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Attention-Deficit/Hyperactivity Disorder and Academic Performance: Student Engagement in the Classroom

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ATTENTION-DEFICIT/HYPERACTIVITY DISORDER AND ACADEMIC
PERFORMANCE: STUDENT ENGAGEMENT IN THE CLASSROOM

by

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ABSTRACT

Youth with Attention/Deficit-Hyperactivity Disorder (ADHD) have many obstacles to positive development (including difficulties in school settings) and are in need of support. However, few studies have focused on the ways in which positive factors, such as student engagement (SE), may be beneficial for this population to identify strategies for supporting their strengths. Although many studies have examined academic and behavioral aspects of SE, few studies have examined the psychological (i.e., teacher-student relationships, peer support for learning, family support for learning) and cognitive (i.e., control and relevance of school work, future aspirations and goals, extrinsic motivation) sub-components of engagement. The current study fills a gap in this literature by exploring the moderating effects of each area of SE on the relationship between ADHD symptoms and academic performance. Participants included 647 high school students who were identified as having emotional, behavioral, and academic difficulties, from 50 high schools in five states across the United States. Results indicated a significant positive relationship between ADHD symptoms and parent-reported overall impairment. Interestingly, as level of perceived peer-support for learning increased, the number of failing grades a student received also increased. Future directions are discussed, as well as implications for schools and families.

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LIST OF ABBREVIATIONS

ADHD	Attention-Deficit/Hyperactivity Disorder
ADHD-HI	Hyperactivity/Impulsivity
ADHD-I	Inattention
CRSW	Control and Relevance of Schoolwork
DRC	Daily Report Card
DBD	Disruptive Behavior Disorders
EM	Extrinsic Motivation
FSL	Family Support for Learning
FG	Future Aspirations and Goals
PSL	Peer Support for Learning
SE	Student Engagement
SEI	Student Engagement Instrument
TSR	Teacher-Student Relationships

CHAPTER 1

INTRODUCTION: ADHD AND ACADEMIC FUNCTIONING

It is well established that children diagnosed with Attention-Deficit/Hyperactivity Disorder (ADHD) experience difficulties in daily life functioning, including problems in school, along with a number of cognitive, social, and emotional problems that interfere with their school success. Although the majority of research on individuals with ADHD currently focuses on children (Kuriyan et al., 2013), problems associated with ADHD often worsen throughout middle school and high school, as instruction becomes more departmentalized and the organization of the school environment changes (Abramowitz & O'Leary, 1991; Kent et al., 2011). High school presents particular difficulties for these students, with teachers reporting that students with ADHD complete a lower percentage of assignments and obtain more tardies and absences than same age peers. Further, these students are *eight* times more likely to drop out of high school altogether (Kent et al., 2011), which results in greater consequences and costs to society as a whole. In 2007, Pelham, Foster, and Robb conducted a preliminary meta-analysis that conservatively estimated the annual cost of illness for ADHD in childhood and adolescence to be between \$12,005 and \$17,458 per individual and the annual societal cost of illness for ADHD in childhood and adolescence (using a 5% prevalence rate estimate) between \$36 billion and \$52.4 billion (in 2005 dollars).

Given the frequency, severity, and persistence of these problems throughout childhood and adolescence, it is not surprising that individuals with ADHD continue to

experience educational and occupational difficulties into adulthood. For example, they are less likely to pursue education after high school (Barkley, Fischer, Smallish, & Fletcher, 2006) and those who do, complete fewer years of college than comparison groups (Barkley, Murphy, & Fischer, 2008; Mannuzza, Klein, Bessler, Malloy, & Hynes, 1997). Further, adults with ADHD often experience occupational difficulties in adulthood, including job instability, interpersonal difficulties, and lower job status (Barkley, 2006; Barkley, Murphy, & Fischer, 2008; Mannuzza et al., 1993; see review, Murphy & Barkley, 2007).

As ADHD-related difficulties are often closely associated with difficulties in school and poor life outcomes in general, it is crucial to understand how these difficulties impact school functioning, with important implication for early identification and intervention. Understanding how and why youth with ADHD exhibit difficulties that negatively impact school functioning is essential. However, little is known about the complexity of associations between ADHD symptoms (i.e., inattention and hyperactivity/impulsivity) and academic performance.

LIMITS OF ADHD SYMPTOMS PREDICTING IMPAIRMENT

Current treatments for individuals with ADHD were developed based on the premise that core symptoms of ADHD lead to the educational, occupational, and social impairments that these individuals often experience. These treatments aim to reduce symptomology in order to decrease impairment in these areas. Although many of the current available treatments for ADHD have effectively reduced symptoms for individuals (e.g., Abikoff et al., 2004; see review by Hinshaw, Klein, & Abikoff, 2007; MTA Cooperative Group, 1999; Pelham, Carlson, Sams, Vallano, & Dixon, 1993; see reviews by Van der Oord, Prins, Oosterlaan, & Emmelkamp, 2008), research examining

their impact on impairment in educational, occupational, and social settings has had varied results. A review of the literature examining psychopharmacological, psychosocial, and academic treatments follows.

It appears that psychopharmacological treatment is the primary treatment for many individuals with ADHD (Abikoff et al., 2004; Fabiano et al., 2013; Hinshaw, Klein, & Abikoff, 2007; MTA Cooperative Group, 1999; Pelham, et al., 1993; Rowland, Umbach, Stallone, Naftel, Bohlig, & Sandler, 2002; Van der Oord, Prins, Oosterlaan, & Emmelkamp, 2008). Stimulant medication use has been associated with improvements in intelligence scores, sustained attention, memory, and executive functions for many individuals with ADHD (Graziano, Geffken, & Lall, 2011). However, psychopharmacological treatments often fail to impact target behaviors of greatest concern in schools (e.g., academic productivity and accuracy; Rapport, Denney, DuPaul, & Gardner, 1994; Hoffman & DuPaul, 2000). Further, use of stimulant medication alone, has not been associated with long-term improvements (e.g., Langberg & Becker, 2012; Molina et al., 2009; Pelham, 1999). Thus, while in some cases stimulant medication facilitates some aspects of achievement, it does not alter the underlying deficits in cognitive processing that compromise learning (e.g., phonemic awareness, phonological processing related to reading; Miller & Hinshaw, 2012) and is insufficient to address the range of problems these individuals face in an array of areas over time.

In addition to psychopharmacological treatments, individuals with ADHD-related difficulties may be treated through psychosocial interventions, which typically consist of cognitive and/or behavioral approaches (Barkley, 2006). There is some early evidence that cognitive interventions for ADHD (e.g., focusing on changing self-talk, verbal

mediation) are effective in reducing symptoms in subclinical cases (e.g., Kendall & Braswell, 1982). However, Sibley, Kuriyan, Evans, Waxmonsky, and Smith (2014), in a systematic review of the literature on ADHD treatments published from 1999-2014, found no evidence that cognitive enhancement trainings (e.g., working memory training, Electroencephalogram [EEG] Neurofeedback training) improved functioning of adolescents with ADHD. There is more support for psychosocial treatments grounded in learning theory, such as contingency management strategies (e.g., token economy, contingent teacher attention, home-school contingencies), behavioral management training with parents and teachers, and self-management strategies (e.g., homework completion strategies, interventions that target organization), in terms of reducing ADHD symptomatology (e.g., Evans et al., 2009, Langberg, Epstein, Urbanowicz, Simon, & Graham, 2008; Pelham, Wheeler, Trilby, & Chronis, 1998; Pfiffner, Villodas, Kaiswer, Rooney, & McBurnett, 2013; Raggi, Chronis-Tuscano, Fishbein, & Groomes, 2009). In 2009, Fabiano et al. conducted a comprehensive research synthesis of literature on behavioral treatments for ADHD that reviewed all behavior modification treatments and study designs since 1976. The authors analyzed one hundred, seventy-four studies from 114 separate reports with 2094 participations and found a large effect size (as classified by Cohen, 1992) of between group effects from 20 studies approaches the range classified as “large” by Cohen (1992). The weighted effect size of .74 for between-group studies indicates that behavioral interventions implemented at home, school, or peer settings, result in substantial improvement for individuals with ADHD. Sibley et al.’s (2014) review found small to medium improvements in ADHD symptomology ($d's=.34-.49$) and small to large effect sizes for improvement in impairment domains (.31-1.20) in

22 studies that implemented behavioral strategies (published between the years of 1999 and 2014). Combining cognitive and behavioral strategies through use of cognitive/behavioral treatments (e.g., verbal self-instructions, problem-solving strategies, cognitive modeling, self-monitoring, self-evaluation, and self-reinforcement) have also shown to be effective for students with ADHD (Pelham, et al., 1998; Pfiffner, et al., 2013).

Although psychosocial interventions have shown to be effective for some individuals with ADHD, they are not sufficient for all individuals with the disorder (Pelham et al., 1998; Trout, Lienemann, & Epstein, 2007). For instance, children with moderate to severe impairment are unlikely to respond to any one psychosocial intervention when provided individually (Evans, Schultz, & Sadler, 2008), which may make implementing psychosocial treatments more complex and time consuming. Further, research has shown that difficulties often present with obtaining generalization and maintenance for psychosocial interventions (Miller & Hinshaw, 2012; Pelham et al., 1998). Further, methodological limitations are apparent in many of the studies that do exist. For instance, in Fabiano et al.'s literature synthesis of behavioral interventions, the authors found that of the studies published between 1979 and 2009, only 12% conducted randomized, controlled, between-group studies, with many studies employing within-subject and single subject designs. Overall, the limitations described above indicate that psychosocial interventions are insufficient to treat *all* individuals with ADHD and may be impractical given their time requirements and complexity of implementation.

Although studied less frequently (see review by DuPaul and Eckert, 1997), academic interventions that aim to help students develop specific skill-sets (e.g.,

improving organization skills, time management) also help students with ADHD improve academic functioning. For instance, highly structured academic activities such as interventions that target note taking and organizational skills have also been associated with improvements in functioning (Evans, Pelham, & Grudberg, 1995; Langberg, et al., 2008; Smith, Waschbusch, Willoughby, & Evans, 2000). In a sample of 63 outcome studies, DuPaul and Eckert (1997) conducted a meta-analysis, examining the effectiveness of school-based interventions for children and adolescents with ADHD. Positive and significant effect sizes were found across between-subjects ($d=.45$), within-subjects ($d=.64$), and single-subject ($d=1.16$) designs, with contingency management strategies and academic interventions having larger effect sizes than cognitive-behavioral strategies for within –subjects ($d's= .69, .94, \text{ and } .19$, respectively). Despite these improvements, important limitations exist. Efficacy studies for academic interventions with children and adolescents with ADHD are limited. Much of the research that does exist portrays studies that have noteworthy methodological limitations (e.g., non-representative samples, small sample sizes), making it difficult to draw clear conclusions about the effectiveness of these treatments. For instance, there is variability in the extent to which certain interventions, such as the Daily Report Card are implemented as intended, with studies showing that teachers and parents implement these interventions as intended 56%-73% percent of the time (e.g., Owens, Murphy, Richerson, Girio, & Himawan, 2008; Fabiano et al., 2010). Further, in a 2007 meta-analysis, Trout, Lienmann, Reid, and Epstein examined 41 intervention studies published between the years of 1979 and 2002. Results indicated that nearly half of these studies were identified as single-subject designs and important information regarding demographics (e.g.,

participant characteristics) and classroom settings were often poorly defined. Further, many of these studies did not reflect the current population of students with ADHD and most studies did not examine long-term outcomes and maintenance of treatment gains. The authors reported: “There simply were no programmatic research lines focused on academic interventions for children with ADHD. Instead, we found a hodgepodge of studies with no systematic replication and extension (p. 222).” These significant limitations in the literature allow for few conclusions about academic interventions.

