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ADHD and SCT Symptomatology in Relation to College Students' Use of Self-Regulated Learning Strategies

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Abstract

Objective: The present study examined the relation between self-regulated learning (SRL) strategies and ADHD and sluggish cognitive tempo (SCT) symptomatology. **Method:** Participants were 303 college students, aged 18 to 25 (*M* = 20.04, *SD* = 1.45), from a Midwestern university who completed the Barkley Adult ADHD Rating Scale-IV (BAARS-IV), and a shortened, generalized version of the Motivated Strategies for Learning Questionnaire (MSLQ). **Results:** Among college students, inattention symptomatology was consistently predictive of deficits in use of value, expectancy, and self-regulation strategies, while SCT symptomatology was only predictive of deficits in the use of self-regulation strategies. **Conclusion:** This study is the first to examine the relation between SCT symptomatology and SRL strategy use in college students. The findings revealed that SRL strategy use differs between college students exhibiting ADHD or SCT symptomatology. Remediation focusing on these deficits would likely increase academic achievement. Clinical implications, limitations, and suggestions for future research are discussed. *(J. of Att. Dis. XXXX; XX(X) XX-XX)*

Keywords

ADHD, sluggish cognitive tempo, self-regulated learning, college students

According to the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; *DSM-5*; American Psychiatric Association [APA], 2013), ADHD is a neurobehavioral disorder that is characterized by inappropriate levels of attention, hyperactivity, and impulse control that lead to impairment in social, academic, and occupational settings. Moreover, ADHD is one of the most common disorders diagnosed in childhood (Akinbami, Liu, Pastor, & Reuben, 2011). Using criteria set forth in the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev.; *DSM-IV-TR*; APA, 2000), research suggests it affects 9% of children and adolescents aged 5 to 17 in the United States (Wolraich et al., 2011), as well as 2% to 8% of college students (Weyandt & DuPaul, 2012).

Conversely, sluggish cognitive tempo (SCT) is not a recognized disorder in the *DSM-5*, and there are no standardized criteria used for diagnostic purposes (Barkley, 2015). However, research over the past several decades, predominantly among child and adolescent populations, has led to significant insights into this construct, including that SCT is likely distinct from ADHD, although with some overlap (Barkley, 2012a; Neeper & Lahey, 1986). SCT is characterized by daydreaming, difficulty remaining alert, mental and physical lethargy, and difficulty with processing certain types of information (Barkley, 2015). However, very little research has examined how SCT affects individuals across their life span and in particular how it affects emerging adult college students (18-25 years old), with multiple researchers reporting a need for more investigation (Barkley, 2015; Becker, Langberg, Luebbe, Dvorsky, & Flannery, 2014; Leopold, Bryan, Pennington, & Willcutt, 2015; Wood, Lewandowski, Lovett, & Antshel, 2014). For example, a meta-analysis of the internal (i.e., are the symptoms reliably distinct from other disorders) and external validity (i.e., do the symptoms cause functional impairment) of SCT across the life span found just two independent studies of college students that examined correlates associated with SCT in this population (Becker et al., 2016). Limited research suggests that SCT affects between 5.1% (Barkley, 2012a), and 12% to 13% (Flannery, Becker, & Luebbe, 2014; Wood et al., 2014) of college students.

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Over the last several decades, thousands of studies have been devoted to examining ADHD (Willoughby, 2003). However, this literature has largely focused on children (Harpin, 2005; Young, 2000). The literature on college populations specifically is in its infancy, with most research having been done post-2000 (DuPaul, Weyandt, O'Dell, & Varejao, 2009). College students with ADHD tend to have academic problems, a lower high school grade point average (GPA), lower college GPA, and lower ACT scores (Advokat, Lane, & Luo, 2011; DuPaul et al., 2009; Heiligenstein, Guenther, Levy, Savino, & Fulwiler, 1999; Rabiner, Anastopoulos, Costello, Hoyle, & Swartzwelder, 2008; Weyandt & DuPaul, 2006). Furthermore, college students with ADHD have a greater need for academic support, such as remedial classes (Wolf, 2001); are more likely to be on academic probation (Heiligenstein et al., 1999; Weyandt & DuPaul, 2006); and have problems with study habits and study skills (Norwalk, Norvilitis, & MacLean, 2009). With regard to ADHD subtype differences in college populations, Wolf, Simkowitz, and Carlson (2009) found that hyperactivity/impulsivity is more related to behavioral and social problems, while inattention is more related to academic problems. Although there are some conflicting results, most of the literature suggests that inattention and not hyperactivity/impulsivity in college students is significantly related to increased academic difficulties, such as lower GPA and SAT scores, increased academic concerns, and decreased study skills (Frazier, Youngstrom, Glutting, & Watkins, 2007; Norwalk et al., 2009; Rabiner et al., 2008; Wolf et al., 2009).

