fluency. Reading fluency refers to the ability to read words accurately, quickly and effortlessly. Additionally, fluency skills include the ability to read with appropriate expression and intonation or prosody. Fluency therefore relies on three key skills: accuracy, rate, and prosody. Reading fluency can and should vary, even for skilled readers, depending on the type of text, familiarity with the vocabulary, background knowledge of the content, and the amount of practice the student has had with a particular text or type of text. Fluency comes from many successful opportunities to practice reading (Lambert, 2007). Fluency is a necessary but

not sufficient component for comprehension. It is, however, the bridge that links accurate word decoding to comprehension (Rasinski, 2004). The ability to read fluently allows readers to free up processing "space" so that they can comprehend, make connections to the text and acquire new vocabulary. Typically, students who cannot read fluently show a significant lag in reading comprehension skills as well.

Reading comprehension. This disability interferes with a student's ability to understand and extract meaning from text. Reading comprehension is "the process of simultaneously extracting and constructing meaning through interaction and involvement with written language" (Rand Reading Study Group, 2002). Reading comprehension is a complicated set of processes that has been studied less often than other areas of reading. It is most common for students to have basic reading skill deficits combined with comprehension deficits, and/or fluency deficits. If this is the case, it is critical to instruct on the basic skill deficits as well as the comprehension deficits. A reading comprehension deficit assumes that basic reading skills are intact and that the student can read fluently without errors. Students with a reading comprehension disability are typically not identified until the shift occurs from learning to read, to reading to learn. In most cases, this is around the third or fourth grade (Berninger & Richards, 2002).

The Emotional sequelae of reading disabilities

Internalizing symptoms such as anxiety do not directly impair reading comprehension, but anxiety can increase the amount of time spent reading words. Therefore, the anxious reader will need to garner more resources to process the information (Calvo & Carreiras, 2011). If the anxious reader continues to struggle, feelings of failure may result in avoidance of reading in order to avoid feeling bad about reading ability (Shaywitz, 2007). To clarify this point, Willcutt and Pennington (2000a) found that children with learning disabilities had high rates of both

internalizing and externalizing disorders. However, they posited that internalizing symptoms of anxiety, depression, and avoidance were found more often in girls, while boys were more likely to demonstrate externalizing psychopathology. These results alone can have ramifications in educating and treating children with learning disabilities. The anxiety these children experience may not constitute a formal *DSM-IV* disorder, but a high level of anxiety may affect academic progress and needs to be closely monitored.

The extant research demonstrates that students who score low in verbal skills and reading abilities likely experience shame due to their inability to read (Shaywitz, 2007). Research suggests that the shame and accompanying low self-esteem which these children feel might sometimes be externalized through antisocial behavior (Shaywitz, Shaywitz, & Fulbright, 2003). In fact, it is specifically students who also exhibit comorbid hyperactive-impulsive behaviors who tend to miss social cues and are more likely to enter the criminal justice system (Moffit, 1990). However, continuous advances in neuropsychological research are pointing to this subtype of learner who possesses a learning disability with comorbid health impairments as seen in children with ADHD and emotional disorders. The shame, frustration, poor self-esteem and increased criticism that precede school failure have been a cause for behavioral problems in children with learning disabilities (Brier, 1989). This is exemplified by Shaywitz, B.A. (2007),

> One of the least appreciated consequences of protracted reading difficulties is shame. Feeling shame for being unable to read well enough leads to feelings of shame *while* trying to read. This can lead to a dangerous downward spiral for two reasons: 1) When shame triggers it 'shocks' and disrupts cognitive processing and weakens or breaks the flow of processing necessary to continue reading, and 2) People instinctually avoid engaging in activities that cause them to feel shame. The more learning to read triggers

feelings of shame, the greater the desire to avoid learning to read. To make matters worse, reading shame leads people to hide their reading difficulties from those who could most help them (Shaywitz, 2005).

Eligibility procedures in identification of ED

Research suggests that emotional and behavioral problems identified during adolescence can often be linked to early childhood behavioral patterns (Hinshaw, 1992). Although teachers in public schools typically consider 10%-20% of their students to have emotional or behavioral problems, a conservative estimate of the number whose problems are both severe and chronic is 2%-3% of the school-age population (ERIC, 2011). According to the U.S. Department of Education (2002), individuals classified as having ED represent 8.1% of all students aged 6 to 21 served under IDEA. Further, in the National Longitudinal Transition Study (NLTS), 76.4% of secondary students with emotional disturbances were male (U.S. Department of Education, 2001). ED classified students who have emotional and behavioral disturbances exhibit significant behavioral excesses or deficits. Some of the dimensions of disordered behavior include internalizing disorders such as anxiety and depression, and externalizing behaviors such as conduct disorder, personality disorders, and socialized delinquency (Achenbach, 1982; Quay, 1972).

Research suggests that SLD and ED are the most common types of disabilities among youth in correctional settings. According to Mears and Aron (2003), 10%-36% of youth in correctional facilities have SLD, 50% have ED, and between 20%-50% of incarcerated youth have ADHD. Further, an emotional disorder can lead to serious life-long mental health issues, including lack of education, unemployment, underemployment, poverty, health problems,

incarceration, substance abuse, relational problems and even lower life expectancy (Goulding, Chien, & Compton, 2011; Schubert, Mulvey, & Glasheen, 2011; Wiles, et al., 2008).

IDEA defines an emotional disturbance as Code of Federal Regulations §300.8.

(34) Emotional disturbance.

A) In general. The term 'emotional disturbance' means a condition exhibiting one or more of the following characteristics over a long period of time and to a marked degree that adversely affects a child's educational performance:

1) An inability to learn that cannot be explained by intellectual, sensory, or health factors;

2) An inability to build or maintain satisfactory interpersonal relationships with peers and teachers.

3) Inappropriate types of behavior or feelings under normal circumstances.

4) General pervasive mood of unhappiness or depression.

5) A tendency to develop physical symptoms or fears associated with personal or school problems.

6) Emotional disturbance includes schizophrenia. The term does not apply to children who are socially maladjusted, unless it is determined that they have an emotional disturbance under paragraph IDEA defines an emotional disturbance in Title 20 United States Code Section 1401 (34) [cited as 20 USC 1401§ (34)] 300.8 (c)(4)(i) of this section.

Comorbidity of SLD and ED

Children with SLD who also experience emotional-behavioral difficulties are often less accepted than their peers. According to Erhardt and Hinshaw (1994), peer rejection is most often

attributed to externalizing behaviors of aggression and noncompliance. Accordingly, social skill deficits are often to blame in poor peer relationships because children with SLD have poor problem solving skills and engage in destructive externalizing and antisocial behaviors (Swanson & Malone, 1992). Similarly, Bryan, Burstein, and Ergul (2004) suggested that students with SLD experience negative emotions and have poor emotional regulation. Kavale and Nye (1986) reported that 70% of students with SLD have reported lower self-esteem than their non-SLD peers. Bryan et al. (2004) and Hinshaw (1992) posit that part of the problem in children with SLD who also have comorbid externalizing behaviors lies in their inability to process emotional stimuli, which leads to problems with misunderstanding social cues and often leads to difficulties navigating their social environments. Thus, for these children, high levels of peer rejection and loneliness, low self-concept, and high levels of depression and anxiety and even shame may be experienced (Alyagon-Levin, 2007; Margalit & Alyagon-Levin, 1994).

The research points to deficits in attention, hyperactivity, poor social skills, and executive functions as characteristics common to students with SLD and ED (Rock, Fessler, & Church, 1997). Children with SLD have comorbid executive function strategic control processing deficits that often result in difficulties with strategizing and developing compensatory skills to correct their learning disability (Rock et al., 1997). The combination of reading disorders with externalizing behaviors can have deleterious effects on the learning, behavior, and socioemotional development of affected children. These externalizing disorders have been termed under-controlled behaviors, which appear as defiance, aggression, and impulsivity (Achenbach & Edelbrock, 1978). Children with externalizing behaviors often have peer relationship problems; they also have lowered self-esteem and a history of acting out behaviors (Hinshaw, 1992). These externalizing behavior disorders are persistent and are connected to

learning difficulties, which result in academic underachievement and can even lead to school failure (Hinshaw, 2000).

Eligibility procedures in identification of other health impairment

Although many health problems can be considered for classification under OHI, ADHD is the main health problem of concern in relationship to ED/RD. Children with ADHD have functional impairment across multiple settings including home, school, and peer relationships. ADHD has also been shown to have long-term adverse effects on academic performance, vocational success, and social-emotional development. These children experience peer rejection and engage in a broad array of disruptive behaviors. Their academic and social difficulties have far-reaching and long-term consequences. These children have higher injury rates. As they grow older, children with untreated ADHD, in combination with conduct disorders, engage in drug abuse, antisocial behavior, and sustain injuries of all sorts. For many individuals, the impact of ADHD continues into adulthood (Psych Central, 2007).

IDEA ([34 Code of Federal Regulations §300.9 (c)(9)]) defines OHI as:

> 1) In general. The term 'Other Health Impairment' means having limited strength, vitality or alertness, including a heightened alertness to environmental stimuli, that results in limited alertness with respect to the educational environment, that:
>
> (2) Is due to chronic or acute health problems such as asthma, attention deficit disorder or attention deficit hyperactivity disorder, diabetes, epilepsy, a heart condition, hemophilia, lead poisoning, leukemia, nephritis, rheumatic fever, sickle cell anemia, and Tourette syndrome; and adversely affects a child's educational performance.

Attention deficit hyperactivity disorder

One of the main disorders frequently included under the educational classification of OHI is ADHD. This is a diagnosis that encompasses chronic symptoms of hyperactivity, inattention, and/or impulsivity (American Psychiatric Association, 1994; Cuckrowicz, Taylor, Schatschneider, & Iacono, 2006). This diagnosis was originally conceptualized as a diagnosis of childhood; however, recent studies suggest that approximately 35% to 70% of children with ADHD experience these symptoms in their adolescent years, as well (Mannuzza & Klein, 2000; Mannuzza, Klein, Bessler, Malloy, & LaPadula, 1998). The impairment experienced by children with ADHD may have profound effects on academic achievement, social relationships, family life, and adjustment. These detrimental effects place children with ADHD at greater risk for the development of symptoms of other psychological disorders such as conduct disorder, substance use disorders, learning disabilities, and depression (Pliszka, 2000; Schubiner, Tzelepis, & Milberger, 2000; Willcutt, Pennington, Chhablidas, Friedman, & Alexander, 1999).

ADHD is often thought to emerge from atypical development of prefrontal neural systems and their associated neuropsychological executive functions (Barkley, 1997; Pennington & Ozonoff, 1996). According to Willcutt, Pennington, Olson, Chhabildas, & Huslander (2005), the slower and more variable response speed in the ADHD groups suggests that children with ADHD may have difficulty sustaining attention. All these results support the hypothesis that ADHD is associated with a deficit in response inhibition (Barkley 1997), but suggest that additional weaknesses in executive functioning (EF) and non-EF domains are also important facets of the neuropsychology of ADHD. However, above all, processing speed appears to be the most common deficit found in both RD and ADHD (Willcutt, et al., 2005).

Further, strong evidence indicates that children with ADHD are impaired in various other EF domains (Barkley, Grodzinsky, & DuPaul, 1992; Pennington & Ozonoff, 1996). Response variability across a variety of tasks is one of the most consistent findings associated with ADHD, particularly when motor decision or effortful response organization is required (Castellanos & Tannock, 2002). Based on similarities between ADHD symptoms and the behavioral demonstration of frontal lobe injuries, several authors have proposed that ADHD is attributable to a core deficit in some facet of executive functions (see Barkley, 1997; Pennington & Ozonoff, 1996).

According to a consensus statement by Barkley (2002), ADHD involves a serious deficiency in behavioral inhibition and sustained attention. ADHD is one of the most widely diagnosed and widely discussed childhood psychiatric syndromes in the United States (Barkley, 1997, 1998). The child with ADHD is easily distracted, has poor focus and concentration and lacks social skills. ADHD can lead to impairments in major life activities, including social relations, education, family functioning, occupational functioning, self sufficiency and adherence to social rules, norms, and laws. The central psychological deficits in those with ADHD have now been linked to problems in the frontal lobe, its connections to the basal ganglia and their relationship to the central aspect of the cerebellum. Most neurological studies find that as a group, those with ADHD have less brain electrical activity and show less reactivation to stimulation in one or more of these regions. The same deficits are found in identical as well as fraternal twins, and these findings are consistent in various countries (Barkley, 1997).

In fact, the genetic contribution to these traits is routinely found to be among the highest for any psychiatric disorder (70% to 90%), nearly approaching the genetic contribution to human height. Those with ADHD are 32% to 40% more likely than those without ADHD to drop out of school.

Only 5% to 10% ever complete college and as many as 50% to 70% have few or no friends. They are 70% to 80% more likely to underperform at work and in school, and they are 40% to 50% more likely to engage in antisocial activities and use illicit drugs. Children growing up with ADHD are 18% to 25% more likely to have personality disorders and to mismanage and endanger their lives and the lives of others (Barkley, 2002).

Likewise, neurocognitive correlates of ADHD and RD provide additional support for the hypothesis that ADHD is associated with a significant weakness in response inhibition (Barkley, 1997; Nigg, 2000, 2001). As such, school age boys with ADHD have right hemisphere dysfunction which has been suggested to be the reason behind the accompanying hyperactivity and externalizing behaviors often encountered in these children (Nussbaum, Bigler, Koch, & Ingram, 1988).

Because of the prevalence of the diagnosis, the common perception of ADHD may be too limited. In accordance with Pennington (2008), it would be nice to think that there is one single cause for developmental disorders such as ADHD. Instead, research points to combinations of cognitive deficits as the cause. Such developmental disorders rarely occur in isolation; they often share cognitive deficits. Thus, the concept of comorbidity is an important impetus for a multiple cognitive deficit model of developmental disorders. Results of a community sample of 8 – to 18 year-old twin pairs in which one twin in each pair exhibited a history of learning difficulties indicated that extreme ADHD scores were almost entirely attributable to genetic influences across several increasingly extreme diagnostic cutoff scores (Willcutt, Pennington, & DeFries, 2000a). Willcutt & Pennington (2000a) discovered that the association between RD and externalizing symptoms is at least partially attributable to common familial factors. Results from several previous twin studies suggest that the association between RD and externalizing

symptoms is largely attributable to common genetic influences (Light, Pennington, Gilger, & DeFries, 1995; Stevenson, et al., 1993; Willcutt, Pennington, & DeFries, 2000b).

Processing speed

Individuals with SLD are impaired in several abilities in which children who have ADHD are also weak: processing speed, time processing, verbal working memory, cognitive flexibility, planning, and response inhibition. Deficits in phonological processing are more specific to RD, which might be related to an auditory temporal processing deficit, deficits in rapid sequential processing, or a deficit in the automatization of skills. Pennington, Groisser, and Welsh (1993) reported that the comorbid RD/ADHD group exhibited significant phonological processing deficits. Along with attention difficulties, processing speed was consistently found to be a neuropsychological deficit common to both RD and ADHD. In fact, results indicate that both disorders are associated with weaknesses in multiple neuropsychological domains. These results are most consistent with the predictions of the common genetic etiology hypothesis and suggest that slow and variable processing speed may be one of the common denominators in the studies of links between RD and ADHD (Willcutt et al., 2002; Willcutt, et al., 2005).

In accordance with the aforementioned findings, results from a study by Shanahan et al. (2000) suggest that a general processing speed deficit exists in both RD and ADHD children; however, those with RD demonstrate greater processing speed deficits than children with ADHD. It appears that processing speed is a shared cognitive risk factor that may help explain the comorbidity of these two disorders. In order to assess processing speed, the WISC-IV Coding and Symbol Search subtests have been shown to be associated with RD and ADHD in previous studies (Chhabildas, Pennington & Willcutt, 2001; Hinshaw, 2002).

Executive functioning

Additional comorbidity with executive functioning deficits places the SLD child or adolescent at high risk for significant impairments in academic functioning (Biederman & Faraone, 2004). Likewise, EF deficits have been suggested as an important factor in many childhood disorders and a key feature of many psychiatric disorders (Powell & Voeller, 2004). Wang (2008) posits that executive functioning deficits are the result of poorly developed frontal-subcortical circuits, thus contributing to emotional dysregulation. In kind, Hale, Fiorello, and Brown (2005) posit that it is the combination of frontal-subcortical circuits along with the dorsolateral and orbital cortical structures, which have been implicated in numerous disorders, including ADHD. Externalizing symptoms appear to stem from under-activation of these circuits. Likewise, children and adolescents with EF deficits often display difficulties in behavioral, emotional, social, and academic areas (Whitaker, Detzer, Isquith, Christiano, & Casella, 2004). Executive functioning deficits are also found in those with ADHD (Barkley, 1997; Denckla, 1996; Seidman, Biederman, Faraone, Weber, & Ouellette, 1997; Sullivan & Riccio, 2006). Also, children with SLD show a higher incidence of behaviors associated with executive dysfunction when compared with non-disabled peers (Sullivan & Riccio, 2006).