Despite the benefits documented in studies examining psychopharmacological, psychosocial, and academic treatments, the current battery of empirically supported treatments is still well below the threshold of providing clinically meaningful and lasting benefits for most children with ADHD (Molina et al., 2009). Given these limitations, it is likely that youth with ADHD experience further difficulties that also contribute to academic impairment. In addition to direct intervention on behaviors and academic skill deficits associated with ADHD (as reviewed above), the literature on protective factors in youth provides potential new directions for innovative interventions. The movement toward positive psychology has been influential in identifying potential protective factors of interest (reviewed next).

AN ALTERNATE TO THE DEFICIT-FOCUSED MODEL OF MENTAL HEALTH

Historically, researchers and practitioners have concentrated primarily on identifying and treating negative outcomes of mental health. Psychologists assess for behavioral deficits and mental disorders, seeking to “repair damage within a disease model of human functioning” (Seligman & Csikszentmihalyi, 2000; p. 5). This deficit-focused or “disease” model of mental health (Suldo, Huebner, Savage, & Thalji, 2010) neglects the factors that contribute to understanding the individual as a whole and

recognizing the factors that allow individuals, families, and communities to flourish (Seligman & Csikszentmihalyi, 2000).

Recognizing the clear missing link of positive indicators in the current psychological research, Seligman, the president of the American Psychological Association at the time, raised a public call for a new, more positive focus in psychology in his 1998 presidential address (Seligman & Koocher, 1999). As opposed to focusing primarily on “psychopathology” (a highly pejorative term), he advocated that research in psychology should be able to help document positive indicators of functioning, such as “what kinds of families result in children who flourish, what work settings support the greatest satisfaction among workers, what policies result in the strongest civic engagement, and how people’s lives can be most worth living” (Seligman & Csikszentmihalyi, 2000; p. 5). As a result of the task force he constructed the following year, the field of *positive psychology* emerged and has been defined as the study of positive emotions, character strengths, and the way in which social institutions can help facilitate positive outcomes such as happiness, positive emotions, and optimistic thinking in human beings (Seligman, Steen, Park, & Peterson, 2005).

Positive psychologists study both mental health and well-being, examining how and why positive emotions and positive character thrives (Seligman et al., 2005). Research findings from a positive psychology framework are intended to supplement—not replace—what is known about human suffering, weakness, and disorder in order to obtain a more comprehensive, balanced, and scientific understanding of human experiences: “the peaks, the valleys, and everything in between” (Seligman et al., 2005; p. 2). In addition to the shift in focus on emotions (or affect) and character, positive

psychology holds a unique perspective on building skills and strength. Compared to more traditional deficit-focused models of mental health, researchers embracing a positive psychology framework adopt a strengths-based approach for assessing and intervening on positive constructs such as engagement, positive emotions, character strengths, and optimal human functioning. In contrast to assessing for behavioral deficits and mental disorders exclusively, positive psychology places a strong emphasis on early assessment and intervention strategies to improve developmental assets and factors such as positive coping skills, goal setting, self-efficacy, and gratitude in children and adolescents (Seligman et al., 2005).

CHAPTER 2

STUDENT ENGAGEMENT

The movement toward positive psychology has been influential in identifying potential protective factors for student success. Studying such positive factors provides a means for both understanding and intervening when early signs of students' disconnection with school and learning are noted. One variable that has received relatively little attention is Student Engagement (SE), or the extent to which students are actively involved in their learning process as well as how connected they feel to their classes and school (Axelson & Flick, 2010). A review of SE follows.

Originating in the 1980s, SE was initially utilized as a way to understand and reduce student alienation, boredom, and drop out (Finn & Zimmer, 2012). At that time two prevailing models emerged as influential foundations for conceptualizing student engagement: Connell and Wellborn's *Self-systems Processes Model* (Connell & Wellborn, 1991) and Finn's *Participation-Identification Model* (1989). In the *Self-systems Processes Model* (Connell & Wellborn, 1991) SE and academic success are fostered in school environments by promoting competence (e.g., well-developed reading skills, problem solving strategies), autonomy (e.g., independent learning), and relatedness (e.g., student-teacher relationships, school connectedness). Finn's *Participation-Identification Model*, encompassing both contextual and intrapersonal viewpoints of SE, serves as a means to understand school dropout and the gradual process by which students disconnect from school. The model explains how participatory behaviors (e.g.,

asking questions, following school rules) and affect (e.g., sense of affiliation, inclusion in the school environment) impact engagement, academic success, and ultimately high school graduation, whereas non-participatory behaviors lead to non-engagement, academic difficulties, and high school dropout (see Finn & Rock, 2007; Finn & Zimmer, 2012). Currently, targeting SE as an intervention is thought of as among the most promising approaches to prevent high school dropout (Reschly & Christenson, 2006).

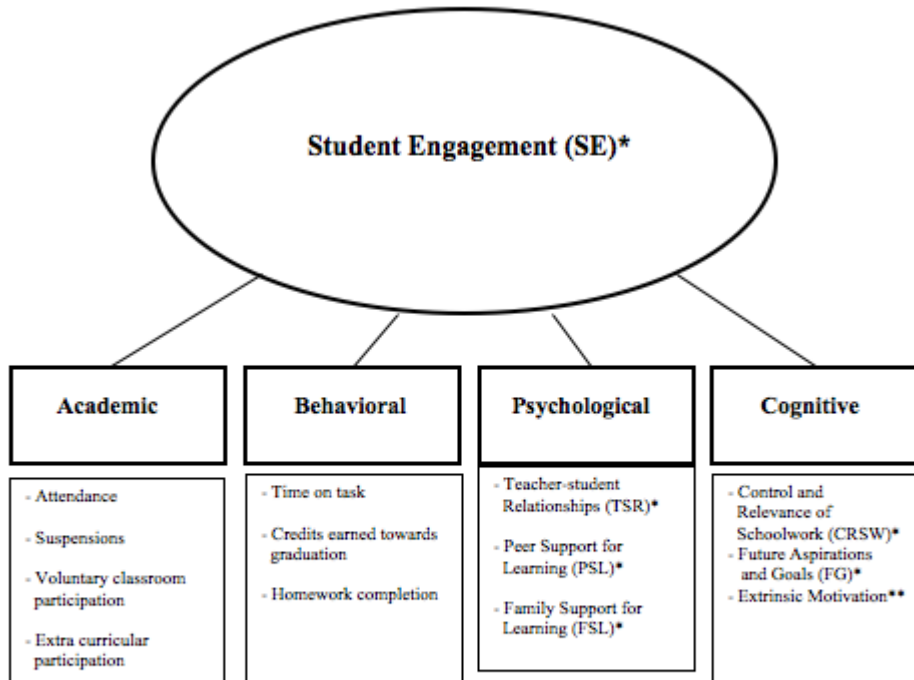
In addition to the promise for preventing high school dropout, SE has been documented as an essential protective factor that promotes positive educational and social outcomes (e.g., O'Farrell & Morrison, 2003; Van Ryzin, 2011). Empirical research has repeatedly confirmed the relationship between SE and academic performance (Finn & Zimmer, 2012), with evidence of the importance of SE accumulating in the areas of achievement, school behavior, and school completion (e.g., Reschly & Christenson, 2006; Klem & Connell, 2004). Further, relationships between SE and academic performance have been observed across all levels of economic and social advantage or disadvantage, which lends additional creditability to SE as a promising construct to target in improving academic performance.

DEFINING SE

Although a consensus has not been reached regarding the operational definition of SE, contemporary models describe it as multi-dimensional (e.g., Appleton et al., 2006; Fredricks, Blumenfeld, & Paris, 2004; Jimerson, Campos, & Grief, 2003; National Research Council and Institute of Medicine, 2004). Appleton and colleagues (2006) conceptualize a four-component model of SE that includes behavioral, academic, psychological, and cognitive engagement (see *Figure 2.1*). *Behavioral Engagement*

includes involvement in academic and extracurricular activities and includes indicators such as attendance, suspensions, voluntary classroom participation, and extra-curricular participation. *Academic Engagement* is conceptualized as time and effort involved in academic tasks (e.g., time on task, percentage of work completion, and number of credits earned toward graduation). *Psychological Engagement* involves the social/emotional aspects of functioning and addresses the student's perceived connection to the school climate and individuals within the school context (e.g., teachers, classmates). It includes indicators such as teacher-student relationships, peer support for learning, and family support for learning. *Cognitive Engagement* is conceptualized as a student's level of investment in learning and includes indicators such as perceived relevance of schoolwork, future aspirations and goals, and extrinsic motivation (Appleton & Lawrenz, 2011; Fredricks et al., 2004).

Although researchers agree on broad definitions of SE, consensus regarding operational definitions for the subtypes has not yet been reached (Reschly & Christenson, 2012). Despite these definitional variations, empirical research shows that behavioral, academic, psychological, and cognitive engagement are positively related to academic outcomes such as state test performance, student achievement, and high school completion (e.g., Finn & Rock, 1997; Fredricks et al., 2004; Sinclair, Christenson, Evelo, & Hurley, 1998). Overall, agreement has been reached that SE is (a) multidimensional, (b) essential for learning, (c) developmental in nature, and (d) malleable (Finn & Zimmer, 2012, as cited by Carter et al., 2012).



*Note: Model obtained from the Student Engagement Instrument (SEI, Appleton et al., 2006),
 * = Subscale used in the current study, ** = Subscale excluded in the analyses of the current study.*

Figure 2.1. *Conceptual Model and Measurement Indicators of Student Engagement.*

CHAPTER 3

COVERT AREAS OF SE: PSYCHOLOGICAL AND COGNITIVE ENGAGEMENT

Since the 1980s, the majority of research examining SE has focused primarily on academic and behavioral engagement, examining more observable indicators such as time on task, behavior referrals, percentage of work completion, and number of credits earned toward graduation. Despite budding evidence importance in school performance, few researchers have examined the more covert areas of SE (e.g., psychological and cognitive engagement). Unfortunately, the few studies that have examined these areas have had significant limitations. For instance, the same scale items have been used to represent different indicators of SE across studies. Further, although there is broad agreement that SE is multidimensional, as above (also see Carter et al., 2012), subtypes of SE are often examined in isolation (see review by Appleton et al., 2006).

The collection of current research examining SE represents a mix of isolated studies examining only one or two indicators of a single subtype, which is contrary to the comprehensive view of SE (see review by Appleton et al., 2006). A review of the literature examining psychological and cognitive engagement, which is the focus of the current study, is presented below. As limited research exists for cognitive engagement (compared to psychological engagement), the information that follows is more comprehensive for psychological engagement.