Little is known about SCT in college populations. The few studies available demonstrate that SCT symptomatology in college students is associated with increased (a) endorsement of other mental health problems (e.g., depression and anxiety symptoms), (b) social adjustment issues, (c) emotional dysregulation, (d) disturbances in sleep, (e) functional impairment, and (f) deficits in executive functioning (Flannery et al., 2014; Langberg, Becker, Dvorsky, & Luebbe, 2014). Research by Becker et al. (2014) suggests that SCT can have a significant impact on students' academic functioning (e.g., productivity, efficiency, and overall performance) as well as GPA. They also found that SCT symptoms were associated with worse outcomes for college students than ADHD, leading the authors to suggest that it may be critically important to assess for SCT in college populations.

While it is clear that college students with ADHD suffer from significant academic deficits, the reasons for these deficits are less clear (Weyandt & DuPaul, 2006). Studies suggest that college students with ADHD have cognitive impairments, such as inattention, internal restlessness, intrusive thoughts, and forgetfulness (DuPaul et al., 2009; Resnick, 2005; Weyandt & DuPaul, 2006; Weyandt et al., 2003). Moreover, college students with ADHD, SCT, or both also suffer from deficits in executive functioning, the ability to focus on rules, and academic coping strategies, such as organizational skills, study skills, and time management skills (Dehili, Prevatt, & Coffman, 2013; DuPaul et al., 2009; Jarrett, Rapport, Rondon, & Becker, 2014; Resnick, 2005; Weyandt & DuPaul, 2006, 2008; Wood et al., 2014). Given the academic difficulties that college students with ADHD face and those with SCT likely face, as well as the limited research on the subject, it is clear that more research is needed to better understand the relations among ADHD, SCT, and self-regulated learning (SRL) strategies used in the academic environment.

SRL

SRL is part of the overarching framework of self-regulation that is used in many different domains (Wolters, 2010). SRL includes the ways in which students' plan, adapt, and regulate their thinking and behavior to help achieve their academic goals. Most studies suggest that SRL occurs through the use of cognitive and metacognitive strategies, and resource management. In addition, many theorists now believe that motivation plays an integral part in SRL and academic achievement (Lichtinger & Kaplan, 2011; Pintrich, 1999, 2000; Puustinen & Pulkkinen, 2001; Vanderstoep, Pintrich, & Fagerlin, 1996; Zimmerman, 1990). It is clear that SRL can impact academic achievement (Pintrich, 1999; Rachal, Daigle, & Rachal, 2007; Vanderstoep et al., 1996); yet studies have shown that regardless of deficits, anyone can improve his or her SRL performance through training and practice (Schunk, 2005; Wolters, 2010; Zusho & Edwards, 2011).

When entering college, all students face challenges that may affect their academic achievement. College students typically have workloads with increases in both difficulty and scale compared with workloads in middle school and high school (Wolf, 2001; Wolf et al., 2009). Entering college for most students also means a loss of close support and supervision that were previously provided by teachers and parents, because college is much less structured (Wolf, 2001; Wolf et al., 2009). To manage these changes effectively, college students need to be able to plan, organize, and follow through with required tasks.

Overall, college students can be differentiated by their use of SRL strategies (Montalvo & Torres, 2004), and students who are capable and proficient in these skills often have higher academic achievement (Zusho & Edwards, 2011). Common skills needed by all students to increase the likelihood of success in college include the ability to plan and set goals, initiate and sustain attention, and organize, monitor, and manage time and materials, as well as the ability to follow through (Wolf, 2001). Vanderstoep et al. (1996) found that among college students using SRL strategies, all three cognitive strategies (i.e., rehearsal, elaboration, and

organizational) were correlated with academic achievement. In addition, academic performance was positively correlated with the use of metacognitive strategies (Vanderstoep et al., 1996). It should be noted that Vanderstoep et al. measured SRL strategies using the Motivated Strategies for Learning Questionnaire (MSLQ), which is used in the present study and discussed in more detail in the "Method" section.

