January 2021

Dimensions Of Attention-Deficit/Hyperactivity Disorder And Sluggish Cognitive Tempo As Predictors Of Executive Functioning, Depression, Anxiety, Substance Use, And Convergence Insufficiency

Danielle Beyer

DIMENSIONS OF ATTENTION-DEFICIT/HYPERACTIVITY DISORDER AND SLUGGISH COGNITIVE TEMPO AS PREDICTORS OF EXECUTIVE FUNCTIONING, DEPRESSION, ANXIETY, SUBSTANCE USE, AND CONVERGENCY INSUFFICIENCY

by

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Bachelor of Arts, University of North Dakota, 2012
Master of Arts, University of North Dakota, 2017

A Dissertation
Submitted to the Graduate Faculty

of the

University of North Dakota

in partial fulfillment of the requirements

for the degree of

Doctor of Philosophy

Grand Forks, North Dakota

January
2021

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PERMISSION

Title	Dimensions of Attention-Deficit/Hyperactivity Disorder and Sluggish Cognitive Tempo as Predictors of Executive Functioning, Depression, Anxiety, Substance Use, and Convergence Insufficiency
Department	Psychology
Degree	Doctor of Philosophy

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Danielle Lynn Beyer
01/02/2021

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ACKNOWLEDGMENTS

I wish to express my profound gratitude to my committee chairperson, Dr. Thomas Petros. The dedication and guidance he offered throughout the process of this project were invaluable and have aided my personal growth as a researcher. I would also like to offer my appreciation to all the members of my advisory committee, Dr. Joseph Miller, Dr. Dmitri Poltavski, Dr. Alan King, and Dr. Bonni Gourneau, whose critiques and suggestions for my project have added to its quality and challenged me to think more analytically of my own work. Finally, I am appreciative of the support provided by the University of North Dakota's Department of Psychology, which afforded me the opportunity to develop my skills in academia, as well as in the clinical setting.

ABSTRACT

Attention-Deficit/Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder marked by symptoms of inattention, hyperactivity, and impulsivity. In addition to the well-known ADHD symptom clusters, a fourth dimension has been identified as sluggish cognitive tempo (SCT) and describes symptoms of sluggishness, drowsiness, and daydreaming. SCT represents a unique symptom domain than cannot be accounted for by the other ADHD dimensions. The current study sought to replicate and expand upon the extant literature, hypothesizing that ADHD/SCT symptoms would significantly predict: 1a) impairment in executive functioning on a self-report measure; 1b) impairment on laboratory measures of executive functioning; 2) symptoms of depression and anxiety; 3) symptoms of substance use disorders; and 4) symptoms of convergence insufficiency. These hypotheses were tested using a series of multiple linear regressions. A total of 103 university students completed this laboratory study. Results indicated ADHD/SCT symptoms significantly predicted impairment on self-reported, but not laboratory measures of executive functioning. SCT symptoms, but not any of the traditional ADHD dimensions, significantly predicted symptoms of depression and anxiety. Conversely, ADHD dimensions significantly predicted problematic substance use while SCT symptoms did not. Lastly, only SCT symptoms predicted symptoms of convergence insufficiency. Overall, these findings suggest that ADHD dimensions and SCT symptoms are distinct in predicting different deficits and comorbidities in a community sample of college students.

Keywords: Attention-Deficit/Hyperactivity Disorder, Sluggish Cognitive Tempo, Executive Functioning, Depression, Anxiety, Substance Use Disorders, Convergence Insufficiency

CHAPTER I

INTRODUCTION

Attention-Deficit/Hyperactivity Disorder

Attention Deficit/Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder that has been shown to negatively impact an individual's educational, vocational, and interpersonal functioning (American Psychiatric Association [APA], 2013). Prevalence rates of ADHD are heavily debated, with the 5th Edition of the Diagnostic and Statistical Manual (DSM-5) indicating a childhood prevalence rate of 5% and an adult prevalence rate of 2.5% (Polanczyk, De Lima, Horta, Biederman, & Rohde, 2007; Simon, Czobor, Bálint, Mészáros, & Bitter, 2009). A more recent study has indicated prevalence rates worldwide as high as 7.2% (Thomas, Sanders, Doust, Beller, & Glasziou, 2015). Given the large number of individuals diagnosed with ADHD and the disorders potential to negatively impact multiple life domains (i.e., educational, social, etc.), researchers continuing to seek a better understanding of the functional impairments associated ADHD.

In order to understand how ADHD affects an individual, one must first fully understand the diagnostic criteria. This disorder presents as a continuous pattern of inattention and/or hyperactivity/impulsivity that interferes with functioning or development (APA, 2013). To meet the DSM-5 diagnostic criteria for ADHD inattention subtype, six or more of the following symptoms must be present in at least two different settings: a) often fails to give close attention to details or makes carless mistakes; b) often has difficulty sustaining attention in tasks or play activities; c) often does not seem to listen when spoken to directly; d) often does not follow through on instructions and fails to complete tasks; e) often has difficulty organizing tasks and activities; f) often avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort; g) often loses things necessary for tasks or activities; h) is often easily distracted by extraneous stimuli; and i) is often forgetful in daily activities (APA, 2013). To meet DSM-5 diagnostic criteria for ADHD hyperactivity/impulsivity subtype, six or more of the following symptoms must be present in at least two different settings: a) often fidgets with or taps hand or feet or squirms in seat; b) often leaves seat in situations where remaining seated is expected; c) often runs about or climbs in situations where it is inappropriate; d) often unable to play or engage in leisure activities quietly; e) often "on the go," acting as if "driven by a motor"; f) often talks excessively; g) often blurts out an answer before a question has been completed; h) often has difficulty waiting his or her turn; and i) often interrupts or intrudes on others. Based upon whether an individual meets one or both symptom clusters, an individual can be diagnosed with ADHD predominantly inattentive presentation, ADHD predominantly hyperactive/impulsive presentation, or ADHD combined presentation.

The DSM-5 classifies ADHD as a Neurodevelopmental Disorder, which means ADHD is a condition with onset in the developmental period (APA, 2013). Specific to the diagnostic criteria for ADHD, onset of symptoms must be present prior to the age of 12 years, and often continue into adulthood (Simon et al., 2009). ADHD-related symptoms must result in distress and/or impairment in at least two domains (i.e., social, academic, occupational, etc.; APA, 2013). Furthermore, there must be clear evidence that the symptoms interfere with, or reduce the quality of social, academic, or occupational functioning and must have been present for the past 6 months. The current severity of an individual's ADHD presentation (mild, moderate, severe) is determined by symptom count and degree of impairment.

Diagnosing ADHD in Adults & Exclusionary Factors

Previously, ADHD had been viewed as a childhood disorder, but research has demonstrated that symptoms and impairment continue into adulthood for two-thirds of children diagnosed with ADHD (Lin, Lo, Yang, & Gau, 2015; Turgay et al., 2012). The behavioral presentation of ADHD changes across the lifespan as does an individual's environmental demands, supportive resources, and available health professionals (Turgay et al., 2012). Specifically, symptoms of hyperactive/impulsivity decrease with age while attentional impairments remain relatively the same. In addition, adulthood ADHD has milder cognitive dysfunction than childhood ADHD and an equal female-to-male ratio (Seidman, Biederman, Weber, Hatch, & Faraone, 1998). No one assessment measure can be used in isolation to determine if an individual meets diagnostic criteria for ADHD in adulthood (Lin et al., 2015).

Gibbins and Weiss (2007) provided recommended practice guidelines in the assessment of ADHD in adults. One recommendation includes a comprehensive clinical interview which assesses development history, school performance history, retrospective mental status, current functioning and mental status, psychiatric history, and medical history. The clinical interview aids in clarifying age of onset, symptoms and progression over time, and distress/impairment. Furthermore, the clinical interview is helpful in determining if any exclusionary criteria have been met. Exclusionary criteria include symptom onset after the age of 12 years, symptoms present in only one setting (e.g., school), the symptoms do not interfere with quality of functioning (i.e., lack of impairment), and the symptoms are better explained by another mental health diagnosis (APA, 2013). Furthermore, this interview process clarifies comorbidity and differential diagnosis (Gibbins & Weiss, 2007).

In addition to a clinical interview, several self-report ADHD questionnaires assessing current and childhood symptoms have been developed for adult populations (Kooij, Boonstra, Swinkels, Bekker, de Noord, & Buitelaar, 2008). Barkley (2011a) created a series of self- and other-report questionnaires designed to assess both current and historical symptoms of ADHD. Conners and colleagues (1999) developed the Conners' Adult ADHD Rating Scale, a self-report questionnaire that retained core features of ADHD while incorporating adult-specific factors (i.e., manifestations of symptoms, item wording, validity of subtyping, symptom threshold). Turgay and colleagues (2012) recommend utilizing self-report questionnaires such as: ADHD Rating Scale IV with adult prompts; Conners' Adult ADHD Rating Scale; Adult ADHD Self-Report Scale, Symptom Checklist; Adult ADHD Quality of Life Scale; Youth Quality of Life Instrument, Research Version; Behavior Rating Inventory of Executive Functioning, Adult Version; ADHD Impact Module for Adults; Brown ADHD Scale for Adults; and Endicott Work Productivity Scale. However, retrospective self-report information has the potential to be influenced by recall bias, comorbid mental health symptoms, and nonspecific clinical features associated with ADHD (Lin et al., 2015).

Another practice guideline recommended by Gibbins and Weiss (2007) suggests the use of collateral reports by parents, spouses, or others who know the individual well. This information can be gathered though the use of other-report forms and/or an interview. Gibbins and Weiss (2007) maintain that collateral reports are helpful because they confirm and/or contradict information given by the individual, allow for the assessment of potential “drug-seeking” motives, and aid in the evaluation of an individual’s insight. Although these collateral reports are advantageous, they are not essential (Belendiuk, Clarke, Chronis, & Raggi, 2007). Belendiuk and colleagues (2007) demonstrated that self-report and other-report questionnaires were highly correlated in a sample of children (ages 6 to 10 years) and their biological mothers. Furthermore, self-report questionnaires and diagnostic interviews were also highly correlated. These results provide evidence that children are likely to adequately report ADHD symptoms through self-report questionnaires and/or diagnostic interviews, reducing the necessity for collateral support. To date there is no known research investigating the correlation between self and other report forms in adult samples. Currently it is unclear if adults adequately report ADHD symptoms or if they exaggerate symptom presentation for external reasons (e.g., malingering for prescription stimulant medication).

Neuropsychological Differences Between ADHD & Non-ADHD Adults

From a neurophysiological perspective, ADHD symptoms (i.e., inattention, hyperactivity, impulsivity) are believed to be the result of impaired dopaminergic activity in the ventral striatum and the prefrontal cortex (Cools, Aarts, & Mehta, 2011). Individuals with a diagnosis of ADHD experience abnormal phasic bursts of dopamine in their ventral striatum, increasing the availability of a reward to elicit impulsive behavior. Other behaviors associated with ADHD such as inhibitory control, working memory, and incentive motivation, have all been linked to maladaptive ventral striatum functioning. Regarding the prefrontal cortex, dopaminergic levels of functionality are hypothesized as an inverted U-Shaped function with the optimal functional level at the top of the inverted "U". Cools and colleagues (2011) suggest individuals with ADHD have dopamine levels which fall to the left of the peak, resulting in sub-optimal functionality. Other behaviors associated with ADHD, working memory impairment, distractor resistance, sustained attention, and response inhibition, have been linked to the sub-optimal functioning of the prefrontal cortex.

As noted above, the dopaminergic activity of the ventral striatum and the prefrontal cortex are responsible for a subset of behavioral functions. Researchers have classified many of these behaviors as "executive functioning" (Willcutt, Doyle, Nigg, Faraone, & Pennington, 2005). Willcutt and colleagues (2005) define executive functioning as a "neurocognitive process that maintain an appropriate problem-solving set to attain a future goal". A confirmatory factor analysis by Miyake, Friedman, Emerson, Witzki, and Howerter (2000) established three separate but related facets of executive functioning: inhibition, updating (i.e., working memory), and set shifting.

Seidman and colleagues (1998) were among one of the first to investigate the neuropsychological features of adults with ADHD. The participants were clinically referred adults with a diagnosis of childhood onset ADHD as well as non-ADHD diagnosed controls. All participants were administered the Wechsler Adult Intelligence Scale-Revised (WAIS; Vocabulary, Block Design, Arithmetic, Digit Symbol, & Digit-Span) and measures of academic achievement, sustained attention/vigilance, planning and organization, response inhibition, set shifting and categorization, selective attention and visual scanning, verbal and visual learning, and memory. Results indicated adults with ADHD performed significantly worse on an achievement (i.e., Arithmetic) measure, the California Verbal Learning Test (CVLT), and the auditory Continuous Performance Task (CPT) than controls. No group differences were observed regarding intelligence, other measures of achievement (e.g., Reading), the REY Complex Figure, the Stroop, and Wisconsin Card Sorting Test. Overall adults with ADHD symptoms demonstrated significantly more executive functioning deficits (i.e., continuous focusing of attention, rapid responding, and semantic organization of verbal information) than controls, potentially leading to lower educational and occupational achievement.