PSYCHOLOGICAL ENGAGEMENT

Psychological engagement is defined as having feelings of identification or belonging and includes three sub-components: Teacher-student relationships (TSR), peer support for learning (PSL), and family support for learning (FSL; Appleton et al., 2006). Apart from research on scale development and validation studies of the Student Engagement Instrument (SEI; Appleton et al., 2006; Betts et al., 2010; Carter et al., 2012), to the author's knowledge, only one study exists that has examined psychological engagement comprehensively (i.e., examined all three indicators for this domain). Goodenow (1993a) developed a measure of adolescents' perceived belonging or psychological school membership. The scale was administered to students in one predominately white suburban middle school ($n=454$) and two multi-ethnic urban junior high schools ($n=301$). Findings indicated that psychological engagement was associated with adaptive school behaviors, including task persistence, participation, and attendance.

Apart from the above study, no other studies have examined psychological engagement comprehensively. However, several studies have examined a single indicator of psychological engagement in isolation and found significant relationships with school performance. A summary of studies examining individual components of psychological engagement (i.e., TSR, PSL, and FSL) is presented below.

TEACHER-STUDENT RELATIONSHIPS (TSR). TSR, or the relationship a student has with his or her classroom teachers, has been considered a critical determinant of a student's development, functioning, and achievement (Lynch & Cicchetti, 1992; Pianta, 1994; Pianta & Steinberg, 1993; Pianta, Steinberg, & Rollins, 1995; Sroufe & Jacobvitz, 1989). Students who feel connected to and cared for by their teachers report attitudes of

inquiry and enjoyment towards learning, are more motivated to do well in school, and ultimately, have better learning outcomes (Goodenow, 1993b; Lin, Yang, & Lai, 2013; Telli, den Brok, & Cakiroglu, 2010). Further, positive relationships between teachers and students is associated with higher rates of school completion, better academic performance, and lower rates of depression and misconduct in adolescents (Wang, Brinkworth, & Eccles, 2013).

PEER SUPPORT FOR LEARNING (PSL). PSL, or the support an adolescent's peer group provides in relation to learning, has also been associated with school success. Proactive social interventions at school- classroom- and individual-levels have shown to improve a variety of behaviors including attendance, self-esteem, behavior, bullying, emotional support, and collaborative skills (Roffey, Majors, & Tarrant, 1997). For instance, at the classroom-level, adolescents involved in cooperative learning groups achieve higher than those who are not (Bertucci, Johnson, Johnson, & Conte, 2012). Additionally, social competence and peer acceptance have been significantly associated with academic performance (Oberle, 2013; Zorza, Marino, de Lemus, & Mesas, 2013).

FAMILY SUPPORT FOR LEARNING (FSL). FSL, or the involvement and support an adolescent's family provides in their learning and in their school, has shown to improve students' self-determination, motivation, competence, self-regulation, and mastery goal orientation. Family involvement in has also been associated with higher performance on standardized tests (Gonzalez-DeHass, Willems, & Holbien, 2005; Rackensperger, 2012; Rothon, Goodwin, & Stansfeld, 2012). Further, longitudinal studies examining high school transitions have shown that seniors who have high family-school involvement in the twelfth grade have higher work salience two years after graduation (Diemer, 2007).

However, too much or too little family supervision can be detrimental for students. For instance, higher parental surveillance of homework, negative reactions to grades, and over-controlling family styles have been associated with lower academic performance (Ginsburg & Bronstein, 1993).

Overall, positive psychological engagement, including relationships and support from teachers, peers, and family, is associated with a range of positive school outcomes. Although fewer studies examining the cognitive domain of SE exist, this construct has also been associated with positive outcomes for students.

COGNITIVE ENGAGEMENT

Cognitive engagement is defined as a student's level of investment in learning (Appleton & Lawrenz, 2011; Fredricks et al., 2004) and includes three sub-components: Control and relevance of schoolwork (CRSW), future aspirations and goals (FG), and extrinsic motivation (EM). This construct includes being thoughtful or purposeful in one's approach to school tasks and the willingness to exert necessary effort to comprehend complex ideas. To the author's knowledge, no studies exist that have comprehensively examined cognitive engagement (i.e., examined all indicators). However, several studies have examined a single component of cognitive engagement in isolation and have found relationships between these areas and student success. A summary of this research follows.

CONTROL AND RELEVANCE OF SCHOOLWORK (CRSW). CRSW is defined as a student's perception of the relevance and challenge sufficiency of coursework, as well as perceived competence (i.e., the ability to perform a certain task) in school work completion and the ability to appropriately apply learning strategies to comprehend

information (Appleton & Lawrenz, 2011; Fredricks et al., 2004). Research has shown that students' perceptions of the connection between academic tasks and future goals predicts intrinsic and extrinsic value in learning (Miller, DeBacker, & Greene, 1999). Further, self-regulation (i.e., the ability to control, monitor, and regulate actions toward goals) and effortful control (i.e., the ability to regulate one's responses to external stimuli) has shown to predict positive academic performance. For instance, students who report having better self-regulation and effortful control demonstrate better academic performance and social competence (Cho, 2013; Helle, Helle, Laakkonen, Tuijula, & Vermunt, 2013; Zorsza, Marino, de Lemus, & Mesas, 2013).

FUTURE ASPIRATIONS AND GOALS (FG). Multiple studies have shown that FG, or a student's desire to persist toward goals, plays an important role in educational and occupational attainment (Israelashvili, 1997; Sirin, Dimer, Jackson, Gonsalves, & Howell, 2004). Further, personal goal orientation has been associated with investment in learning and cognitive engagement in school (Greene & Miller, 1996; Greene, Miller, Crowson, Duke, & Akey, 2004), which in turn has been associated with higher academic achievement (Miller, Greene, Montalvo, Ravindran, Nichols, 1996).

EXTRINSIC MOTIVATION (EM). Motivation has been documented as a fundamental component of many models of human performance (Campbell & Pritchard, 1976; Mainer, 1955; Pinder, 2011) and a critical issue for academic performance (Hidi & Harackiewicz, 2000) and motivational forces are typically described as either extrinsic or intrinsic (Pinder, 2011). EM refers to behaviors that are motivated by the prospect of instrumental gain and loss (e.g., receipt of incentives), whereas intrinsic motivation refers to behaviors that are motivated by internal factors, such as engaging in a behavior for

their own sake (e.g., task enjoyment; Cerasoli, Nicklin, & Ford, 2014). Although some studies have shown that extrinsic rewards promote quality of performance and student achievement in general (for example see Cerasoli et al., 2014; Emmett & McGee, 2013; McGeown, Norgate, & Warhurst, 2012), this literature review revealed multiple studies documenting the importance of intrinsic motivation over extrinsic motivation in predicting academic success (which is in contrast to Appleton et al.'s model of student engagement 2006). For instance, in a study examining goal-framing among 5th and 6th grade children, extrinsic goal framing (i.e., framing goals in a way that highlighted external rewards) resulted in poor autonomous motivation, conceptual learning, and persistence, compared to intrinsic goal framing, regardless of participants' personal intrinsic or extrinsic goal orientations (Vansteenkiste, Timmermans, Lens, Soenens, & Van den Broeck, 2008). Other studies have shown that EM may negatively influence school outcomes. For instance, another study found that for males, extrinsic goal orientation at the beginning of the year was related to decreased self-efficacy, less use of regulatory and decreased performance at the end of the year (Patrick, Ryan, & Pintrich, 1999).

Overall, this literature review revealed that cognitive engagement, including CRSW and FG, plays an important role in student achievement. Although EM may promote some areas of achievement, this may be at the expense of other important areas of performance.

Given the findings from the above literature review, it is important to move beyond indicators of academic and behavioral engagement in order to gain a comprehensive understanding of the underlying cognitive and psychological needs of

students. Although certain aspects of psychological and cognitive engagement have been associated with positive outcomes for students in general, few studies have examined these factors for students with ADHD-related difficulties. A review of the literature examining SE and ADHD follows.

CHAPTER 4

STUDENT ENGAGEMENT AND ADHD

Few researchers have examined influence that Student Engagement (SE) has on school performance in students with Attention-Deficit/Hyperactivity Disorder (ADHD). No studies have examined SE comprehensively (i.e., examining all indicators of psychological and cognitive engagement). However, several researchers have conducted isolated intervention studies of individual components of psychological engagement (i.e., teacher-student relationships [TSR], peer support for learning [PSL], and family support for learning [FSL]) and cognitive engagement (i.e., control and relevance of school work [CRSW], future aspirations and goals [FG], and extrinsic motivation [EM]) in students with ADHD, which is the focus of this paper. These studies are described below.

PSYCHOLOGICAL ENGAGEMENT AND ADHD

Several intervention studies have documented improvements in school behavior and academic performance through the use of strategies aimed at improving teacher-student relationships (TSR), peer support for learning (PSL), and family support for learning (FSL) for students with ADHD. The results of these studies are reviewed below.

TEACHER-STUDENT RELATIONSHIPS (TSR). Having good relationships with one's teachers has been associated with multiple benefits for children with ADHD and a teacher's approval, appreciation, and respect for a child with ADHD can enhance the teacher-student relationship (Barkley, 2006). Use of certain classroom strategies such as "strategic teacher attention," in which a teacher purposefully uses attention to help

students remain on task and redirect those who are off task have shown to improve relationships between teachers and students as well as impact classroom behavior and academic performance (Barkley, 2006). Additional classroom strategies such as use of praise and other forms of positive attention (e.g., smiling, nodding, patting a child on the back) have shown to be effective in improving classroom behavior (Barkley, 2006). Further, play therapy interventions with teachers and young students with ADHD reduce teacher stress surrounding ADHD behaviors (Ray, 2007).

PEER SUPPORT FOR LEARNING (PSL). In addition to strategies aimed at improving teacher-student relationships, classroom interventions that target increasing peer support have also shown to improve academic outcomes for students with ADHD. Use of group contingencies motivates students to encourage appropriate behavior and discourage misbehavior in their classmates, including students with ADHD (Barkley, 2006). For instance, contingencies that divide students into competing teams, such as the Good Behavior Game (Barrish, Saunders, & Wolf, 1969), in which teams earn or lose points depending on their behavior, has shown to be effective in reducing problematic behavior (Tingstrom, 1994) and improving homework performance (Olympia, Sheridan, Jenson, & Andrews, 1994). Peer tutoring strategies that focus on improving academic skills help to provide a learning environment well-suited to meet the needs of students with ADHD (e.g., provision of immediate feedback, active response to students' mistakes; DuPaul & Stoner, 2003). Studies have shown that class-wide peer tutoring strategies, in which students are trained in rules and procedures for tutoring their peers and awarded points for following the rules, enhance the on-task behavior and academic

performance of unmedicated students with ADHD as well as students without ADHD (DuPaul, Ervin, Hook, & McGoey, 1998; DuPaul & Henningson, 1993).