SRL in College ADHD Populations

Examination of SRL strategies in college populations, specifically in relation to ADHD and SCT is important and can provide meaningful clinical utility when working with this population. However, the literature on SRL in college students with ADHD is scarce and more research is needed, particularly with regard to potential differences in ADHD subtypes (Reaser, Prevatt, Petscher, & Proctor, 2007). Reaser et al. (2007) examined correlates between college ADHD populations and learning strategies using the Learning and Study Strategies Inventory, a self-report scale designed to assess learning and study strategies in students. However, the authors noted that the Learning and Study Strategies Inventory may not be the best instrument to use when assessing academic achievement in an ADHD sample because strategies did not reliably predict GPA in the ADHD group (Reaser et al., 2007).

Reaser et al. (2007) found that college students with ADHD had lower information processing and self-testing abilities when compared with students without ADHD. Furthermore, Wallace, Winsler, and NeSmith (1999) demonstrated that the ability to follow directions, was a significant predictor of GPA for college students with ADHD. In terms of cognitive strategies, Reaser et al. found that when compared with college students without ADHD, students with ADHD tend to have less effective overall test strategies and are not as good at selecting main ideas. In addition, students self-reporting high ADHD symptomatology were significantly less organized than students self-reporting low ADHD symptomatology (Turnock, Rosen, & Kaminski, 1998). There are also differences in motivation, affect, and behavior among college ADHD populations. According to Wallace et al. (1999), among college students with ADHD, confidence and competence significantly predicted GPA. College students with ADHD are also more likely to have lower levels of motivation when compared with college students without ADHD (Reaser et al., 2007). In addition, Turnock et al. (1998) found significantly lower levels of self-control and self-discipline among students self-reporting high ADHD symptomatology. Finally, differences in resource management exist between college students with and without ADHD. College students with ADHD do not manage their time well (Reaser et al., 2007), and thus have difficulty with timed tests (Lewandowski, Lovett, Codding, & Gordon, 2008). In addition, high self-reported ADHD symptomatology is associated with increases in procrastination and decreases in note taking and studying (Advokat et al., 2011; Turnock et al., 1998).

The Present Study

Research suggests that the number of individuals with ADHD attending college is increasing (Blase et al., 2009; DuPaul et al., 2009; Wolf, 2001) and that the prevalence of SCT in college students may actually be greater than ADHD (Wood et al., 2014). Research also shows that college students with ADHD, SCT, or both, have problems across a variety of domains including academic, psychological, and social functioning (Becker et al., 2014; Flannery et al., 2014; Shaw-Zirt, Popali-Lehane, Chaplin, & Bergman, 2005; Weyandt & DuPaul, 2008), and are prone to have deficits in executive functioning and self-regulation (Dehili et al., 2013; Jarrett et al., 2014; Wolf et al., 2009; Wood et al., 2014). Furthermore, the literature on SRL in college students with ADHD or ADHD symptomatology is scarce and nonexistent among SCT populations. However, these are skills with which college students with ADHD, SCT, or both are likely to have difficulty (Dehili et al., 2013; DuPaul et al., 2009; Jarrett et al., 2014; Resnick, 2005; Weyandt & DuPaul, 2006, 2008; Wood et al., 2014). Moreover, SRL strategies among ADHD and SCT populations may not be homogeneous; instead, there may be significant diversity in the SRL strategies used by individuals with ADHD or SCT symptomatology. It is, therefore, important to understand how ADHD and SCT symptomatology in college students are related to SRL strategies. Through a better understanding of this relation, more effective intervention strategies can be developed and deployed across college campuses.

Therefore, the aim of the study was to investigate the ways college students with ADHD (inattention and hyperactivity/impulsivity) or SCT symptomatology use SRL strategies. Due to the paucity of literature available examining the relation among ADHD (either categorically or dimensionally), SCT, and SRL strategies, this study is largely exploratory in nature. However, based on the limited available research suggesting that inattention is associated with stronger academic deficits than is hyperactivity/impulsivity, we generated several a priori hypotheses. Hypothesis 1: Inattention would be uniquely and negatively associated with Expectancy, while Hyperactivity/Impulsivity and SCT would not. Hypothesis 2: Inattention would be uniquely and negatively associated with Value, while Hyperactivity/Impulsivity and SCT would not. Hypothesis 3: Inattention, Hyperactivity/Impulsivity, and SCT would be negatively associated with Self-Regulation, although Inattention would be the strongest predictor, followed by SCT.