Walker, Shores, Troller, Lee, and Sachdev (2000) expanded upon previous neuropsychological performance of adults diagnosed with ADHD by comparing their performance not only to healthy controls, but also a psychiatric group. Participants completed a standardized battery that measured estimated intelligence, attention, psychomotor speed, arithmetic skills, executive functioning, depression, anxiety, and ADHD symptoms. The ADHD group preformed significantly worse than the healthy control group on the following neuropsychological variables: CPT (Omission Errors, Commission Errors, Response Speed Variability, Overall Index), mental and psychomotor performance speed (Digit Symbol, Stroop Test), working memory (Digits Backwards), and verbal fluency (Controlled Oral Word Association Test [COWAT], Animals subtest). The ADHD group did not perform significantly different than the psychiatric group on any of the 18 neuropsychological variables; however, there were trends for worse performance by the ADHD group on CPT (Omission Errors) and psychomotor speed (Digit Symbol). This study demonstrated adults with ADHD show impairments on a variety of executive and attentional measures when compared to healthy controls; however, similar impairments are observed for adults with mild depression and/or anxiety. Overall, the most notable features for the adults with ADHD were inattention and slowed information processing.

A later meta-analysis utilized thirty-three studies that investigated neuropsychological differences between adults with ADHD and healthy controls (Hervey, Epstein, & Curry, 2004). Hervey and colleagues (2004) noted general and specific performance differences between the two groups. General deficits of medium effect size were noted for adults with ADHD on tasks that required processing of verbal information; however, no effects were detected for visual processing of information. In addition, as tasks became more difficult (i.e., increased task complexity, time requirement, processing speed, motor functioning), adults with ADHD generally performed significantly worse than healthy controls. The following specific deficits were noted for adults with ADHD: attention, behavioral inhibition, and memory.

A recent study investigated self-reported executive functioning, intelligence, and neuropsychological performance among college students with and without an ADHD diagnosis (Weyandt, Oster, Gudmundsdottir, DuPaul, & Anastopoulos, 2017). Participants with ADHD reported significantly higher levels of executive dysfunction (i.e., organization, planning, inhibition, working memory, metacognition) than non-ADHD peers. No group differences were noted on an abridged measure of intelligence (i.e., WAIS: Vocabulary, Similarities, Block Design, Matrix Reasoning). Regarding neuropsychological performance, participants with ADHD performed significantly worse on several CPT measures, such as Omissions %, Commissions %, Hit RT Std. Error, Variability, Detectability (d'), Preservations %, Hit RT, Block Change, Hit SE Block Change, and Hit RT ISI Change.

Overall, a review of the literature indicates that no one specific neuropsychological assessment can be used to diagnosis adults with ADHD. Rather, an amalgamation of neuropsychological tests is recommended to help inform the diagnosis. Based upon established findings, adults with ADHD will likely score lower than healthy peers on measures of attention (i.e., CPT), behavioral inhibition (i.e., Stroop Test), and memory (i.e., Arithmetic, CVLT, Digit Symbol, Digit Span-Backward, COWAT-Animals subtest; Hervey et al., 2004; Seidman et al., 1998; Walker et al., 2000; Weyandt et al., 2017). However, as previously noted, many of the established neuropsychological differences become less or non-significant when comparing adults with ADHD to adults with psychiatric diagnoses, such as depression or anxiety (Walker et al., 2000).

Comorbid Psychological Disorders in Individuals Diagnosed with ADHD

Individuals with a diagnosis of ADHD may have a history of co-occurring mild developmental delays in language, motor, and social domains (APA, 2013). During childhood, low frustration tolerance, irritability, and mood lability may be noted. Seidman and colleagues (1998) found that adults with ADHD reported more repeated grades and extra assistance in school than healthy controls.

In adulthood, individuals with a diagnosis of ADHD are significantly more likely to report comorbid diagnoses of a mood, anxiety, and/or history of conduct disorders (Seidman et al., 1998). These findings were supported and expanded upon in a recent population-based birth cohort study (Yoshimasu et al., 2018). Yoshimasu and colleagues (2018) divided participants into one of three groups: persistent ADHD (i.e., ADHD diagnosis meet in childhood and adulthood), childhood ADHD (i.e., ADHD diagnosis meet only in childhood), and no ADHD. Adults with persistent ADHD were eight times more likely to have a comorbid psychiatric disorder than non-ADHD peers and were almost five times more likely to have a comorbid psychiatric disorder than individuals with childhood ADHD. In total, 84% of males and 74% of females with persistent ADHD also had another psychiatric diagnosis such as mood, anxiety, antisocial personality, and/or alcohol use disorder(s). Men were more likely to have externalizing disorders (e.g., personality & substance use), while females were more likely to have internalizing disorders (e.g., anxiety & depression). Furthermore, a study by Agosti, Chen, and Levin (2011) found young adults with ADHD and one or more comorbid psychological disorders are 4 to 12 times more likely to have a past suicide attempt than peers with only an ADHD diagnosis.

Regarding substance use disorders (SUDs), Zulauf, Sprich, Safren, and Wilens (2014) found that children and adolescents with ADHD are at an increased risk for developing early onset SUDs compared to peers. In a sample of "substance-abusing" adults, 11-35% of participants also had a comorbid diagnosis of ADHD (Kalbag & Levin, 2005). Given the well-established comorbidity between ADHD and SUDs, researchers recently sought to gain a better understand of the relationship between these disorders (Capusan, Bendtsen, Marteinsdottir, & Larsson, 2016). Their results replicated previous findings, suggesting that individuals with a high number of ADHD symptoms were at an increased risk for developing SUDs. Specifically, individuals with high ADHD symptoms were at a 1.88 times increased risk for alcohol abuse, 2.27 times increased risk for illicit drug use, and 2.54 times increased risk to engage in multiple substances when compared to peers with low ADHD symptoms. In addition, regular nicotine and marijuana use were 1.33 times and 7.49 times (respectively) more likely among individuals with a high number of ADHD symptoms. No differences were observed across ADHD subtypes and/or gender or participants.

The complex relationship between ADHD and SUDs remains unclear, with no single causal pathway identified (Zulauf, et al., 2014; Young & Sedgwick, 2015). Additional comorbidities (e.g., Conduct Disorder, Antisocial Personality Disorder) make understanding this relationship even more convoluted (Kalbag & Levin, 2005). Despite these challenges, researchers have hypothesized several factors which appear to play a role in substance taking behaviors such as self-medication and disinhibition (Young & Sedgwick, 2015). Kalbag and Levin (2005) proposed that individuals with ADHD may be inclined to engage in nonmedical stimulant use to temporarily reduce inattention and/or hyperactivity symptoms (i.e., self-medication). Further, individuals with ADHD are often more disinhibited, resulting in an increased willingness to engage in novel substances (i.e., disinhibition).

Other possible comorbidities, including those that are not psychiatric in nature, are important to consider when conducting and applying research. For example, atypical oculomotor functioning and visual abnormalities may produce similar behavioral problems and attentional difficulties as seen in individuals with ADHD (Borsting, Rouse, & Chu, 2005; Poltavski, Biberdorf, & Mark, 2016). Grönlund, Aring, Landgren, and Hellström (2007) found that 76% of children and adolescence diagnosed with ADHD have comorbid oculomotor and visual abnormalities. Convergence insufficiency (CI) is a type of a sensory motor abnormality characterized by an impaired ability to attain and/or sustain eye convergence when a stimuli is at a close visual distance (Marran, De Land, & Nguyen, 2006). Individuals with a diagnosis of CI are 3 times more likely to have a comorbid ADHD diagnosis and the reciprocal direction of the relationship is also threefold (Granet, Gomi, Ventura, & Miller-Scholte, 2005).

Poltavski, Biberdorf, and Mark (2016) demonstrated that individuals who reported high CI symptoms on the Convergence Insufficiency Symptoms Survey performed significantly worse on the Conners' Continuous Performance Test (CPT) than peers with low CI symptoms. In additional studies, artificially created accommodation and convergence impairment resulted in poorer participant performance on Stroop Test and Conners' CPT than the control conditions (i.e., not wearing lenses to artificially create visual impairment; Daniel & Kapoula, 2019; Poltavski, Biberdorf, & Petros, 2012). These findings suggest that CI symptoms results in similar neuropsychological impairments (i.e., high Commission Errors, high Perseverative Errors, poor Target Detection, high Interference) as individuals with an ADHD diagnosis.

Sluggish Cognitive Tempo

In the late 1980s, Lahey and colleagues (1988) were investigating symptoms related to the DSM-III-R classification of disorders that are currently conceptualized as ADHD. Using teacher-rating forms, three symptom clusters were identified: children with no symptoms, children with inattention and hyperactivity symptoms, and children with inattention and sluggish cognitive tempo without hyperactivity. Sluggish cognitive tempo (SCT) symptoms were described as sluggishness, drowsiness, and apparent daydreaming. During the field studies for the DSM-IV, Frick and colleagues (1994) looked at symptoms related to disruptive behavior disorders, such as ADHD, to determine predictive utility. Results indicated that SCT symptoms had adequate positive predictive power but lacked negative predictive power for the inattentive subtype of ADHD. Simply stated, individuals with SCT symptoms often had inattention symptoms, however individuals with inattention symptoms did not always have SCT symptoms. As a result, the SCT symptoms were not included in the DSM-IV’s description of ADHD.

Nearly a decade later, McBurnett, Pfiffner, and Frick (2001) renewed interest in SCT symptoms by drawing attention to the methodological limitations of that earlier study (i.e., Frick et al., 1994). Specifically, the 1994 analysis likely lacked negative predictive power because the analysis included inattentive and hyperactive presentations despite prior work suggesting the use of only inattentive presentations (see Lahey et al., 1988). McBurnett and colleagues (2001) used a factor analytic procedure, including the previously identified SCT symptoms (i.e., forgets, daydreams, sluggish/drowsy), to re-evaluate ADHD inattention subtype. Results produced two separate but related factors: inattention and SCT. These findings suggested either the three symptoms are adequate to include when determine the inattention subtype or SCT symptoms represent a different attentional disorder altogether. This study acted as a springboard to revitalize research into the potential diagnostic implications related to SCT.

In one such study, investigators sought to theoretically and operationally define SCT by creating an empirically based measure to assess these symptoms in children (Penny, Waschbusch, Klein, Corkum, & Eskes, 2009). SCT symptoms were based upon a literature review and further refined through questionnaires completed by parents and teachers of the study's participants. This process yielded 14 items associated with SCT symptoms that demonstrated good content validity and strong reliabilities (i.e., internal consistency and test-retest). These items included: 1) prone to daydreaming; 2) has trouble staying alert or awake; 3) mentally foggy or easily confused; 4) stares a lot; 5) spacey, their mind seems to be elsewhere and not paying attention to what is going on around them; 6) lethargic, more tired than others; 7) underactive compared to other children; 8) slow moving or sluggish; 9) doesn't seem to understand or process questions or explanations as quickly or as accurately as others; 10) seems drowsy or has a sleepy appearance; 11) apathetic or withdrawn, seems less engaged in activities than others; 12) gets lost in his or her thoughts; 13) slow to complete tasks, needs more time than others; and 14) lacks initiative to complete work or their effort fades quickly after getting started.

Barkley (2013) sought to replicate these findings and expand upon them by including ADHD inattention and hyperactivity-impulsivity symptoms to determine whether SCT is an additional subtype of ADHD or an independent disorder. A survey of 1,922 parents who had children/adolescents between 6 to 17 years of age was conducted. Participants completed a demographic and psychiatric history questionnaire, the Child ADHD rating scale, 14-item Child SCT ratings, the Functional Impairment Rating Scale-Children and Adolescents, and the Deficits in Executive Functioning Scale-Children and Adolescents. The 18-item ADHD and 14-item SCT ratings were subjected to a principal component factor analysis and resulted in four, often intercorrelated, factors (hyperactivity-impulsivity, inattention, sluggishness, and daydreaming). These findings provided further support that SCT symptoms represent a unique factor, separate from ADHD inattention.

Leopold and colleagues (2016) contributed to the SCT literature by investigating stability of symptoms over time. Using a 10-year longitudinal sample, spanning roughly 4 to 15 years of age, these researchers collected parent ratings on the Disruptive Behavior Rating Scale and seven potential SCT items. Results indicated that ADHD-inattentive, ADHD-hyperactivity-impulsivity, and SCT symptoms were separate but related constructs with different developmental trajectories. Across the developmental period, hyperactivity-impulsivity symptoms decreased, SCT symptoms slightly increased, and inattention symptoms remained the same from childhood to adolescence. This study was the first to demonstrate that SCT symptoms are temporally stable and increase in severity with age.