FAMILY SUPPORT FOR LEARNING (FSL). Interventions that aim to increase family support for learning have also shown to improve academic outcomes for students with ADHD. For instance home-based contingency programs, such as the Daily Report Card (DRC), have been cited as among the most commonly recommended interventions for students with ADHD (Barkley, 2006). Through use of a DRC, the teacher provides feedback to the student and parent about each target behavior and the child's performance on each target is evaluated in relation to goals. Parents review the DRC with the child each day and provide rewards based on the level of success across all target behaviors (Kelley, 1990). The DRC has been shown to be effective for students with ADHD in modifying both academic and behavioral problems (Vannest, Davis, Davis, Mason, & Burke, 2010), as well as improving academic productivity and academic skills (Murray, Rabiner, Schulte, & Newitt, 2008).

Findings from the above literature review suggests that utilizing interventions that target teacher-student relationships, family engagement, and peer support, may be efficacious when aiming to improve academic performance for students with ADHD. Although cognitive engagement has been studied less frequently than psychological engagement for students with ADHD, this construct is also associated with a variety of positive outcomes for students. Research examining cognitive engagement in students with ADHD is described below.

COGNITIVE ENGAGEMENT AND ADHD

Intervention studies have documented improvements in school behavior and academic performance through the use of strategies aimed at improving control and relevance of school work (CRSW), future aspirations and goals (FG), and extrinsic motivation (EM) for students with ADHD. A review of the research examining each component of cognitive engagement in students with ADHD is presented below.

CONTROL AND RELEVANCE OF SCHOOL WORK (CRSW). Recently, interventions involving Electroencephalogram Neurofeedback (EEG-NF) training have been used with individuals with ADHD to increase cognitive control. EEG-NF involves teaching individuals to self-regulate ongoing neuronal oscillations, or the rhythmic or repetitive neural activity in the central nervous system (Gazzaniga, et al., 2009), recorded by the EEG, through operant learning strategies. Multiple researchers have conducted controlled trials using EEG neurofeedback and have found improvement of ADHD symptoms and cognitive functions (e.g., enhanced attention, inhibition, and self-regulatory behavior), compared to control conditions (e.g., Arns et al., 2009; Gevensleben et al., 2009; Heinrich et al., 2007; Monastra et al., 2005).

FUTURE ASPIRATIONS AND GOALS (FG). In addition to interventions aimed at improving control and relevance of schoolwork, several studies have examined the effects of goal-setting on academic performance. Figarola, Gunter, Reffel, Worth, Hummel, and Gerber (2008), with a sample that included three first- and second-grade students with ADHD diagnoses, examined how goal-setting impacts academic accuracy and productivity. Findings indicated that goal-setting was associated with improvements in academic productivity and number of questions answered correctly for two out of three

of the students. In another study, Martin (2012), with a sample of 3,461 Australian youth with ADHD ($n=87$) and without ADHD ($n=3,374$), found significant improvement in academic performance for students who developed personal-best goals (i.e., goals that are specific, challenging, and competitively self-referenced). Interestingly, although both students with- and without-ADHD demonstrated improvements, trends for individuals with ADHD were more pronounced than for those without ADHD. The authors suggest that individuals with ADHD may be more susceptible to improvements in academic performance through the use of goal-setting interventions; however, they note an important limitation in the inequity in sample size for the ADHD and non-ADHD groups.

EXTRINSIC MOTIVATION (EM). Further, researchers have examined extrinsic motivation and its influence on academic performance for students with ADHD. Although EM appears to be less important than intrinsic motivation in community samples (see review of EM above), studies suggest that children with ADHD may be more motivated by extrinsic rewards (e.g., reading a book to receive verbal reinforcement from a teacher) than intrinsic rewards (e.g., reading a book for the enjoying of reading; Carlson, Booth, Shin, & Canu, 2002). Much of the intervention literature surrounding ways to increase motivation and academic performance for students with ADHD recommends the use of extrinsic rewards such as contingent reinforcement (e.g., token economy systems and visual aids that keep track of progress toward established goals; Barkley, 2006). Token reinforcement strategies, such as home-based reinforcement for school behavior (e.g., use of a Daily Report Card [DRC], see description above) and response-cost contingencies have shown to improve behavior and academic performance for students with ADHD. There is ample support for use of DRCs for students with

ADHD, especially in combination with classroom-based behavioral interventions (e.g., response-cost contingencies; Pelham, Hoza, Pillow, Gnagy, Kipp, & Greiner, 2002). The concurrent use of token reinforcement and response cost has been demonstrated to increase the levels of on-task behavior, seatwork productivity, and academic accuracy of children with ADHD (DuPaul, Guevremont, & Barkley, 1992; Rapport, Murphy, & Bailey, 1980, 1982).

The above studies suggest that utilizing interventions that target control and relevance of schoolwork, future aspirations and goal setting, as well as extrinsic motivation, may be efficacious ways to improve academic performance for students with ADHD. Overall, findings suggest that limited research has comprehensively examined SE as a potential moderator of academic outcomes, particularly for individuals with ADHD. Research that has examined the effects of SE on individuals with ADHD suggests that at least some aspects of SE are malleable and can be altered through intervention efforts. Engagement provides a means for both understanding and intervening when early signs of students' disconnection with school and learning are noted. It calls for a focus on alterable variables to help increase school completion rates and to reform high school experiences to help foster students' achievement motivation. It is important to examine different aspects of SE in order to determine which areas should be targeted when developing interventions for these students.

RATIONALE FOR THE CURRENT STUDY

Youth with ADHD have many obstacles to positive development (including difficulties in school settings) and are in need of support. However, few studies have focused on the ways in which positive factors, such as SE, may be beneficial for this

population to identify strategies for supporting these students' strengths. Although many studies have examined academic and behavioral aspects of SE, few studies have examined the psychological and cognitive sub-components of engagement. There is some support for certain aspects of SE that impact academic functioning for students with ADHD. However, no studies have examined psychological engagement (i.e., TSR, PSL, and FSL) and cognitive engagement (i.e., CRSW, FG, and EM) comprehensively for students with ADHD.

The current study fills a gap in this literature by exploring the moderating effects of SE on the relationship between ADHD symptoms and academic performance. Understanding this relationship is crucial for being able to better understand for whom there is a negative impact of ADHD symptoms on academic impairment and to help researchers and interventionists to systematically target aspects of SE that are responsive to changes in school and teacher practices. Data for the study were obtained from the Center for Adolescent Research in Schools (CARS) study, a multi-site randomized controlled trial across fifty high schools in five states, exploring the impact of student- and classroom-level supports on student emotional/behavioral and academic functioning.¹ The current study explores the impact that psychological engagement (i.e., Teacher-Student Relationships [TSR], Peer Support for Learning [PSL], and Family Support for Learning [FSL]) and cognitive engagement (i.e., Future Aspirations and Goals [FG], Control and Relevance of School Work [CRSW], and Extrinsic Motivation [EM]) have on the interrelationship of ADHD behaviors (i.e., inattention [ADHD-I] and

¹ Data of the larger CARS study included a battery of psychosocial assessments of student functioning in school, social, and family contexts, completed by students, parents and teachers across five data points over two years. Parent interviews were also conducted, which examined current and previous experience with services. The procedures and measures described here is limited to the measures used in the current study.

hyperactivity/impulsivity [ADHD-HI]) and five areas of academic performance: (1) math performance, (2) reading performance, (3) overall impairment reported by parents, (4) failing grades, and (5) behavior problems. For the purposes of this study, only data were used from the first wave of assessments, collected in the fall of 2011, prior to the implementation of interventions. It is possible that SE may buffer the impact of ADHD behaviors on students' academic performance; however, little is known about the different dimensions of SE and how they impact the relationship between ADHD symptoms and academic performance.

Empirical research has repeatedly confirmed the relationship between SE and academic performance (see review above) and there is some support for SE as an important factor in classroom interventions for students with ADHD. However, few studies have examined *multiple* sub-components of SE for this group of students. This underscores the importance of determining how each area of SE impacts academic impairment and may mitigate the effect of ADHD symptoms on academic performance. If SE significantly contributes to the academic functioning of youth with high levels of ADHD behaviors, new intervention and/or prevention efforts that focus on increasing certain areas of SE within the individual or manipulating contextual factors within the school environment may be developed, which may help to improve outcomes for these students.

CHAPTER 5

METHOD

PARTICIPANTS

Data collection took place prior to or at the beginning of fall of 2011. Demographic and descriptive variables are summarized in *Table 5.1*. Participants included 647 male (64.1%) and female (32.8%) students in the eighth (6.3%), ninth (44.8%), tenth (42.8%), and eleventh (4.6%) grades (1.4% of students did not identify their grade level), who were enrolled in 50 high schools spanning five states in the Midwestern, Northeastern, and Southeastern regions of the United States. The majority of students identified as White/Caucasian (50.4%), followed by Black/African American (37.6%) and the remaining 9% identified as “other,” or did not identify their ethnicity (3.1%). Most participants were male (66.5%) and, according to parent report, had not received special education services (53.3%). According to parent report, 68.9% of students received free or reduced lunch at school and 35.1% reported a total household income as less than \$20,000 per year. The majority of mothers or female guardians identified their highest level of education as falling between one and three years of college (31.5%), followed by high school graduate (30.8%). Although highest level of education was not identified for 41.3% of fathers (or male guardians), the majority of those who responded to this item reported highest level of father education as high school graduate (25.8%), followed by one to three years of college education (13.9%).

Collectively, the sample had an average IQ of 91 ($SD= 11.4$; range=70-140), based on scores from a standardized and norm-based intelligence test (e.g., Stanford-Binet, Wechsler Intelligence Scale for Children, Woodcock-Johnson Tests of Cognitive Abilities, or Wechsler Abbreviated Scale of Intelligence) and according to parent report, 30.9% of students had been previously identified as having a learning disability. All students were identified by school personnel as students with emotional and/or behavioral concerns, who may be at-risk for high school dropout, and according to parent report, most of the sample had previously received a diagnosis of an emotional or behavioral problem, including ADHD (46.7%), Depression (27.7%), Anxiety (24.9%), Bipolar Disorder (9.7%), or another mental health problem (7.4%). Parents reported that 43.4% of students ($n=271$) were currently taking psychopharmacological medication to address emotional or behavioral problems and 77.1% ($n=209$) of those who were taking medication (and 32.6% of the entire sample) reported taking this medication to address difficulties related to ADHD.

As mentioned, all participants for the current study were enrolled in a larger, national research study by the Center for Adolescent Research in Schools (CARS), a five-year study funded by the Department of Education that examined the efficacy of implementing academic, social, emotional, and behavioral interventions to students who were at-risk for high school dropout. Using a randomized-controlled trial (RCT) design, CARS implemented and evaluated a consultation model for supporting school personnel through the process of implementing empirically-based interventions to provide support for these students (e.g., identification of students, initial assessment, and problem diagnosis, selection of intervention, implementation of intervention, progress monitoring,

and evaluation of intervention outcomes). Data used in the current study are from CARS students who were recruited and determined eligible for participation based on the initial assessment, prior to this intervention phase of the project. Thus, this sample reflects 647 at-risk students who had not yet received interventions through the CARS project.