Method

Participants

Participants were college students from a Midwestern state university, recruited through the Experiment Management System (SONA) and with the cooperation of several professors at the university. Introductory psychology classes, as well as other psychology classes, served as the primary source of participants. Recruitment of participants also took place in several journalism courses. Participation was voluntary, and all participants received a small amount of class credit as an incentive for their involvement.

The final sample (N = 303) comprised mainly women (n = 222, 73.3%). The ages of the participants ranged from 18 to 25 (M = 20.04, SD = 1.45). In terms of ethnicity, 202 (66.7%) were Caucasian, 74 (24.4%) African American, 11 (3.6%) Hispanic or Latino, seven (2.3%) Asian/Pacific Islander, and nine (3%) Other. The participants were asked about prior ADHD diagnosis, and 19 (6.3%) indicated that they received a diagnosis of ADHD at some point in their lives. Of those 19 participants, nine indicated that they were diagnosed with combined type, eight with predominantly inattentive type, and one with predominantly hyperactive/impulsive type. In terms of ADHD treatment, 11 (3.6%) participants indicated they were currently taking medication to treat ADHD, 18 (5.9%) indicated they received medication to treat ADHD in the past, and seven (2.3%) indicated prior behavioral treatment for ADHD.

Measures

Barkley Adult ADHD Rating Scale-IV: Current symptoms (BAARS-IV). The BAARS-IV Current Symptoms scale (Barkley, 2011) measures current ADHD and SCT symptoms, as well as areas of impairment. The 18 ADHD items, composed of nine inattention items and nine hyperactive/impulsive items are based on ADHD symptom criteria in the *DSM-IV-TR* (APA, 2000). The items were adapted for use with adult populations by replacing words such as *play* with adult terms such as *fun* (e.g., "Difficulty sustaining my attention in tasks or fun activities"). Nine items measure SCT symptoms in adults (i.e., Prone to daydreaming when I should be concentrating on something or working; Have trouble staying alert or awake in boring situations; Easily confused; Easily bored; Spacey or "in a fog"; Lethargic, more tired than others; Underactive or have less energy than others; Slow moving; I don't seem to process information as quickly as others).

Participants use a 4-point Likert-type scale ranging from 1 = *never or rarely* to 4 = *very often* to indicate the frequency of each item in the past 6 months. Level of impairment can be assessed through either total sum scores (severity score) or through symptom count. For the purposes of the present study, symptomatology of inattention, hyperactivity/impulsivity, and SCT were derived from their respective subscale severity scores on the BAARS-IV. The scale was normed on a sample of (N = 1,249) adults aged 18 to 89. Participants' ADHD total severity scores, subscale severity scores, and symptom counts can be compared with the norms to determine ADHD symptomatology levels. According to Barkley (2011), the BAARS-IV has good internal consistency ratings ranging from .78 to .90, as well as strong test–retest reliability and high construct and face validity. In this study, the internal consistency of the BAARS-IV ranged from .82 to .94.

MSLQ. The MSLQ (Pintrich, Smith, García, & McKeachie, 1991) is an 81-item self-report scale designed to measure motivation and learning strategies of college students in a specific course. Students are asked to rate how each item relates to their experiences in a specific class. All of the items are rated using a 7-point Likert-type scale ranging from 1 = *not at all true of me* to 7 = *very true of me*. The present study used a modified version of the MSLQ. The modifications served to generalize the instrument so that it was no longer specific to a single course. Specifically, participants rated how true the statements were for all of their classes in general (e.g., "If I study in appropriate ways, then I will be able to learn the material in my courses," rather than ". . . material in this course").