Recent studies have sought to examine SCT symptoms and impairment in adult samples, while simultaneously assessing other psychological symptoms. In one such study, Becker, Langberg, Luebbe, Dvorsky, and Flannery (2014) examined the factor structure of ADHD and SCT in a large, nonclinical sample of college students using the Barkley Adult ADHD Rating Scale-IV (BAARS-IV; Barkley, 2011a). The authors also examined whether ratings of inattention, hyperactivity, impulsivity, and SCT could predict self-reported symptoms of anxiety, symptoms of depression, academic adjustment, academic performance, and high school grade point average. The following measures were utilized: The Depression Anxiety Stress Scales, 21-item (DASS-21; Antony, Bieling, Cox, Enns, & Swinson, 1998; Lovibond & Lovibond, 1995) and two subscales from the Student Adaption to College Questionnaire (Baker & Siryk, 1999). The results support previous findings for a three-factor model (inattention, hyperactivity, impulsivity) of ADHD in adults. Furthermore, analyses indicated SCT symptoms were distinct from those of ADHD. Overall, SCT symptoms were the best predictor of poor academic functioning and internalizing symptoms. Their second study replicated these findings in a sample of clinically referred college students (i.e., SCT was the best predictor of poor academic functioning and internalizing symptoms).

Becker, Burns, and colleagues (2018) created a unified set of self-report questions assessing SCT symptoms in an adult sample. In order to achieve this goal, the researchers investigated: 1) convergent and discriminant validity of SCT items in relation to symptoms of ADHD-inattention, depression, and anxiety; 2) reliability of the SCT factor and the fit of SCT, ADHD-inattention, ADHD-hyperactivity/impulsivity, and internalizing symptoms; 3) SCT symptoms and external factors (i.e., demographic characteristics, socio-emotional functioning, daily life executive functioning, and functional impairment); and 4) if SCT symptoms were related to self-reported socio-emotional adjustment, daily life executive functioning, and functional impairment above that of ADHD-inattention and ADHD-hyperactivity/impulsivity. A sample of 3,172 undergraduate students completed the following measures: Adult Concentration Inventory (Becker, Burns et al., 2018), BAARS-IV (Barkley, 2011a), DASS-21 (Antony et al., 1998), Barkley Deficits in Executive Functioning Scale-Long Form (BDEFS-LF; Barkley, 2011b), Difficulties in Emotion Regulation Scale (Gratz & Roemer, 2004), Rosenberg Self-Esteem Scale (Rosenberg, 1965), UCLA Loneliness Scale-Version 3 (Russell, 1996), and The Barkley Functional Impairment Scale (BFIS; Barkley, 2011c). This was the first study to investigate item-level convergent and discriminate validity separate from symptoms of ADHD-inattention, anxiety, and depression. Results indicated that 10 of the 16 Adult Concentration Inventory items meet the stringent threshold, with 8 items derived from the meta-analysis and 2 items derived for the mental confusion literature on SCT. Further analysis indicated SCT symptoms were related to poorer adulthood functioning and was moderately-to-strongly correlated with poorer socio-emotional adjustment (internalizing symptoms, emotion dsyregulation, loneliness, and self-esteem), greater daily life executive functioning deficits (Self-Organization/Problem-Solving, Self-Management to Time, and Self-Regulation of Emotion), and higher global functioning impairment. Lastly, small but significant effects were found for gender, indicating women were more likely than men to report SCT symptoms.

The impacts of SCT symptoms on functional impairment and executive functioning have also been investigated in a sample of 458 college students (Wood et al., 2017). Participants completed a variety of self-report measures including the BAARS-IV (Barkley, 2011a), BDEFS-LF (Barkley, 2011b), and DASS-21 (Antony et al., 1998). The results indicated that increased symptoms of inattention, SCT, and depression led to more problems with Time Management, Self-Organization/Problem Solving, and Self-Motivation. Additionally, the results revealed that symptoms of inattention, hyperactivity/impulsivity, SCT, and depression led to more problems with Self-Motivation and Self-Regulation of Emotion. Overall, many college students are affected by SCT symptoms which moderately overlap with symptoms of inattention, depression, and anxiety. However, approximately half of the participants solely endorsed high SCT symptoms, indicating that these symptoms deserve diagnostic consideration—particularly because the degree to which SCT symptoms negatively impact daily functioning.

Flannery, Becker, and Luebbe (2016) investigated the relationship between SCT and social functioning. In particular, they explored 1) if individuals with SCT symptoms report greater levels of emotional dysregulation than individuals with other psychopathology symptoms, and 2) if the relationship between SCT and social impairment would be mediated by emotion dysregulation. A total of 158 undergraduate participants completed self-report measures that assessed symptoms of ADHD, SCT, depression, and anxiety, as well as measures of social functioning and emotion regulation. Specific assessment measures included: BAARS-IV (Barkley, 2011a), Center for Epidemiologic Studies Depression Scale-Short Form (Radloff, 1977), DASS-21

(Antony et al., 1998), Behavior Assessment System for Children, 2nd edition, Self-Report of Personality–College Version (BASC; Reynolds & Kamphaus, 2004), BFIS (Barkley, 2011c), and Difficulties in Emotion Regulation Scale (Gratz & Roemer, 2004). Results were mixed regarding the impact of SCT symptoms on social functioning. Specifically, SCT symptoms were related to impairments in social functioning on the BFIS but were not related to impairments in interpersonal relations on the BASC. Significant indirect effects of SCT symptoms on social impairment through emotion dysregulation were detected. These results indicated emotional regulation mediates the relationship between SCT symptoms and social impairment in an adult sample.

Flannery and colleagues (2017) also explored the relationship between SCT symptoms and potential impairment in college students, including an attempt to replicate the association between SCT symptoms and global functional impairment. A total of 158 undergraduate students completed the following self-report questionnaires: BAARS-IV (Barkley, 2011a), Center for Epidemiologic Studies Depression Scale—Short Form (Radloff, 1977), DASS-21 (Antony et al., 1998), Learning and Study Strategies Inventory, 2nd Edition (Weinstein & Palmer, 2002), BFIS (Barkley, 2011c), and Barkley Deficits in Executive Functioning Scale, Short Form (Barkley, 2011b). Results indicated that SCT symptoms and poor study skills (affective learning strategy and goal strategy) were associated, even after accounting of symptoms of other psychopathologies (i.e., ADHD, depression, anxiety). Once SCT symptoms were entered into the regression model, the relationship between ADHD-inattention and study skills was no longer significant. Only one facet of poor study skills (i.e., comprehension monitoring strategies) was not significantly associated with SCT symptoms. Regarding domains of functional impairment, SCT symptoms were significantly related to managing chores and other household tasks, managing money/finances, work, educational activities, community activities, social situations with strangers/acquaintances, and social situations with friends. When SCT symptoms were included to the regression model, the relationships between ADHD-inattention and impairment in managing chores/household tasks, work, and educational activities were no longer significant. SCT symptoms did not significantly impact the following areas of functional impairment: romantic relationships and sexual activities, driving, organization, and daily self-care/health maintenance.

Another recent study attempted to replicate previous regarding deficits in self-reported executive functioning and expand upon the literature by including laboratory measures of neuropsychological functioning (Jarrett, Rapport, Rondon, & Becker, 2017). On a self-report measure of executive functioning (i.e., BDEFS-LF), ADHD-inattention was strongly associated with Self-Motivation and Self-Management to Time, while ADHD-impulsivity and hyperactivity were strongly associated with problems with Self-Restrain and Self-Regulation of Emotions. Symptoms of SCT uniquely predicted significant executive dysfunction across all five subscales. The two strongest relationships with SCT symptoms were observed on the Self-Organizational/Problem and the Self-Regulation of Emotion subscales. None of the ADHD domains or SCT symptoms significantly predicted performance on any of the laboratory tasks of neuropsychological functioning (i.e., Visual Working Memory Task, Stroop Test, Conners' Continuous Performance Test, 2nd Edition). Conclusions from this study suggested that while college students with ADHD and SCT symptomology demonstrate executive functioning deficits on self-report measures that these same deficits are not observed on laboratory measures of executive functioning.

Current Study

The current study sought to gain a better understanding of the well-established ADHD domains (i.e., inattention, impulsivity, hyperactivity) and to expand upon findings related to a potentially new attentional disorder (i.e., SCT). The first hypotheses focused on how ADHD/SCT symptoms impact executive functioning. Previous literature indicated that individuals with ADHD (Turgay et al., 2012; Weyandt et al., 2017) and SCT (Becker, Burns et al., 2018; Wood et al., 2017; Flannery et al., 2016; 2017) self-report significantly higher levels of impairment in executive functioning. Hypothesis 1a predicted that ADHD/SCT symptoms will significantly predict impairment in executive functioning on a self-report measure. In addition to the self-report literature, a large body of research has established that individuals with an ADHD diagnosis perform significantly worse on laboratory measures of executive functioning (Hervey et al., 2004; Seidman et al., 1998; Walker et al., 2000). However, to date, only one known study has investigated the impact of SCT symptoms on laboratory measures of executive functioning (Jarrett et al., 2017). Jarrett and colleagues (2017) failed to find any significant differences between SCT symptoms and laboratory measures of executive functioning; however, their study only utilized a few assessment measures. The current study used several laboratory measures of executive functioning that represent the three hypothesized domains of executive functioning (i.e., inhibition, updating/working memory, set shifting). Hypothesis 1b predicted that ADHD/SCT symptoms will significantly predict impairment on laboratory measures of executive functioning.

Regarding comorbidity, ADHD (Seidman et al., 1998; Yoshimasu et al., 2018) and SCT symptoms (Becker, Burns et al., 2014; Becker & Barkley, 2018) have been associated with higher risk of internalizing disorders. The current study will utilize depression and anxiety self-report questionnaires to replicate previous findings. Hypothesis 2 predicted that ADHD/SCT symptoms will significantly predict depression and anxiety symptoms. Individuals with an ADHD diagnosis are at an increased risk for developing an early onset SUDs (Zulauf et al., 2014) and/or to have a comorbid SUDs (Capusan et al., 2016; Kalbag & Levin, 2005; Zulauf et al., 2014). To date, only one study has investigated the relationship between SCT symptoms and SUDs (Wood, Lewandowski, Lovett, & Antshel, 2020). The current study seeks to replicate and expand upon the current literature by using a self-report SUDs questionnaire. Hypothesis 3 predicted that ADHD/SCT symptoms will significantly predict symptoms of SUDs. Lastly, convergence insufficiency (CI) symptoms appear to be highly comorbid with ADHD (Granet, Gomi, Ventura, & Miller-Scholte, 2005; Grönlund et al., 2007); however, the relationship between CI and SCT has yet to be explored. Thus, the current study seeks to replicate CI and ADHD findings while investigating the potential relationship between CI and SCT. Hypothesis 4 predicted that ADHD/SCT symptoms will significantly predict symptoms of CI.

CHAPTER II

METHOD

Participants

Participants were recruited from a large Midwestern University though SONA Systems, an online subject pool software program available to undergraduate Psychology students. Through the SONA Systems webpage, students were able to review a brief description of this study. Students interested in this study could sign up for a 90-minute laboratory timeslot. A total of 103 students completed the study and were compensated for their time through course research credit.

Self-Report Questionnaires and Measures

Demographic Questionnaire

A short demographic questionnaire assessed participants' age, gender, and race/ethnicity. To evaluate academic performance and years of education, cumulative undergraduate GPA (4-point scale ranging from 0.0 to 4.0) and total university credit hours were obtained. In addition, participants were asked several questions regarding medical, psychological, and developmental history.

Barkley Adult ADHD Rating Scale-IV (BAARS-IV), Current Symptoms Scale-Self Report Form

This questionnaire asked participants to read 27-items and indicate on a four-point scale (1 - Never or Rarely; 2 - Sometimes; 3 - Often; 4 - Very Often) the extent to which the items describes their behaviors over the past 6 months. Overall a total of 9 inattention symptoms, 5 hyperactivity symptoms, 4 impulsivity symptoms, and 9 SCT symptoms were assessed. An additional three questions helped provide clarity as to severity, onset, and functional impairment of the participant's symptom endorsement. The BAARS-IV subscales demonstrated adequate internal consistency (*Cronbach's Alpha* = .776 to .914), test re-test reliability (*r* = .66 to .88), and discriminate validity (*Positive Predictive Power* = .78 to .91; *Negative Predictive Power* = .84 to .98; Barkley, 2011a; Caterino, Gómez-Benito, Balluerka, Amador-Campos, & Stock, 2009).