PROCEDURE

During the initial recruitment process, which occurred during the 2010-2011 school year (the year prior to data collection), teachers, administrators, and other school personnel were asked to identify up to 20 students at each of the 50 participating schools, using the following inclusion criteria to guide referrals:

1. Students must currently be in 8th, 9th, 10th, or 11th grade (during 2010-2011 school year) and must plan to attend one of the participating high schools in the fall of 2011.
2. Students must have social, emotional, or behavioral problems, as indicated by parent reports on a broad band rating scale or student self-report on measures of anxiety and depression.
3. Students must demonstrate impairment at school as indicated by at least one of the following:
 - a. Absences other than illness and/or tardies: Combined total of five or more in any month during the current semester.
 - b. Office Referrals/Behavioral Infractions: Four or more over the course of a single semester.
 - c. In school suspensions (ISS) or out of school suspensions (OSS): Two or more in the current academic year.

- d. Failing classes: One or more Fs or two or more Ds in any core academic subject, in one of the two most recent grading periods.
4. Students diagnosed with a Pervasive Developmental Disorder (e.g., Autism, Aspergers) or Mental Handicap (e.g., Intellectual Disability) are not eligible to participate.
5. Students' cognitive ability must be in the average range (IQ equal to or greater than 75).
6. Student and at least one parent/guardian must speak English fluently.
7. Students may be receiving special education services or may be in general education.

School personnel were then directed to contact parents or guardians of identified students to obtain permission for the CARS staff to initiate contact via phone (e.g., make phone calls to parents/guardians or send a permission slips home with the student). Students that failed to return permission slips within a week were offered a \$5 gift card as an incentive. Reinforcement was based upon return of the form, not on whether or not permission was granted to for CARS staff to initiate contact. Parents who provided permission were then contacted by CARS staff who explained the project and asked if the parent/guardian would be interested in scheduling a meeting to discuss involvement in the project further. Initial meetings were held at the high school, university, in the student's home, or at another neutral location (e.g., restaurant or public library) determined by convenience for the family and lasted about 15 minutes.

During the initial meeting, goals and procedures of the project were described to the parent(s) and the student, along with the risks and benefits of participation, including

monetary compensation. Informed consent was obtained from the parent/guardian and assent was obtained from the student. After consent/assent was granted, many families chose to complete the initial surveys during the same meeting, which took about two hours to complete. Surveys included a battery of psychosocial assessments of student functioning in school, social, and family contexts, as well as interviews about previous experience with services. Parents and students each received a \$50 incentive for completion of the surveys. Surveys that were not completed during the initial meeting were administered to students and their parents/guardians either before or during the fall semester of 2011 in their home, school, or another agreed upon location.

Participants also provided consent for CARS staff to gather data from the school to capture additional demographic information as well as indicators of school functioning and academic performance (e.g., Intelligence Quotient [IQ] score, number of behavior referrals, number of courses in which a student was receiving a failing grade, and attendance data) in order to determine eligibility based on study criteria listed above. Information regarding attendance and course grades was collected from the school. In addition, IQ scores for students were obtained from the school. Students who did not have an IQ score on file were administered the Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 2011) by staff trained in assessment administration.

As stated above, the study involved a multisite RCT, with sites in five states (Kansas, Missouri, Ohio, Pennsylvania, and South Carolina), and each site was affiliated with a university. Institutional review board approval was obtained at each site from the university and from collaborating school districts. The study adhered to all ethical

principles of research using human subjects. Prior to data analysis, respondents were assigned numbers only, excluding any identifying information.

MEASURES

DEMOGRAPHICS AND OTHER DESCRIPTIVE VARIABLES. General demographic information was collected from parents/guardians (e.g., gender, age, grade, ethnicity, free/reduced lunch status, medication status [i.e., a dichotomous variable that depicted whether or not a student was currently taking medication to address ADHD-related difficulties]). Intellectual Quotient (IQ; used as a covariate in this study) was also obtained for students who had a valid IQ score on file in school records (i.e., they had been administered a standardized and norm-based intelligence test for a psychoeducational evaluation within the past three years [e.g., Stanford-Binet Intelligence Scales, Wechsler Intelligence Scale for Children, Woodcock-Johnson: Tests of Cognitive Abilities, or Wechsler Abbreviated Scale of Intelligence]). Those who did not have a valid IQ score on file were administered the Wechsler Abbreviated Scale of Intelligence: Second Edition (WASI-II; Wechsler, 2011).

ADHD BEHAVIORS AND CONDUCT PROBLEMS. The Disruptive Behaviors Disorders (DBD) scale, parent version (Pelham, Evans, Gnagy, & Greenslade, 1992) was used to measure ADHD behaviors (i.e., inattention [ADHD-I] and hyperactivity/impulsivity [ADHD-HI]). The DBD is composed of 36 items from the *Diagnostic and Statistical Manual of Mental Disorders – 4th Edition, Text Revision* (DSM-IV-TR; 2000) that reflect diagnostic criteria for ADHD (18 items), Oppositional Defiant Disorder (ODD; eight items), and Conduct Disorder (CD; 15 items). Items were originally written to duplicate *DSM-III-R* criteria (1987). Each item is rated on a 4-point

Likert scale (0= *not at all*, 1= *just a little*, 2= *pretty much*, 3= *very much*). The DBD has yielded reliable internal consistency for ADHD, ODD, and CD (α 's = .81, .76, and .82, respectively; Pelham, Fabiano, & Massetti, 1992). In the current study, the two subscales of the ADHD construct (i.e., ADHD-I and ADHD-HI) were examined separately, as previous literature has indicated that although these two symptoms are related, they represent distinct constructs (α =.55, reported by Van Eck, Finney, & Evans, 2010). For the current study, total scores from ADHD-I and ADHD-HI subscales were totaled to create two, separate continuous variables. In the current sample, the measure yielded acceptable internal consistency for ADHD-I (α = .76) and ADHD-HI (α = .67).

As ODD and CD are often disorders that are comorbid with ADHD (Barkley, 2006; The MTA Cooperative Group, 1999, Wilens et al., 2002), individuals with symptoms related to ODD and CD often score lower on indicators of academic achievement, compared to youth without these symptoms (Greene, Beszterczey, Katzenstein, Park, & Goring, 2002; Kuhne, Schachar, & Tannock, 1997), which could potentially confound the link between ADHD symptoms and these constructs. Thus, a single variable measuring *Conduct Problems* (CP; i.e., total scores for ODD and CD, combined to create one continuous variable) was included as a covariate in the model. The CP variable also yielded acceptable internal consistency in the current study (α =.86).

STUDENT ENGAGEMENT (SE). The Student Engagement Instrument (SEI; Appleton et al., 2006) was used to measure students' perceptions of student engagement. The SEI is a 35-item measure, designed for use with middle and high school, examines self-reported engagement from the perspective of the student. Theoretically based on Appleton colleagues' (e.g., Appleton et al., 2006; Christenson et al., 2008) four-part

typology of engagement (including academic, behavioral, psychological, and cognitive engagement), the SEI is designed to evaluate the more covert areas of engagement: psychological and cognitive. The SEI measures six subtypes of SE: Teacher-Student Relationships (TSR; nine items), Peer Support for Learning (PSL; six items), Family Support for Learning (FSL; four items), Control and Relevance of School Work (CRSW; nine items), Future Aspirations and Goals (FG; five items), and Extrinsic Motivation (EM; two items). Items are rated on a 4-point Likert rating scale (1 = *strongly agree*, 2 = *agree*, 3 = *disagree*, and 4 = *strongly disagree*), with higher scores indicating higher levels of engagement. Items for the SEI were created or adapted from the results of an extensive literature review and items were refined via focus groups with diverse sample of students (as outlined by Appleton et al., 2006). Multiple studies have examined the psychometric properties of the SEI (e.g., Appleton et al., 2006; Betts, Appleton, Reschly, Christenson, & Huebner, 2010; Carter, Lovelace, Appleton, & Thompson, 2012; Lovelace, Reschly, Appleton, & Lutz, 2012; Spanjers, 2007) and use of the SEI is widespread in districts across the United States (Reschly, Betts, & Appleton, 2012), which suggests there is growing evidence to support the utility of this instrument.

Although the original SEI consisted of six distinct factors (Appleton et al., 2006) the current study was designed to be consistent with follow-up validation research on the instrument conducted by Betts et al. (2010), who raised questions about the viability of the sixth factor (EM), because it consisted of only two items that were both reverse scored. Scale development research has suggested that scales with too few items may lack content and construct validity, internal consistency, and test-retest reliability (Kenny, 1979; Nunnally, 1976) and at least three items are needed to obtain adequate internal

consistency reliabilities (Cook, Hepworth, Wall, & Warr, 1981). In line with Betts et al.'s (2010) recommendation to remove the two items that comprised the sixth factor, the sixth factor (EM) was removed from the instrument and was not a part of the present study. This is consistent with previous literature that has also used a five-factor model to examine SE using the SEI (e.g., Carter et al., 2012). Previous research on the SEI has yielded good internal consistency estimates for the five SE subtypes (TSR=.88; PSR=.82; FSR=.76; CRSW=.80, and FG=.78) and there is support for the validity of scores with a wide range of intended outcomes related to SE (Appleton et al., 2006; Spanjers, Burns, & Wagner, 2008). In the current study, items from each subscale were summed to create a total score for each of the five domains. Scores were used separately in the model, in order to examine the unique influence of each domain of SE. In the current sample, internal consistency was acceptable for the following subscales: teacher-student relationships ($\alpha=.85$), family support for learning ($\alpha=.85$), control and relevance of school work ($\alpha=.68$), and future aspirations and goals ($\alpha=.77$). However, internal consistency for peer support for learning was poor ($\alpha=.51$). The five SEI subscales were not consistently relative to one another (intraclass correlation coefficient=.38), indicating independence of data.

MATH AND READING PERFORMANCE. The Woodcock-Johnson Tests of Achievement – Third Edition (WJ-III ACH; Woodcock, McGrew, & Mather, 2001) was used to measure math performance and reading performance in the current study. The WJ-III ACH assesses specific areas of achievement for individuals two through 90 or more years of age. The measure is psychometrically sound, based on long standing research, and is linked to other achievement assessments: Wechsler Individual

Achievement Test, 3rd Edition (WIAT-III; Wechsler, 2009), Kaufman Test of Educational Achievement, 2nd Edition (KTEA-II; Kaufman & Kaufman, 2004), and Woodcock-Johnson Tests of Achievement – Revised (WJ-R ACH, 1989) as reported by Woodcock et al. (2001). The WJ-III ACH (standard battery) contains academic clusters for Broad Reading (subtests: Letter-word Identification, Reading Fluency, and Passage Comprehension), Broad Math (Calculation, Math Fluency, and Applied Problems), and Broad Written Language (Spelling, Writing Fluency, and Writing Samples). Basal (i.e., at least six correct responses) and ceiling (i.e., at least six incorrect responses) cut-off points determine starting and ending points of the test. Scores are reported in standard scores ($M=100$, $SD=15$) and indicate how a student performed in relation to peers in a norm-sample. Adequate reliability has been established for all three clusters across all age groups. For example, for individuals aged 14-19 years, reliability estimates range from .92 to .96 for Broad Reading, .94 to .96 for Broad Math, and .91 to .94 for Broad Written Language (Woodcock, McGrew, & Mather, 2001). The Broad Reading cluster is significantly correlated with the WIAT-III ($\alpha=.67$) and KTEA-II ($\alpha=.76$) total Reading composite scores and the Broad Math cluster is correlated with the WIAT-III and KTEA-II math composite scores (α 's=.70 and .66, respectively; Woodcock, McGrew, & Mather, 2001).