Comorbidity of Reading Disability and ADHD

The strong correlation of ADHD symptoms and phonological awareness may be due to the "snowball effect" hypothesis, which suggests that young, hyperactive children go on to develop reading problems. Many of the students shared characteristics such as low average IQ, low-income backgrounds, behavioral problems, and poor reading skills consistent with their IQ level (Halperin, Gittelman, Klein, & Rudel, 1984). The prevalence of RD is significantly higher than would be expected by chance in samples of individuals with ADHD, with the rate of

comorbidity typically falling between 25% and 40% (August & Garfinkel, 1990; Dykman & Ackerman, 1991; Semrud-Clikeman, Guy, Griffin, & Hynd, 1992; Shaywitz, Fletcher, & Shaywitz, 1995; Willcutt, Chhabildas, & Pennington, 2001; Willcutt & Pennington, 2000b; Willcutt, DeFries, Pennington, et al., 2001).

Although fewer studies have been conducted in samples selected for RD, the results of two previous studies have indicated that between 15% and 26% of individuals with RD also met criteria for ADHD (Gilger, Pennington, & DeFries, 1992; Shaywitz, et al., 1995). Unfortunately, a common means of assessment is difficult because a reading disability is assessed directly through cognitive tests, and ADHD is usually assessed indirectly through a series of parent, teacher, and medical behavioral ratings (Willcutt, Pennington, Boada, et al., 2001). Research suggests that these common genetic influences contribute to comorbidity of a reading disability and ADHD (Hinshaw, 1992).

The extant literature has substantial evidence to support a link between reading disability and ADHD; twin studies have indicated that RD and ADHD are each highly heritable and polygenic (DeFries & Alarcon, 1996; Faraone, Doyle, Mick & Biederman, 2001; Fisher & DeFries, 2002; Gayan & Olson, 2001; Levy, Hay, McStephen, Wood, & Waldman, 1997; Willcutt, Pennington, & DeFries, 2000a). Thus, it appears that there is strong support for the hypothesis that comorbidity between RD and ADHD is due at least in part to a common genetic etiology. Further, Willcutt and Pennington (2000a) found that both parents and teachers reported that individuals with RD exhibited significantly more symptoms of ADHD than individuals without RD. This suggests that the comorbidity between RD and ADHD is not restricted to the school setting and argues against the common clinical impression that children with RD exhibit symptoms of ADHD in the classroom only because of ongoing academic frustration.

According to Pennington (2008), RD and ADHD are common developmental disorders, with estimates of 5% to 10% prevalence in both cases, and they both have genetic and environmental components of their etiology (American Psychiatric Association, 2000; Shaywitz, Shaywitz, Fletcher, & Escobar, 1990). In fact, Pennington and Olson (2005) estimate the heritability of RD is estimated at 58% and the heritability of ADHD is estimated at 76% (Faraone et al., 2005). Although the genetic evidence for these disorders is quite strong, there is still a component of both genetic and environmental influence. It appears that reading disorders are more heritable in a favorable environment, while ADHD is more heritable in a risk environment (Rutter, 2006).

Comorbidity of RD, ED, and OHI

According to Reynolds et al. (1996), behavioral disorders are often seen in children with reading disabilities. Reading difficulties have been shown to be significantly associated with ADHD as well as with other externalizing behaviors (Achenbach, 1978; Barkley, 1998; Stevenson et al, 2005; Willcutt & Pennington, 2003). The reported rates of ADHD combined with a RD range from 10% to 40% depending on which standard is used to define ADHD (Reynolds, Elksinan, & Brown, 1996). Researchers agree that primary neurologically based deficits of attention span and impulse control or ADHD can be early warning signs of potential reading disabilities. According to Reynolds et al. (1996), it is still unclear what proportion of poor school performance in children with ADHD is secondary to coexisting reading disabilities or is caused by short attention spans or behavioral interference. In effect, is a short attention span the result of a primary neurologically based disorder or is it the manifestation of an underlying reading disorder? It depends. A child with a reading disability may only appear to be

inattentive when asked to read. Thus, it is important to determine whether poor attention span is present in all settings or only when reading (Reynolds et al., 1996).

As previously mentioned, disordered language can cause difficulty with communication, socialization and behavior. However, research shows that children with SLD and comorbid antisocial behavior frequently exhibit conduct problems by the age of three (McKinney, 1989). In addition, they exhibit more anxiety and loneliness as well as less social flexibility, academic self regulation and on task behavior. Such children also feel that they have less internal control over such things as academic achievement. They have difficulty with interpersonal relationships and often receive less social acceptance than do children without learning disabilities. In general, behavior disorders are associated with lower achievement (McKinney, 1989). In addition, behavior disorders should be carefully investigated to determine if they are present in all settings or occur only in settings where children are stressed by their disability (Reynolds, et al., 1996). In fact, there is actually some evidence that children with learning disabilities demonstrate behavioral abnormalities long before they begin to fail in school. It is therefore not surprising that individuals with reading disabilities are at high risk for poor social and emotional adjustment and behavior problems (Gottesman, 1991; McKinney, 1989).

Thus, when examining the link between RD and ADHD, there is accumulating evidence for bio-ecological interactions in RD and diathesis-stress interactions with ADHD. However, at this point, it seems more likely that the disorder itself and not the environmental risk factors are actually driving these interactions. While family and marital discord may be a more important environmental risk factor for ADHD, family support for language and literacy development may be more important for RD (Pennington, 2008).

Risk for Delinquency

According to Moffit (1993), a strong correlation between delinquent behavior and variables related to verbal deficits and underachievement has been found in adolescents. Moffitt (1990) found that boys with delinquency and ADHD were more antisocial, and had lower verbal intelligence, and poorer reading achievement than boys with delinquency or ADHD alone. Thus, it has been suggested that specific maltreatment, such as malfunctioning, cold, and uncaring home environments, is associated with subsequent psychosocial problems. Moreover, both hyperactivity and psychopathy have both been regularly associated with antisocial involvement (Frick, Barry, & Bodin, 1999). Research suggests that hyperactivity in childhood/adolescence is an influential precursor of psychopathy tendencies in adulthood (Biederman, et al., 1995). In addition to specific deficits in reading, individuals with RD have been shown to exhibit more frequent emotional and behavioral difficulties than children without reading problems (Beitchman & Young, 1997).

Early epidemiological studies indicated that children with specific deficits in reading were nearly five times more likely to exhibit antisocial behaviors than children in the general population (Rutter & Yule, 1970), and more recent studies have found elevated rates of specific reading problems and general academic failure in samples of conduct disordered or delinquent children (Frick, Lahey, Christ, Loeber, & Green, 1991). Of significance, it is possible that the common genetic influences associated with RD and ADHD may interact with the social environment. For example, previous studies have suggested that familial factors, such as family adversity, parental psychopathology, and inconsistent or punitive parenting techniques, may partially determine which children with ADHD develop later antisocial behaviors (Moffitt,

1990). It appears that the academic difficulties associated with RD may predispose children with RD to become more withdrawn, anxious, and depressed than children without RD.

According to Bryan et al. (2004), estimates of the prevalence of social problems in students with SLD in the United States range from 38% to 75%. One of the most frequently cited findings is that students with RD have lower academic self-concepts than peers. In fact, a relatively ignored area in education is the impact of affect/emotions on social relationships and learning. Negative affect such as anger, fear, anxiety, disgust, and depression negatively impact memory and produce inefficient information processing. Bryan et al. (2004) found that affect and emotions, which are regulated by the nervous system, have been implicated as a cause and/or correlate in SLD because negative affect has negative effects on learning and social relations and problems in emotional regulation influence responses in social situations. As a result, students with RD and Learning Disabilities were found to be less well liked and more frequently rejected than average/high achieving students (Elksnin & Elksnin, 1996; Vaughn, Elbaum, & Schumm, 1996).

Not surprisingly, clinical and forensic studies have reported high rates of language impairments in incarcerated youth. In community samples followed to early adolescence, language impaired students reported higher rates of arrests and convictions than controls (Brownlie et al, 2004). Indeed, students with disabilities particularly learning disabilities, are widely regarded as having social skills difficulties with estimates suggesting that 75% of students with LD exhibit social skills deficits. According to Elksinin and Elksinin (2004), youth with RD are less accepted by their peers. The peer rejection likely stems from poorly developed social emotional skills. Further, Elksinin and Elksinin (2004) suggest that not only poor language and communication skills, but also difficulty recognizing and understanding others'

emotions, cognitive processing deficits, comorbid psychiatric disorders such as ADHD, depression and dysthymia, and academic problems and educational isolation all contribute to emotional problems from repeated failure and low self-esteem. In conjunction with previous findings, Palacios and Semrud-Clikeman (2005) suggest that the incidence of reading disabilities in children with ADHD is higher than would be expected by chance. Their findings suggested a significant negative linear relationship between hyperactivity and reading skills.

It is likely that these children with RD who have comorbid ADHD are at higher risk of acting out their low feelings of self-worth towards others in antisocial behaviors. Children with comorbid SLD/ED are most likely to drop out of school because of persistent behavioral deficits (Bender & Wall, 1994). The National Longitudinal Transition Study found that outcome studies for children with SLD indicate that they are more apt to have serious academic deficits in secondary school, with 30% scoring two standard deviations below the national mean (NLTS2, 2005). School-age boys with learning disabilities are significantly overrepresented in the juvenile justice system; recent estimates suggest that at least 35% of youth in the juvenile justice system are eligible for special education services (Quinn, Rutherford, Leone, Osher & Poir, 2005). Rates of learning disability are astonishingly high among prisoner populations; in studies conducted among incarcerated juveniles, learning disabilities have been estimated to occur in up to 55% of youth nationwide (Ottnow, 1988). Children with verbal-based SLD and frontal subcortical difficulties often are adjudicated delinquents and are incarcerated, whereas, children with nonverbal SLD are not (Hale & Fiorello, 2004).

Faigel, Doak, and Howard (1992) found that those with language-based disorders are more likely to have Conduct Disorder (CD) and are at greater risk for delinquency (McGee & Share, 1988). These children with CD and comorbid antisocial behavior frequently possess risk

factors such aggressiveness, low IQ, language-based learning disabilities, a parent who is a criminal or substance abuser or who gives inconsistent parenting, and lack of appropriate social skills to interact appropriately with law enforcement and judicial personnel (Reynolds, et al., 1996). The extant literature points to environmental influences, poor preschool motor performance, and low IQ as prognostic indicators for delinquent outcome (Moffit, 1990).

In a study by Babinsky, Hartsough, and Lambert (1999), both hyperactivity-impulsivity and early conduct problems independently, as well as jointly, predicted a greater likelihood of having an arrest record for males. Therefore, it appears that predominantly the symptoms of hyperactivity-impulsivity contribute to the risk for criminal involvement over and above the risk associated with early conduct problems alone. Several longitudinal research studies have found that children with ADHD are at higher risk for criminal involvement than non-behaviorally disordered groups (Satterfeld, Hoppe, & Schell, 1982; Weiss, Minde, Werry, Douglas, & Nemeth, 1971). Subjects with hyperactivity-impulsivity alone may be at higher risk for less serious crimes, such as public disorder and property crimes, related specifically to their impulsivity and inability to delay gratification.

The comorbidity of juvenile delinquency and learning disabilities has been heavily debated for many years by several researchers (Hinshaw, 1992; McGee & Share, 1988). Children with reading disabilities have a "greater than chance" possibility of having ADHD and CD. Behavior problems likely develop because the RD disrupts the learning process. In addition, reading difficulties and the frustration and failure lead to acting out disruptive behavior, anxiety, and other problems. Finally, genetics as well as environment are both factors in the development of comorbid disorders. Reading problems and behavior problems each strongly predict later maladjustment (Hinshaw, 1992).

Research questions

Given the mounting neuropsychological evidence for differential SLD/ED subtypes based upon neurocognitive and psychosocial functioning, it would be best practice to investigate the impact of multiple factors (i.e., cognition, behavior, and environment) in children's learning (Bandura, 1978) and conceptualize a mental trilogy (i.e., cognitive, emotional, and motivational) in the assessment of children's learning deficiencies (LeDoux, 2002). Given this thinking, the current study proposed to identify and describe meaningful cognitive subtypes of children with learning disorders (who may have been classified as SLD, ED, or OHI) as determined by hierarchical cluster analysis, and to examine subtype differences on standardized cognitive measures, standardized academic measures, and BASC-2 behavior ratings. Although the study was designed to address research questions rather than explicit research hypotheses, the results highlight how children with different types of neurocognitive assets and deficits experience learning problems in different academic domains (e.g., reading, writing, and math). In addition, these could be related to different patterns of psychosocial adjustment (e.g., internalizing, externalizing, or adaptive behaviors). Ultimately extracting these subtypes may lead to targeted interventions that will ameliorate many of the factors included in the comorbid picture, thus preventing poor long-term outcomes for these children.

1. Are there meaningful cognitive subtypes of children in this sample of school-age boys with learning disorders, emotional disorders, and other health impairments, such as ADHD, based on a cluster analysis of WISC-IV subtest scores?
2. If so, will these subtypes perform significantly differently across cognitive, academic, and emotional-behavioral variables?

3. Will a cognitive subtype of children with RD demonstrate higher levels of teacher-rated psychopathology than students with other subtypes of cognitively based learning disorders?

Chapter Three

Method

Source for Data

Subjects were drawn from school-age boys classified with either a specific learning disability, an emotional disturbance and/or an other health impairment (or a combination thereof) in the school setting per IDEA regulations and who also have learning disorders. The archival data were obtained from the Lakewood School District in Lakewood, New Jersey. Data from the 2010 Census reported that Lakewood Township is comprised of 92,843 people (a 53.8% increase from 2000 Census data). The median age in the township is 23.9 years. There was an equal amount of females and males 46,115 versus 46,728 respectively. The 2010 census reports the following ethnic classifications: 78,290 White (up from 47,542 in 2000); 5,898 Black; 276 American Indian; 791 Asian; 6,199 other; 1,389 comprised of two or more races, and 16,062 Hispanic (increased from 8,935 in 2000). The median household income is $35,634.

In the Lakewood School District, there were 4,295 regular education students and 972 special education students. Forty-four percent were classified as having SLD, 7.5% were classified as ED, and 9.9% were classified as OHI. Archival data were obtained from previous psychoeducational evaluations completed by both New Jersey certified school psychologists and learning disability teacher consultants. The data drawn from the Lakewood School District special education confidential files were representative of metropolitan and suburban areas. Permission was sought from participating school psychologists and teacher consultants for utilization of this data, following approval by the Philadelphia College of Osteopathic Medicine Institutional Review Board.

Inclusion and Exclusion Criteria

The data consisted of a convenience sample of students served through special education support programs. All archived data were collected anonymously. Data were limited to students between the ages of 6 and16 to comply with the WISC-IV criteria for age. Inclusion criteria were student files that contained a BASC-2 Teacher Rating Scale (TRS), current WISC-IV results, and current achievement testing results in the areas of reading, mathematics, and/or written language completed simultaneously within the same evaluation period. Exclusion criteria were student files which did not contain a BASC-2 teacher rating scale, current WISC-IV results, and current achievement testing results in the areas of reading, mathematics, and written language completed simultaneously within the same evaluation time period. Data were not accepted if the file did not have full WISC-IV subtest scale scores, including all four index scores, or if the BASC-2 TRS was not completed in full (e.g., missing items, missing scores). The final sample consisted of 110 male students with a mean age of 10 years.

Table 1

Basic Demographic Characteristics of Sample

Grade	*n*	%
First	8	7.3
Second	15	13.6
Third	16	14.5
Fourth	12	10.9
Fifth	18	16.4
Sixth	13	11.8
Seventh	8	7.3
Eighth	9	8.2
Ninth	9	8.2
Tenth	2	1.8

Measures

The first measure utilized in this study was the WISC-IV standard battery which is considered to be a reliable and valid measure of individual cognitive functioning according to Wechsler (2003). The WISC-IV measure consists of multifactor-determined subtests that is widely used and respected (Baron, 2005). The WISC-IV is internally consistent with reliability coefficients of the subtests ranging from .79 to .90 and reliability coefficients for the composite scores ranging from .88 to .97. The WISC-IV is considered equally reliable for children with learning disabilities and is considered to have adequate stability over time (Wechsler, 2003). Flanagan (2000) criticized the earlier versions of the Wechsler scales for lacking a theoretical framework; however, the WISC-IV is much more theoretical in its design (Wechsler, 2003). Initial internal validity studies have had that the WISC-IV measures what it purports to measure through subtest exploration (Wechsler, 2003). In addition, the four factor structure of the WISC-IV has been a concern for its psychometric value. Several researchers, namely Flanagan (2000) and Keith, Foldenring-Fine, Taub, Reynolds, & Kranzler (2006), have examined the Wechsler scales over time through the Cattell-Horn-Carroll (CHC) approach and have found different

factor structures for the WISC-IV. In contrast, Flanagan (2000) found the WISC-IV does not directly measure aspects of auditory processing or long-term retrieval, both aspects of CHC.

The WISC-IV standard battery is comprised of 10 core subtests (Block Design, Similarities, Coding, Vocabulary, Digit Span, Picture Concepts, Matrix Reasoning, Letter Number Sequencing, Comprehension, and Symbol Search). Four index scores (Verbal Comprehension, Perceptual Reasoning, Working Memory, and Processing Speed) and a Full Scale Intelligence Quotient (FSIQ) are computed from these subtests. In addition, subtest process scores can be computed to provide greater in-depth information regarding a student's performance.