Barkley Adult ADHD Rating Scale-IV (BAARS-IV), Childhood Symptoms Scale-Self Report Form

This questionnaire asked participants to read 18-items and indicate on a four-point scale (1 - Never or Rarely; 2 - Sometimes; 3 - Often; 4 - Very Often) the extent to which the items describes their behaviors between 5 and 12 years of age. Overall a total of 9 inattention symptoms and 9 hyperactivity-impulsivity symptoms were assessed. An addition two questions helped provide clarity as to severity and functional impairment of the participant's symptom endorsement. The BAARS-IV subscales demonstrated adequate internal consistency (*Cronbach's Alpha* = .776 to .914), test re-test reliability (*r* = .66 to .88), and discriminate validity (*PPP* = .78 to .91; *NPP* = .84 to .98; Barkley, 2011a; Caterino et al., 2009).

Barkley Deficits in Executive Functioning Scale, Long Form (BDEFS-LF)

This questionnaire asked participants to read 89-items and indicate on a four-point scale (1 - Never or Rarely; 2 - Sometimes; 3 - Often; 4 - Very Often) the extent to which the items describes their behaviors during the past 6 months. The BDEFS-LF assesses the following 5 domains: Self-Management to Time, Self-Organization/Problem Solving, Self-Restraint, Self-Motivation, and Self-Regulation of Emotions. The BDEFS-LF demonstrated satisfactory internal consistency (*Cronbach's Alpha* = .842 to .958) and test re-test reliability (r = .62 to .90; Barkley, 2011b).

Beck Depression Inventory - 2nd Edition (BDI-II)

The BDI-II is a 21-item, self-report measure which assessed an individual's experiences of affective, cognitive, and vegetative symptoms of depression over the past 2 weeks. Each item is measured on a 4-point scale, ranging from 0 to 4. Psychometric properties are acceptable, with non-clinical reliability equaling 0.93, corrected item-total correlation varying from 0.27 to 0.74 in a sample of nonclinical college students, and test-retest reliability of 0.93 (Beck, Steer, & Brown, 1996).

Beck Anxiety Inventory (BAI)

The BAI is a 21-item, self-report measure which assessed the severity of anxiety in adults and adolescents over the past week. Each item is measured on a 4-point scale, ranging from 0 (not at all) to 3 (severely). Psychometric properties are adequate in samples of nonclinical undergraduate students, with internal consistency of 0.90 to 0.91 and moderate 6-week test-retest reliability of 0.62 (Creamer, Foran, & Bell, 1995).

The Adult Substance Abuse Subtle Screening Inventory, 4th Edition (SASSI-4)

This self-report questionnaire was intended to screen participants for Substance Use Disorders (SUDs). Participants were asked to read and complete each of the three sections. The first section has 74 true/false items that are both a direct measure of acknowledge substance misuse and statements that appear to be unrelated to substance use. The second (Face-Valid Alcohol; FVA) and third (Face-Valid Other Drugs; FVOD) sections consist of face-valid frequency questions regarding experienced consequences related to substance use. Overall, the SASSI-4 yields the following scales: Face-Valid Alcohol, Face-Valid Other Drugs, Symptoms, Obvious Attributes, Subtle Attributes, Defensiveness, Supplemental Addiction Measure, Family vs. Control subjects, Correctional, Random Answering Patterns and Prescription Drug scale. The SASSI-4 demonstrated acceptable psychometric properties: Overall accuracy = 92%, Sensitivity = .93, Specificity = .89, *PPP* = .96, *NPP* = .81 (Lazowski & Geary, 2016).

Convergence Insufficiency Symptoms Survey (CISS)

Convergence insufficiency (CI) refers to the inability of an individual's eyes to work together to clearly see nearby objects, resulting in double or blurred vision ("Convergency insufficiency", 2020). The CISS is a 15-item, self-report questionnaire designed to assess the severity of CI symptoms. Each item is measured on a 5-point scale, ranging from 0 (Never) to 4 (Always). Psychometric properties demonstrated adequate discrimination (sensitivity = 97.8%; specificity = 87%) in a sample of adults when using a cut score of 21 (Rouse et al., 2004).

Laboratory Measures of Executive Function

Laboratory measures of executive functioning have been subdivided into three basic categories: updating/working memory, set shifting, and inhibition (Miyake, Friedman, Emerson, Witzki, & Howerter, 2000). First, the updating function is thought to be involved in the active revision and monitoring of working memory representations. In general, updating is assessed by tests that require performing a revision of working memory content by replacing older, no longer relevant information, with newer information. Examples of updating working memory assessments include the Reading Span Task (RSPAN) and the N-Back Task. Second, the set shifting function is assumed to play a role when participants must switch between tasks or mental sets. Shifting is assessed by tests that require participants to perform repeated shifts from one task (or mental set) to another. Examples of shifting assessments include the Trail Making Test and the Wisconsin Card Sorting Test. Third, the inhibition is the ability to actively suppress responses or thoughts or to generally keep the participant's attention focused on goal-relevant information in the face of interference. Tests of voluntary inhibition require stopping prepotent responses and resisting interfering stimuli or thoughts (Friedman et al., 2008). Examples of assessments that measure inhibition include the Stroop Test and the Plus-Minus Task.

Reading Span Task (RSPAN)

The RSPAN required participants to read a series of sentences out loud to the examiner. Following the completion of each sentence set, participants were asked to repeat, in order, the last word of each sentence. As the task progressed, the number of sentences in each set gradually increased. Every participant began with two sentences per set, and depending upon correct responses, could have been administer up to six sentences per set.

N-Back Task

The N-Back task is frequently used to measure participants' capacity to update and actively manipulate the contents of working memory (Owen, McMillan, Laird, & Bullmore, 2005). Participants were presented with a series of single digit numbers. Each number was briefly presented in the center of the computer screen. Participants were required to press the spacebar whenever the digit presented on the screen was the same as the digit presented two serial positions earlier in the series (2-back). Participants completed a practice session before the test trials and performance was measured as the proportion of correct responses. Unfortunately, due to unanticipated data management problems, the results from the N-Back Task were lost and therefore unable to be analyzed.

Trail Making Test (TMT)

The TMT is a timed paper-and-pencil tasks that consists of two separate parts. On the first part (TMT-A), participants were asked to draw a line connecting consecutively numbered dots from 1 to 25, which are set in a random pattern on a single piece of paper. On the second part (TMT-B), participants were asked to draw a line connecting alternating numbers and letters in a progressive sequence (i.e., 1 to A, A to 2, 2 to B, B to 3, 3 to C, etc.), which are set in a random pattern on a single piece of paper.

Wisconsin Card Sorting Test (WCST)

The WCST required participants to generate sorting rules when organizing a series of cards into piles by correctly identifying and utilizing sorting rules. Participants were asked to sort cards according to color, shape, and number of stimuli shown on the card. The examiner initially verbally reinforced sorting the cards in one category, but after the participant made 10 consecutive correct responses in that category, the examiner began reinforcing another category without alerting the participant to the change. The participant was then required to shift to a new rule. The WCST variables of interest are the Number of Trials Administered, Trials to Complete First Category (i.e., the number of trials taken to make 10 consecutive correct responses), Total Number of Categories Achieved, Total Number Correct, Failure to Maintain Set (i.e., interruption of the correct sorting strategy after five consecutive correct responses have been made), Preservative Errors/Responses (i.e., responses that would have been correct on the previous sorting rule), and Total Errors.

Stroop Test

The Stroop Test is comprised of three timed conditions: Word, Color, and Color-Word. In the Word Condition, participants saw names of colors written in black ink. Participants were asked to read the words aloud. In the Color Condition, the participants saw “XXX” printed in different colors of ink. Participants were asked to verbally identify the color of each “XXX”. In the Color-Word Condition, participants saw the name of a color printed in a different color ink (e.g., “RED” printed in green ink). Participants were asked to verbally identify the color of the ink, and not to read the printed word.

Plus-Minus Task

The Plus-Minus Task is a paper-and-pencil task that is commonly used to evaluate the capacity to resist interference when shifting between tasks (Jersild, 1927; Miyake, Friedman, Emerson, Witzki, Howerter, & Wager, 2000; Spector & Biederman, 1976).

First, participants were asked to add three to each number within a series. Next, participants were asked to subtract three from each number within another series. Finally, participants were asked to alternate between adding and subtracting three from each number within a third series. Participants had to keep in memory the current goal because no external cues were provided as a reminder. Prior to the administration of each of the three tasks (addition, subtraction, alternating), a short training series was presented. Participants were asked to work both quickly and accurately. Participants completion time was measured for each series using a stopwatch. Each series of numbers were composed of 30 two-digit numbers between 10 and 99 that were randomly generated without replacement. Performance (i.e., a shift cost) was assessed by taking the difference between the reaction time needed to complete the third (alternating) series and the mean reaction times of the first two series.

Procedure

This study was completed in the laboratory setting. Upon arrival, participants were provided with an Institutional Review Board approved document of informed consent. No potential participants refused to provide consent for this study. After consent was received, participants began the study immediately. Participants completed all questionnaires and laboratory tasks listed in the measures section. Following the participant's completion of the study protocol, they were thanked and received research credit for their undergraduate psychology course.

Analytic Strategy

The scores for the BAARS-IV Current Symptoms Scale (Inattention, Hyperactivity, Impulsivity, SCT) and BAARS-IV Childhood Symptoms Scale (Inattention, Hyperactivity/Impulsivity) were computed and used as the predictor variables. These six variables were used to predict scores on the five subtests of BDEFS-LF, subscales of the SASSI-4, BDI-II, BAI, CISS, and the raw scores on the laboratory measures of executive function (RSPAN, TMT, WCST, Stroop Test, and Plus-Minus Task). The predictor variables were examined for indices of collinearity and multicollinearity and based upon those findings' adjustments were made.

For the power analysis, a medium effect size (f^2 =.15; Cohen, 1992) was anticipated based upon previous studies (Becker, Burns et al., 2018; Hervey et al., 2004; Jarrett et al., 2017). G*Power 3.1 was used to calculate the necessary sample size for a Multiple Linear Regression with six predictors (i.e., Current Inattention, Current Hyperactivity, Current Impulsivity, Current SCT, Childhood Inattention, and Childhood Hyperactivity/Impulsivity). Using the goodness of fit model, with a minimum acceptable power of .80, 5 degrees of freedom, and a medium anticipated effect size (f^2 =.15), a minimum of 55 participants were required.

CHAPTER III

RESULTS

A total of 103 participants completed this laboratory study. Of these participants, 4 were excluded from further analysis as the result of 1) failed two or more embedded validity questions on the self-report measures (n = 3), or 2) English was not their first language (n = 1). The sample was largely comprised of white (92.9%), female (60.6%) underclasspersons (i.e., Freshman or Sophomore; 78.8 %). See Table 1 for additional demographic information.

Table 1

Demographic Information

Gender	Frequency (*n*)	Percent (%)
Male	39	39.4
Female	60	60.6
Race/Ethnicity		
White	92	92.9
African American or Black	2	2.0
Hispanic or Latino	1	1.0
American Indian or Alaska Native	3	3.0
Other	1	1.0
Age		
18 Years	24	24.2
19 Years	34	34.3
20 Years	23	23.2
21 Years	10	10.1
22 Years	4	4.0
23 Years	2	2.0
24 Years	1	1.0
Not Specified	1	1.0
Years of Education		
12 (Freshman)	43	43.4
13 (Sophomore)	35	35.4
14 (Junior)	16	16.2
15 (Senior)	5	5.1
Current and/or Historical Psychiatric Diagnoses		
Attention Deficit/Hyperactivity Disorder	9	9.1
Learning Disorder/Disability	6	6.1
Mood Disorder/Depression	16	16.2
Anxiety Disorder	24	24.2

Based upon the proposed hypotheses, a total of six predictor variables were calculated: Current Inattention, Current Hyperactivity, Current Impulsivity, Current SCT, Childhood Inattention, and Childhood Hyperactivity/Impulsivity. See Table 2 for the mean, standard deviation, and range of the predictor variables.

Table 2

Independent Variables

Predictors	Mean	*SD*	Range
Current Inattention	15.030	4.612	9-35
Current Hyperactivity	8.455	2.815	5-19
Current Impulsivity	5.778	2.193	4-14
Current SCT	16.162	5.521	9-35
Childhood Inattention	15.889	6.149	9-36
Childhood Hyperactivity Impulsivity	16.020	6.086	9-34

Bivariate correlations were computed between all predictor variables to assess for collinearity and are presented in Table 3. As the correlation between two variables approaches unity, regression coefficients can become unstable and inaccurate. Therefore, only predictor variables that minimized problems of collinearity ($r < .8$) were utilized.