In the current study, the WJ-III ACH was administered by CARS staff, who received assessment-specific training. Subtest scores from reading (i.e., Letter-word Identification, Reading Fluency, and Passage Comprehension) and math (i.e., Calculation, Math Fluency, and Applied Problems) components of the test were averaged to create two variables: Reading Performance and Math Performance. The current

sample yielded acceptable reliability for Reading Performance ($\alpha=.82$) and Math Performance ($\alpha=.86$).

OVERALL IMPAIRMENT. Overall Impairment was assessed by the Impairment Rating Scale (IRS), parent version (Fabiano et al., 2006). The IRS is a 10-item measure that assesses parent perception of the severity of a student's behavior across a variety of domains, as well as a student's overall need for treatment and special services. The rater is asked to assess the severity of a child's problem in each of seven domains (i.e., relationship with peers, relationship with siblings, relationship with parents, academic progress, self-esteem, influence on family functioning, and overall impairment) by placing an "X" on a line that signifies the child's placement on a continuum of impairment. Under each domain rating is also a section for the rater to describe his or her view of the child's functioning in a narrative. Only the quantitative ratings on each of the seven domains were utilized for the current study. For scoring the IRS, the line is divided into seven equally spaced segments, and the segment where the X was placed constitutes the score between 0 (*no problem; definitely does not need treatment or special services*) and 6 (*extreme problem; definitely needs treatment or special services*). The IRS yielded acceptable internal consistency ($\alpha=.75$) in the current study.

FAILING GRADES AND BEHAVIOR REFERRALS. Two additional measures of school performance were included in the current study. The Failing Grades variable reflects the total number of final course grades a student received in core academic classes (e.g., Science, Math, English, History) that were failing (i.e., total average was below 70 percent) during the two most recent grading periods. The Behavior Referrals

variable reflects the sum of number of referrals (i.e., in-school suspensions, out-of-school suspensions, and office referrals) a student received over the previous academic year.

DATA ANALYTIC STRATEGY

This study was guided by three primary research questions: (1) As severity of symptoms related to ADHD (i.e., inattention [ADHD-I] and hyperactivity/impulsivity [ADHD-HI]) increase, does academic performance (i.e., Math Performance, Reading Performance, Overall Impairment, Failing Grades, and Behavior Problems) worsen for youth?; (2) As SE (i.e., teacher-student relationships [TSL], peer support for learning [PSL], family support for learning [FSL], control and relevance of school work [CRSW], and future aspirations and goals [FG]) increases, does academic performance improve for youth?; (3) Does increased SE (in any of the six areas of SE) moderate the relationship between ADHD behaviors and academic performance?

Multiple Regression was used to answer the research questions and examine the following hypotheses:

- (1) Both ADHD-I and ADHD-HI symptoms were expected to have a negative linear relationship to Math Performance and Reading Performance, while ADHD-I and ADHD-HI were expected to have a positive linear relationship to Overall Impairment, Failing Grades, and Behavior Problems.
- (2) The main effects of each of the variables representing SE were expected to have a positive linear relationship with Math Performance and Reading Performance, while each of the SE variables were expected to have a negative linear relationship to Overall Impairment, Failing Grades, and Behavior Problems.

(3) SE was expected to have a significant moderating effect that mitigates the relationship between ADHD symptoms and academic performance. As research regarding relationships within the specific areas of SE is exploratory, specific predictions were not denoted, regarding which specific subscales will be related or not related. However, it was expected that in general, for students scoring higher in the domains of ADHD-I and ADHD-HI, the effects of academic performance would be less severe for those who have higher levels of SE. Similarly, for students scoring higher in the domains of ADHD-I and ADHD-HI, the effects of academic performance were expected to become more severe for those with lower SE.

In order to gain a better understanding of the sample and to examine the assumptions of regression, descriptive analyses (e.g., means, standard deviations, histograms, skewness, kurtosis) were computed for each of the predictor variables (ADHD-I, ADHD-HI, TSR, PSL, FSL, CRSW, and FG). The six assumptions of regression were examined for each variable:

- (1) Independence of errors (residuals) was assessed by examining the Durbin-Watson statistic.
- (2) Linear relationship between the predictor variables and dependent variables was assessed by plotting the studentized residuals against the (unstandardized) predicted values. Partial regression plots between each independent variable and dependent variable were also created to examine this assumption.

- (3) Homoscedasticity of residuals (equal error variances) was assessed by examining the scatter plot of studentized residuals and (unstandardized) predicted values.
- (4) Absence of multicollinearity was examined by inspecting bi-variate correlation coefficients, as well as the Tolerance/VIF values.
- (5) Absence of significant outliers, leverage, and influential points was examined by inspecting each case's standardized residual as well as the studentized deleted residual. Cases that were greater than 3+/- standard deviations were considered "outliers" and were deleted from the dataset. Absence of leverage points was examined by assessing the leverage values in each of the models. Cases that exhibited high leverage (i.e., values of 0.5 and above) were removed from the dataset. Influential points were examined by assessing Cook's Distance Values in each of the models. Any values above one were investigated.
- (6) Normal distribution of errors (residuals) was examined by inspection of histograms with a superimposed normal curve, P-P Plots, Normal Q-Q Plots of the studentized residuals. Skewness and kurtosis values were also computed and examined.

A correlation matrix was used to examine the relationship between all variables, including variables suspected to have an impact on the outcome. Covariates included IQ score, ethnicity, free-reduced lunch status, medication status, and conduct problems. As ADHD-I and ADHD-HI were strongly related ($r=0.69$), according to Spearman's (1904)

rank correlations, the ADHD-I and ADHD-HI variables were summed to create a single ADHD variable.

As recommended by Baron and Kenny (1986), a three-step procedure for measuring and testing moderational hypotheses was used to examine if the relation between ADHD and academic performance changes as a function of SE. The procedure is described below:

- (1) The first step examined the relationship between the first predictor (i.e., ADHD) and the five academic performance (outcome) variables (i.e., [1] math performance, [2] reading performance, [4] overall impairment, [4] failing grades, and [5] behavior problems).
- (2) The second step examined the relationship between the second set of predictors, which included all five SE variables (i.e., [1] TSR, [2] PSL, [3] FSL, [4] CRSW, and [5] FG) and the five academic performance (outcome) variables.
- (3) In the third step of the analysis, the moderating effects of each of the five SE predictor variables were examined separately to investigate the unique impact that each area of SE has on the relationship between ADHD and academic performance. In order to examine this, interaction terms were be created by using the following steps:
 - a. Variables were centered to reduce the collinearity between the main effects and the interaction term, as well as to aid in interpretation of the coefficients on the predictor variables (DeCoster & Claypool, 2004). To center the variables, the mean of

each independent variable will be subtracted from each participant's score on that variable.

- b. The interaction term was constructed from the centered variables by multiplying them together (i.e., ADHD*TSR, ADHD*PSL, ADHD*FSL, ADHD*CRSW, and ADHD*FG).

The model itself was then tested using the centered main effects and the constructed interaction term. Differences in the impact of the unique dimensions of SE were then examined in order to understand associations between ADHD behaviors and academic performance, examining each potential moderator separately.

Models were run separately for each dependent variable (i.e., five models) and all predictor variables were included in the same model in order to gain an understanding of the unique influence of each predictor variable on each outcome variable. To counteract the problem of making multiple comparisons and to reduce the likelihood of making a Type I error, alpha levels were adjusted to .0009, using a Bonferroni correction. An a-priori power analysis using *G*Power 3* (Faul, Erdfelder, Buchner, & Lang, 2009) for linear multiple regression with fixed group differences indicated adequate power to detect medium effects for all five proposed models (see *Table 5.2*)

Table 5.1. Demographic and descriptive variables for participants (N=647).

	<i>n</i>	%
<i>Gender</i>	--	--
Male	415	64.1
Female	212	32.8
<i>Grade</i>	--	--
8	41	6.3
9	290	44.8
10	277	42.8
11	30	4.6
<i>Ethnicity</i>	--	--
Caucasian	326	50.4
African American	243	37.6
Other	58	9.0
<i>Special Education Classification*</i>	281	43.4
<i>Receipt of Free or Reduced Lunch*</i>	446	68.9
<i>Annual Household Income*</i>	--	--
\$0 to \$20,000	227	35.1
\$20,001 to \$40,000	200	30.9
\$40,001 to \$60,000	95	15.4
\$60,001 +	95	15.4
<i>Highest Level of Maternal Education</i>	--	--
4 year college or university education or higher	88	11.6
1-3 years of college	204	31.5
High school graduate	199	30.8
Some high school education	95	14.7
Completed less than eight years of school	12	1.8
<i>Highest Level of Paternal Education</i>	--	--
4 year college or university education or higher	47	7.2
1-3 years of college	90	13.9
High school graduate	167	25.8
Some high school education	70	10.8
Completed less than eight years of school	6	0.9
<i>Mental Health Diagnoses*</i>	--	--
ADHD/ADD	302	46.7
Bipolar Disorder	63	9.7
Depression	179	27.7
Anxiety	161	25.9
Other Mental Health Problem	48	7.4
<i>Medication Status*</i>	--	--
Emotional/Behavioral Medication**	271	43.1
ADHD Medication***	209	32.6

Note: * = Variable reported by parent or legal guardian. **= Currently taking medication to address any emotional or behavioral difficulties (including ADHD), *** = Currently taking medication to address ADHD related difficulties.

Table 5.2. A-priori power estimates from G*Power for effect sizes of .02, .08, and .15.

	N	Main Effects			Interaction		
		.02	.08	.15	.02	.08	.15
Math Performance	402	.09	.90	.99	.05	.80	.99
Reading Performance	383	.08	.88	.99	.05	.70	.99
Overall Impairment	470	.14	.96	.99	.89	.97	.99
Failing Grades	520	.17	.98	.99	.10	.94	.99
Behavior Problems	440	.12	.94	.99	.06	.95	.99

Note: $\alpha = .0009$

CHAPTER 6

RESULTS

Descriptive statistics for study variables and correlations are presented first. *Table 6.1* shows the levels of cognitive and psychological engagement for this sample of high school students. Correlations among all study variables are described next and can be found in *Table 6.2*. The results of the tests used to examine the assumptions of regression are then presented (*Tables 6.3* and *6.4*). Finally, the results of the regression models are described.

DESCRIPTIVE STATISTICS FOR STUDY VARIABLES

Cut-off scores were created to aid in interpretation of the descriptive statistics. Cut-off scores allowed for understanding of high and low level of symptomology across variables. According to parent report, the average number of ADHD symptoms was 29 ($SD=16$), as measured by the DBD, with 55% ($n=353$) of students reporting high levels of ADHD symptoms.