According to Wechsler (2003), the Verbal Comprehension Index requires utilization of reasoning, comprehension, and conceptualization in measuring verbal abilities. It consists of the Similarities, Vocabulary, and Comprehension subtests. The Similarities subtest is thought to measure concept formation and reasoning with verbal information. The Vocabulary subtest measures word knowledge, fund of knowledge, concept formation and verbal expression (Wechsler, 2003). The Comprehension subtest measures reasoning with verbal information and conceptualization, verbal comprehension, and expression. It also involves knowledge of conventional behavior, social judgment, and common sense (Sattler, 2001). According to alternate approaches such as CHC or demands analysis, the verbal-nonverbal dichotomy is somewhat misleading because the subtests are probably measuring various and sometimes overlapping aspects of cognitive processing. For example, the Vocabulary subtest is considered to be a measure of long-term retrieval and word knowledge for some children (Hale & Fiorello, 2004). However, Fiorello et al., (2006) found that the Vocabulary and Information subtests are measures of auditory-crystallized-language based skills, as well. Deficient language skills in

expressive and receptive language can hinder performance on subtests within the VCI, indicating the dependence on language for this measure (Sattler, 2001). Groth-Marnat and colleagues also suggest that the VCI measures facility with concept formation and language skills (Groth-Marnat, Gallagher, Hale, & Kaplan, 2000). According to Keith and colleagues, the VCI can be interpreted confidently because the subtests that compose the VCI measure are thought to measure comprehension, knowledge, and crystallized intelligence (Keith et al., 2006). The VCI is a measure of crystallized language and knowledge and Vocabulary (Flanagan, 2000).

The Perceptual Reasoning Index assesses perceptual reasoning, fluid reasoning, and perceptual organization. It consists of the Picture Concepts, Matrix Reasoning, and Block Design subtests. The Picture Concepts subtest is thought to measure abstract reasoning and the ability to reason categorically and may also include verbal mediation and naming (Keith et al., 2006). The Matrix Reasoning subtest measures fluid reasoning, visual information processing, and abstract reasoning. These two subtests together measure inductive reasoning which is a major component of fluid reasoning (Keith et al., 2006). The Block Design subtest assesses analyzation and visualization of abstract visual stimuli and integrated brain functioning (Kaufman, 1994). However, Block Design may be better described as a measure of visual processing rather than fluid reasoning (Flanagan, 2000; Keith et al., 2006). According to Keith and colleagues, the Perceptual Reasoning factor measures two different cognitive processes, fluid reasoning (Gf) and visual processing (Gv) (Keith et al., 2006) and Block Design is seen as a measure of Gv (Flanagan, 2000). The Block Design subtest has also been shown to measure spatial ability (Groth-Marnat & Teal, 2000) and ability to separate figure and ground (Sattler, 2001). The Block Design subtest is thought to measure many cognitive processes such as visual processing, processing of part to whole relationships, discordant and divergent thought processes

(analysis), concordant or convergent thought processes (synthesis) and attention and executive functioning (planning and strategy usage) (Hale & Fiorello, 2004).

The Working Memory Index assesses attention, concentration, and working memory. It consists of Digit Span (Forward and Backward) and Letter Number Sequencing. It is important to note the differences between these tasks because they likely measure different aspects of functioning (Hale, Hoeppner, & Fiorello, 2002). For example, according to Satler (2001), Digit Span Forward measures rote learning and memory, attention, encoding, and auditory processing and sequencing. In the Flanagan (2000) study, it was likewise found to be a determinant on the CHC short-term memory (Gsm) factor. The DS forward task also appears to measure immediate rote auditory memory and measures aspects of the phonological loop for holding information in immediate memory (Hale et al., 2002; Hale & Fiorello, 2004). Digit Span Backward is considered to be a measure of working memory which involves mental manipulation and visuospatial imaging (Sattler, 2001; Wechsler, 2003). Performance on Digit Span Backward as related to visuospatial imaging was disputed by Hale et al., (2000). According to Hale et al. (2002), the Digit Span Backward subtest does not measure visuospatial imaging, but does measure working memory and mental flexibility. Hale and Fiorello (2000) posit that Digit Span Backward also likely measures aspects of self-regulatory executive functions such as planning, strategizing, organizing, executing, monitoring, maintaining, evaluating, and changing behaviors. The WMI measures a mixture of short-term memory (Gsm) and fluid reasoning (Gf) when Arithmetic is included. Digit Span and Letter Number Sequencing are measures of short-term and working memory processes (Keith et al., 2006).

The Processing Speed Index is thought to assess speed of mental and graphomotor processing. It consists of the Coding and Symbol Search subtests (Wechsler, 2003). The Coding

subtest assesses short-term memory, learning ability, visual perception, visual-motor coordination, cognitive flexibility, attention, motivation, and is a good measure of processing speed or psychomotor speed (Keith et al., 2006; Sattler, 2001). The Symbol Search subtest involves short-term memory, visual-motor coordination, cognitive flexibility, visual discrimination, and concentration (Sattler, 2001). However, Symbol Search may also be better described as visual processing. In the Keith et al., (2006) study, Symbol Search loaded with Block Design on the Gv factor. Symbol Search also taps sustained attention and visual discrimination, requiring less motor requirement (Hale & Fiorello, 2004). Coding measures visual motor integration, graphomotor skills, and processing speed (Hale & Fiorello, 2004). Coding was also loaded on the processing speed (Gs) factor in the Flanagan (2000) study. Overall, the PSI can be interpreted confidently because the component subtests measure a coherent factor (Keith et al., 2006).

The second measure utilized in this study was the BASC-2 Teacher Rating Scales (BASC-2; Reynolds & Kamphaus, 2004), which is a standardized broad-band behavior rating scale completed by the child's teacher. The BASC-2, was designed to facilitate differential diagnosis of emotional and behavioral disorders, and is considered multi-dimensional by examining both positive and negative indicators of psychosocial functioning (Kamphaus, Reynolds, Hatcher, & Kim, 2004). Behavior rating scales such as the BASC-2 enable educational practitioners to further define the internalizing, externalizing, and psychosocial problems in children with SLD. The use of teacher ratings is proper practice because teachers are often the first line observer of child behaviors in the school setting and by obtaining behavior ratings, the emotional and behavioral deficits of children with SLD can be defined (Gresham, 2002). Teacher ratings are important in screening children for possible psychopathology not only

in adolescence, but also for the prediction of future psychosocial functioning in adulthood (Carbonneau, Tremblay, Vitaro, Saucier, & Jean-Francois, 2005). Teacher ratings are also useful for discriminating between children with various disorders by assessing the characteristics of emotional/behavioral functioning (Riccio, Cohen, Garrison, & Smith, 2005).

The BASC demonstrates validity in differentiating children with ADHD (Jarratt, Riccio, & Siekierski, 2005), and is also valid in determining frontal lobe and executive deficits in children, differentiating those with these disorders from typical peers (Sullivan & Riccio, 2006). It has been valid for children with social skill deficits as well (Flanagan, Alfonso, Primavera, Povall, & Higgins, 1996). Furthermore, the BASC scales are valid for examining academic, social and emotional adjustments in children and adolescents and can help describe emotional/behavioral subtypes evident in children through the use of teacher ratings (Lindstrom, Lease, & Kamphaus, 2007). Because of its multi-method approach, the BASC is a tool that provides rich information pertaining to a child's functioning in multiple settings and to differential diagnosis method approach (Kamphaus et al., 2004).

In this study, teacher perceptions of a child's social, emotional, and behavioral functioning, observed in the classroom setting was also assessed from BASC-2 archival data. During the completion of the BASC-2, teachers circled one of four descriptions of the targeted behavior in the question item, rating the child on a 1 to 4 type scale with never = 1, sometimes = 2, often = 3, and almost always = 4. The BASC-2 includes 139 items on the TRS. A child's profile on the scales is expressed in the form of *T* scores standardized by age and grade with a mean of 50 and a standard deviation of 10; elevations above the mean suggest a greater likelihood of emotional/behavioral symptoms. For the adaptive skills scales, lower scores are suggestive of less adaptive skills (high scores are better and lower scores are perceived as

lacking the positive quality). The psychometric properties of reliability of the BASC-2 include good test-retest reliability of .91, good inter-rater reliability of .80, and internal consistency of .89. Furthermore, the BASC-2 has been seen as the standard in terms of behavior rating scales utilized in the school setting, with convergent validity established through significant correlations between the original BASC and the BASC-2 (Waggoner, 2005).

The different areas utilized in this study included the *T* scores for the following 15 clinical and adaptive scales including: Hyperactivity, Aggression, Conduct Problems, Anxiety, Depression, Somatization, Attention Problems, Learning Problems, Atypicality, Withdrawal, Adaptability, Social Skills, Leadership, Study Skills, and Functional Communication as well as T scores from the 7 areas on the Content Scales which include: Anger, Bullying, Developmental Social Disorders, Emotional Self-Control, Executive Functioning, Negative Emotionality and Resiliency. In addition, the Internalizing, Externalizing, School Problems, Behavioral Symptoms Index and Adaptive Skills Composites were examined for differences in means across the SLD subtypes.

The BASC-2 Manual (Reynolds & Kamphaus, 2004) provides a description of each clinical scale and can be consulted for more thorough explanation: Hyperactivity (over active, impulsive); Aggression (acts in a hostile manner either in a verbal or physical manner that is threatening to others); Conduct Problems (antisocial and rule breaking behaviors); Anxiety (nervous, fearful about real or imagined problems); Depression (unhappiness, sadness, thoughts of suicide); Somatization (overly sensitive to minor physical problems); Attention Problems (easily distracted and difficulty concentrating); Learning Problems (learning difficulties as observed in the school setting); Atypicality (behaves in ways that are immature or different than typical peers); Withdrawal (avoiding social contacts); Adaptability (adaptation to changing

situations and ability to recover from difficult situations); Social Skills (possessing sufficient social skills and/or experiencing social difficulties); Leadership (ability to work under pressure, and/or an ability to bring others together to complete a work assignment); Study Skills (ability to demonstrate effective study skills) and Functional Communication (expressive and receptive communication skills, seeking out and finding of information).

A brief description of the Content Scale includes: Anger Control (tendency to become irritated and/or angry quickly and impulsively); Bullying (tendency to be intrusive, cruel, threatening, or forceful to get what is wanted through manipulation or coercion; Developmental Social Disorders (tendency to display behaviors characterized by deficits in social skills, communication, interests and activities); Emotional Self Control (ability to regulate one's affect and emotions in response to environmental changes); Executive Functioning (ability to control behavior by planning, anticipating, inhibiting, or maintaining goal-directed activity); Negative Emotionality (tendency to react in an overly negative way and to any changes in everyday activities or routines); Resiliency (ability to access both internal and external support systems to alleviate stress and overcome adversity).

The Hyperactivity, Aggression, and Conduct Problems domains are considered externalizing disorders; but, the Anxiety, Depression, and Somatization domains are considered internalizing disorders. The BSI is composed of Hyperactivity, Aggression, Depression, Attention Problems, Atypicality, and Withdrawal. The Adaptive Skills composite is composed of the Adaptability, Social Skills, Study Skills, Leadership, and Functional Communication domains. The Content Scale Summary is comprised of Anger Control, Bullying, Developmental Social Disorders, Emotional Self-Control, Executive Functioning, Negative Emotionality and Resiliency.

The school psychologist and/or learning consultant volunteers were provided with the workbook and were asked to supply the raw, scaled, and standard scores for the WISC-IV and the achievement measures, and the *T* scores for the BASC-2 TRS clinical, adaptive and composite and content scale domains. Participating school psychologists and/or learning consultants provided the workbook scores to the student investigator. Achievement scores were then examined in the areas of reading, math, and written language from the archival data sample. Achievement scores were derived from the Woodcock Johnson Tests of Achievement, Third Edition (WJ-III; Woodcock, McGrew, & Flanagan, 2001). The WJ-III is an instrument which has good reliability and validity and has been used extensively in evaluations for SLD in the Lakewood School District. The WJ-III is a good measure for assessing academic achievement in children and adolescents. The reliability characteristics of the WJ-III indicate that most of the subtests have reliability coefficients of .80 or higher and the coefficients rise to .90 and higher for the cluster scores (WJ-III; Woodcock, McGrew, & Flanagan, 2001).

These achievement scores are an integral part of the evaluation battery towards the identification of a specific learning disability. Administration of the WJ-III was conducted by the respective learning consultants and was included in the data file. Standard scores were provided for the achievement assessments. These scores were utilized in determining differences between the SLD subtypes across academic domains.

Procedure

Archival records of students identified with a specific learning disability in the school setting were used for this study. School psychologists who are state and/or nationally certified (i.e., Nationally Certified School Psychologist) and learning disability teacher consultants (LDTCs) were asked to volunteer data for this study. Individual student records were reviewed

by the respective school psychologists to determine if BASC-2 teacher rating scales were present as well as WISC-IV subtest scaled scores and four factor indices from the standard battery. Achievement standard scores were documented for all areas across available reading, math, and/or written language domains as well as achievement domains. This data was entered into a document entitled *Dissertation: Student Data Collection Worksheet* (see Appendix A) by the participating school psychologist and/or LTDC. Each file was assigned a participant identification code number in the workbook. The student name and other confidential information was not procured or released to the study investigators. Only age, grade, disability category and a brief discipline history (history of truancy, suspensions, history of arrest) were collected as additional variables. At no time did the student investigator or primary investigator have access to confidential information or to filed data. The school psychologist and LDTC volunteers were provided with the workbook and were asked to supply the raw, scaled, and standard scores for the WISC-IV and the achievement measures, and the *T* scores for the BASC-2 TRS clinical, adaptive, composite and content scale domains. Participating school psychologists and LDTCs provided the workbook scores to the student investigator. Only those data meeting the criteria were utilized. The workbook database of participant data was then transferred to the SPSS Version 18 for statistical analyses.

Analyses

The WISC-IV subtest scores were subjected to a hierarchical cluster analysis to determine if different subtypes would emerge in a sample of children with disabilities. The cluster analysis utilized the Average Linkage Within Groups variant of the Unweighted Pair-Group Method Arithmetic Average (UPGMA) as the amalgamation or linkage rule. This variant also combined clusters so that the average distance between all possible pairs of cases in the

resulting cluster was small as possible, thereby minimizing within group variability. The Euclidean method was chosen as the distance measure involved in determining the amount of distance that served as a criterion for grouping items. Analyses of variance were then conducted between the subtypes and study variables. Bonferroni post hoc tests were then utilized for multiple group comparisons.

Chapter 4

Results

Descriptive Statistics

Reported in Table 2 are descriptive statistics for the entire sample across the WISC-IV variables. The FSIQ was low average, albeit on the upper end of the low average range. The VCI and PRI means were relatively comparable and in the average range; however, the VCI was at the border between the low average and average ranges. The WMI and PSI means tended to be much lower than expected for this sample of children with learning disorders, with the WMI mean falling at the upper end of the low average range and the PSI falling at the lowest end of the average range. This finding has been found in numerous clinical populations for children with learning disorders (see Kaufman, 1994; Mayes & Calhoun, 2004; Prifitera & Dersh, 1993). Further, the standard deviations of the VCI and PSI tended to be large, suggesting great variability; whereas, the FSIQ, PRI, and WMI tended to have lower standard deviations and less dispersion among the scores. Although the overall means across the VCI fell in the average range, lowered means were found for the subtests of Vocabulary and Comprehension which fell in the low average range. Similarly, means for the Block Design and Matrix Reasoning subtests were also in the low average range for this sample of students. For both the WMI and PSI subtests, all subtest means fell in the low average range. The students performed the best on the Picture Concepts subtest which fell in the average range; whereas, they performed the worst on the Coding subtest which fell in the low end of the low average range.

Table 2

Means and Standard Deviations for Entire Sample across WISC-IV Variables

Variable	M	SD
	Global Scores	
Full Scale Intelligence Quotient	87.20	14.05
Verbal Comprehension Index	90.43	15.49
Perceptual Reasoning Index	93.83	14.29
Working Memory Index	89.64	14.68
Processing Speed Index	83.52	15.60
	Subtest Scores	
Similarities	9.15	3.27
Vocabulary	7.39	2.61
Comprehension	8.55	3.36
Block Design	8.12	2.81
Picture Concepts	10.17	3.07
Matrix Reasoning	8.60	2.73
Digit Span	8.30	3.14
Letter-Number Sequencing	8.11	3.06
Coding	6.79	3.13
Symbol Search	7.30	3.26

Examination of the achievement variables revealed that all academic scores fell below the average range. Table 3 illustrates the means and standard deviations. The sample performed the best on tasks tapping math problem solving, but performed the worse on tasks tapping reading comprehension skills.