Table 3

Bivariate correlations between BAARS predictor variables

	Current Inattention	Current Hyperactivity	Current Impulsivity	Current SCT	Childhood Inattention	Childhood Hyperactivity Impulsivity
Current Inattention	1	.583**	.337**	.669**	.566**	.474**
Current Hyperactivity		1	.513**	.581**	.355**	.562**
Current Impulsivity			1	.360**	.293**	.581**
Current SCT				1	.470**	.500**
Childhood Inattention					1	.632**
Childhood Hyperactivity Impulsivity						1

** Correlation is significant at the 0.01 level (2-tailed).

The criterion variables used in the analyses are listed in Table 4 to Table 13 along with their bivariate correlations with the predictor variables.

Table 4

Bivariate correlations between BDEFS-LF predictors and BAARS criterion variables

	BDEFS-LF 1	BDEFS-LF 2	BDEFS-LF 3	BDEFS-LF 4	BDEFS-LF 5
Current Inattention	.798**	.703**	.618**	.648**	.295**
Current Hyperactivity	.591**	.627**	.535**	.525**	.343**
Current Impulsivity	.358**	.357**	.560**	.406**	.379**
Current SCT	.776**	.711**	.502**	.519**	.493**
Childhood Inattention	.540**	.569**	.507**	.569**	0.156
Childhood Hyperactivity Impulsivity	.439**	.489**	.610**	.408**	.352**

** Correlation is significant at the 0.01 level (2-tailed).
BDEFS-LF 1 = Self-Management to Time; BDEFS-LF 2 = Self-Organization/Problem Solving; BDEFS-LF 3 = Self-Restraint; BDEFS-LF 4 = Self-Motivation; BDEFS-LF 5 = Self-Regulation of Emotion.

Table 5

Bivariate correlations between RSPAN predictors and BAARS criterion variables

	Total Spans	Longest Span
Current Inattention	0.156	0.156
Current Hyperactivity	0.114	0.114
Current Impulsivity	0.093	0.092
Current SCT	.257*	.256*
Childhood Inattention	0.147	0.146
Childhood Hyperactivity Impulsivity	0.068	0.067

** Correlation is significant at the 0.01 level (2-tailed).

Table 6

Bivariate correlations between TMT predictors and BAARS criterion variables

	Trails A	Trails B	Trails B-A
Current Inattention	.243*	0.13	0.108
Current Hyperactivity	.240*	.218*	.199*
Current Impulsivity	0.132	-0.073	-0.086
Current SCT	.201*	.309**	.294**
Childhood Inattention	0.091	-0.04	-0.049
Childhood Hyperactivity Impulsivity	0.165	-0.034	-0.05

** Correlation is significant at the 0.01 level (2-tailed).

Table 7

Bivariate correlations between WCST predictors and BAARS criterion variables

	Trials Admin	Total Correct	Total Errors	Perseverative Errors	Categories Completed	Trials to 1st Category	Failure 2 Maintain
Current Inattention	0.083	0.087	0.085	0.089	0.089	0.093	0.089
Current Hyperactivity	0.03	0.03	0.028	0.027	0.028	0.028	0.028
Current Impulsivity	-0.018	-0.018	-0.019	-0.021	-0.019	-0.017	-0.019
Current SCT	0.138	0.135	0.139	0.137	0.136	0.141	0.136
Childhood Inattention	0.009	0.007	0.006	0.006	0.004	0.007	0.004
Childhood Hyperactivity Impulsivity	-0.081	-0.082	-0.084	-0.084	-0.084	-0.088	-0.085

** Correlation is significant at the 0.01 level (2-tailed).

Table 8

Bivariate correlations between Stroop Test predictors and BAARS criterion variables

	Word	Color	Color of Words	Interference
Current Inattention	-0.131	-0.061	-0.057	0.019
Current Hyperactivity	0.109	-0.004	-0.015	-0.066
Current Impulsivity	0.089	0.113	0.071	-0.008
Current SCT	0.018	0.045	0.087	0.082
Childhood Inattention	-0.134	-0.032	0.009	0.091
Childhood Hyperactivity Impulsivity	-0.018	-0.029	0.038	0.071

** Correlation is significant at the 0.01 level (2-tailed).

Table 9

Bivariate correlations between Plus-Minus Task predictors and BAARS criterion variables

	Addition Time	Subtraction Time	Switching Time	Switch Cost
Current Inattention	0.125	0.106	0.052	-0.059
Current Hyperactivity	0.068	0.051	0.051	0.018
Current Impulsivity	0.025	-0.052	-0.023	-0.016
Current SCT	0.029	0.077	-0.013	-0.108
Childhood Inattention	0.060	0.179	0.095	0
Childhood Hyperactivity Impulsivity	0.085	0.083	0.067	0.014

** Correlation is significant at the 0.01 level (2-tailed).

Table 10

Bivariate correlations between BDI and BAI predictors and BAARS criterion variables

	BDI	BAI
Current Inattention	.358**	0.183
Current Hyperactivity	.377**	.296**
Current Impulsivity	.296**	.224*
Current SCT	.559**	.434**
Childhood Inattention	.222*	0.119
Childhood Hyperactivity Impulsivity	.321**	.316**

** Correlation is significant at the 0.01 level (2-tailed).

Table 11

Bivariate correlations between SASSI-4 predictors and BAARS criterion variables

	FVA	FVOD	SYM	OAT	SAT
Current Inattention	.202*	.303**	.178	.397**	.369**
Current Hyperactivity	-.052	.166	.139	.451**	.320**
Current Impulsivity	-.028	.178	.128	.340**	.253*
Current SCT	.075	.103	.079	.331**	.364**
Childhood Inattention	.204*	.332**	.214*	.420**	.335**
Childhood Hyperactivity Impulsivity	.128	.302**	.304**	.437**	.294**

** Correlation is significant at the 0.01 level (2-tailed).

FVA = Face Valid Alcohol; FVOD = Face Valid Other Drug; SYM = Symptoms of Substance Misuse; OAT = Obvious Attributes; SAT = Subtle Attributes.

Table 12
Bivariate correlations between SASSI-4 predictors and BAARS criterion variables

	DEF	SAM	FAM	COR	RAP	RX
Current Inattention	-.419**	.486**	-.253*	.409**	-.025	.131
Current Hyperactivity	-.438**	.381**	-.354**	.356**	.002	-.043
Current Impulsivity	-.397**	.268**	-.247*	.375**	-.020	-.044
Current SCT	-.447**	.396**	-.221*	.288**	.022	.083
Childhood Inattention	-.367**	.490**	-.204*	.451**	.041	.190
Childhood Hyperactivity Impulsivity	-.453**	.496**	-.275**	.505**	-.071	.168

** Correlation is significant at the 0.01 level (2-tailed).
DEF = Defensiveness; SAM = Supplemental Addiction Measure; FAM = Family vs. Controls; COR = Correctional; RAP = Random Answering Pattern; RX = Prescription Drug Abuse

Table 13
Bivariate correlations between CISS predictor and BAARS criterion variables

	CISS
Current Inattention	.361**
Current Hyperactivity	.238*
Current Impulsivity	.238*
Current SCT	.485**
Childhood Inattention	.248*
Childhood Hyperactivity Impulsivity	.257*

** Correlation is significant at the 0.01 level (2-tailed).

The significance of each predictor variable was tested with degrees of freedom dependent based upon the number of cases for each dependent variable. The reported slope coefficient estimates the amount of change in the dependent variable associated with one unit of change in the predictor variable. The beta weight is a standardized slope coefficient that allows a comparison of the predictive strength of each of the predictor variables because all the variable have an equal standard deviation of 1. The part r squared indicates the percentage of variance of the dependent variable that is uniquely accounted for by the independent variable.

Hypothesis 1a: ADHD/SCT Symptoms and Self-Reported Executive Dysfunction

The results of a regression analysis using the predictor variables to predict BDEFS-LF Self-Management to Time are presented in Table 14. The BDEFS-LF Self-Management to Time scale assessed 21 items related to self-management to time (i.e., “Can’t seem to get things done unless there is an immediate deadline”). The results indicated that symptoms of Current Inattention and Current SCT were positively associated with symptoms of difficulties with Self-Management to Time. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 14
Linear regression analyses summary predicting BDEFS-LF Self-Management to Time (Raw Score)

Predictors	*b*	*β*	*t*	Part r^2
Current Inattention	1.229	.434	5.519**	0.080
Current Hyperactivity	.486	.105	1.409	0.005
Current Impulsivity	.350	.059	.890	0.002
Current SCT	.982	.415	5.619**	0.082
Childhood Inattention	.308	.145	1.962	0.010
Childhood Hyperactivity Impulsivity	-.339	-.158	-1.920	0.010

Note: *$p < 0.05$; ** $p < 0.01$.

The results of a regression analysis using the predictor variables to predict BDEFS-LF Self-Organization/Problem Solving are presented in Table 15. The BDEFS-

LF Self-Organization/Problem Solving scale assessed 24 items related to organization and problem solving (i.e., “Have difficulty explaining things in their proper order or sequence”). The results indicated that symptoms of Current Inattention, Current Hyperactivity, Current SCT, and Childhood Inattention were positively associated with symptoms of difficulties with Self-Organization/Problem Solving. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 15
Linear regression analyses summary predicting BDEFS-LF Self-Organization/Problem Solving (Raw Score)

Predictors	*b*	β	t	*Part* r^2
Current Inattention	.661	.231	2.470*	0.023
Current Hyperactivity	1.214	.259	2.928*	0.032
Current Impulsivity	.048	.008	.102	0.000
Current SCT	.799	.334	3.807**	0.054
Childhood Inattention	.529	.246	2.804*	0.029
Childhood Hyperactivity Impulsivity	-.203	-.094	-.956	0.003

Note: *$p < 0.05$; ** $p < 0.01$.

The results of a regression analysis using the predictor variables to predict BDEFS-LF Self-Restraint are presented in Table 16. The BDEFS-LF Self-Restrained scale assessed 20 items related to self-restraint (i.e., “Make impulsive comments to others”). The results indicated that symptoms of Current Inattention and Current Impulsivity were positively associated with symptoms of difficulties with Self-Restraint. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 16

Linear regression analyses summary predicting BDEFS-LF Self-Restraint (Raw Score)

Predictors	*b*	*β*	t	*Part* r^2
Current Inattention	.599	.362	3.419*	0.055
Current Hyperactivity	.108	.040	.399	0.001
Current Impulsivity	.959	.275	3.104*	0.046
Current SCT	-.004	-.003	-.031	0.000
Childhood Inattention	.097	.078	.784	0.003
Childhood Hyperactivity Impulsivity	.261	.208	1.880	0.017

Note: *$p < 0.05$; ** $p < 0.01$.

The results of a regression analysis using the predictor variables to predict BDEFS-LF Self-Motivation are presented in Table 17. The BDEFS-LF Self-Motivation scale assessed 12 items related to self-motivation (i.e., "Inconsistent in the quality or quantity of my work performance"). The results indicated that symptoms of Current Inattention, Current Impulsivity, and Childhood Inattention were positively associated with symptoms of difficulties with Self-Motivation. The symptoms of Childhood Hyperactivity/Impulsivity were negatively associated with symptoms of difficulties with Self-Motivation. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 17

Linear regression analyses summary predicting BDEFS-LF Self-Motivation (Raw Score)

Predictors	*b*	*β*	t	*Part* r^2
Current Inattention	.357	.326	3.024*	0.045
Current Hyperactivity	.362	.202	1.980	0.019
Current Impulsivity	.473	.206	2.274*	0.026
Current SCT	.049	.054	.534	0.001
Childhood Inattention	.316	.385	3.799**	0.071
Childhood Hyperactivity Impulsivity	-.208	-.250	-2.217*	0.024

Note: *$p < 0.05$; ** $p < 0.01$.

The results of a regression analysis using the predictor variables to predict BDEFS-LF Self-Regulation of Emotion are presented in Table 18. The BDEFS-LF Self-Regulation of Emotion assessed 13 items related to emotion regulation (i.e., "I remain emotional or upset longer than others"). The results indicated that symptoms of Current SCT were positively associated with symptoms of difficulties with Self-Regulation of Emotions. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 18
Linear regression analyses summary predicting BDEFS-LF Self-Regulation of Emotion (Raw Score)

Predictors	*b*	*β*	t	*Part* r^2
Current Inattention	-.055	-.037	-.281	0.001
Current Hyperactivity	-.091	-.037	-.299	0.001
Current Impulsivity	.643	.205	1.848	0.026
Current SCT	.596	.480	3.852**	0.111
Childhood Inattention	-.213	-.191	-1.536	0.018
Childhood Hyperactivity Impulsivity	.172	.152	1.098	0.009

Note: **p* < 0.05; ** *p* < 0.01.