Analyses were conducted using an alternative factor structure developed through confirmatory factor analyses (CFA; Hilpert, Stempien, van der Hoeven Kraft, & Husman, 2013). Hilpert et al. proposed the use of three factors—represented by items from six of the original 15 subscales and 38 of the original 81 items—to assess for use of SRL strategies (for specific scale item numbers, see Hilpert et al., 2013). The Expectancy scale measures belief that academic outcomes are a result of internal efforts, task mastery appraisals, and task performance expectations (e.g., "I'm confident I can learn the basic concepts taught in my courses" and "I'm confident I can understand the most complex material presented by my instructors"). The Value scale measures perceptions regarding internal value, importance, and usefulness of accomplishing academic tasks (e.g., "I prefer course material that arouses my curiosity, even if it is difficult to learn"). The Self-Regulation scale measures use of self-regulatory strategies when learning, such as planning, monitoring, and regulating academic learning activities, as well as ability to maintain study efforts when distracted or working with uninteresting material (e.g., "When I become confused about something I'm reading for a class, I go back and try to figure it out"). According to Pintrich, Smith, García, and McKeachie (1993), the MSLQ has internal consistency ratings ranging from .52 to .93, with most scales between .62 and .79. The MSLQ also demonstrates predictive validity when correlated to student's final grade in a class, although the

correlation is modest. In the present study, the internal consistency of the modified MSLQ ranged from .83 to .92.

Procedure

During the proposal stage, the study was reviewed and approved by the institutional review board at the second author's institution. Administration of the survey occurred both electronically, as well as in person. After signing informed consent forms, the participants were either handed a sheet of paper with login instructions for them to begin the electronic survey on one of the computers provided, or they were given a paper copy of the survey to complete. The survey included the current symptom form of the BAARS-IV, the MSLQ, and a demographics questionnaire. The presentation of the BAARS-IV and the MSLQ scales were counterbalanced to eliminate any order effects. The demographics questionnaire was the last form completed by participants. Following completion of the study, participants received a debriefing statement that explained the premise of the study. The debriefing statement also included contact information for the researchers, as well as for the Student Success Center and the Counseling Center at the university, in the event that participants felt the need to follow up with more qualified experts about something they experienced during their participation.

Analytic Approach

Prior to analyses, the original data set (N = 309) was screened for potential issues that could affect interpretation of the results. Missing data (>1 item) existed for five participants. As the pattern of missing data was Missing Completely at Random (MCAR), these data were excluded from further analyses. In the final data set, there were 10 participants each with a single case of missing MSLQ data (there were no cases of missing BAARS-IV data). As these data were also MCAR and since the MSLQ allows for up to one missing item per subscale these data were not excluded from analyses. Next, we screened the remaining data (N = 304) to attend to potential issues with interpretation and generalizability of the results, due to potential outliers. To detect potential univariate, model fit, and prediction outliers, all variables of interest were screened using single and multiple construct techniques and examined for both global and specific influences on regression equations. Variables that exceeded each of the research-design-based cutoffs (Aguinis, Gottfredson, & Joo, 2013) across Cook's D, DFFITS, and DFBETAS statistics were excluded from the data set (n = 1). Finally, the data from the final sample (N = 303) were examined for violations of assumptions. Analyses demonstrated that the final data set met all assumptions of normality (i.e., linearity, independence, normality, and equality of variance) required for linear regressions.

Analytic procedures. Sample characteristics, including means, standard deviations, and all first-order relations among both severity scores and SRL strategies, were examined (Table 1). Next, a series of multiple regression analyses were conducted to examine our primary hypotheses, and to determine whether severity scores (Inattention, Hyperactivity/Impulsivity, and SCT) were predictors of SRL strategies (Expectancy, Value, and Self-Regulation). If regression models were significant, all lower order terms within the model were evaluated and reported in Table 2. Partial correlations were calculated and provided in Table 2 as a means of providing effect sizes (prs of .14, .36, and .51 represent small, medium, and large effect sizes, respectively; Cohen, 1988) and to allow for use in calculations of power.

Results

Bivariate Correlations

All bivariate correlations were significant at the .01 level (with the exception of Value and Hyperactivity/Impulsivity, $p < .05$); however, the strength and direction of the associations differed. The first-order correlations among the severity scores (Inattention, Hyperactivity/Impulsivity, and SCT) demonstrated large, positive associations, ranging from r = .539 to .751. Similarly, the first-order correlations among the SRL strategies (Expectancy, Value, and Self-Regulation) were also large, positive associations, ranging from r = .518 to .630. However, the associations between severity scores and SRL strategies were all small to medium, negative correlations, ranging from r = −.146 to −.465.