Table 3

Means and Standard Deviations for Entire Sample across Achievement Variables

Variable	*n*	*M*	*SD*
Word Attack	109	84.31	15.60
Letter-Word Identification	109	83.43	17.76
Passage Comprehension	108	78.66	15.57
Reading Vocabulary	96	79.30	14.95
Reading Fluency	105	82.67	14.44
Story Recall	107	87.95	15.99
Understanding Directions	108	82.67	14.01
Spelling	109	83.09	16.10
Writing Samples	109	81.72	16.28
Writing Fluency	108	82.45	14.28
Math Calculation	109	85.12	18.04
Math Fluency	109	84.39	16.42
Applied Problems	108	86.86	14.66

Tables 4 and Table 5 report the means and standard deviations of the BASC-2 variables. Heightened means were found in the clinical areas of Hyperactivity, Aggression, Attention Problems, Atypicality and Withdrawal with the mean scores falling in the at-risk range. The clinical composite scores of Learning Problems, School Problems, Leadership, Study Skills and Functional Communication were elevated and found to be in the at-risk range suggesting overall communication problems for this sample of children. Additionally, clinically significant scores were found for the Behavioral Symptoms Index and Anger Control domains. The sample also had at-risk levels for Executive Functioning, Developmental Social Disorders, Emotional Self-Control, and overall Externalizing Problems. Overall, the level of Resiliency for this sample is lower than expected.

Table 4

Means and Standard Deviations for Entire Sample across BASC-2 TRS Clinical Variables

Variable	M	SD
Hyperactivity	63.14	13.71
Aggression	60.19	15.45
Conduct	58.87	12.62
Externalizing Problems	62.09	13.64
Anxiety	54.05	11.97
Depression	58.61	14.38
Somatization	52.93	12.72
Internalizing Problems	56.25	12.31
Attention Problems	63.84	8.72
Learning Problems	58.65	10.74
School Problems	61.77	9.40
Atypicality	64.25	17.29
Withdrawal	60.73	11.91
Behavioral Symptoms Index	65.01	12.67
Anger Control	65.01	10.72
Bullying	61.99	13.70
Developmental Social Disorders	64.52	9.61
Emotional Self-Control	63.60	13.33
Executive Functioning	61.22	13.40
Negative Emotionality	60.07	12.57
Resiliency	36.37	7.99

Table 5

Means and Standard Deviations for Entire Sample across BASC-2 TRS Adaptive Variables

Variable	M	SD
Adaptability	36.51	9.00
Social Skills	38.31	7.76
Leadership	39.28	6.12
Study Skills	37.03	6.71
Functional Communication	37.49	7.71
Adaptive Skills Composite	36.23	7.15

Cognitive Learning Disorder Subtypes

In this study, cluster analysis was undertaken with the purpose of identifying and classifying homogeneous subtypes of children with learning disorders, based upon cognitive performance across the WISC-IV subtests. Utilizing this method revealed six cognitive subtypes. Exploring the means of the WISC-IV subtests and composite scores across the six clusters helped to differentiate the cognitive subtypes. These cognitive subtypes were identified as: Executive /Working Memory (E/WM), GCI (GI), Auditory/ Verbal (A/V), Visual Spatial/Constructional (VS/C), Crystallized Language (CL) and High Functioning/Processing Speed (HF/PS).

Figure 1 and Figure 2 provide graphic displays of the cognitive variables across the six cognitive subtypes.

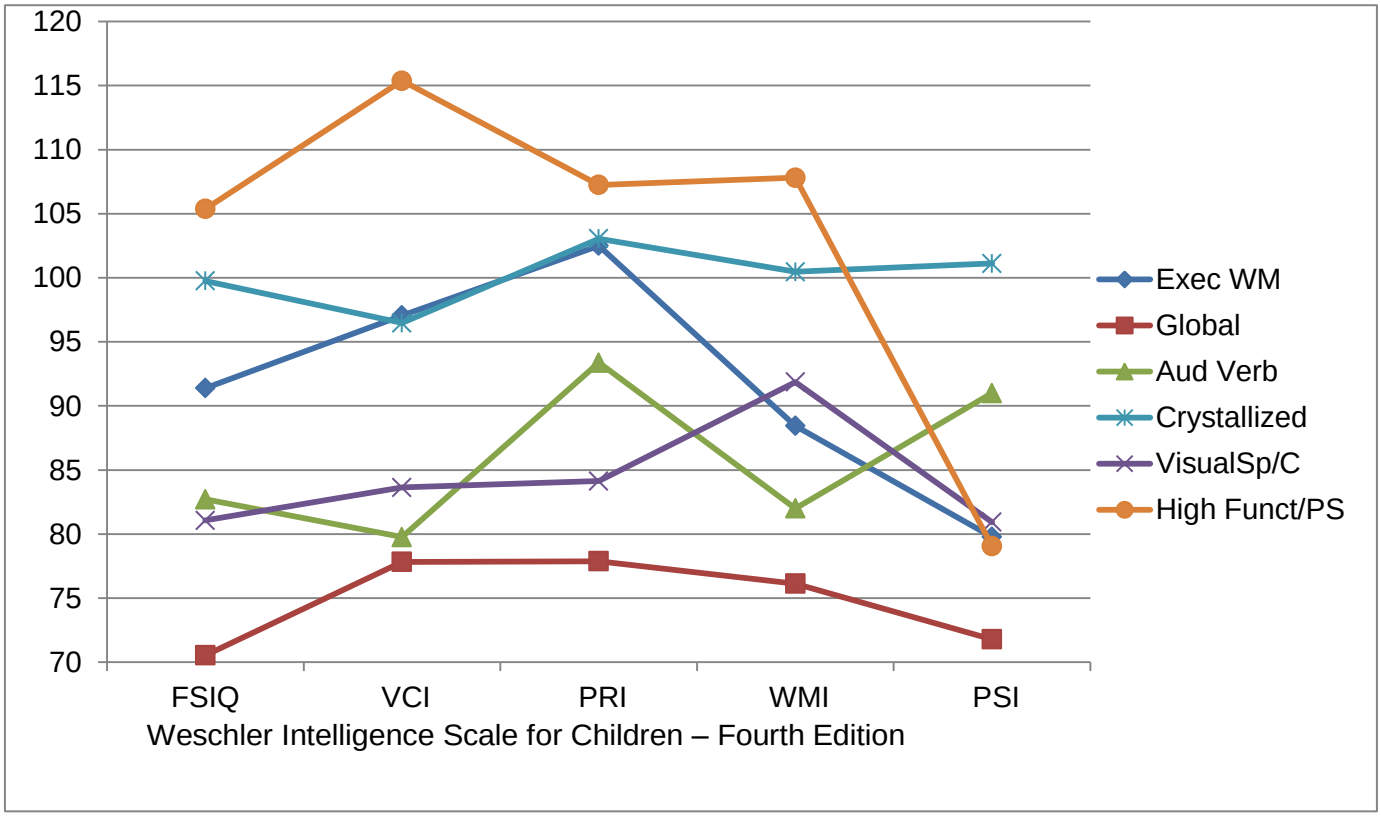

Figure 1. Composite profiles for the cognitive subtypes

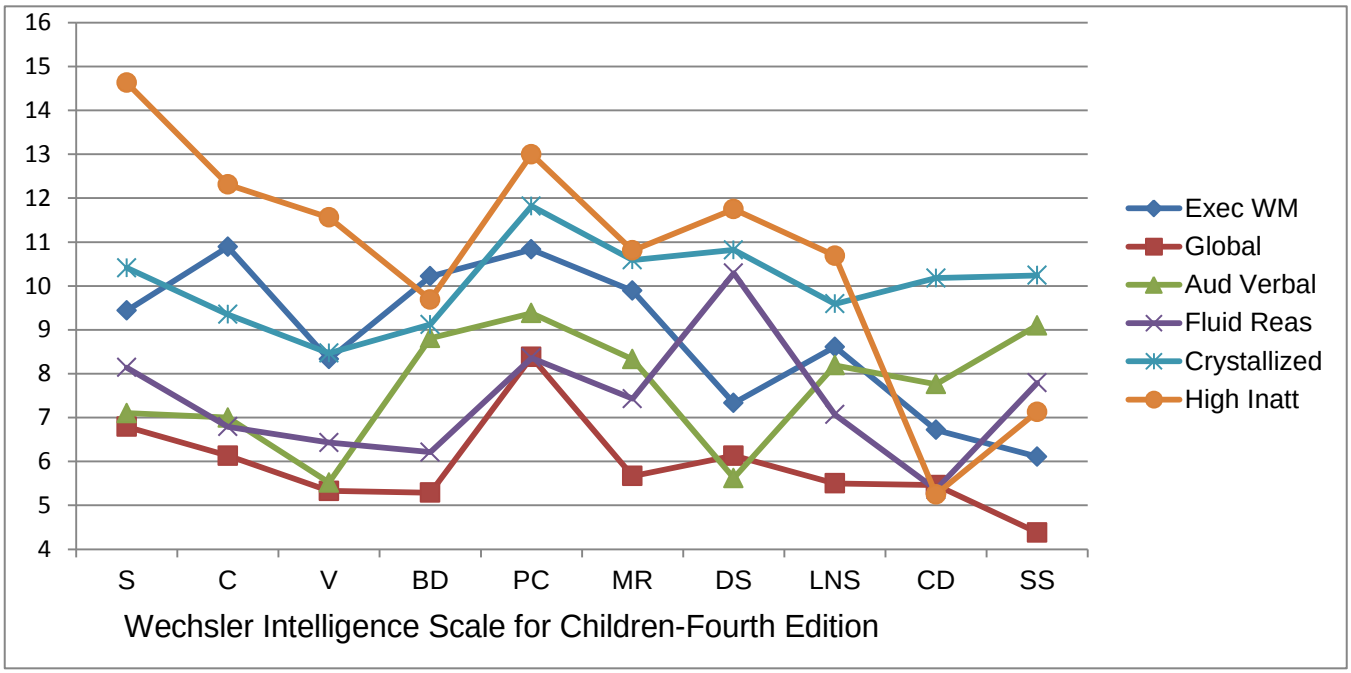

Figure 2. Subtest profiles for cognitive subtypes.

To further differentiate, these cognitive subtypes were also examined across the achievement variables.

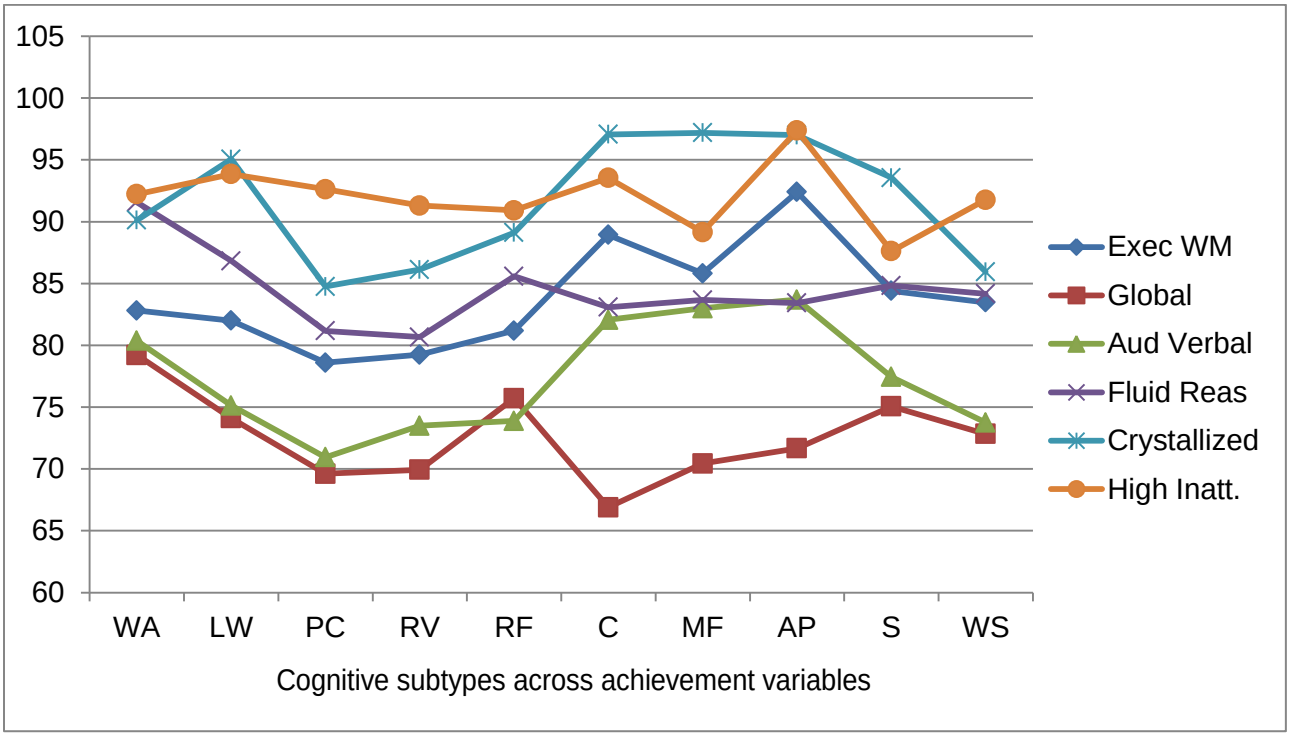

Figure 3. Cognitive subtypes across achievement variables.

Executive functioning/working memory. This subgroup recorded the third highest FSIQ mean. Verbal reasoning skills, as evidenced by the VCI, were well within the average range. Although the Similarities and Comprehension scores were well within the average range, the Vocabulary subtest score was at the lowest possible end of the average range, suggesting possible retrieval difficulties. This subtype had intact perceptual reasoning skills, as measured by the PRI, with all scores solidly in the average range of functioning. This subtype was predominantly characterized by deficits in Working Memory (WM) and Processing Speed (PS), particularly with visual-motor psychomotor speed, areas denoted in the literature as representative of frontal lobe functioning. This subtype revealed difficulty on Digit Span (DS), especially Digit Span Backward (DSB), evidencing working memory weaknesses. Within the PSI, this group had weakness on Coding (CD) and Symbol Search (SS) with scaled scores in the below average range. Overall, this subtype's greatest areas of deficit were found in working memory and overall executive functioning skills.

This subtype indicates process-oriented impairment and is often found in children with executive dysfunction due to frontal-subcortical circuit dysfunction (Hale & Fiorello, 2004). These frontal circuits serve as a check and balance between the left and right hemispheres, as well as a conduit for efficient processing between the anterior and posterior portions of the brain. The anterior cingulate is responsible for executive attention functions, which facilitate the transfer of communication between the anterior and posterior regions of the brain. In addition to attention activation, decision making, monitoring of performance and attention, the anterior cingulate is responsible for motor planning, organization, flexibility and sustained attention which is needed for the Coding and Symbol Search subtests. The problems this subgroup experiences with DS and Letter Number Sequencing (LNS) of the WMI, indicate possible

encoding, working memory and retrieval challenges which are necessary for higher level cognition. With these deficiencies, this subgroup is likely to experience multiple learning and psychosocial problems (Hale & Fiorello, 2004).

Exploration of the achievement means revealed that this subtype scored in the average range on Applied Problems. This subtype scored in the high borderline range on both Passage Comprehension and Reading Fluency; all other subtest means were in the below average range. When comparing this E/WM subgroup with other subtypes, this group scored second lowest in Reading Vocabulary and third lowest in both Passage Comprehension and Reading Fluency.

Global cognitive impairment. This subtype had an overall FSIQ mean at the lowest end of the borderline range which was the lowest overall mean all of subtypes. It is interesting to note that this subgroup had the largest overall percentage of participants; approximately 21% of the participants were found to be in this subtype. In addition to obtaining the lowest FSIQ score, of particular interest within this subtype, were the scores on tasks requiring language. This was most salient with the performance on the VCI, which was the lowest of all subtypes. This subtype scored highest on the Similarities (S) subtest within the VCI, but even this score was the lowest obtained when compared with the other subtypes. In kind, their scores on Comprehension (C) and Vocabulary (V) were also found to be the lowest among the six cognitive subtypes with subtest scaled score means not higher than 6. Within the PRI, this subgroup also scored lowest among the six subgroups, with the lowest overall scores on Block Design (BD) and Matrix Reasoning (MR), with both scaled scores in the well below average range. Within the PRI, this subtype scored second lowest on Picture Concepts (PC) with a score in the lower end of the average range. This high score on PC may have inflated the overall PRI score, but it was still the lowest among the subgroups. On the WMI, this subgroup had the second lowest on both digits

forward and backward and second lowest on overall DS, but reverted to the lowest score on LNS. Within the PSI, this subgroup scored the second lowest mean score on CD and the lowest mean score on SS. Upon further examination of all subtypes across all cognitive variables, no other subgroup scored consistently as low in all cognitive areas as the GCI group.

Review of the achievement areas indicates this subtype had the lowest scores on Word Attack (WA), Letter-Word Identification (LW), Passage Comprehension (PC), Reading Vocabulary (RV) and Comprehension (C). This subgroup scored second lowest on Reading Fluency (RF) and had its lowest mean score on PC (SS= 69) and highest mean score on Word Attack (SS=79). The overall means in reading were lower than any other subgroup. Across the math achievement tests and written language achievement tests, this subtype scored lower than all other groups demonstrating the difficulties with global cognitive impairment that negatively impacts on learning academic tasks.

Auditory/Verbal. This subtype was characterized by low verbal scores relative to their performance on tasks that call upon nonverbal skills. This subgroup had the third lowest FSIQ, the second lowest VCI, and the second lowest WMI, but obtained the second highest score on the PSI, suggesting that auditory-verbal skills may be impaired; whereas, nonverbal perceptual reasoning skills are spared. Examination of the VCI revealed the second lowest S, Comprehension, and Vocabulary subtest scores of all subtypes. PRI scores were all within the average range. The WMI was the lowest scored composite area for this subtype, reflecting poor DS performance. This subtype had the lowest score on both digits forward as well as digits backward, resulting in the lowest score for DS among the subgroups. Within the PSI, this subgroup scored second highest on both CD and SS, showing no weaknesses with psychomotor speed.