Hypothesis 1b: ADHD/SCT Symptoms and Laboratory Measures of Executive Functioning

The results of a regression analysis using the predictor variables to predict the Total Number of Spans, a measure obtained from the Reading Span Task, are presented in Table 19. The Total Number of Spans assessed the number of total correct spans completed by each participant. A span was considered correct if the participant correctly recalled the last words, in the correct order of each sentence set. The results indicated that none of the predictors were associated with Reading Span: Total Number of Spans performance. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 19
Linear regression analyses summary predicting Reading Span: Total Number of Spans (Raw Score)

Predictors	*b*	*β*	t	*Part* r^2
Current Inattention	-.039	-.104	-.668	0.005
Current Hyperactivity	-.046	-.076	-.510	0.003
Current Impulsivity	.213	.260	1.926	0.038
Current SCT	.068	.211	1.441	0.022
Childhood Inattention	.045	.155	1.085	0.012
Childhood Hyperactivity Impulsivity	-.054	-.189	-1.171	0.014

Note: *$p < 0.05$; ** $p < 0.01$.

The results of a regression analysis using the predictor variables to predict Longest Span, a measure obtained from the Reading Span Task, are presented in Table 20. The Longest Span assessed the largest number of sentences read and last word recalled correctly by each participant. The results indicated that none of the predictors were associated with Reading Span: Longest Span performance. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 20

Linear regression analyses summary predicting Reading Span: Longest Span (Raw Score)

Predictors	*b*	*β*	t	*Part r*^{2}
Current Inattention	-.004	-.021	-.135	0.000
Current Hyperactivity	.003	.010	.066	0.000
Current Impulsivity	.037	.097	.706	0.005
Current SCT	.036	.238	1.599	0.028
Childhood Inattention	.009	.067	.462	0.002
Childhood Hyperactivity Impulsivity	-.032	-.239	-1.456	0.023

Note: **p* < 0.05; ** *p* < 0.01.

The results of a regression analysis using the predictor variables to predict Trails A are presented in Table 21. Trails A assessed the number of seconds each participant took to draw lines connecting consecutive numbers from 1 to 25. The results indicated that none of the predictors were associated with Trails A performance. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 21

Linear regression analyses summary predicting Trails A (Raw Score)

Predictors	*b*	*β*	t	*Part r*^{2}
Current Inattention	.360	.190	1.237	0.015
Current Hyperactivity	.368	.119	.816	0.007
Current Impulsivity	-.046	-.012	-.089	0.000
Current SCT	.040	.025	.176	0.000
Childhood Inattention	-.163	-.115	-.796	0.006
Childhood Hyperactivity Impulsivity	.108	.075	.467	0.002

Note: **p* < 0.05; ** *p* < 0.01.

The results of a regression analysis using the predictor variables to predict Trails B are presented in Table 22. Trails B assessed the number of seconds each participant took to draw lines connecting alternating numbers and letters, in order from 1 to 13. The results indicated that none of the predictors were associated with Trails B performance. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 22

Linear regression analyses summary predicting Trails B (Raw Score)

Predictors	*b*	*β*	t	*Part* r^2
Current Inattention	.715	.169	1.081	0.012
Current Hyperactivity	-.154	-.022	-.147	0.000
Current Impulsivity	-.400	-.045	-.340	0.001
Current SCT	.590	.161	1.089	0.012
Childhood Inattention	-.048	-.015	-.103	0.000
Childhood Hyperactivity Impulsivity	-.141	-.044	-.269	0.001

Note: *$p < 0.05$; ** $p < 0.01$.

The results of a regression analysis using the predictor variables to predict Trails B – Trails A are presented in Table 23. Trails B – A assessed the time difference for each participant between their Trails B performance and their Trails A performance. The results indicated that none of the predictors were associated with Trails B – Trails A performance. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 23

Linear regression analyses summary predicting Trails B – Trails A (Raw Score)

Predictors	*b*	*β*	t	*Part r*^{2}
Current Inattention	.335	.087	.550	0.003
Current Hyperactivity	-.462	-.072	-.481	0.002
Current Impulsivity	-.411	-.051	-.378	0.002
Current SCT	.596	.178	1.192	0.015
Childhood Inattention	.103	.036	.240	0.001
Childhood Hyperactivity Impulsivity	-.264	-.090	-.545	0.003

Note: $*p < 0.05$; $** p < 0.01$.

The results of a regression analysis using the predictor variables to predict WCST Trials Administered are presented in Table 24. WCST Trails Administered assessed the total number of tails administer to each participant. The number of trials administered was dependent upon each participants' performance. If participants were able to complete all 6 categories, then the trials were discontinued. However, if participants were unable to complete the 6^{th} category, then test administration was discontinued following the 128^{th} trial. The results indicated that none of the predictors were associated with WCST Trails Administered. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 24

Linear regression analyses summary predicting WCST Trials Administered (Raw Score)

Predictors	*b*	*β*	t	*Part r*^{2}
Current Inattention	-.869	-.236	-1.514	0.026
Current Hyperactivity	.396	.066	.439	0.002
Current Impulsivity	-.057	-.007	-.055	0.000
Current SCT	.313	.100	.669	0.005
Childhood Inattention	.406	.143	.933	0.010
Childhood Hyperactivity Impulsivity	-.081	-.030	-.170	0.000

Note: $*p < 0.05$; $** p < 0.01$.

The results of a regression analysis using the predictor variables to predict WCST Total Correct are presented in Table 25. WCST Total Correct assessed the number of correct responses given by each participant. The results indicated that none of the predictors were associated with WCST Total Correct. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 25

Linear regression analyses summary predicting WCST Total Correct (Raw Score)

Predictors	*b*	*β*	t	*Part r^2*
Current Inattention	-.210	-.158	-1.019	0.011
Current Hyperactivity	.245	.114	.756	0.006
Current Impulsivity	.007	.003	.020	0.000
Current SCT	-.129	-.114	-.765	0.006
Childhood Inattention	.162	.158	1.035	0.012
Childhood Hyperactivity Impulsivity	.054	.055	.314	0.001

Note: $*p < 0.05$; $** p < 0.01$.

The results of a regression analysis using the predictor variables to predict WCST Total Errors are presented in Table 26. WCST Total Errors assessed the number of incorrect responses given by each participant. The results indicated that none of the predictors were associated with WCST Total Errors. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 26
Linear regression analyses summary predicting WCST Total Errors (Raw Score)

Predictors	*b*	*β*	t	*Part r*^{2}
Current Inattention	-.659	-.218	-1.403	0.022
Current Hyperactivity	.151	.031	.204	0.000
Current Impulsivity	-.064	-.101	-.076	0.000
Current SCT	.441	.173	1.155	0.015
Childhood Inattention	.244	.105	.686	0.005
Childhood Hyperactivity Impulsivity	-.135	-.060	-.347	0.001

Note: *$p < 0.05$; ** $p < 0.01$.

The results of a regression analysis using the predictor variables to predict WCST Perseverative Responses are presented in Table 27. WCST Perseverative Responses assessed the number or perseverative responses given by each participant. A perseverative response is defined as a response that matches the perseverate-to principle and the response may or may not match the presently correct principle. The results indicated that none of the predictors were associated with WCST Perseverative Responses. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 27
Linear regression analyses summary predicting WCST Perseverative Responses (Raw Score)

Predictors	*b*	*β*	t	*Part r*^{2}
Current Inattention	-.064	-.032	-.203	0.000
Current Hyperactivity	-.195	-.060	-.397	0.002
Current Impulsivity	-.323	-.079	-.575	0.004
Current SCT	.065	.039	.257	0.001
Childhood Inattention	.158	.103	.666	0.005
Childhood Hyperactivity Impulsivity	.017	.011	.065	0.000

Note: *$p < 0.05$; ** $p < 0.01$.

The results of a regression analysis using the predictor variables to predict WCST Perseverative Errors are presented in Table 28. WCST Perseverative Errors assessed the number of perseverative errors given by each participant. A perseverative error is defined as a response that matches the perseverated-to principle and does not match the presently correct principle (i.e., continuing to respond to a previously correct category although the set has shifted). The results indicated that none of the predictors were associated with WCST Perseverative Errors. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 28
Linear regression analyses summary predicting WCST Perseverative Errors (Raw Score)

Predictors	*b*	*β*	t	*Part* r^2
Current Inattention	-.064	-.038	-.245	0.001
Current Hyperactivity	-.171	-.064	-.419	0.002
Current Impulsivity	-.229	-.067	-.490	0.003
Current SCT	.080	.057	.376	0.002
Childhood Inattention	.127	.100	.646	0.005
Childhood Hyperactivity Impulsivity	.014	.011	.063	0.000

Note: $*p < 0.05$; $** p < 0.01$.

The results of a regression analysis using the predictor variables to predict WCST Categories Completed are presented in Table 29. WCST Categories Completed assessed the number of blocks of 10 consecutive correct matches to the presently correct principle. The results indicated that none of the predictors were associated with WCST Categories Completed. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 29
Linear regression analyses summary predicting WCST Categories Completed *(Raw Score)*

Predictors	*b*	*β*	t	*Part* r^2
Current Inattention	.009	.046	.299	0.001
Current Hyperactivity	-.020	-.064	-.426	0.002
Current Impulsivity	.016	.040	.291	0.001
Current SCT	-.020	-.119	-.796	0.007
Childhood Inattention	-.018	-.122	-.793	0.007
Childhood Hyperactivity Impulsivity	.034	.233	1.337	0.020

Note: $^*p < 0.05$; $^{**}\ p < 0.01$.

The results of a regression analysis using the predictor variables to predict WCST Trials 1st Category are presented in Table 30. WCST Trials 1st Category assessed the total number of trials from the beginning of the test through completion of the first category (i.e., color). The results indicated that none of the predictors were associated with WCST Trials 1st Category. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 30
Linear regression analyses summary predicting WCST Trials 1st Category *(Raw Score)*

Predictors	*b*	*β*	t	*Part* r^2
Current Inattention	.143	.056	.363	0.001
Current Hyperactivity	-.243	-.059	-.392	0.002
Current Impulsivity	.606	.115	.855	0.008
Current SCT	.306	.141	.953	0.010
Childhood Inattention	.296	.150	.991	0.011
Childhood Hyperactivity Impulsivity	-.573	-.302	-1.752	0.033

Note: $^*p < 0.05$; $^{**}\ p < 0.01$.

The results of a regression analysis using the predictor variables to predict WCST Failure to Maintain Set are presented in Table 31. WCST Failure to Maintain Set assessed the number of times a participant completed five or more consecutive correct matches and then made an error. A failure to maintain set occurs when, despite positive feedback, the respondent abandons a successful matching strategy. The results indicated that none of the predictors were associated with WCST Failure 2 Maintain. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 31

Linear regression analyses summary predicting WCST Failure 2 Maintain (Raw Score)

Predictors	*b*	β	t	*Part* r^2
Current Inattention	.007	.045	.290	0.001
Current Hyperactivity	.017	.071	.470	0.002
Current Impulsivity	.016	.053	.390	0.002
Current SCT	-.001	-.011	-.074	0.000
Childhood Inattention	.024	.212	1.389	0.021
Childhood Hyperactivity Impulsivity	-.034	-.312	-1.800	0.036

Note: *$p < 0.05$; ** $p < 0.01$.

The results of a regression analysis using the predictor variables to predict Stroop Word are presented in Table 32. Stroop Word assessed the number of words each participant read was able to read in 45 seconds. The results indicated that none of the predictors were associated with Stroop Word. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 32

Linear regression analyses summary predicting Stroop Word (Raw Score)

Predictors	*b*	*β*	t	*Part* r^2
Current Inattention	-.983	-.296	-1.938	0.037
Current Hyperactivity	1.266	.233	1.610	0.026
Current Impulsivity	.618	.089	.690	0.005
Current SCT	.344	.124	.864	0.007
Childhood Inattention	-.235	-.095	-.658	0.004
Childhood Hyperactivity Impulsivity	-.156	-.062	-.389	0.002

Note: *$p < 0.05$; ** $p < 0.01$.

The results of a regression analysis using the predictor variables to predict Stroop Color are presented in Table 33. Stroop Color assessed the number of colors each participant could name in 45 seconds. The results indicated that none of the predictors were associated with Stroop Color. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 33

Linear regression analyses summary predicting Stroop Color (Raw Score)

Predictors	*b*	*β*	t	*Part* r^2
Current Inattention	-.389	-.166	-1.064	0.012
Current Hyperactivity	-.123	-.032	-.218	0.000
Current Impulsivity	1.022	.208	1.585	0.026
Current SCT	.316	.162	1.101	0.013
Childhood Inattention	.062	.035	.241	0.001
Childhood Hyperactivity Impulsivity	-.277	-.156	-.954	0.009

Note: *$p < 0.05$; ** $p < 0.01$.

The results of a regression analysis using the predictor variables to predict Stroop Color-Word are presented in Table 34. Stroop Color-Word assessed number of colors of words each participant could name in 45 seconds. The results indicated that none of the predictors were associated with Stroop Color-Word. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 34

Linear regression analyses summary predicting Stroop Color-Word (Raw Score)

Predictors	*b*	*β*	t	*Part* r^2
Current Inattention	-.378	-.203	-1.294	0.017
Current Hyperactivity	-.262	-.086	-.578	0.003
Current Impulsivity	.372	.095	.721	0.005
Current SCT	.358	.230	1.559	0.025
Childhood Inattention	.026	.018	.124	0.000
Childhood Hyperactivity Impulsivity	.001	.001	.004	0.000

Note: *$p < 0.05$; ** $p < 0.01$.