Primary Analyses

Hypothesis 1 (Expectancy). The model was significant, $F(3, 299) = 18.29$, $p < .001$, $R^2 = .155$, and accounted for 15.5% of the total variance in Expectancy. Inattention, $t(299) = -4.21$, $p < .001$, $b = -.06$, 95% CI [−.09, −.03], $sr_{yi}^2 = .050$, was the only significant, unique predictor of Expectancy. Furthermore, the squared semipartial correlation indicated that Inattention uniquely accounted for 5.0% of the variance in Expectancy, after controlling for the other predictor variables.

Hypothesis 2 (Value). The model was significant, $F(3, 299) = 16.69$, $p < .001$, $R^2 = .143$, and accounted for 14.3% of the total variance in Value. Inattention, $t(299) = -3.74$, $p < .001$, $b = -.06$, 95% CI [−.09, −.03], $sr_{yi}^2 = .040$, and Hyperactivity/Impulsivity, $t(299) = 2.25$, $p = .025$, $b = .03$, 95% CI = [.003, .059], $sr_{yi}^2 = .014$, were the only significant, unique predictors of Value. Furthermore, the squared semipartial correlations indicated that after controlling for the other predictor variables, Inattention and Hyperactivity/Impulsivity uniquely accounted for 4.0% and 1.4% of the variance in Value, respectively.

Table 1. Sample Characteristics for Symptom and Self-Regulated Learning Scales (N = 303).

Bivariate associations	1	2	3	4	5	6
1. Inattention	—					
2. Hyperactivity and Impulsivity	.663**	—				
3. Sluggish Cognitive Tempo	.751**	.539**	—			
4. MSLQ: Expectancy	−.375**	−.177**	−.324**	—		
5. MSLQ: Value	−.348**	−.146*	−.320**	.630**	—	
6. MSLQ: Self-Regulation	−.452**	−.230**	−.465**	.518**	.616**	—
Descriptive statistics	1	2	3	4	5	6
M	14.93	14.77	17.86	5.35	5.18	4.59
SD	5.17	4.67	5.65	0.81	0.91	0.88
Range	9-36	9-32	9-35	2.1-7.0	2.1-7.0	1.3-6.7

Note. MSLQ = Motivated Strategies for Learning Questionnaire.
*p < .05. **p < .01.

Table 2. Summary of Multiple Regression Analyses With Inattention, Hyperactivity/Impulsivity, and SCT Predicting MSLQ Expectancy, Value, and Self-Regulation Strategies.

Predictor variable	*B*	*SE B*	β	*pr*	*p*
Expectancy strategies (R^2 = .155; adjusted R^2 = .147)					
Inattention	−.060	.014	−.383	−.237	<.001
Hyperactivity/Impulsivity	.024	.012	.135	−.109	.058
Sluggish Cognitive Tempo	−.016	.012	−.109	−.078	.176
Value Strategies (R^2 = .143; adjusted R^2 = .135)					
Inattention	−.060	.016	−.342	−.211	<.001
Hyperactivity/Impulsivity	.031	.014	.161	−.129	.025
Sluggish Cognitive Tempo	−.024	.013	−.150	−.106	.066
Self-Regulation Strategies (R^2 = .252; adjusted R^2 = .245)					
Inattention	−.055	.015	−.322	−.213	<.001
Hyperactivity/Impulsivity	.028	.013	.146	.125	.030
Sluggish Cognitive Tempo	−.047	.012	−.302	−.224	<.001

Hypothesis 3 (Self-Regulation). The model was significant, $F(3, 299) = 33.66$, $p < .001$, $R^2 = .252$, and accounted for 25.2% of the total variance in Self-Regulation. All three severity scores were significant, unique predictors of Self-Regulation: Inattention, $t(299) = -3.77$, $p < .001$, $b = -.06$, 95% CI [−.08, −.03], $sr_{yi}^2 = .036$; Hyperactivity/Impulsivity, $t(299) = 2.18$, $p = .030$, $b = .03$, 95% CI = [.003, .052], $sr_{yi}^2 = .012$; and SCT, $t(299) = -3.97$, $p < .001$, $b = -.05$, 95% CI = [−.07, −.02], $sr_{yi}^2 = .039$. The squared semipartial correlations indicated that after controlling for the other predictor variables, SCT uniquely accounted for 3.9% of the variance in Self-Regulation. Inattention and Hyperactivity/Impulsivity also uniquely accounted for 3.6% and 1.2% of the variance in Self-Regulation, respectively.