Examination of the achievement means for this cognitive subtype revealed subtest mean scores reflecting challenges in the area of reading and written language. This subgroup scored second lowest on Word Attack, Letter Word Identification, Passage Comprehension, Reading Vocabulary, Reading Fluency, Spelling (S), Writing Samples (WS), Writing Frequency (WF), Story Recall (SR) and Understanding Directions (UD). All of these academic skills require the use of auditory-verbal skills to do well. Where this subtype differed from the Global Impairment (GI) subtype was in the mathematics area, where this group outscored the GI subtype. This subtype's calculation and problems solving skills in the math area were still weaker when compared to other subtypes, but relatively speaking, the math area was considered relative strength.

Upon examination of the overall scores for this subgroup, a great deal of variability existed between cognitive and achievement scores. The lowest cognitive score was found on the VCI followed by WMI and FSIQ with the highest cognitive scores on PRI and PSI. Within the achievement scores, this subtype's lowest score was found on Passage Comprehension and greatest strength was on Applied Problems. This subgroup had moderate deficiencies in academics when a comparison was made among scores from the other subgroups, especially in tasks calling upon auditory language.

Visual Spatial/Constructional. This subtype was characterized by great variability among the cognitive and achievement areas with weaknesses noted on tasks requiring visual-spatial processing under timed conditions and which also required graphomotor constructional abilities. This subtype had the second lowest FSIQ and the second lowest PRI, second only to the Global Impairment subgroup. This subgroup had the third lowest VCI and PSI scores. This subtype had the fewest members, suggesting that the profile is rare. Examination of the

variability inherent in this group revealed weaknesses on tasks using visual-spatial processing and the production of written symbols quickly and efficiently. Within the PRI, below average scores were noted on BD and MR, both of which require visual-spatial fluid abstract reasoning skills to perform well. The highest PRI score was for Picture Concepts which was in the lower end of the average range and is a task that requires identification of familiar information. The lower Perceptual Reasoning scores within this subgroup suggest poorly developed fluid reasoning ability. In addition, this group's PSI was just above the borderline range with the CD subtest the lowest area achieved. Cognitive scores demonstrate particular weakness in visual spatial tasks such as BD and CD, both which require production of a task under time constraints and both require fine motor constructional abilities. Both of these tasks appeared to be challenging for this subgroup.

Whereas this subtype's FSIQ, VCI, PRI, and PSI were below the average range, the WMI was the second highest score among the subgroups. In fact, this subgroup scored highest on Digits Forward (DF) and the WMI fell at the lower end of the average range of functioning. This group appears to have the opposite profile from the Auditory/Verbal group in which auditory skills appear spared, while visual-spatial constructional abilities are problematic.

This group's poor visual spatial reasoning may be a result of right hemisphere impairment and may suggest anterior involvement which affects attention and executive functioning (Hale & Fiorello, 2004; Miller & Hale, 2008). This subtype may also struggle with pragmatic language, novel problem solving and inferential reasoning processes which are required to perform socially relevant tasks as evidenced by the poor score on the Comprehension subtest (Hain, 2008). The attributes of this subgroup appear to correspond with many of the

symptoms seen with the Nonverbal Learning Disability subtype, including visual-spatial deficits which are consistent with more posterior right hemisphere dysfunction (Rourke, 1989).

Within the achievement areas, examination across the reading, math, and writing domains had particular strength in WA and SR skills, with scores within the average range, but had a weakness in RV and PC skills. Areas of greatest need academically were found in PC, RV, Math Calculation (MC), Math Fluency (MF) and Applied Problems (AP), all consistent with findings of Hain, Hale, and Kendorski, (2009). Achievement weaknesses were noted primarily for math areas where visual-spatial problems may interfere with MC, MF and math problem solving skills. This subtype may be more comfortable with explicit, rote learning and comprehension and may excel in lower grades with had strength in their rote learning ability. However, they will likely struggle once they reach middle school, when faced with increased academic as well as complex fluid reasoning, novel problem solving and right hemisphere language processing demands (Berninger & Richards, 2002; Bryan & Hale, 2001; Hain, 2008; Hale & Fiorello, 2004; Rourke, 1994).

Crystallized Language. This subgroup had intact average overall cognitive functioning. This subtype performed less well on the VCI tasks than on the other tasks tapped across the WISC-IV subtests, emerging as relative weaknesses. Their lowest score on VCI was on V with a scaled mean in the low end of the average range which stands in stark contrast to the performance on the PRI tasks. Within the PRI, this subgroup's lowest score was on the BD subtest, while the highest score was found on PC. Their scores on WMI were solidly within the Average range, though their score on DSB fell in the low average range. Within the PSI, this group outscored all other groups on both CD and SS.

Review of achievement means for this subgroup had academic deficiencies in on PC, RV, RF, Writing Samples (WS), and UD, in accordance with the Crystallized Language (CL) subtype profile created by Hain et al. (2009). In math, their scores for Calculation (C), Math Fluency (MF) and AP were at the higher end of the average range in accordance with the PRI. Despite the higher mean score in WA and LW, this subgroup had deficiency in all areas of reading that called upon crystallized knowledge (implicit and explicit) such as C, RV, RF, and Written Expression despite their solid academic skills in the areas of math.

This subgroup possibly has diminished left hemisphere function, as had by their lower crystallized language skills. According to Goldberg's (2001) gradiential theory, there is a gradual shift from right to left hemisphere processes as tasks become learned and automatic. Even though their overall FSIQ is in the average range, those with crystallized language problems are always relearning what is taught in the classroom, as they struggle with their ability to infuse the knowledge and skills into long-term memory storage. This subtype has been compared to the Verbal Learning Disability (VLD) subtype because difficulty with understanding and processing of language negatively impacts academic skills that require these subcomponent cognitive functions (Berninger & Richards, 2002).

High Functioning/Processing Speed. This subtype obtained the highest means for the FSIQ, VCI, PRI, and the WMI. Given this profile, it is striking that this subtype had the second lowest PSI, second only to the GI group. It is the substantially lower Processing Speed Index score that differentiates this subtype among the cognitive subtypes. The lower CD and SS scores suggest possible difficulties with balancing speed and accuracy in task production. This subtype appears able to learn at an average level, but experiences difficulties when asked to produce

quickly and efficiently. This subtype scored the lowest of all subtypes on the Coding subtest. This unique subtype had the second fewest students (*N*=16).

Although there are a myriad of possible reasons for this type of processing problem, it is likely the result of anterior cingulate/cingulate frontal-subcortical circuit dysfunction. The cingulate frontal-subcortical circuit is responsible for motivation to perform well, persistence on tasks and online monitoring of performance. This subtype likely struggled with sustained effort on tasks. They may also lack ability in balancing the speed and accuracy necessary to effectively communicate between the anterior and posterior brain regions (Hale & Fiorello, 2004). In addition to the frontal-subcortical circuit, the cerebellum may also play a role in the timing involved in fast processing speed. In addition to impairment in the frontal-subcortical circuit, this subtype therefore may have impaired functioning in the cerebro-cerebellar circuit (Lichter & Cummings, 2005).

Exploration of the achievement means revealed that this subtype had all subtest means in the average range, with the exception of Spelling and MF. They scored highest on WA, PC, RV, RF, AP, WS, WF and UD. This subtype also had the second highest score on LW, MC, MF, S, and SR. This subgroup is characterized by high cognitive and academic achievement with speed of processing as its only deficiency. Poor speed of processing may implicate the graphomotor system and helps to explain difficulties working within time constraints. This group appears to sacrifice speed in order to maintain accuracy.

Subtype differences across cognitive and achievement variables

Table 6 and Table 7 display the *M*, *SD*, and *F* statistics for the WISC-IV variables across the cognitive subtypes. One-way analyses of variance were computed to identify significant differences between the six cognitive subtypes and the WISC-IV composite and subtest

variables. Significant group differences were found between the subtypes on all cognitive measures. Post-hoc comparison utilizing Bonferroni multiple comparisons had significant differences between the subtypes on the FSIQ, VCI, PRI, WMI and PSI. Multiple comparisons utilizing the Bonferroni method were also conducted for the WISC-IV subtest variables. Significant subtype differences also existed between groups across the subtest variables.

Table 6

Nomothetic Results for WISC-IV Composites and Cognitive Subtypes

		E/WM (n = 18)	GI (n = 24)	A/VP (n = 21)	VS/C (n = 14)	CL (n = 17)	HF/PS (n =16)	F[1]
VCI	*M*	97.06	77.83	79.76	83.64	96.47	115.38	47.59
	SD	5.71	7.88	11.34	8.20	9.48	8.50	
PRI	*M*	102.5	77.88	93.38	84.14	103.06	107.25	29.71
	SD	8.59	12.85	8.34	6.96	5.39	10.45	
WMI	*M*	88.44	76.13	82.00	91.86	100.47	107.81	25.63
	SD	9.31	9.62	11.29	9.48	9.54	10.79	
PSI	*M*	79.78	71.79	91.00	80.93	101.12	79.06	13.40
	SD	8.09	12.18	12.46	12.18	13.19	15.90	
FSIQ	*M*	91.39	70.54	82.71	81.07	99.76	105.38	58.48
	SD	7.45	6.58	9.74	5.47	4.48	8.57	

[1]All F ratios significant at $p < .001$

Table 7

Results for WISC-IV Subtests and Cognitive SLD Subtypes

		E/WM *(n = 18)*	G/I *(n = 24)*	A/VP *(n = 21)*	VS/C *(n = 14)*	CL *(n = 17)*	HF/I *(n =16)*	*F*[1]
S	*M*	9.44	6.79	7.10	8.14	10.41	14.63	36.37
	SD	1.97	1.91	1.86	1.99	2.52	1.85	
C	*M*	10.89	6.13	7.00	6.79	9.35	12.31	17.94
	SD	1.84	2.30	2.89	3.42	2.06	2.49	
V	*M*	8.33	5.33	5.52	6.43	8.47	11.56	43.11
	SD	1.18	1.46	1.88	1.74	1.73	.814	
BD	*M*	10.22	5.29	8.81	6.21	9.12	9.69	17.02
	SD	3.07	2.21	1.94	1.05	1.76	2.02	
PC	*M*	10.83	8.38	9.38	8.36	11.82	13.00	9.36
	SD	2.55	3.29	1.98	2.43	2.24	2.73	
MR	*M*	9.89	5.67	8.33	7.43	10.59	10.81	20.43
	SD	1.93	2.23	2.10	1.65	2.06	1.60	
DS	*M*	7.33	6.13	5.62	10.29	10.82	11.75	29.63
	SD	1.91	2.07	2.10	1.63	2.27	2.29	
LNS	*M*	8.61	5.50	8.19	7.07	9.59	10.69	9.79
	SD	2.35	2.62	3.04	2.64	1.87	2.70	
CD	*M*	6.72	5.46	7.76	5.36	10.18	5.25	9.01
	SD	2.27	2.90	3.08	1.90	28.56	2.56	
SS	*M*	6.11	4.38	9.10	7.79	10.24	7.13	13.10
	SD	2.08	2.44	2.40	2.83	2.53	3.44	

[1]All *F* ratios significant at $p < .001$

To differentiate groups based on academic achievement, one way analyses of variance were computed to determine significant differences between the six cognitive subtypes on the achievement variables. Table 9 depicts the means and standard deviations for these variables across the six cognitive subtypes. As is noted, there were significant subtype differences between all the cognitive subtypes on the achievement measures.

Table 8

Results for Achievement Measures and Cognitive Subtypes

		E/WM *(n = 18)*	G/I *(n = 24)*	A/VP *(n = 21)*	VS/C *(n = 14)*	CL *(n = 17)*	HF/PS *(n =16)*	*F*[1]
WA	*M*	82.82	79.22	80.37	91.58	90.13	92.23	2.52
	SD	13.46	15.47	13.14	9.19	9.93	21.85	
LW	*M*	82.0	74.11	75.13	86.83	95.06	93.85	4.72
	SD	14.93	15.46	15.08	12.48	21.48	17.67	
PC	*M*	78.59	69.61	70.94	81.17	84.75	92.62	5.87
	SD	8.64	19.85	13.42	8.00	12.12	15.66	
RV	*M*	79.24	69.94	73.50	80.67	86.13	91.31	5.15
	SD	8.87	17.34	12.63	11.20	13.82	15.38	
RF	*M*	81.18	75.72	73.88	85.58	89.12	90.92	3.94
	SD	9.95	14.65	15.57	11.73	15.46	14.35	
MC	*M*	88.94	66.89	82.06	83.08	97.06	93.54	7.65
	SD	13.58	18.09	18.91	13.85	12.18	16.79	
MF	*M*	85.82	70.44	83.00	83.67	97.19	89.15	6.29
	SD	13.91	13.21	16.82	14.52	11.17	16.37	
AP	*M*	92.41	71.67	83.69	83.42	97.00	97.38	10.54
	SD	12.87	14.15	12.90	9.49	9.28	13.84	
S	*M*	84.41	75.06	77.44	84.83	93.56	87.62	3.04
	SD	11.19	20.38	14.39	11.70	14.08	19.36	
WS	*M*	83.47	72.83	73.75	84.17	85.94	91.77	3.29
	SD	10.73	18.46	18.66	13.14	16.70	15.07	
WF	*M*	80.12	76.11	77.31	84.83	90.44	91.69	3.51
	SD	11.35	16.42	14.76	12.26	13.25	14.47	
SR	*M*	87.47	76.89	87.13	90.25	97.38	95.69	4.28
	SD	13.92	14.88	20.80	6.07	8.88	15.49	
UD	*M*	86.41	74.89	80.44	82.58	88.31	94.46	5.00
	SD	12.55	12.56	11.80	6.45	11.71	14.03	

[1]All *F* ratios significant at $p < .05$ with exception of Word Attack

Examination of subtypes across emotional-behavioral variables

Figure 4 and Figure 5 graphically depict the BASC-2 TRS clinical and composite variables. Review of the means across these subtypes helped to delineate further differentiating factors between the subtypes. As with the cognitive and achievement variables, the emotional-behavioral variables were also significantly different between groups and further differentiate the cognitive subtypes.

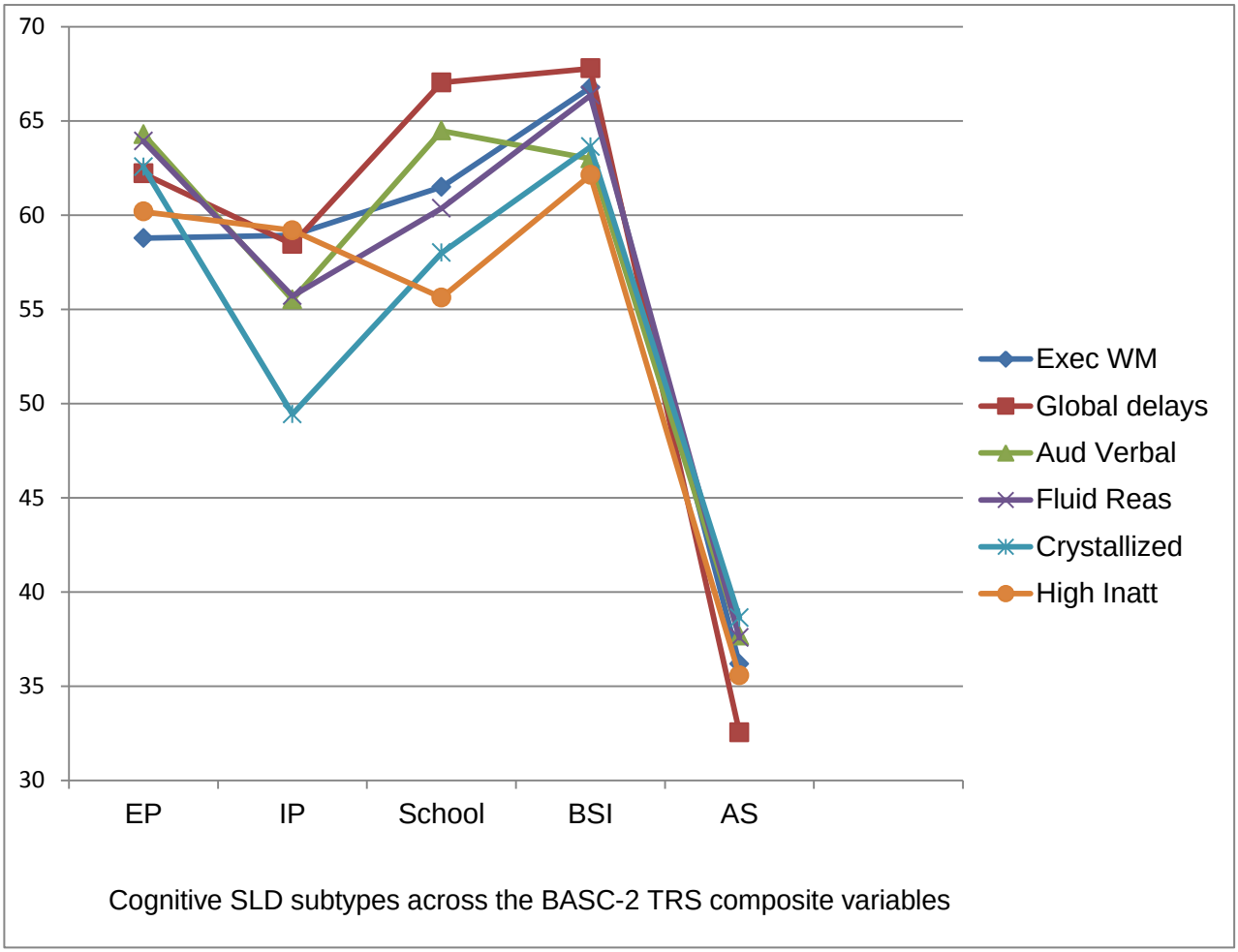

Figure 4. Cognitive SLD subtypes across the BASC-2 TRS composite variables.