The results of a regression analysis using the predictor variables to predict Stroop Interference are presented in Table 35. Stroop Interference is a calculated score derived from subtracting each participants' predicted score from their Color Word score. The results indicated that none of the predictors were associated with Stroop Interference. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 35

Linear regression analyses summary predicting Stroop Interference (Raw Score)

Predictors	*b*	*β*	t	*Part* r^2
Current Inattention	-.057	-.040	-.254	0.001
Current Hyperactivity	-.467	-.198	-1.336	0.019
Current Impulsivity	-.080	-.026	-.200	0.000
Current SCT	.187	.156	1.055	0.012
Childhood Inattention	.054	.050	.341	0.001
Childhood Hyperactivity Impulsivity	.117	.108	.655	0.004

Note: *$p < 0.05$; ** $p < 0.01$.

The results of a regression analysis using the predictor variables to predict Plus Minus: Addition Time are presented in Table 36. Plus Minus: Addition Time assessed the number of seconds each participant took to complete the addition task. The results indicated that none of the predictors were associated with Plus Minus: Addition Time. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 36

Linear regression analyses summary predicting Plus Minus: Addition Time (Raw Score)

Predictors	*b*	*β*	t	*Part* r^2
Current Inattention	.866	.193	1.219	0.016
Current Hyperactivity	.030	.004	.027	0.000
Current Impulsivity	-.460	-.049	-.367	0.001
Current SCT	-.430	-.115	-.772	0.006
Childhood Inattention	-.170	-.050	-.340	0.001
Childhood Hyperactivity Impulsivity	.369	.108	.655	0.004

Note: *$p < 0.05$; ** $p < 0.01$.

The results of a regression analysis using the predictor variables to predict Plus Minus: Subtraction Time are presented in Table 37. Plus Minus: Subtraction Time assessed the number of seconds each participant took to complete the subtraction task. The results indicated that none of the predictors were associated with Plus Minus: Subtraction Time. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 37
Linear regression analyses summary predicting Plus Minus: Subtraction Time (Raw Score)

Predictors	*b*	*β*	t	*Part r²*
Current Inattention	.145	.022	.139	0.000
Current Hyperactivity	.401	.037	.248	0.001
Current Impulsivity	-2.006	-.143	-1.089	0.012
Current SCT	-.025	-.004	-.031	0.000
Childhood Inattention	.930	.186	1.263	0.017
Childhood Hyperactivity Impulsivity	.099	.020	.120	0.000

Note: *$p < 0.05$; ** $p < 0.01$.

The results of a regression analysis using the predictor variables to predict Plus Minus: Switching Time are presented in Table 38. Plus Minus: Switching Time assessed the number of seconds each participant took to complete the alternating addition and subtraction task. The results indicated that none of the predictors were associated with Plus Minus: Switching Time. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 38
Linear regression analyses summary predicting Plus Minus: Switching Time (Raw Score)

Predictors	*b*	*β*	t	*Part r²*
Current Inattention	.310	.040	.253	0.001
Current Hyperactivity	1.050	.083	.554	0.003
Current Impulsivity	-1.585	-.097	-.734	0.006
Current SCT	-.824	-.128	-.858	0.008
Childhood Inattention	.522	.090	.605	0.004
Childhood Hyperactivity Impulsivity	.381	.065	.393	0.002

Note: *$p < 0.05$; ** $p < 0.01$.

The results of a regression analysis using the predictor variables to predict Plus Minus: Switch Cost are presented in Table 39. Plus Minus: Switch Cost is a calculated score derived by taking the difference between the reaction time needed to complete the alternating series and the mean reaction times of the addition and subtraction series. The results indicated that none of the predictors were associated with Plus Minus: Switching Cost. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 39

Linear regression analyses summary predicting Plus Minus: Switch Cost (Raw Score)

Predictors	*b*	*β*	t	*Part* r^2
Current Inattention	-.195	-.050	-.316	0.001
Current Hyperactivity	.835	.130	.870	0.008
Current Impulsivity	-.352	-.043	-.322	0.001
Current SCT	-.596	-.182	-1.228	0.016
Childhood Inattention	.142	.048	.326	0.001
Childhood Hyperactivity Impulsivity	.147	.049	.299	0.001

Note: *$p < 0.05$; ** $p < 0.01$.

Hypothesis 2: ADHD/SCT symptoms and internalizing symptoms

The results of a regression analysis using the predictor variables to predict BDI are presented in Table 40. The BDI assessed participants' experiences of affective, cognitive, and vegetative symptoms of depression over the past 2 weeks. The results indicated that symptoms of Current SCT were positively associated with symptoms of depression. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 40

Linear regression analyses summary predicting BDI (Total Score)

Predictors	*b*	*β*	t	*Part r²*
Current Inattention	-.063	-.032	-.246	0.000
Current Hyperactivity	.129	.041	.327	0.001
Current Impulsivity	.368	.090	.819	0.005
Current SCT	.878	.542	4.398**	0.141
Childhood Inattention	-.120	-.082	-.667	0.003
Childhood Hyperactivity Impulsivity	.062	.042	.305	0.001

Note: *$p < 0.05$; ** $p < 0.01$.

The results of a regression analysis using the predictor variables to predict BAI are presented in Table 41. The BAI assessed participants for a variety of common anxiety symptoms during the past week. The results indicated that symptoms of Current SCT were positively associated with symptoms of anxiety. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 41

Linear regression analyses summary predicting BAI (Total Score)

Predictors	*b*	*β*	t	*Part r²*
Current Inattention	-.387	-.190	-1.368	0.015
Current Hyperactivity	.150	.045	.343	0.001
Current Impulsivity	-.031	-.007	-.062	0.000
Current SCT	.848	.497	3.817**	0.119
Childhood Inattention	-.275	-.179	-1.377	0.015
Childhood Hyperactivity Impulsivity	.387	.250	1.721	0.024

Note: *$p < 0.05$; ** $p < 0.01$.

Hypothesis 3: ADHD/SCT Symptoms and Substance Use Disorder Symptoms

The results of a regression analysis using the predictor variables to predict SASSI-4: Face Valid Alcohol (FVA) are presented in Table 42. The FVA scale assessed participants' acknowledged motivations and consequences of alcohol use, as well as loss of control. The results indicated that symptoms of Current Inattention were positively associated with symptoms of alcohol use. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 42
Linear regression analyses summary predicting SASSI-4 (Face Valid Alcohol)

Predictors	*b*	*β*	t	*Part* r^2
Current Inattention	.238	.311	2.059*	0.041
Current Hyperactivity	-.344	-.273	-1.916	0.035
Current Impulsivity	-.149	-.093	-.732	0.005
Current SCT	-.040	-.062	-.436	0.002
Childhood Inattention	.042	.072	.509	0.003
Childhood Hyperactivity Impulsivity	.101	.174	1.101	0.012

Note: *$p < 0.05$; ** $p < 0.01$.

The results of a regression analysis using the predictor variables to predict SASSI-4: Face Valid Other Drug (FVOD) are presented in Table 43. The FVOD scale assessed participants' acknowledged motivations and consequences of drug use, as well as loss of control. The results indicated that symptoms of Current Inattention were positively associated with symptoms of drug use. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 43

Linear regression analyses summary predicting SASSI-4 (Face Valid Other Drug)

Predictors	*b*	*β*	t	*Part* r^2
Current Inattention	.245	.308	2.120*	0.040
Current Hyperactivity	-.055	-.042	-.306	0.001
Current Impulsivity	.058	.035	.284	0.001
Current SCT	-.174	-.262	-1.923	0.033
Childhood Inattention	.101	.170	1.243	0.014
Childhood Hyperactivity Impulsivity	.111	.183	1.206	0.013

Note: $*p < 0.05$; $** p < 0.01$.

The results of a regression analysis using the predictor variables to predict SASSI-4: Symptoms of Substance Misuse (SYM) are presented in Table 44. The SYM scale assessed the extent to which participants acknowledged specific problems associated with substance misuse. The results indicated that symptoms of Childhood Hyperactivity Impulsivity were positively associated with symptoms of problematic substance misuse. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 44

Linear regression analyses summary predicting SASSI-4 (Symptoms of Substance Misuse)

Predictors	*b*	*β*	t	*Part* r^2
Current Inattention	.087	.151	1.000	0.010
Current Hyperactivity	-.025	-.026	-.185	0.000
Current Impulsivity	-.074	-.061	-.485	0.002
Current SCT	-.081	-.168	-1.189	0.014
Childhood Inattention	.002	.006	.040	0.000
Childhood Hyperactivity Impulsivity	.159	.364	2.304*	0.051

Note: $*p < 0.05$; $** p < 0.01$.

The results of a regression analysis using the predictor variables to predict SASSI-4: Obvious Attributes (OAT) are presented in Table 45. The OAT scale assessed participants' acknowledged characteristics commonly associated with substance abuse. The results indicated that symptoms of Current Hyperactivity were positively associated with characteristics associated with substance abuse. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 45
Linear regression analyses summary predicting SASSI-4 (Obvious Attributes)

Predictors	*b*	*β*	t	*Part* r^2
Current Inattention	.038	.086	.639	0.003
Current Hyperactivity	.192	.265	2.079*	0.033
Current Impulsivity	.074	.079	.700	0.004
Current SCT	-.022	-.060	-.471	0.002
Childhood Inattention	.075	.227	1.796	0.025
Childhood Hyperactivity Impulsivity	.030	.088	.625	0.003

Note: *$p < 0.05$; ** $p < 0.01$.

The results of a regression analysis using the predictor variables to predict SASSI-4: Subtle Attributes (SAT) are presented in Table 46. The SAT scale assessed participants' lesser apparent substance use characteristics. The results indicated that none of the predictors were associated with subtle signs of substance misuse. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 46

Linear regression analyses summary predicting SASSI-4 (Subtle Attributes)

Predictors	*b*	*β*	t	*Part r^2*
Current Inattention	.054	.114	.789	0.005
Current Hyperactivity	.065	.084	.614	0.003
Current Impulsivity	.094	.093	.773	0.005
Current SCT	.059	.147	1.086	0.010
Childhood Inattention	.062	.172	1.273	0.014
Childhood Hyperactivity Impulsivity	-.016	-.044	-.290	0.001

Note: $^*p < 0.05$; $^{**} p < 0.01$.

The results of a regression analysis using the predictor variables to predict SASSI-4: Defensiveness (DEF) are presented in Table 47. The DEF scale assessed participants' unwillingness to acknowledge common flaws and shortcomings. The results indicated that none of the predictors were associated with significant denial of common flaws and shortcomings. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 47

Linear regression analyses summary predicting SASSI-4 (Defensiveness)

Predictors	*b*	*β*	t	*Part r^2*
Current Inattention	-.037	-.086	-.648	0.003
Current Hyperactivity	-.079	-.112	-.888	0.006
Current Impulsivity	-.138	-.153	-1.367	0.014
Current SCT	-.061	-.171	-1.366	0.014
Childhood Inattention	-.023	-.071	-.568	0.002
Childhood Hyperactivity Impulsivity	-.042	-.130	-.929	0.007

Note: $^*p < 0.05$; $^{**} p < 0.01$.

The results of a regression analysis using the predictor variables to predict SASSI-4: Supplemental Addiction Measure (SAM) are presented in Table 48. The SAM scale assessed participants' substance use, while accounting for potential defensiveness. The results indicated that none of the predictors were associated with substance use disorders in participants with high defensiveness. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 48

Linear regression analyses summary predicting SASSI-4 (Supplemental Addiction Measure)

Predictors	*b*	*β*	t	*Part* r^2
Current Inattention	.126	.244	1.887	0.025
Current Hyperactivity	.039	.046	.373	0.001
Current Impulsivity	-.050	-.046	-.422	0.001
Current SCT	.003	.006	.050	0.000
Childhood Inattention	.069	.178	1.464	0.015
Childhood Hyperactivity Impulsivity	.104	.265	1.955	0.027

Note: *$p < 0.05$; ** $p < 0.01$.

The results of a regression analysis using the predictor variables to predict SASSI-4: Family vs. Control Subjects (FAM) are presented in Table 49. The FAM scale assessed characteristics common among family members of participants with substance use disorders. The results indicated that none of the predictors were associated with these characteristics. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 49

Linear regression analyses summary predicting SASSI-4 (Family vs. Controls)

Predictors	*b*	*β*	t	*Part* r^2
Current Inattention	-.023	-.051	-.346	0.001
Current Hyperactivity	-.199	-.268	-1.907	0.034
Current Impulsivity	-.057	-.060	-.480	0.002
Current SCT	.015	.040	.287	0.001
Childhood Inattention	-.015	-.044	-.316	0.001
Childhood Hyperactivity Impulsivity	-.020	-.058	-.371	0.001

Note: $*p < 0.05$; $** p < 0.01$.