Discussion

An examination of the differences in SRL strategies between college students with ADHD or SCT symptomatology yielded several significant findings. Consistent with our first hypothesis, inattention was the only factor associated with expectancy strategies. The negative association indicates that as inattention increases, use of expectancy strategies decreases. The results only partially supported our second hypothesis. Again, inattention was the only factor negatively associated with value strategies, indicating that as inattention increases, use of value strategies decreases. Interestingly, hyperactivity/impulsivity was positively related to value strategies. However, inattention accounted for a greater percentage of unique variance than did hyperactivity/impulsivity. Finally, the results only partially supported our third hypothesis. Both inattention and SCT were negatively associated with the use of self-regulation strategies; however, SCT was the strongest predictor, followed by inattention. Yet, inconsistent with our hypothesis, hyperactivity/impulsivity was positively associated with the use of self-regulation strategies.

Further examination of the positive association between hyperactivity/impulsivity and use of value and self-regulation

strategies suggests that in this sample, both inattention and SCT acted as net suppression variables on hyperactivity/impulsivity. Our assertion is further validated by the bivariate correlations (Table 1) that demonstrated negative associations between hyperactivity/impulsivity and all three SRL strategies. After removing the shared variance accounted for by both inattention and SCT, the relations between hyperactivity/impulsivity and SRL strategies were positive. Although the effects were small, they were significant and reliable across both value and self-regulation strategy use, and marginally significant, in relation to expectancy strategy use (Table 2). This flip in association is interesting, and if replicated could be indicative of potential small, but protective effects offered by hyperactive/impulsive symptoms. It is not unfeasible to reason that this positive association with SRL strategy use could be the result of higher levels of energy in students with hyperactive/impulsive symptoms when compared to those with inattentive or SCT symptoms. This increase in energy may help to keep students engaged, which results in small but reliable increases in use of SRL strategies. It would also be interesting in future studies to examine whether hyperactivity/impulsivity acts as a protective factor for other variables, such as depression. It is important to note that this effect could also be the result of potential response bias in the sample, and therefore replication is needed.

Overall, the findings illustrate a number of important trends in the use of SRL strategies by college students with ADHD or SCT symptomatology. The differences in the relations between SRL strategies and inattention and hyperactivity/impulsivity, respectively, are largely consistent with the literature. Most of the research suggests that inattention, but not hyperactivity/impulsivity, in college students is significantly related to lower GPA and SAT scores, increased academic concerns, and decreased study skills (Frazier et al., 2007; Norwalk et al., 2009; Rabiner et al., 2008; Wolf et al., 2009). The literature, which largely finds no association between hyperactivity/impulsivity and academic deficits, is not inconsistent with our hypothesis regarding the positive relation between hyperactivity/impulsivity and SRL strategy use. However, more research is needed to clarify if hyperactivity/impulsivity may act as a small but protective factor against deficits in SRL strategy use or overall academic achievement. Finally, the negative association between SCT and self-regulation is also consistent with limited research suggestive of an association between SCT in college students and difficulties with executive functioning, specifically in the domains of self-organization and problem solving (Dehili et al., 2013; Jarrett et al., 2014; Wood et al., 2014). Moreover, SCT accounting for slightly more of the unique variance than inattention is congruent with results from Becker et al. (2014), which demonstrated SCT was associated with similar, and sometimes, even worse outcomes than inattention in college populations.

Clinical Implications

As a result of the limited data available to inform the literature on ADHD and SCT in college populations, our findings can provide the first steps toward elucidating the relation between ADHD and SCT on SRL strategy use. Differences in these relations could mean that methods to effect change and increase academic functioning and achievement in this population may differ depending on symptomatology presentation. While these findings will likely have a greater, immediate impact, on basic clinical research, they can still be applied to, and impact change in, clinical work. For example, the study replicated the high internal consistency of the shortened MSLQ using the new CFA (Hilpert et al., 2013) and also using a generalized version of the measure to examine SRL strategies broadly rather than within a specific course. Based on our results, the short, generalized version of the MSLQ may provide a useful measure for practitioners to quickly assess for deficits in self-reported SRL strategy use within specific ADHD or SCT college populations seeking help for issues with academic functioning. Assessing for use of SRL strategies could help a number of college student treatment providers identify potential areas of difficulty for students. These providers might include private psychologists, or practitioners in offices that typically serve students in need, such as university counseling centers, university disability support services, and student support services.