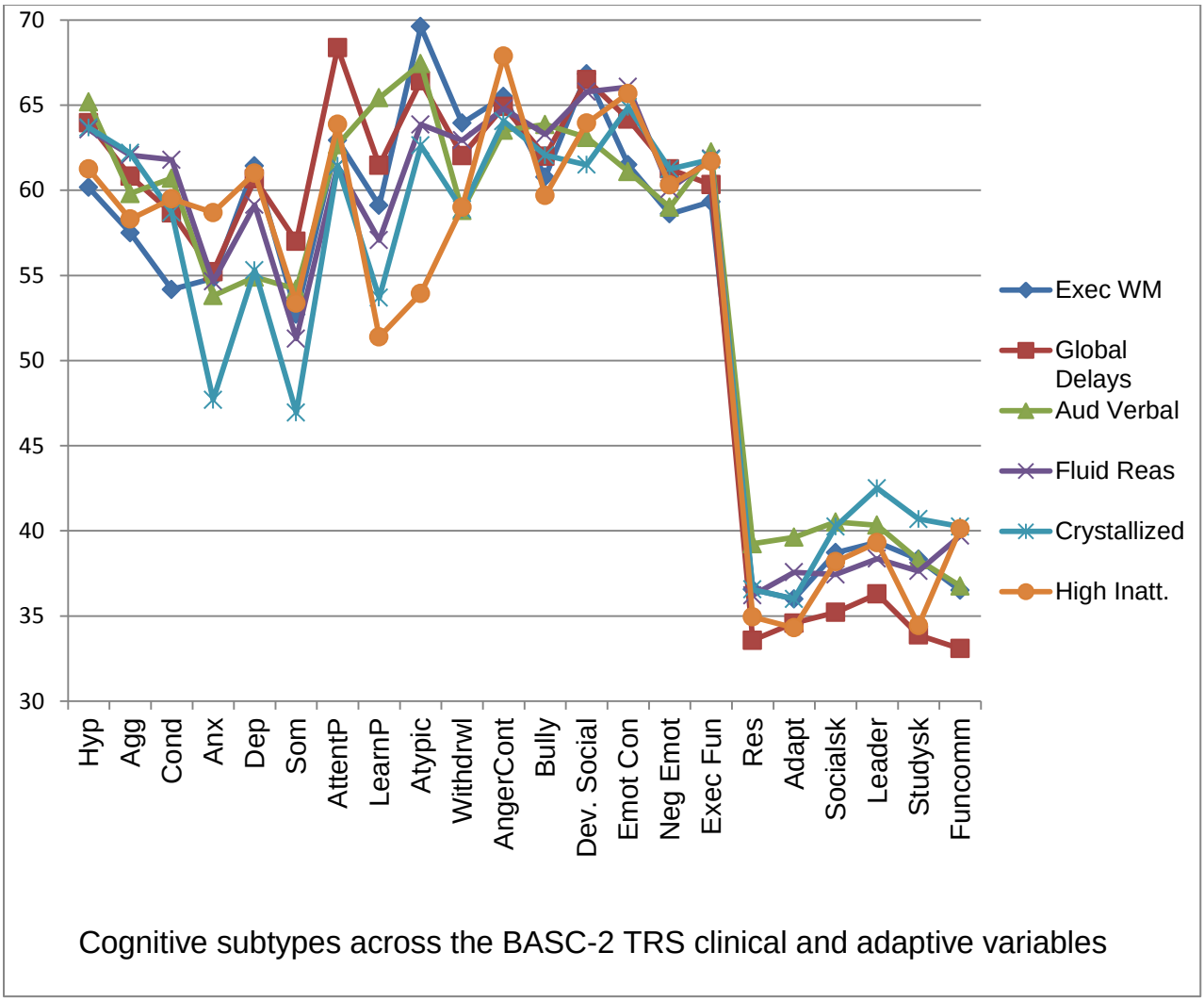

Figure 5. Cognitive subtypes across the BASC-2 TRS clinical and adaptive variables.

Executive/Working Memory. This subtype was characterized primarily by Hyperactivity, Depression, and Attention Problems reflective of overall at-risk School Problems. This subgroup had heightened means for Atypicality, Withdrawal, and the global Behavioral Symptoms Index. The E/WM subtype had the highest mean for Atypicality and the second highest mean for the Behavioral Symptoms Index. These scores reflect a cognitive subtype who appears to be frustrated by the inability to self-regulate in school, leading to comorbid social and emotional

symptomatology. This group scored second highest in Social Skills, Leadership, and Study Skills, but achieved the lowest score on Functional Communication.

Global cognitive impairment. This subtype is most easily characterized by having the highest means for the following: Attention Problems, Behavioral Symptoms Index, School Problems and Negative Emotion. This group also had the second highest scores for Hyperactivity, Learning Problems and Developmental Social Problems. This subgroup is further characterized by the third highest scores for Aggression, Depression, Atypicality, Withdrawal, and Anger Control. Other scores of heightened means were Externalizing Problems, Bullying, Emotional self control and Executive Functioning. As would be expected given the cognitive profile, this subtype scored the lowest adaptive levels (Social Skills, Leadership, Study Skills, Functional Communication and the global Adaptive Skills composite). Overall, this subtype had mean scores in the at-risk range in several areas, which would be expected, given this group had the lowest cognitive profile suggestive of difficulties with problem solving.

Auditory/Verbal. This subtype is characterized by the highest mean score for Hyperactivity, Externalizing Problems, Learning Problems, Bullying and Executive Functioning. This subgroup had the second highest mean for School Problems, Atypicality and Conduct Problems. This subgroup had the lowest mean scores in: Anger Control, the Behavioral Symptom Index and Emotional self control. On the Adaptive Scale, this subgroup had the highest mean for Social Skills, and had the second highest mean on Adaptability, Study skills, Leadership, and overall Adaptive Skills.

Visual spatial/constructional. This group is characterized by the highest score outside the mean on Conduct Problems and Emotional Self-Control. This subgroup was further characterized by having the second highest scores outside the mean in Aggression, Externalizing

Problems, Bullying, Withdrawal and Executive Functioning. Not surprisingly, this subgroup had the second lowest adaptive means for Social Skills and Leadership.

Crystallized Language. This subgroup had the highest score outside the mean in: Aggression and Negative Emotion. This subtype had one of the lowest means among the cognitive subgroups for Developmental Social Disorders and Anger Control. Areas of heightened means which were third highest among the subgroups were found in Hyperactivity, Externalizing Problems, Bullying, Emotional self control and problems with Executive Functioning. While few other subgroups had heightened means for these categories, the CL subgroup had the highest means for Leadership Ability, Study Skills and Functional Communication abilities, making it the highest functioning subgroup in Adaptive Skills. This subgroup also had the second highest mean for Social Skills. This subgroup appears to have some element of borderline clinical functioning in most areas assessed on the BASC-2 which is consistent with research showing socially maladjusted youth who have language deficits and an increased rate of incarceration.

High functioning/processing speed. This subgroup had the highest score outside the mean on Anger Control and the lowest score on the Behavioral Symptoms Index. This subtype had the second highest means in Depression, Emotional Self-Control, and Negative Emotion. They also had the third highest score outside the mean on Attention Problems. This subgroup had one of the lowest scores outside the mean on Hyperactivity and Externalizing Problems, though all the subtypes reported some degree of externalizing problems. This subgroup did not score outside the mean on Aggression, Conduct Problems, Anxiety, Somatic Complaints, Internalizing Problems, Learning Problems, School Problems, Atypicality, Withdrawal or Bullying whereas most of the other subgroups did have scores outside the mean. In addition, this

group had the lowest mean score on Adaptability, with the second lowest scores on Study Skills and overall Adaptive Skills. From all these reported scores, it appears that this subtype experiences a great deal of difficulty in their ability to control emotions, consistent with anterior cingulate difficulties, as this area of the brain is a connection between the cognitive and emotional systems. This subgroup tends to struggle with comorbidity of depression and emotional self-control, including feeling more negative emotion than the other subgroups which is congruent with anterior cingulate dysfunction with abulia and pseudo-depression.

Tables 9, 10, 11, 12 and 13 display the *M*, *SD* and *F* statistics for the BASC-2 variables across the cognitive subtypes. Analyses of variance were computed to determine significant differences between the six cognitive subtypes and the BASC-2 variables. Significant group differences were found between the subtypes on some variables.

Table 9

BASC-2 TRS Internalizing and Externalizing Variables and Cognitive Subtypes

		E/WM (*n* = 18)	G/I (*n* = 24)	A/VP (*n* = 21)	VS/C (*n* = 14)	CL (*n* = 17)	HF/PS (*n* = 16)	*F*
Hyp	*M*	60.17	63.96	65.19	63.57	63.69	61.25	.33
	SD	14.76	13.34	14.48	14.06	15.94	10.82	
Agg	*M*	57.50	60.83	59.81	62.07	62.19	58.31	.25
	SD	16.35	14.94	17.16	16.42	17.46	11.20	
Con	*M*	54.17	58.67	60.71	61.79	58.69	59.50	.73
	SD	13.39	10.84	13.31	15.82	11.85	11.86	
EP	*M*	58.78	62.21	64.29	63.93	62.56	60.19	.42
	SD	15.04	11.82	15.53	14.58	15.38	10.41	
Anx	*M*	54.83	55.21	53.81	54.64	47.69	58.69	1.49
	SD	12.35	11.34	10.80	13.99	8.63	13.49	
Dep	*M*	61.44	60.67	54.90	59.14	5.31	61.00	.76
	SD	17.08	14.19	14.51	9.69	12.34	16.69	
Som	*M*	52.72	57.00	54.19	51.29	46.94	53.38	1.30
	SD	12.70	16.39	13.43	10.55	6.53	11.24	
IP	*M*	58.94	58.46	55.52	55.71	49.44	59.19	1.55
	SD	13.59	12.93	12.89	11.49	6.81	12.51	

Table 10

BASC-2 TRS School Problems and Behavioral Symptoms Index and Cognitive SLD

		E/WM (*n* = 18)	G/I (*n* = 24)	A/VP (*n* = 21)	VS/C (*n* = 14)	CL (*n* = 17)	HF/PS (*n* = 16)	*F*
AP	*M*	62.94	68.37	62.27	61.43	61.44	63.88	1.93
	SD	9.07	6.07	9.61	8.62	9.32	8.98	
LP	*M*	59.11	61.46	65.43	57.07	53.69	51.38	5.00*
	SD	11.33	11.13	10.44	9.36	8.44	6.31	
SP	*M*	61.50	67.04	64.48	60.36	58.00	55.62	4.40*
	SD	10.25	6.77	9.94	9.06	7.30	8.88	
Aty	*M*	69.61	66.42	67.43	63.86	62.63	53.94	1.79
	SD	22.09	12.50	17.38	16.17	19.45	13.36	
With	*M*	63.94	62.04	58.81	62.93	58.88	59.00	.67
	SD	9.79	13.37	11.03	11.90	13.61	10.57	
BSI	*M*	66.78	67.79	63.00	66.36	63.63	62.13	.62
	SD	15.02	9.07	16.02	10.88	14.47	9.61	

*F ratios significant at $p < .05$

Table 11

BASC-2 TRS Adaptive Scales and Cognitive Subtypes

		E/WM (*n* = 18)	G/I (*n* = 24)	A/VP (*n* = 21)	VS/C (*n* = 14)	CL (*n* = 17)	HF/PS (*n* = 16)	*F*
Adapt	*M*	36.00	34.58	39.62	37.57	36.00	34.31	.994
	SD	9.48	8.16	11.15	8.21	7.90	6.97	
Social	*M*	38.72	35.21	40.52	37.43	40.25	38.19	1.36
	SD	6.28	6.22	8.57	7.56	7.63	10.00	
Leader	*M*	39.33	36.29	40.33	38.36	42.50	39.31	2.38*
	SD	3.89	4.99	7.18	5.38	6.70	6.68	
Study	*M*	38.33	33.88	38.29	37.64	40.69	34.44	3.06*
	SD	7.08	5.52	7.57	5.27	5.48	6.92	
FC	*M*	36.50	33.08	36.76	39.71	40.25	40.12	3.12*
	SD	6.90	4.61	9.39	8.01	8.21	4.61	
AS	*M*	36.17	32.54	37.67	37.57	38.63	35.56	2.06*
	SD	6.45	4.70	8.59	8.07	6.55	6.98	

*F ratios significant at $p < .05$

Table 12

BASC-2 TRS Content Scales and Cognitive Subtypes

		E/WM *(n = 18)*	G/I *(n = 24)*	A/VP *(n = 21)*	VS/C *(n = 14)*	CL *(n = 17)*	HF/PS *(n = 16)*	*F*
AC	*M*	65.50	64.92	63.52	64.79	64.06	67.88	.
	SD	9.49	11.78	11.75	11.50	11.01	9.26	
B	*M*	60.78	62.00	63.86	63.29	62.06	59.69	.21
	SD	16.38	12.61	14.63	14.35	15.47	9.97	
DS	*M*	66.83	66.50	63.10	65.79	61.50	63.94	.89
	SD	8.22	8.35	11.26	8.29	11.70	8.29	
EC	*M*	61.50	64.17	61.10	66.07	64.88	65.69	.43
	SD	13.32	13.98	15.17	13.15	15.25	8.13	
NE	*M*	58.61	61.25	59.00	60.07	61.25	60.31	.14
	SD	12.63	13.44	14.55	13.08	14.24	7.07	
EF	*M*	59.33	60.33	62.24	61.86	61.81	61.69	.12
	SD	14.19	13.24	14.06	14.44	16.10	9.60	
R	*M*	36.56	33.67	39.24	36.21	36.56	34.94	1.29
	SD	7.461	7.323	9.159	6.216	8.058	6.816	

Examination of history of disciplinary actions among study participants

The data for truancy and suspensions depended upon various reporters in various schools within the district without any reliable method of collection. The history of arrests, however, was obtained from the Ocean County Office of Probation as per data collection guidelines (Appendix A). Per instruction, school psychologists and/or LDTCs reported a history of truancy, suspension, or arrest with 1for yes and 2 for no. Table 13 displays the frequencies and percentages of truancy, suspension and/or arrest among subjects. Analyses of variance for the derived cognitive subtypes were not significantly different with $p > .05$ for all analyses. Subsequent correlations among the Hyperactivity, Aggression, and Conduct scales of the BASC-2 and the disciplinary variables revealed significant correlations between suspensions and Aggression ($r = .189$, $p < .05$), and Conduct ($r = .262$, $p < .01$) for this sample of children. Further significant correlations were found for arrests and Conduct ($r = .228$, $p < .01$). No significant correlations were found for Truancy and these BASC-2 variables.

Table 13

Frequency of disciplinary history among all archival participants

	Frequency	Percent
Truancy	10	9.1
Suspensions	44	40
Arrests	16	14.5

Chapter 5

Discussion

The current study proposed to identify and describe meaningful cognitive subtypes of children with learning disorders, as determined by hierarchical cluster analysis, and to examine subtype differences on standardized cognitive measures, standardized academic measures, and BASC-II teacher ratings. Although the study was designed to address research questions rather than explicit research hypotheses, the results highlight how children with different types of neurocognitive assets and deficits experience learning problems in different academic domains (reading, writing, and math). In addition, these profiles could be related to different patterns of psychosocial adjustment (e.g., internalizing, externalizing, and adaptive behavior). Ultimately extracting these subtypes may lead to targeted interventions thus preventing poor long-term outcomes for these children. The following research questions were addressed.

1. Are there meaningful cognitive subtypes of children in this sample of school-age boys with learning disorders, emotional disorders, and other health impairments (ADHD) based on a cluster analysis of WISC-IV subtest scores?
2. If so, will these subtypes perform significantly differently across cognitive, academic, and emotional-behavioral variables?
3. Will a cognitive subtype of children with RD demonstrate higher levels of teacher-rated psychopathology than students with other subtypes of cognitively based learning disorders?

The results of the hierarchical cluster analysis revealed six clearly delineated cognitive subtypes. After examination of the interconnected areas of cognition, and academic, emotional and behavioral function as well as discipline problems in this sample population, it became clear

that various types of cognitive and or learning issues did lead the classified students under study to engage in various clinically elevated levels of psychopathology.