The results of a regression analysis using the predictor variables to predict SASSI-4: Correctional (COR) are presented in Table 50. The COR scale assessed participants' relative level of risk for legal problems. The results indicated that none of the predictors were associated with increased risk for legal problems. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 50

Linear regression analyses summary predicting SASSI-4 (Correctional)

Predictors	*b*	*β*	t	*Part* r^2
Current Inattention	.111	.207	1.571	0.018
Current Hyperactivity	.030	.034	.269	0.001
Current Impulsivity	.146	.129	1.163	0.010
Current SCT	-.060	-.133	-1.076	0.008
Childhood Inattention	.072	.179	1.444	0.015
Childhood Hyperactivity Impulsivity	.109	.266	1.929	0.028

Note: $*p < 0.05$; $** p < 0.01$.

The results of a regression analysis using the predictor variables to predict SASSI-4: Random Answering Pattern (RAP) are presented in Table 51. The RAP scale assessed participants' who may not have answered the questionnaire meaningfully. The results indicated that none of the predictors were associated with non-meaningful responses.

Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 51
Linear regression analyses summary predicting SASSI-4 (Random Answering Pattern)

Predictors	*b*	*β*	t	*Part* r^2
Current Inattention	-.011	-.132	-.834	0.007
Current Hyperactivity	.011	.077	.515	0.003
Current Impulsivity	.006	.034	.258	0.001
Current SCT	.006	.080	.538	0.003
Childhood Inattention	.012	.185	1.246	0.016
Childhood Hyperactivity Impulsivity	-.015	-.228	-1.378	0.020

Note: **p* < 0.05; ** *p* < 0.01.

The results of a regression analysis using the predictor variables to predict SASSI-4: Prescription Drug Abuse (RX) are presented in Table 52. The RX scale assessed participants' non-medical use of prescription medications. The results indicated that none of the predictors were associated with the misuse of prescription medications. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 52
Linear regression analyses summary predicting SASSI-4 (Prescription Drug Abuse)

Predictors	*b*	*β*	t	*Part* r^2
Current Inattention	.022	.150	.983	0.010
Current Hyperactivity	-.054	-.231	-1.603	0.025
Current Impulsivity	-.048	-.157	-1.230	0.015
Current SCT	.001	.009	.063	0.000
Childhood Inattention	.006	.051	.360	0.001
Childhood Hyperactivity Impulsivity	.031	.281	1.761	0.031

Note: **p* < 0.05; ** *p* < 0.01.

Hypothesis 4: ADHD/SCT Symptoms and Convergence Insufficiency Symptoms

The results of a regression analysis using the predictor variables to predict CISS are presented in Table 53. The CISS assessed participants for a variety of symptoms associated with CI (e.g., "Do your eyes feel tired when reading or doing close work?"). The results indicated that symptoms of Current SCT were positively associated with symptoms of CI. Multicollinearity did not influence any of the predictors as all intercorrelations were less than 0.8 and all indices of multicollinearity (i.e., tolerance and VIF) were within acceptable limits.

Table 53
Linear regression analyses summary predicting CISS (Total Score)

Predictors	*b*	*β*	t	*Part* r^2
Current Inattention	.241	.103	.742	0.004
Current Hyperactivity	-.562	-.146	-1.114	0.010
Current Impulsivity	.572	.116	.997	0.008
Current SCT	.913	.465	3.576*	0.104
Childhood Inattention	-.012	-.007	-.054	0.000
Childhood Hyperactivity Impulsivity	-.009	-.005	-.037	0.000

Note: *$p < 0.05$; ** $p < 0.01$.

CHAPTER IV

DISCUSSION

The goal of the present study was to investigate the predictive relationship of ADHD and SCT symptoms on executive functioning, depression, anxiety, substance use, and convergence insufficiency. While decades of research have established relationships amongst the ADHD dimensions and the aforementioned, renewed interest in SCT as a potential psychological diagnosis has provided a unique avenue in which to replicate and explore these potential relationships. In the current study, a variety of self-report and laboratory measures were utilized to test the hypotheses: 1a) ADHD/SCT symptoms would significantly predict impairment in executive functioning on a self-report measure; 1b) ADHD/SCT symptoms would significantly predict impairment on laboratory measures of executive functioning; 2) ADHD/SCT symptoms would significantly predict depression and anxiety symptoms; 3) ADHD/SCT symptoms would significantly predict symptoms of SUDs; 4) ADHD/SCT symptoms would significantly predict symptoms of Convergence insufficiency (CI). Overall, the results are largely consistent with previous literature; however, a few discrepancies are noted.

Different dimensions of ADHD and SCT symptoms predicted several aspects of self-reported impaired executive functioning. Current Inattention and SCT predicted significantly poorer Self-Management to Time, which is consistent with previous findings (Becker, Burns et al., 2018; Wood et al., 2017). Also, in agreement with the extant literature, Current Inattention, Current Hyperactivity, Current SCT, and Childhood Inattention predicted significantly more difficulty with Self-Organization/Problem Solving (Becker, Burns et al, 2018; Wood et al., 2017). However, Hyperactivity symptoms predicting poorer Self-Organization/Problem Solving is a novel finding. Current Inattention and Current Impulsivity predicted significantly poorer Self-Restraint, which is similar to previous work (Wood et. al., 2017). Unlike Wood and colleagues (2017), the current study did not find Current SCT symptoms to be a significant predictor of poor Self-Restraint and is likely explained by differing analytic strategies. Specifically, the current study utilized SCT symptom total score whereas the previous study relied upon SCT symptom count (Wood et al., 2017). In accordance with previous work (Wood et al., 2017), Current Inattention significantly predicted worse Self-Motivation; however, Childhood Inattention and Current Impulsivity were also novel predictors of poor Self-Motivation. These findings are likely explained by the separation of Current Impulsivity and Current Hyperactivity symptoms, as the previous study had combined those dimensions (Wood et al., 2017). In addition, the present study failed to replicate the finding that Current SCT significantly predicts poor Self-Motivation, which may be due to the use of the total score as opposed to the symptom count. Unique to this study, Childhood Hyperactivity/Impulsivity significantly predicted better Self-Motivation. SCT predicted significantly worse Self-Regulation of Emotions, which is consistent with the literature (Becker, Burns et al., 2018; Wood et al., 2017). However, Inattention, Hyperactivity, and Impulsivity did not predict Self-Regulation of Emotion which contrasts previous work (Wood et al., 2017). Again, these discrepant findings are likely the result of different analytic approaches. Taken together, the current findings suggest that college students with ADHD and SCT symptoms endorse significantly more problems with executive functioning than their peers on self-report measures.

The dimensions of ADHD and SCT symptoms did not predict impairment on laboratory measures of executive functioning. Specifically, ADHD and SCT symptoms did not significantly predict performance on tasks of updating/working memory (i.e., Reading Span: Total Number of Spans or Longest Span), set shifting (Trails: B-A, WCST: Perseverative Errors), or inhibition (Stroop: Color Word or Interference, Plus-Minus: Switching Time or Cost Switch). The failure of the ADHD dimensions to predict poor executive functioning was somewhat unanticipated given previous research has found that individuals with ADHD perform significantly worse than healthy controls on tasks of executive functioning (Hervey et al., 2004; Seidman et al., 1998). However, these previous studies have relied upon clinical samples, whereas the present study utilized a community sample, with only 9 participants reporting a past and/or current ADHD diagnosis. Consistent with previous work, SCT symptoms failed to predict impairment in laboratory measures of executive functioning in a community sample (Jarrett et al., 2017). Overall, these results indicate that the dimensions of ADHD and SCT do not significantly predict performance on laboratory measures of executive functioning in a community sample of college students.

Regarding internalizing disorders, the dimensions of ADHD did not significantly predict symptoms of depression or anxiety. These findings do not align with other college community samples (Mochrie, Whited, Cellucci, Freeman, & Corson, 2020; Nelson &

Liebel, 2018); however, previous studies did not account for SCT symptoms which may have contributed to the association between ADHD and internalizing symptoms. Symptoms of SCT significantly predicted internalizing symptom clusters (i.e., depression and anxiety), which is in line with the existing literature (Becker, Burns et al., 2014; Becker & Barkley, 2018; Penny et al., 2009). Thus, the present study contends that SCT symptoms, but not ADHD symptoms, predict internalizing disorders in a community sample of college students.

The results yielded mixed findings regarding the ability of ADHD dimensions and SCT symptoms to predict substance use. Specifically, Current Inattention significantly predicted acknowledged motivations and consequences of alcohol use and drug use, as well as loss of control. Childhood Hyperactivity/Impulsivity predicted acknowledged problems associated with substance misuse and Current Hyperactivity predicted characteristics commonly associated with substance abuse. These findings are consistent with the traditionally assessed dimensions of ADHD (i.e., inattention, hyperactivity, impulsivity) and their established relationship with SUDs (Kalbag & Levin, 2005; Kessler et al., 2006; Mochrie et al., 2020). Conversely, SCT symptoms failed to predict problematic alcohol or other drug use. These findings appear to be consistent with the limited literature in this area which demonstrated no differences between high and low SCT symptom groups on measures of alcohol and cannabis use (Wood et al., 2020). In general, the current findings indicate the ADHD dimensions, but not SCT symptoms, are associated with problematic substance use.

Regarding CI symptoms, the current study produced varied results between ADHD and SCT symptoms. Regarding ADHD, none of the dimensions predicted CI symptoms. This finding is somewhat unexpected given previous studies have shown a relationship between CI and inattention-like symptoms on laboratory and self-report measures (Daniel & Kapoula, 2019; Poltavski et al., 2016; Poltavski et al., 2012). However, these studies did not directly assess SCT symptoms and therefore the perceived inattention-like symptoms may be more consistent with the current conceptualization of SCT. To further support this notion, the present study found that SCT symptoms significantly predicted CI symptoms. Taken together, the current study demonstrates that SCT symptoms maybe a better predictor of CI symptoms than the traditional dimensions of ADHD (i.e., inattention, hyperactivity, impulsivity).

Strengths, Limitations, & Future Directions

The present study has many notable strengths, which contributes to the extant literature on the dimensions of ADHD and SCT. This study is the first to systemically assess the ability of ADHD and SCT symptoms to predict performance on the three facets of executive functioning (i.e., updating/working memory, set shifting, inhibition). Only one other study has investigated the impact of SCT symptoms on laboratory measures of executive functioning; however, that study did not assess set shifting (Jarrett et al., 2017). The current research is also at the forefront of exploring the relationship between SCT and SUDs (Wood et al., 2020). Given the high comorbidity between ADHD and SUDs, the relationship, or lack thereof, between SCT symptoms and SUDs may play an important role in distinguishing between these two attentional disorders. The current study is the first to examine the relationship between symptoms of SCT and CI, adding a multidisciplinary perspective to the research of SCT. Lastly, the literature investigating the relationships between ADHD and SCT has relied upon the Depression Anxiety Stress Scale (Becker et al., 2014; 2018) and Center for Epidemiologic Studies Depression Scale (Flannery et al, 2016; 2017). The present study replicated many of these established findings utilizing different measures (i.e., BDI, BAI) of internalizing symptoms, adding to the confidence that SCT symptoms are associated with internalizing disorders.

Despite the strengths of the present study, a few limitations are important to note. First due to data management error, only one measure of updating/working memory was available for analysis. This negatively impacted the ability to draw conclusions regarding the updating/working memory facet of executive functioning. Second, the community sample for this study was relatively homogenous (i.e., white, female college students). This study would have benefited from using a more diverse sample, possibly utilizing a clinically referred sample of individuals with ADHD.

Future studies investigating the dimensions of ADHD and SCT symptoms have many promising avenues to explore. For example, one question left unanswered following this study is the ecological validity of laboratory measures of executive functioning. Specifically, "do laboratory measures of executive functioning truly measure how individuals will perform in the real world?". Another way to pose this question, "to what extant do laboratory measures of executive functioning map onto applied, self-reported constructs of executive functioning" (i.e., Self-Management to Time, Self-Organization/Problem Solving, etc.). A second question stemming from the current study is “how would these results differ between a community and a clinical sample?”. Future studies would benefit from utilize clinical samples to gain a more specific understating of how ADHD and SCT symptoms relate to executive functioning, internalizing symptoms, substance use, and convergence insufficiency. Lastly, a gap remains in the literature regarding longitudinal data for individuals who report high SCT symptoms. By conducting a longitudinal study across the developmental period, researchers may gain insight into how SCT symptoms develop over time and how those symptoms impair an individual’s ability to function across settings.

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