The majority of students reported low levels of psychological engagement. For instance, 62% ($n = 397$) of students reported low levels of TSR and 81% ($n = 519$) reported low levels of FSL. However, only 31% ($n=198$) of students reported low levels of PSL. Results for cognitive engagement differed across the two subscales. Seventy-six percent of students ($n = 486$) reported low levels of CRSW, whereas only 24% ($n = 152$) of students reported low levels of FG.

On average, students had low levels of academic performance, with 52% ($n=251$) of students demonstrating low levels of Math Performance and 60% ($n=271$) demonstrating low levels of Reading Performance. Students also demonstrated high levels of impairment, according to parent report, with 58% ($n=235$) of parents reporting high levels of Overall Impairment. School record data indicated that the students had an average of four ($SD=3$) failing grades and 12 ($SD=13$) behavior problems (i.e., a total of behavior referrals, in-school suspensions and out-of-school suspensions) in the past year.

CORRELATIONS AMONG STUDY VARIABLES

Several areas of SE were significantly associated with one another (seen in *Table 6.2*). All indicators of lower psychological engagement were significantly associated with lower cognitive engagement such that poor psychological engagement in TSR was associated with poor CRSW ($r=.59, p<.05$) and lower FG ($r=.39, p<.05$). Poor psychological engagement in PSL was associated with poor CRSW ($r=.34, p<.05$). Finally, poor psychological engagement in FSL was significantly associated with poor CRSW ($r=.49, p<.05$).

There were also several predictor variables that were correlated with the academic outcome variables. The variables with the highest correlation were ADHD and Overall Impairment ($r=.40; p<.05$). ADHD was also significantly correlated with Reading Performance ($r=.10; p<.05$). CRSW was significantly associated with four of the outcome variables: Math Performance ($r=-.16; p<.05$), Reading Performance ($r=-.22; p<.05$), Overall Impairment ($r=-.12; p<.05$), and Failing Grades ($r=-.13; p<.05$). Further, TSR was significantly correlated with Failing Grades ($r=-.15; p<.05$) and Behavior Problems ($r=-.15; p<.05$). FSL was significantly correlated with Overall Impairment ($r=-$

.09; $p < .05$) and Failing Grades ($r = -.08$; $p < .05$). Finally FG was significantly associated with Failing Grades ($r = -.15$; $p < .05$). PSL was not significantly associated with any of the outcome variables.

ASSUMPTIONS OF REGRESSION

The results of the tests used to examine the six assumptions of regression are described below.

- (1) Independence of residuals was indicated for all variables, as assessed by the Durbin-Watson statistic (Reading Performance=1.91, Math Performance=1.84, Overall Impairment= 1.98, Failing Grades=1.71, Behavior Referrals=1.73).
- (2) Partial regression plots showed an approximately linear relationship between the continuous predictor variables (including covariates) and three of the outcome variables (Reading Performance, Overall Impairment, Failing Grades). However, two of the outcome variables (Math Performance and Behavior Problems) had nonlinear relationships with the predictor variables. As recommended by Taachnick and Fidell (2007), a square transformation was applied to the Math Performance and Behavior Problems variables. Once transformed, visual inspection of the partial regression plots showed an approximately linear relationship between Math Performance and all of the predictor variables; however, the Behavior Problems Variable still appeared non-linear. Thus, a logarithmic (Log10) transformation (Taachnick & Fidell, 2007) was then applied to Behavior Problems. Re-examination of the Durbin-Watson statistic and partial regression plots showed independence of residuals

and an approximately linear relationship between all of the predictor variables and dependent variables.

- (3) Homoscedasticity of residuals was indicated for all variables, as assessed by equally spread residuals across the scatter plots of studentized residuals and (unstandardized) predicted values.
- (4) Examination of a bivariate correlations were examined (see *Table 6.2*) and Tolerance/VIF values indicated absence of multicollinearity in all variables.
- (5) Absence of significant outliers was examined by inspecting each case's standardized residual as well as the studentized deleted residual. Cases that were greater than ± 3 standard deviations were considered "outliers" and were deleted from the dataset. Outliers that were removed included three cases of the Behavior Problems variable and two cases from the ADHD variable. Absence of leverage points was indicated, as all leverage values were below .02. Absence of influential points was indicated as all Cook's Distance values were below 1.
- (6) Finally, examination of histograms, P-P Plots, Q-Q Plots, as well as skewness and kurtosis values (see *Table 6.1*) indicated normal distribution of errors (residuals) for all variables except for the ADHD predictor variable and the Conduct Problems (CP) variable. Visual inspection of the distribution of scores as well as examination of the skewness statistics indicated a moderately positively skewed distribution. Therefore, a square-root transformation was applied to the ADHD and CP variables (Taachnick & Fidell, 2007). Once the variables were transformed, all six assumptions were reassessed for all

variables and assumptions were met for all variables indicating absence of outliers, homogeneity of variance, no major deviations from normality, and independence of errors.

Next, results of the Multiple Regression models are discussed. A summary of the results can be found in *Tables 6.3* and *6.4*.

RESULTS FROM MULTIPLE REGRESSION MODELS

The first step of the analyses examined the main effect of ADHD on all five academic outcome variables (Math Performance, Reading Performance, Overall Impairment, Failing Grades, and Behavior Problems). The full results of the analyses are reported in *Table 6.3*. Results indicated that while controlling for IQ, ethnicity, free/reduced lunch status, medication status, and conduct problems, ADHD symptoms significantly predicated changes in Overall Impairment, $\beta = .16$, $F(16, 453) = 9.336$, $p = .00003$, adj. $R^2 = .015$, in the anticipated direction. For example, as ADHD symptom severity increased, Overall Impairment reported by parents increased. This suggests that for every one-unit increase of ADHD symptoms, Overall Impairment is predicted to increase by .16 units. Inconsistent with hypotheses, ADHD symptoms did not significantly predict any of the other academic outcome variables (Math Performance, Reading Performance, Failing Grades, or Behavior Problems).

The second step of the analyses examined the main effects of the five SE variables (TSR, PSL, FSL, CRSW, and FG) on the five academic outcome variables (see *Table 6.4*). Interestingly, results indicated that while controlling for IQ, ethnicity, free/reduced lunch status, medication status, and conduct problems, PSL significantly predicted Failing Grades, $\beta = .17$, $F(16, 503) = 3.422$, $p = .00009$, adj. $R^2 = .001$, in the

unanticipated direction. This suggests that the higher level of peer support a student perceived, the more failing grades they received in core classes. Thus, for every one-unit increase in PSL, number of Failing Grades was predicted to increase by .17 units. Inconsistent with hypotheses, results did not indicate a significant influence of any of the other SE predictor variables (TSR, FSL, CRSW, or FG) on any of the academic outcome variables (Math Performance, Reading Performance, Overall Impairment, Failing Grades, or Behavior Problems).

The Third step of the analyses examined the moderating effect of each SE variable on the relationship between ADHD and each of the academic outcome variables. Results suggest that SE did not significantly moderate the relationship between ADHD and any of the academic outcome variables, as none of the interaction terms (ADHD*TSR, ADHD*PSL, ADHD*FSL, ADHD*CRSW, or ADHD*FG) significantly predicted any of the academic outcome variables (Math Performance, Reading Performance, Overall Impairment, Failing Grades, or Behavior Problems). The complete results of these analyses are reported in *Table 6.5*.

Table 6.1 *Descriptive statistics for the main study variables.*

	<i>n</i>	<i>M(SD)</i>	Low Levels (%)	High Levels (%)	<i>Skewness</i>	<i>Kurtosis</i>
<i>ADHD Total Symptoms*</i>	647	29(16)	45	55	-.90	1.79
<i>Psychological Engagement</i>						
Teacher-Student Relationships (TSR)	627	28(5)	62	38	-.06	.68
Peer Support for Learning (PSL)	636	13(2)	31	69	-.41	.28
Family Support for Learning (FSL)	632	18(3)	81	19	-.49	1.20
<i>Cognitive Engagement</i>						
Control and Relevance of School Work (CRSW)	627	25(4)	67	33	-.07	.40
Future Aspirations and Goals (FG)	634	23(4)	24	76	-.54	.17
<i>Math Performance</i>	487	81(11)	52	49	.35	-.47
<i>Reading Performance</i>	459	90(11)	60	40	-.06	.102
<i>Overall Impairment</i>	557	22(11)	42	58	-.25	-.78
<i>Failing Grades</i>	641	4(3)	--	--	.76	-.13
<i>Behavior Problems</i>	635	12(13)	--	--	-.32	-.35

Note: *ADHD=Parent reported Attention-Deficit/Hyperactivity Disorder symptoms.

Table 6.2 Means, standard deviations, and correlations for study variables.

	1	2	3	4	5	6	7	8	9	10	11
1 ADHD Total Symptoms	--	.01	-.01	.03	-.08*	.03	.05	.10*	.40*	.07	.01
<i>Psychological Engagement</i>											
2 TSR		--	.34*	.40*	.59*	.38*	-.03	-.01	-.06	-.15*	-.15*
3 FSL			--	.30*	.41*	.50*	.01	.03	-.09*	-.08*	-.02
4 PSL				--	.34*	.37*	.05	.01	-.01	.04	.05
<i>Cognitive Engagement</i>											
5 CRSW					--	.54*	-.16*	-.22*	-.12*	-.13*	-.04
6 FG						--	.05	-.02	-.06	-.15*	-.04
<i>Academic Outcomes</i>											
7 Math Performance							--	.53*	.04	-.12*	.01
8 Reading Performance								--	.11*	-.05	-.03
9 Overall Impairment									--	.07	.01
10 Failing Grades										--	.18*
11 Behavior Problems											--

Note: TSR=Teacher-student relationship; PSL=Peer support for learning; FSL=Family support for learning; CRSW=Control and relevance of school work; FG=Future aspirations and goals.

*. Correlation is significant at the 0.05 level (2-tailed).

Table 6.3 *Multiple Regression analyses for Overall Impairment*

	β	<i>SE</i>	<i>t-value</i>	<i>p-value</i>
Intercept	24.10	5.49	4.39	.0001
<u>Level 1</u>				
Conduct Problems	.18	.03	5.61	.0001
Medication Status	-1.10	.97	-1.13	.258
Gender	-1.34	.97	-1.39	.166
Intellectual Quotient (IQ)	.002	.04	.04	.966
Ethnicity	-2.67	.97	-2.77	.006
<u>Level 2</u>				
ADHD Total Symptoms	.16	.04	4.19	.00003
Psychological Engagement				
TSR	-.02	.13	-.15	.88
PSL	.09	.16	.55	.59
FSL	-.16	.25	-.62	.53
Cognitive Engagement				
CRSW	-.27	.15	.70	.48
FG	.11	.16	-.174	.08
<u>Level 3</u>				
ADHDXTSR	.04	.10	.42	.68
ADHDXPSL	-.02	.12	-.12	.90
ADHDXFSL	-.25	.16	-1.59	.11
ADHDXCRSW	.03	.11	.22	.83
ADHDXFG	.20	.10	2.02	.04

Note: TSR=Teacher-student relationship; PSL=Peer support for learning; FSL=Family support for learning; CRSW=Control and relevance of school work; FG=Future aspirations and goals. $R^2 = .02$; $F(16, 453) = 9.34$. ADHD is used to describe parent reported symptoms. *B* and *SE* indicate unstandardized variables. $\alpha = .0009$.