In this archival study, over half of the population was found to have some type of reading problem. In accordance with data gathered from the general population, the most commonly identified learning disabilities in students are those based on an inability to read. Reynolds, Elksinan, and Brown (1996) state that because of the high incidence (5%-10%) of learning disabilities in the general population and because the majority of learning disabilities involve a reading disability, early identification of affected individuals is crucial to reading progress (Shaywitz, Fletcher, & Shaywitz, 1994). Further, comorbid learning problems are more frequent than expected, and a potential consequence of this comorbidity may be poorer neuropsychological, academic, and behavioral outcomes (Germano, et al., 2010). It is posited that the comorbidity of learning difficulties, emotional issues, and health impairments magnifies maladaptive behaviors, potentially leading to later antisocial behaviors (Willcutt & Pennington, 2000b). The characteristics of this sample population special education students may interfere with a reliable outcome when examining cognitive and achievement subtypes, psychosocial factors and their association with a history of truancy, suspensions and/or arrest.

Subtype differentiation and clinical implications

Several significant cognitive subtypes were found in this study. For example, the subtype was identified and was found to have significantly lower working memory ability and slower processing speeds; this subgroup likely experiences difficulties with frontal-subcortical functioning. The Executive functioning/working memory cognitive subtype was characterized by relatively consistent VCI and Comprehension cognitive profile with difficulty in auditory-verbal working memory and visual motor psychomotor speed as evidenced by SS, WMI, PSI and

DS performance. This group had a FSIQ at the lowest end of average, with higher VCI and Borderline PSI. Subtest scores were consistent with variability noted in low CD, SS and DS scores. This subgroup had weakness on all areas of DS, with particular weakness in DSB. Digit Span Backward involves working memory, transformation of information, mental manipulation, and visuospatial imaging, all skills lacking within this subgroup (Wechsler, 2003). Further, this subgroup had the second lowest score on SS which pertains to weakness in processing speed, short-term visual memory, visual-motor coordination, cognitive flexibility, visual discrimination, psychomotor speed, speed of mental operation, attention and concentration. The inattention may be related to the right posterior attention activation system (Posner & Raichle, 1994). The low score on SS may also represent difficulties in auditory comprehension, perceptual organization, fluid intelligence and planning and learning ability (Wechsler, 2003). Keith, et al., (2006) suggest a lower SS score suggests difficulties with spatial processing and the Working Memory and Processing Speed processing deficits suggest overall problems with achievement, as this subgroup struggles with encoding and storing information.

Deficits noted on the executive functioning skills of Working Memory and Processing Speed suggested global frontal subcortical circuit dysfunction, leading to probable deficits in multiple executive functions (Hale & Fiorello, 2004; Miller & Hale, 2008). This subtype particularly struggled with executive attention, that is regulated by the anterior cingulate, a function which allows the smooth transition of information from the anterior to posterior regions of the brain (Posner & Raichle, 2004). This subgroup also struggled with skills which are regulated by the dorsolateral prefrontal circuit, including motor planning and sustained attention (Hale & Fiorello, 2004). These frontal circuit functions serve as a check and balance system, allowing the brain to freely communicate between the anterior and posterior portions of the

brain. This subgroup had a deficit in functions that are part of the frontal lobe region and may reflect lowered cognitive skills. This subgroup was also found to have borderline Passage Comprehension and Reading Vocabulary scores.

In the psychosocial assessment, this subtype had emotional and behavioral functioning difficulties, with the highest means for the BASC-2 clinical scale for Depressive Symptoms, Atypicality and Withdrawal. This subgroup had Clinically Significant scores for Internalizing Problems, with higher scores for Attention and School Problems, Functional Communication and Anger Control problems as well as the second highest BSI score. This subtype had some emotional and behavioral functioning difficulties, particularly problems relating to the dorsolateral prefrontal circuit and orbital region of the brain. The combination of these symptoms of Depression, Atypicality, Withdrawal and Developmental Social Problems suggests weakened social skills and places this subtype at higher risk for disciplinary actions such as truancy and even arrest.

Prefrontal-subcortical circuits in the orbital region are consistent with executive functions outlined by Goldberg (2001) and McCloskey (2009). The executive functions are referred to as the Chief Exeutive Officer (CEO) of the brain. In accordance with the lowered scores on WMI and PSI this group struggles with such executive function difficulties delineated by McCloskey (2009) and others. Often used interchangeably as a unitary concept, McCloskey (2009) posits that there must be over 25 discrete executive functions which govern our conscious perceptions, feelings, thoughts and actions that all work in concert with one another. This subgroup scored highest on Depression, Atypicality and Internalizing, characterizing a socially isolated young man with comorbid learning and achievement problems and poor social and behavioral

functioning, including poor functional communications skills and an inability to control his anger. Executive functions lacking in this subgroup include

> directive capacities that are responsible for a person's ability to engage in purposeful, organized, strategic, self-regulated, goal-directed processing of perceptions, emotions, thoughts and actions. As a collection of directive capacities, executive functions cue the use of other mental capacities such as reasoning, language and visuospatial representation (McCloskey, 2009).

Berninger and Richards (2003) allocate various executive functions to their own unique circuit pathway within the frontal lobes. Given the poor executive functioning skills in this subgroup, higher rates of disciplinary actions would have been expected. The heart of psychopathology is thought to lie in the prefrontal-subcortical circuits; this subgroup pattern had both global executive dysfunction and the most disabling emotional and behavioral deficits (Miller & Hale, 2008; Powell & Voeller, 2004). A possible explanation for the lowered disciplinary history in this subgroup who did struggle with executive functioning difficulties, is the relatively high VCI and Comprehension scores. Even so, this subgroup did have a more heightened history of truancy and arrests. What is more intriguing is the high rate of internalization of depression in this group, which intrinsically diminishes externalizing behaviors and disciplinary acts such as arrest and truancy.

Another group, the Global cognitive impaired subtype had overall cognitive impairment. The GCI cognitive subtype is significant for the lowest cognitive and achievement scores with the exception of Reading Fluency, which was still the second lowest score. Within the BASC-2 Clinical scales, this subgroup had higher means for Hyperactivity, Externalizing, Depression, Attention, Learning and School Problems, Atypicality, and Withdrawal, and had the highest BSI

score. This subgroup had the lowest resiliency and scored lowest in all areas of Adaptive skills. This group had the highest upward trend for rates of truancy but not for suspension/arrests. Perhaps this subgroup realizes their cognitive and academic limits and feels a sense of failure when attending school.

An identified Auditory/Verbal subgroup was significant for overall lowered cognitive ability, especially pertaining to lowered VCI and working memory abilities. This subgroup was characterized by the lowest DS scores. In addition, this subgroup had the second lowest VCI, WMI scores with the fifth lowest score on Similarities and Vocabulary. The low DS score suggests weakness in rote learning and memory, attention, encoding and auditory processing skills. Examination of achievement for this cognitive subgroup revealed the lowest scores for Reading Vocabulary and Reading Fluency as well. Moreover, this subgroup had the lowest scores for Reading Vocabulary and Reading Fluency, scoring lower than the *GCI* subgroup. Applied Problems was a comparative strength for this subgroup, scoring fourth out of six.

As would be expected, this subgroup had the second lowest scores on the oral language tasks of UD and SR. According to Caplan (1992), oral language tasks involve the integration of complex cognitive processes such as semantic memory and reasoning. Understanding Directions requires listening and mapping a series of sequential directions onto the mental structure under construction and maintaining the sequence in immediate awareness until a new directive changes the sequence (Gernsbacher, 1990,1991, 1997). In CHC theory, this skill is called Working Memory. In kind, this subgroup scored second lowest on Story Recall. The Story Recall test requires comprehending and remembering the principal components of a story by constructing propositional representations (Anderson, 1976, 1985; Kintsch, 1974) and by recoding (Miller, 1956).

Within the BASC-2 Clinical scores, this group also had the second highest score for Conduct problems, School Problems and Atypicality but had the lowest scores for Anxiety and IP. Consistent with orbitofrontal dysfunction (Riccio et al., 2006), this cognitive subgroup was characterized by the highest scores on Hyperactivity and Externalizing and Learning Problems, Bullying and Executive Functioning scores. Maturation of the frontal lobes is correlated with cognitive functioning, which may help to explain why some adolescents take a more risky approach to life, neglecting to consider the consequences of their actions (Reiss, Grubin, Meux, 1996). In examining disciplinary problems, this subgroup had a slight risk for suspensions. However, given all the clinical problems in this subgroup in conjunction with low verbal ability, the present findings of low suspension and arrest rates and lowest level of truancy seem counterintuitive. This subgroup's poor cognitive, reading and auditory learning skills in concert with high externalizing and bullying demonstrate a profile of a young man with externalizing and conduct problems but who has relatively good social skills and low anxiety, which may help to explain the low frequency of disciplinary actions.

Another group, the Visual spatial/constructional subgroup was identified. This group had cognitive, academic and socio-behavioral findings consistent with right brain impairment in concert with a lack of emotional self-control and conduct problems consistent with nonverbal learning disorder (NVLD, Forest, 2004). This subgroup is further characterized by low cognitive levels in all areas except in memory and processing speed, which were a relative strength for this subgroup. Surprisingly, this subgroup has good concrete ability and had the second highest score on Word Attack, suggesting good rote ability, but had the highest BASC-2 mean T scores for Conduct and Emotional self-control problems, followed by the second highest scores for Aggression, Externalizing Problems, Withdrawal, Social Skills, Leadership and Bullying. These

deficiencies are consistent with right hemisphere learning problems including anterior involvement which may affect attention and executive function (Hale & Fiorello, 2004; Miller & Hale, 2008).

Though this subgroup is comfortable with language and explicit and rote learning, it struggles with fluid reasoning and right hemisphere or nonverbal language processes, such as social cues and facial expressions (Berninger & Richards, 2002; Bryan & Hale, 2001; Hain, 2008; Hale & Fiorello, 2004; Rourke, 1994). This subgroup exemplifies the NVLD (Forest, 2004; Rourke & Fuerst, 1991). NVLD is a condition characterized by a significant discrepancy between higher verbal and lower motor, visuo-spatial, and social skills with dysfunction noted in the right cerebral hemisphere. High scores along both the Internalizing and Externalizing areas placed this subgroup at greater risk for psychopathology. With damage to the right frontal lobe, this subgroup has poor sustained attention and emotional self control, which can lead to greater psychopathology and increased risk for arrest (Lichter & Cummings, 2001). Such a lack of emotional self control in combination with externalizing problems suggests poor social competence and a lack of ability to self regulate. Blair (2000) suggests that at a young age qualities of social competence and the ability to self regulate are even more critical to academic success than cognitive and achievement skills. The profile of a nonverbal learning disability is interchangeable with deficits in right hemisphere dysfunction especially parietal lobe dysfunction. Further, while mirror neurons are heavily involved in social-emotional functioning, the angular-gyrus allows for the comprehension of idioms. Moreover, the anterior cingulate cortex is involved in the regulation of empathy and other emotions; it also allows for self awareness and introspections, skills clearly lacking in this subgroup (Deceity & Jackson, 2004: Rolls, 2004). The Visual Spatial/Constructional subtype lacks a theory of mind; they are unable

to see themselves through the eyes of another. It is the orbitofrontal cortex that allows for such empathy (Rolls, 2004). This subtype often presents with significant visual-spatial deficits (Hale & Fiorello, 2004). This subgroup had weaker math skills and low Perceptual Reasoning (PR) consistent with the nonverbal LD type espoused by Hale & Fiorello (2004). This subgroup had the second highest tendency for arrest and the least risk for suspension. An inability to detect nonverbal social cues such as facial expressions, located in the fusiform gyrus, in conjunction with a higher rate of conduct problems and poor emotional self-control results in higher rate of arrest for this subgroup.

The CL subgroup demonstrated relatively high cognitive abilities with comparatively lower VCI, Word Attack score and lower overall scores on tasks that involve integration of right/left brain association, resulting in the highest number of disciplinary problems. This subgroup is characterized by the highest CD and SS scores. This subgroup scored second highest on FSIQ score followed by relative weaknesses and had the third highest scores for VCI, BD, and Comprehension. On Achievement, this subgroup scored highest on Math Calculation, Math Fluency, Spelling, Letter Word Identification and Story Recall. Word Attack was their lowest achievement score, a relative weakness, with the third highest score of all subgroups. The Word Attack test measures both reading decoding and phonetic coding (Ashcraft, 2002) and requires grapheme-to-phoneme translation of pseudo words not contained in the mental lexicon (Gazzaniga, Ivry, & Mangun, 1998). Research suggests that the ability to translate nonwords into sounds is the foundation for understanding orthographic representation (Caplan, 1992). In contrast, this subgroup had the highest score on Letter-Word Identification of all the subgroups. In order to understand the difference between Word Attack and Letter-Word Identification, Caplan (1992) states that in Letter-Word Identification, the reader identifies the letter in a word

and then matches a representation of the word in memory against those letters. There appears to be a deficiency in their ability to decode an unknown word, but strength in their ability to match letters from a new word with words they already know. Unfortunately, the Matthew Effect espoused by Stanovich (1989) suggests that students who have poor decoding skills never catch up. Within the BASC-2 clinical scales, this subgroup scored highest on Aggression, Anger Control and Negative Emotion. Of great interest, this subgroup also had the lowest score on Anxiety, Somatic complaints and Internalizing. Further, this subgroup had the highest scores on all areas of Adaptive Skills including: Leadership, Developmental Social skills, Functional Communication and Social Skills.

Lastly, a High Functioning/ Processing speed subgroup was identified with the highest levels of cognitive ability in conjunction with the lowest PSI score. Differences in achievement skills as well as in psychosocial and disciplinary behaviors were noted, which might further differentiate these subgroups. Understanding the varied and intricate makeup of each cognitive subgroup might afford educators with the tools necessary for differentiated instruction. This subgroup is characterized cognitively by the highest cognitive scores with the exception of the second highest score on BD and Digit Span Forward (DSF), suggesting a possible weakness in the ability to integrate information as well as a personal weakness in their ability to attend to encode newly learned information. These are consistent with the anterior or the executive portion of the brain. On examination of Achievement, this subgroup scored second highest on Letter Word Identification, math Calculation, Math Fluency, Spelling and Story Recall. Psychosocially, this subgroup is likely characterized by heightened Anxiety, Internalizing Problems and poor Anger Control. Feifer (2009) suggests that anxiety and high reactivity can result from minimal stimulation to the amygdala which is needed to activate the cerebral cortex.

It is posited that these highly reactive children may have more internalizing disorders resulting from sensory overload. In conjunction with high anxiety and internalizing behaviors, this subgroup struggles with an inability to control Anger as evidenced by the heightened score on Anger Control on the Content Scale. This subgroup had the least amount of Aggression, School and Learning Problems, Atypicality, and Bullying and had the lowest BSI score out of all six subgroups. Upon inspection of disciplinary behavior, this subtype scored lowest on arrest, followed by fifth out of six on truancy and fourth of six on suspension.

Academic subtype differences

As expected, we found significant differences between the subtypes on measures of cognitive and academic variables. In fact, the results were striking. There were significant group differences in all cognitive and achievement measures. Notably, the Global cogntive impairment, Auditory verbal and Visual spatial/constructional groups consistently had the lowest levels of both cognitive and achievement results. Reading difficulties were found in the executive working memory, GCI, Auditory/verbal and CL subgroups, suggesting left hemisphere and frontal lobe dysfunction (Hale & Fiorello, 2004; Syaywitz, et al., 2002). The executive working memory, GCI, Auditory/verbal subgroups all had deficits in all areas of reading and language, including Vocabulary, Fluency, Decoding and Comprehension. The National Reading Panel Report (National Institute of Child Health and Human Development (2000) reported that effective reading instruction addresses five critical areas: phonemic awareness, phonics, fluency, vocabulary and comprehension.

Though the CL subgroup did not have grave reading difficulties, this subtype did have a relatively low Word Attack score, suggesting that this group may struggle with decoding. In addition, this group scored third lowest on Passage Comprehension. Though

this subgroup may have had average scores on all the Indexes, poor reading skills are likely seen in this group perhaps due to left frontal orbital impairment which may lead to an overall achievement problem (Hale & Fiorello, 2004).

Math difficulties were likewise found within the same three subgroups who experienced reading problems: Executive working memory, Global cognitive impairment and Auditory/verbal but the Visual/spatial constructional subgroup took the place of the CL subgroup in Math problems. Writing difficulties were again found within the same four subgroups who experienced reading problems: Executive working memory, Global cognitive impairment and Auditory/verbal and the Visual/spatial constructional subgroup were found to have deficits in both Writing Samples and Writing Fluency. Such results indicate that linguistic processes, executive impairments, visual-spatial deficits and difficulties with divergent thought processes may be related to written expression disabilities (Hain, 2009). Moreover, writing problems noted in the Visual Spatial/Constructional subgroup may be related to visual/spatial deficits.

Psychosocial and Disciplinary Subtype Differences

The aims of this study were to determine the further contribution of emotional and behavioral variables in the description of the cognitive subtypes and to determine if any psychopathology exists among the subgroups. The disciplinary variables were studied to determine if the comorbidity of psychopathology and disciplinary behaviors might characterize juvenile delinquents. In examination of the individual subgroups, it appears that each subgroup had significant issues with varying aspects of psychosocial functioning and psychopathology.