Remediation focused on SRL strategy deficits would likely lead to increases in academic achievement for college students with ADHD or SCT, as research suggests that anyone can improve SRL strategy performance through practice (Schunk, 2005; Wolters, 2010; Zusho & Edwards, 2011). Although it is important to note that there are currently no established, evidence-based treatments for college students with ADHD or those with high SCT symptomatology, designed to target SRL strategy performance specifically. However, a psychosocial and behavioral intervention based on increasing college students' organization, time management, and planning, has shown promising early results for helping to ameliorate these issues in college students with ADHD (LaCount, Hartung, Shelton, Clapp, & Clapp, 2015; LaCount, Hartung, Shelton, & Stevens, 2015). Moreover, remediation through ADHD coaching may prove effective in helping to ameliorate SRL strategy deficits (Field, Parker, Sawilowsky, & Rolands, 2013; Prevatt & Yelland, 2013).

According to Barkley (2012b), executive functions play a significant role in helping individuals organize, plan, and manage tasks. Because both inattention and SCT involve deficits in executive functioning (Dehili et al., 2013; DuPaul et al., 2009; Jarrett et al., 2014; Resnick, 2005; Weyandt & DuPaul, 2006, 2008; Wood et al., 2014), the treatments described above may be beneficial for students with ADHD,

SCT, or both. One key area for future research is to further test the treatments described above to establish treatment validity for use among college students with ADHD and SRL deficits. A second area of future focus would be to evaluate the existing treatments that show promise for students with ADHD and determine whether they are as effective for students with high SCT symptomatology, or if new treatments need to be developed for this population. Even at this early stage, practitioners could still benefit from screening for SRL strategy use with the modified MSLQ, as a way of determining what factors might be contributing to a student's difficulties with academic functioning and achievement, which would serve to guide treatment planning.

Limitations

There are several limitations with the present study. For example, the size of the sample, while adequate for the statistical analyses, was still relatively small. Had the sample size been larger, more specific tests could have been conducted to (a) examine ADHD and SCT symptomatology at each cutoff level listed in the BAARS-IV manual (Barkley, 2011), (b) analyze the results separately for men and women, and/or (c) test for possible effects of either medication or behavioral treatment history in relation to SRL strategy use among college students with ADHD or high SCT symptomatology. In addition, as comorbidity was not measured or accounted for, the ability to generalize these results is compromised, because several potential comorbid disorders, such as specific learning disorders, may have influenced the results. Furthermore, because the study only used self-report measures, the validity of the data could be called into question. Response sets such as social desirability could have also influenced the responses. Future studies should seek to address these limitations by collecting more demographic data on participant background and mental health history and by using larger samples that would provide the power for more nuanced analyses.

Perhaps the most salient limitation is the homogeneity of the sample. Although the sample was from the intended population, the participants were from only one Midwestern state university. In addition, the sample included a disproportionate number of psychology students, women, and undergraduates. These factors can limit the ability to generalize the findings. To increase the generalizability of these findings, future studies should be conducted at multiple institutions, while trying to maintain a representative distribution across sex, race, year in college, and major. It would also be useful in future studies to include multiple reporters of ADHD and SCT symptomatology (e.g., parent- and significant other-reports) to strengthen the validity of findings. Finally, inclusion of students with verified ADHD diagnoses should be considered so that comparisons can be made between students with and without formal ADHD diagnoses.

Conclusion

Although there is little dispute that students with ADHD and SCT symptomatology face many difficulties in college, research is still needed to determine exactly where those difficulties lie, and how best to treat them. This study is the first to examine SRL strategies in college students with SCT symptomatology and the results demonstrate that SRL strategy use differs in important ways between college students exhibiting ADHD or SCT symptomatology. Students with inattention symptomatology displayed deficits in the use of value, expectancy, and self-regulation strategies, while students with SCT symptomatology displayed deficits only in the use of self-regulation strategies. In addition, this study replicated strong psychometric properties of a modified version of the MSLQ using an alternative factor structure for assessing SRL strategy use among college populations. Overall, these findings have the potential to guide future assessments to identify SRL strategies in college populations as well as develop targeted interventions to help students with ADHD or SCT increase their use of SRL strategies, and ultimately improve their academic achievement.

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