Table 6.4 *Multiple Regression analyses for Failing Grades*

	β	<i>SE</i>	<i>t-value</i>	<i>p-value</i>
Intercept	4.92	1.51	3.27	.001
<u>Level 1</u>				
Conduct Problems	.02	.01	1.83	.07
Medication Status	-.24	.26	-.92	.36
Gender	-.13	.26	-.52	.60
Intellectual Quotient (IQ)	-.01	.01	-.22	.83
Ethnicity	.60	.26	2.33	.02
<u>Level 2</u>				
ADHD Total Symptoms	.01	.01	.88	.38
Psychological Engagement				
<i>Teacher-Student Relationships (TSR)</i>	-.07	.03	-2.03	.04
<i>Peer Support for Learning (PSL)</i>	.17	.04	3.86	.00009
<i>Family Support for Learning (FSL)</i>	.05	.07	.74	.46
Cognitive Engagement				
<i>Control and Relevance of School Work (CRSW)</i>	-.13	.04	-3.05	.002
<i>Future Aspirations and Goals (FG)</i>				
<u>Level 3</u>				
ADHDXTSR	-.05	.04	-1.29	.20
ADHDXPSL	-.01	.02	-.27	.79
ADHDXFSL	-.01	.03	-.11	.91
ADHDXFSL	-.02	.04	-.43	.67
ADHDXCRSW	-.01	.03	-.27	.79
ADHDXFG	.01	.03	.42	.68

Note: $R^2 = .001$; $F(16, 503) = 3.42$, $p < .001$. ADHD is used to describe parent reported symptoms. *B* and *SE* indicate unstandardized variables. $\alpha = .0009$.

CHAPTER 7

DISCUSSION

The current study investigated the moderating effects of Student Engagement (SE) on the relationship between ADHD symptoms and academic performance. The study was designed to fill a meaningful gap in the literature by examining ADHD symptoms as well as the more covert areas of SE (i.e., psychological and cognitive engagement) on school outcomes, which thus far has been neglected in this area of research. Results from the regression analyses are discussed below, along with implications of these findings.

ADHD AND ACADEMIC PERFORMANCE

Results of the first step of the analyses supported the hypothesis that as parent-reported ADHD symptoms increased, parent-reported Overall Impairment also increased. This finding is consistent with a long line of previous research documenting impairment across a variety of settings and in multiple areas of functioning for individuals ADHD (see review, Barkley, 2006). Interestingly, ADHD symptoms did not significantly predict difficulties in Math Performance, Reading Performance, Failing Grades, or Behavior Problems, which is inconsistent with the multitude of previous studies that have documented increased school difficulties for children and adolescents with ADHD (e.g., DeShazo Barry, Lyman, & Klinger, 2002; Biederman et al., 1996; LeFever, Villers, Morrow, & Vaughn, 2002; Rapport, Scanlan, & Denney, 1999). Considering the high-risk nature of the youth in the current study, it is possible that students with high levels of

ADHD symptoms also demonstrated comorbid difficulties (e.g., internalizing or externalizing problems, learning disabilities) that were not accounted for in the current study. It has been documented that a wide-range of difficulties often co-occur with ADHD (Biederman, Newcorn, & Sprich, 1991; Decker, McIntosh, Kelly, Nicholls, & Dean; 2001; Semrud-Clikeman et al., 1992) and these difficulties may have been even greater for youth in the current study, as participation in the larger study required indication of a variety of related risks. It is possible that other unknown confounding variables may have accounted for more of the variance in academic performance than ADHD symptomology in this sample of at-risk youth.

SE AND ACADEMIC PERFORMANCE

Results of the second step of the analyses were inconsistent with hypotheses that higher levels of all SE variables would predict better performance in the academic outcome variables (Math Performance, Reading Performance, Overall Impairment, Failing Grades, and Behavior Problems). Interestingly, as students' perceived level of Peer Support for Learning (PSL) increased, number of Failing Grades also increased. This unexpected finding may have been due to several factors. First, students in the current sample may have inaccurately reported their true level of perceived peer support, as it has been well established that youth with emotional and behavioral difficulties may display inaccurate perceptions of emotions, behaviors, and abilities. Another potential explanation is that students that obtained more failing grades may have truly perceived themselves as having a high level of support from their peers; however, despite a high level of perceived support, students' peers may not have been providing support in areas that are relevant to positive school functioning and academic performance. Finally, items

on the PSL subscale of the Student Engagement Instrument (SEI; Appleton et al., 2006) may be measuring peer support, in general, rather than peer support specifically *for learning*. For instance items on the PSL subscale are as follows: “Other students at school care about me; students at my school are there for me when I need them; other students here like me the way I am; I enjoy talking to the students here; students here respect what I have to say; I have some friends at school.” (p. 436).

Results from other analyses from the second step of the analyses were also inconsistent with hypotheses that higher levels of all SE variables would predict better academic performance. PSL was not significantly related to any of the other outcome variables (Reading Performance, Math Performance, Overall Impairment, or Behavior Problems). Further, none of the other SE predictor variables (TSR, FSL, CRSW, or FG) were significantly related to any of the outcome variables. Although SE is a fairly new construct in this field of study, these findings were unexpected, as previous studies have documented positive effects of interventions targeting SE on a variety of academic outcomes (see literature review above).

ADHD, SE, AND ACADEMIC PERFORMANCE

Results of the third step of the analyses demonstrated no significant interacting effects of ADHD and any of the SE variables (ADHD*TSR, ADHD*PSL, ADHD*FSL, ADHD*CRSW, or ADHD*FG) on any of the five academic performance variables (Math Performance, Reading Performance, Overall Impairment, Failing Grades, and Behavior Problems). As stated above, due to the high-risk nature of the sample in the current study, SE may not be the most informative or efficacious area to target in research or in

intervention for this particular population. Results may be different with sample that demonstrated lower levels of impairment in fewer domains.

Limitations

An important limitation to consider is that, due to the multitude of comparisons conducted in this study, the alpha levels were adjusted to .0009 using a Bonferroni correction. Thus, although chances of conducting a Type I error were reduced, chances of making a Type II error were greatly increased. A post-hoc power analysis using *G*Power* 3 (Faul et al., 2009) for linear multiple regression with fixed group differences, was .96 to detect a small effect (.02) for the main effects in the Failing Grades model. For all other models, the power analyses indicated small effects and insufficient power for main effects and interactions (see *Table 7.1*). Future researchers examining these constructs should conduct fewer comparisons to reduce chances of making a Type II error and to increase power.

Another plausible explanation for the lack of significant findings may be related to difficulties in accurately measuring SE due to the lack of consensus among researchers and practitioners regarding the operational definition and measurement of the SE construct. As definitions of SE and methods of measurement vary widely for this construct (see literature review of SE above), it may be difficult to conclude that SE was measured comparably in this study or in other studies that attempt to examine SE. In order to understand how SE influences student outcomes, it is important for researchers to develop a clear and consistent definition to measure the construct. These findings underscore the importance of continued research in the area of SE to develop a consistent

and agreed upon definition of SE in order to support future research and intervention that may impact student success.

Further, this study relies on a single source for the measures collected cross-sectionally, which is another limitation of the study. ADHD symptoms and Overall Impairment were solely based on parent report and students self-reported SE perceptions. A multi-method approach to collect data would be preferable and could yield a different pattern of results. Additionally, longitudinal studies would be highly informative to understand the developmental impact of SE on academic performance across ages and across time. Further, as schools are very diverse and vary in the amount of resources available for students, there may have been school-based differences that accounted for variance in the outcome variables.

As few studies exist that have specifically examined levels of ADHD symptoms for students at-risk for high school dropout and the impact of SE, these results may provide useful information for future researchers who wish to study similar populations. However, because the sample in the current study included mostly Caucasian males, results of the current study may not generalize to other populations. Findings from the current study should be replicated in more representative samples that are stratified along important demographic characteristics such as age, gender, ethnicity, socioeconomic status, school quality, and geographic location. These limitations suggest further investigation of the relationship between ADHD and SE on Academic Performance in order to form stronger interpretations of the results.

Implications for Research

Future researchers should develop a consensus on the way to conceptualize and define SE. Future studies examining school-based interventions or supports for students with ADHD behaviors should examine the relationship of ADHD and SE on broader areas of impairment (e.g., classroom performance, classroom behavior, teacher- and parent-reported impairment). Additional factors impacting school success should be examined concurrently with ADHD and SE to determine which conditions are best able to predict changes in academic performance. Data should also be collected from multiple sources to ensure comprehensiveness in measuring and understanding SE. The distinct effects of peer support for learning (PSL) should be further evaluated to develop more appropriate interventions for students and PSL should be examined in other high-risk populations to improve understanding of its impact on academic performance in order to help researchers and practitioners develop and utilize interventions for these students to promote school success.

Integrating positive behavioral strategies in schools, such as interventions that aim to increase psychological and cognitive engagement, have been effective in improving positive school functioning and academic outcomes (see literature review above). Examining the impact that interventions targeting SE have on the relationship between ADHD symptomology and academic performance more broadly and with a more diverse sample may help to inform future research as well as intervention for this population more precisely than examining symptoms in isolation.

Implications for Families and Schools

These findings may help school psychologists and other school personnel to understand the wide-spread impairment and difficulties parents perceive in families that have children with high ADHD symptoms. They highlight the importance of developing interventions that help reduce ADHD symptomology (in home and at school) that may decrease overall impairment. Reducing ADHD symptoms and thus, reducing overall impairment, may improve relationships within families and functioning of families in general, which has been cited as an important protective factor in the developmental literature. Further, these findings suggest that improvement of ADHD symptoms, may result in improvement in other areas of adolescent's lives as well. As ADHD symptoms are highly related to impairment in multiple areas of functioning, it is crucial for both researchers and practitioners to find ways that help to mitigate this relationship between ADHD and overall impairment in order to improve student functioning.

Findings from the current study suggest that peer support for learning may be an important area to target in terms of intervention for adolescents. Although students in the current study may have perceived themselves as having high levels of peer support for *learning*, many of these students still received a higher number of failing grades. Students may have perceived their peers as providing a high level of support; however, the type of support provided by peers may be in areas that are not facilitating positive school functioning and performance. These findings highlight the importance of using strategies in home and at school to help students develop positive peer relationships that will help to facilitate educational and academic success.

Table 7.1 *Post-hoc power estimates from G*Power.*

	<i>N</i>	<i>F</i> ²	Power Estimate
Math Performance			
Main Effects	402	.028	.22
Interaction	402	.003	.01
Reading Performance			
Main Effects	383	.029	.20
Interaction	383	.003	.01
Overall Impairment			
Main Effects	470	.046	.64
Interaction	470	.015	.09
Failing Grades			
Main Effects	520	.073	.96
Interaction	520	.001	.01
Behavior Problems			
Main Effects	440	.027	.24
Interaction	440	.005	.01

Note: $\alpha=.0009$

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