The High functioning/processing subgroup had the highest level of IP, while the Auditory/verbal subgroup had the highest score for EP, suggesting high levels of comorbidity between these variables and cognitive subtypes leading to high levels of psychopathology

(Willcutt & Pennington, 2000a). The Executive working memory group had the highest mean scores for Depression, Atypicality, Withdrawal, suggesting not only social problems, but also difficulties with frontal-subcortical circuits. The combination of lack of social skills, learning difficulties, atypicality and social problems, characterizes a disenfranchised young student with high levels of Internalizing Problems and a considerable history of truancy and arrest.

Even the GCI subgroup had a rich psychopathological profile with the lowest levels of Resiliency and all areas of adaptive functioning to the highest rates of Negative Emotion accompanied by the highest BSI, Somatic Problems and School Problems scores. This subgroup struggles in all areas of cognitive, academic and psychosocial functioning. It is not a surprise that this group scored highest in truant behavior.

In kind, the Auditory/verbal subgroup scored lowest in cognitive and academic areas, and highest in Hyperactivity, Externalizing Problems Learning Problems, Bullying and Executive Functioning, followed by second highest rate of Conduct problems, Somatic Complaints, School Problems and Atypicality. Along with the Crystallized Language subgroup, this is a subgroup most at risk for juvenile behaviors. However, upon closer inspection, this subgroup had slight risk of suspension and arrest, but the lowest levels for truancy. This somewhat contradicts the research by Willcutt and Pennington (2000a) which suggests that lower reading levels accompanied by externalizing behaviors would lead to higher rates of disciplinary behaviors.

The Visual spatial/constructional subgroup was the group which scored highest on Conduct and Emotional self-control with the second highest risk for Aggression, Externalizing Problems, Withdrawal, Social Skills, and Bullying and the second lowest on leadership. This

subgroup was found to have the second highest risk for arrest, followed only by the Crystallized Language subgroup.

The High functioning/processing speed subgroup had the highest levels of Anxiety, IP and Anger Control with the lowest adaptive levels. Of interest, this subgroup scored second highest for Negative Emotion, and Emotional self control and had the second lowest score for Resiliency.

Among all the subgroups, it appears that the Crystallized Language subgroup had an intriguing profile when compared within the BASC-2 Clinical and Content scales. According to Doll (2009), there are only six indicators of mental disorders in children: emotional disturbance, avoidance behaviors, self injurious behaviors, maladaptive peer relationships, impulsive behaviors and defiance to rules and authority. This subgroup appears to have many of these elements. This subgroup scored highest on all three areas under discussion: Aggression, Anger Control and Negative Emotion. Strikingly, this description is accompanied by the lowest level of Anxiety, coupled with the highest adaptive levels of all the subgroups, including Leadership, Developmental Social skills, Adaptive Skills, Functional Communication and Social Skills. This subgroup is characterized by not only the highest levels of Aggression and Negative Emotion and in its ability to control anger, but also by the lowest levels of Anxiety. This subtype appears to have some impairment to the amygdala, which is located in the right hemisphere, as the inability to sense emotion in others and generate it in themselves leaves them immune to remorse and punishment, possibly due to a lack of maternal bonding (Carter & Firth, 2000). Brower & Price (2001) suggested that higher rates of neuropsychiatric abnormalities reported in person with violent and criminal behavior suggest an association between aggressive dyscontrol and brain injury, impacting the prefrontal lobes, more specifically, the orbitofrontal cortex area of the

prefrontal cortex, which is involved in the stabilization of behavior and mood regulation. Further, this subgroup had high Aggression and high Negative Emotion. According to Dolan (1999), those who feel constantly threatened or scared often respond to stimuli in an aggressive fashion. Indeed, it is the development of empathy and guilt that is compromised because aggressive tendencies likely interfere with the ability to feel compassion and remorse (Nigg, 2006). The integration of these components suggests a callous-unempathic type of person, who may be prone to have Anti social personality disorder, or a psychopathic pattern of behavior. This pattern of behavior is predictive of proactive, not reactive, aggression. Such persons do not respond to stimuli in an aggressive manner as through trauma or dysregulation (Frick & Morris, 2004); rather, they deliberately plan aggressive acts, as their insensitivity to punishment and a lack of regard for others' feeling increases the likelihood that their aggressive behaviors will be used for some reward (Frick & Morris, 2004; Nigg, 2000). Thus, it is not surprising that this subgroup was characterized by the highest rates of truancy, suspension and arrests.

According to the National Center for Educational Statistics (2007), there is a growing number of children and adolescents exhibiting aggressive and violent behavior. Children who demonstrate psychological and behavioral problems, even criminal behaviors, at an early age are a concern as these behaviors can affect cognitive and academic functioning and impact later social skills (Bloomquist & Schnell, 2002). The frontal lobes are most responsible for behavior. The three areas affected for violent and aggressive behavior are the prefrontal cortex, the cingulate system and third region housed within the temporal lobe. The prefrontal cortex is crucial for emotional regulation, is the last to fully mature (Granman, 1994) and is responsible for regulation and control of affect. The prefrontal cortex is very susceptible to injury; damage to this area can lead to antisocial and criminal behaviors. The combination of cognitive and

language deficiencies in conjunction with executive functioning problems may lead to deviant acts for three possible reasons: difficulty learning from the environment, poor working memory and poor executive functioning, leads these students to have difficulty adapting to their environment and the lack of verbal abilities causes them to struggle with behavioral self control (Moffitt, 2003).

Bartol and Bartol (2008) posit that professionals need to develop an understanding of the neuropsychological and social developmental risk factors associated with delinquency. Liu, Riane, Venables and Medeck (2004) report that neuropsychological deficits in combination with social family risk factors are often found in persistent, serious, violent offenders though such information was not obtained in this study. The data that was obtained for this study, however, fits with the current literature on juvenile delinquency. In particular, the CL subgroup fits the definition of adolescent boys with reading difficulties and externalizing behaviors who engage in juvenile delinquent behaviors. Aggressive tendencies appear to be regulated by the prefrontal cortex, which is closely connected to the limbic system; the "paralimbic" area is the orbitofrontal cortex. If this area is damaged, or children's experiences are overly negative, these children can become stuck, feel threatened and respond to stimuli in an aggressive fashion (Dolan, 1999).

Though this study attem;pted to establish a link between reading problems and ADHD, a subgroup much like that previously mentioned was identified. It should be understood that it is likely that a majority of the subjects had numerous risk factors, most notably, poverty. The data were from an impoverished urban population. It would be reasonable to assume that this subgroup exists in a negative environment, considering their clinically significant rates of Aggression, Anger Control and Negative Emotion in concert with the frequently reported rates of truancy, suspension and arrests, this subgroup fits most descriptions of a potentially violent

criminal. The consistent rate of disciplinary behaviors suggests that this subgroup is committed to these antisocial acts of behavior. It might be safe to say that members of this subgroup are comfortable with committing these devious acts and may engage in them quite often, leading to the increased risk of being apprehended.

Meaningful significant cognitive subtypes were identified that performed significantly differently across cognitive, academic, emotional-behavioral and disciplinary variables. It became clear from the results that students who struggled with RD had high levels of teacher-rated psychopathology and accompanying disciplinary actions as evidenced by correlation between relatively low reading levels and higher overall psychopathology and disciplinary history in the CL subgroup.

In sum, simply using an FSIQ as a meaningful determinant of eligibility for IDEA services may be an inaccurate gauge of ability and may not provide a true representation of each subgroup's cognitive strengths and weaknesses. It may more accurately reflect a general averaging of skills, potentially resulting in a mediocre or saccharine view of each subgroup that fails to address target areas. Use of the FSIQ to classify children for special education in the schools can result in an inaccurate and possibly harmful categorization of students' cognitive/academic skills. Because so much comorbidity and variability exists, it is only when the true strengths and weaknesses of a student are identified, that the educator can develop and implement pertinent and effective strategies which will address a student's individual needs.

We now know that academically, poor Receptive Vocabulary is an indication of future poor reading, and early behavior problems including aggression towards others can be evident by age 3 (Moffitt, 1990). Thus, close examination of an individual's performance on cognitive subtests while simultaneously examining academic and emotional-behavioral factors can

accurately describe each child's specific cognitive, academic and social-emotional needs. It is only when we obtain a true profile of the student, that we will be able to provide appropriate individual interventions which might then prevent arrests and possible incarceration. Thorough, common sense assessment, which uncovers the strengths and weaknesses of our youth might ultimately provide not only improved chances for academic success but might also provide a safer environment for present and future members of society.

Limitations

This study utilized a small sample of archival data. The data were collected and analyzed only on those students who had recently completed the WISC-IV core battery, the BASC-2 and core aspects of the WJ-III achievement test. Nonetheless, it is anticipated that these findings can be generalized to other educational settings with similar demographics. In addition to the small sample, this study sample was limited to males only; gender was therefore not a factor in the overall assessment.

The WISC-IV was the sole cognitive measure utilized in this study. Though the WISC-IV is widely used and recognized as a cognitive measure, it is only because of vocal opposition to the theory of the WISC-III that Kaplan attempted to align the fourth edition of the WISC with the Cattell-Horn-Carroll (CHC) theory. Still, Keith and colleagues (2006) posit that the WISC-IV is not actually based on any empirical theory of intelligence, and ultimately does not measure what it purports to measure.

Another possible limitation was the use of the BASC-2. The BASC-2 Teacher Rating Scale was the sole indicator of behavior. Even though the Clinical Scales as well as the Content Scales were employed, and Teacher rating scales are considered to be more effective than the

subjective parent ratings (Hale et al., 2002). This was the sole measure of these students' emotional/behavioral functioning.

In the assessment of conduct problems, the CL may not have scored highest on CD, as the range was quite narrow (between 58.67 and 61.79), with the Visual spatial/construction subgroup scoring highest in Conduct Problems.

There was a lack of consistency in data collection for disciplinary behaviors used in the Lakewood school district during the time of study. Truancy was inconsistently reported in each of the schools, and was only reported due to the severity of the truant behavior. Suspensions are not given with any consistency throughout the district. The disciplinary behavior of arrest, however, was obtained from the School Representative for the Ocean County Department of Juvenile Justice. Arrest data were objectively collected and were based upon individuals' criminal record.

Implications and Future Directions

This study attempted to identify those individual students within the Lakewood School District, who had reading problems accompanied by externalizing behaviors and potential involvement with the criminal justice system. However, instead of uncovering the one true subtype espoused by Willcutt and Pennington (2000a,2000b) and others, this study found multiple cognitive subtypes with reading and other academic problems and varying degrees of psychopathic and juvenile behaviors. A high degree of juvenile and psychopathic behaviors was found among all the various subgroups. For example, the visual spatial/constructional subtype did not have the lowest levels of reading, but did report the highest BASC-2 score for Conduct Disorder. Not all of the findings were consistent with previous research.

Nonetheless, an important finding of this study was the isolation of the CL subgroup. This subgroup had the second highest intelligence scores, yet it had individual difficulty with decoding words, long seen as the basis for good reading. In addition, when compared with their other scores, it was only the lower overall VCI score and two subtest scores for Comprehension and Block Design on the cognitive portion and Word Attack in the Achievement portion that suggested any type of cognitive or reading disability. They had the highest rates of truancy, suspension and arrest. In line with our hypothesis and the effective research, this subgroup did appear to show evidence of reading problems and accompanying antisocial behavior, such as Aggressive tendencies. However, this particular subgroup had severe psychopathic tendencies, the severity of which was unlikely considered in previous researchers (Shaywitz, 2007; Willcutt & Pennington, 2008).

Closer inspection of cognitive and achievement deficits at an early age might provide the ability to identify the various cognitive and achievement subtypes and their varying potential for maladaptive and even criminal behavior. In concert with addressing the cognitive and achievement needs of these students, a professional might be able to bridge the gap of the impaired maternal bond that may be responsible for the lack of remorse particularly felt by this subgroup. After all, Maslow (1954) clearly outlined the essential need for love and belonging in his hierarchy of needs pyramid over 60 years ago. Early identification would allow teachers and counselors alike to address the individual cognitive, academic and psychosocial needs of these students so that they can make academic progress and would not feel the need to resort to antisocial and/or criminal behaviors because of feelings of disenfranchisement in their social and educational environment. Thus, future research will need to elaborate on the subtypes identified

in this study and continue to assess brain-behavior comorbidity relationships when determining eligibility for special education and the type and extent of intervention.

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Appendix A
Request for Data Letter

Dear School Psychologist,

We would appreciate your participation in a study entitled, *"Examination of the comorbidity between externalizing disorders and reading disabilities in school-age boys".* This research is being conducted by Victoria Loughman, Psy. D. Candidate, as a partial requirement for the Doctor of Psychology degree, and the principal investigator and supervisor of the research project is Lisa A. Hain, Psy. D.

The purpose of this project is to examine whether subtypes of emotional disorders in school-age boys are comorbid with various types of reading disabilities. The archival data sought includes scores from the Wechsler Intelligence Scale for Children – Fourth Edition (WISC-IV) and the Behavior Assessment System for Children – Second Edition, Teacher Rating Scales (BASC-2 TRS). In addition, achievement scores can derive from any standardized, individually-administered achievement test (i.e., WJ-III, WIAT-2/3, or KTEA-2).

We are asking you to provide raw scores and standard scores/scaled scores of the WISC-IV, the raw scores and standard scores/scaled scores from the test of achievement and the T-scores from the BASC-2 teacher form. As this is an *archival record review*, there will be *no contact* between myself, or Dr. Hain and the child, family, or team members. In fact, we ask you to only report the WISC-IV, BASC-2, achievement scores, age, grade, special education classification, and a brief disciplinary history on the student.

Please do not use the child's name or any identifying information. There is no harm to the students or any involvement of the students needed, and all data will be presented in summative form, with no individual data identified. Although there will be no benefit to the individual child, we will be willing to provide participants with a summary of the results after the study is completed.

We thank you in advance for your attention and possible participation. If you wish to participate, you will be asked to sign an agreement form indicating that you have provided permission for the archival data to be utilized in this study. If you need further assistance or have any questions, please contact either Victoria Loughman at victorialo@pcom.edu or Lisa A. Hain at lisahai@pcom.edu.

_____ _____

Victoria Loughman, M.A., NJCSP Lisa A. Hain, Psy.D., NCSP, ABSNP

Appendix B
School Psychologist Agreement

School Psychologist Name: _____

School: _____

Date: _____

I, _____, hereby allow the use of my archival WISC-IV, standardized achievement, BASC-2 Teacher Rating scores, and the disciplinary information of the student in the research project entitled, *""Examination of the comorbidity between externalizing disorders and reading disabilities in school-age boys*". I understand the archival data will be anonymous and will not be shared with any individual, practitioner, or school. I have obtained school district permission if needed for the release of this data.

Signatures:

_____ Date:
School Psychologist/LDTC

_____ Date:
Director (Supervisor) of Special Education (if needed)

_____ Date:
Superintendent (if needed)

Appendix C
Dissertation: Student Data Collection Workbook

For Student Investigator Purposes Only
Participant Identification Code #:_____
Check if data included in study: (All Criteria Met)
_____Yes _____ No

Date data was removed from student file:_____

Check that each assessment has scores provided in full.
_____ WISC-IV Subtests Scaled Scores, Standard Scores
_____ BASC-2 TRS T-scores
_____ Achievement Measure (Name: _____)

Other Variables: (Please indicate the following for the data file.)
Age: _____ Grade: _____

Classification: (Check all that apply and if classified with multiple disabilities (MD), please check separate classifications.)

Specific Learning Disability	(SLD)	_____
Check all that apply.	Basic Word Reading	_____
	Reading Fluency	_____
	Reading Comprehension	_____
	Math Calculation	_____
	Math Problem Solving	_____
	Written Language	_____
	Oral Expression	_____
	Listening Comprehension	_____
Emotional Disturbance	(ED)	_____
Other Health Impairment	(OHI)	_____

Describe reason for classification: _____
(ex: ADHD or medical reason)

Disciplinary History
(Please fill in any information you have available.)

Risk Factors	Yes	No	Unsure	# Times	Comments
History of truancy					
Grade retention					
Suspensions					
History of arrest					

WISC-IV Scores

Measures	**Raw**	**Scaled/Standard**
Similarities		
Comprehension		
Vocabulary		
Block Design		
Picture Concepts		
Matrix Reasoning		
Digit Span Forward (if computed)		
Digit Span Backward (if computed)		
Digit Span		
Letter-Number Sequencing		
Coding		
Symbol Search		
Verbal Comprehension Index		
Perceptual Reasoning Index		
Working Memory Index		
Processing Speed Index		
Full Scale IQ		

Notes:

Achievement Measure

Check which achievement test scores were obtained from.
WJ-III ____
WIAT-2 ____
WIAT-3 ____
KTEA-2 ____
Other: ____

Area (fill in)	**Raw**	**Standard Score**
Reading		
Math		
Written Language		

BASC-2 Scores

Areas	**Raw Scores**	**T Scores**
Hyperactivity		
Aggression		
Conduct Problems		
Externalizing Problems		
Anxiety		
Depression		
Somatization		
Internalizing Problems		
Attention Problems		
Learning Problems		
School Problems		
Atypicality		
Withdrawal		
Behavioral Symptoms Index		
Adaptability		
Social Skills		
Leadership		
Study Skills		
Functional Communication		
Adaptive Skills		

Notes: