SLUGGISH COGNITIVE TEMPO AND ACADEMIC ACHIEVEMENT IN UNDERGRADUATE STUDENTS

A Thesis

Presented to

The Faculty of the Department

of Psychology

University of Houston

In Partial Fulfillment

Of the requirements for

Membership in the Honors College

With Honors in Psychology

By

Andrea P. Ochoa Lopez

May 2018

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ABSTRACT

Although sluggish cognitive tempo (SCT) is now considered an independent attention disorder, most research about this construct has been conducted with children populations and utilized mixed methods for measurement; in addition, the impact of SCT on relevant outcomes, like academic achievement, is relatively unexplored. This study aimed to confirm known statistical attributes of SCT as a construct, including its independent validity and its correlation with known covariates, and to explore the impact of SCT on grade point average while accounting for overlapping clinical variables and well-established predictors of achievement. An online survey measuring demographic variables, SCT symptoms, ADHD inattention and hyperactivity symptoms, positive and negative affect, math anxiety symptoms, and self-efficacy was completed by undergraduate college students between the ages of 18 and 25, and 275 observations were used for correlation and regression analyses. As expected in two of four hypotheses, the statistical independence of SCT as a construct was confirmed, as were its significant moderate correlations with most covariates of interest. However, the other two hypotheses for this study were not supported, as SCT was not found to have a significant zero-order nor partial correlation with academic achievement as measured in the present study. Although it is suggested that grades do not correlate with SCT in young adults, inaccurate measurement of grade point average might be part of the reason for these results; future research addressing SCT in undergraduate students should utilize objective measures of achievement and determine whether their correlation with SCT has significance.

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Sluggish Cognitive Tempo and Academic Achievement in Undergraduate Students

The construct of Sluggish Cognitive Tempo (SCT) has gradually become recognized as a relevant clinical concept in psychology. Having developed from the literature on attention deficit and hyperactivity disorder (ADHD), SCT is now considered separable from ADHD and has gained consideration in research as it has been explored as a possible predictor of various outcomes of interest, such as academic performance and daily functioning. SCT is also associated with a range of internalizing symptomatology, including anxiety and depression, but has been shown to impact functioning (in the form of impairment in daily activities) independently from these disorders, further supporting the idea that it is a unique condition. Despite increased investigation on the subject, there are limitations to our understanding of SCT. Most of what is known about its construct validity is based on studies conducted with children; for example, according to a recent meta-analysis (Becker et al., 2016), 26 studies have evaluated its factor structure, but 23 of these have been on children. Research addressing the impact of SCT on well-being has followed a similar trend, focusing on children populations, and mainly addressing the overlap of SCT with covarying disorders with the goal of distinguishing these issues from one another. Little attention has been granted to outcomes of SCT that might be affected differently in adulthood, such as academic success. Therefore, this study was developed with three goals: to validate the structure of SCT in adults; to evaluate its relation to closely related constructs; and to assess its potential correlation with achievement in undergraduate students within the context of more established predictors of this outcome (e.g. self-efficacy).

Structure and Measurement of SCT

The symptom profile of SCT is characterized by lethargic behavior and thought, mental confusion, daydreaming, and other similar features (Barkley, 2012; Becker et al., 2017). As noted, a key focus of many studies of SCT over the past two decades grew out of the ADHD literature, with studies finding that SCT symptoms occurred in a significant minority of subjects with ADHD who did not match the Inattentive or Hyperactive types (Barkley, DuPaul, & McMurray, 1990; Carlson & Mann, 2002; Diamond, 2005; McBurnett, Pfiffner, & Frick, 2001; Milich et al., 2001). As further research evaluated this symptom cluster, researchers moved from consideration of SCT as a subtype of ADHD to the idea that SCT might represent a disorder of its own (Becker et al, 2014, 2016; Belmar et al, 2017; Garnet et al, 2017; Langberg et al, 2014; Lee, Burns, & Becker, 2017, 2018; Leopold et al, 201, 2016; Servera et al, 2016; Wood et al, 2017), with a potential prevalence of 5.1% of the U.S. population (Barkley, 2012). This led to various measurements of SCT being proposed with different sets of diagnostic items, different samples, and different covariates.

A recent meta-analysis summarized the literature on SCT and concluded that SCT is indeed a singular construct that is separate from the Inattention, Hyperactivity, and combined ADHD symptom patterns of the DSM-IV (Becker et al., 2016). Becker et al. (2016) also designated a group of 10 SCT symptoms with mean factor loading values of .72 to .80 to comprise a brief and reliable adult SCT inventory (Becker et al., 2017). However, the meta-analysis that reported the construct validity of SCT also revealed that 9 in 10 studies contributing to this conclusion have been based on children populations, relying on diverse combinations of teacher ratings, parent ratings, examiner assessments,

and child self-report. Overall test-retest reliability of the instrument though, is generally good in both children (Cronbach's alpha of .74 to .80) and adults (alpha of .88) (Becker et al., 2016). Given the limited availability of SCT studies in adults, and the potential function impact of this construct, there is a need to further expand the literature in this area in college students.

Leopold et al. (2016) argued that SCT symptomatology increases with development, because in their longitudinal study, the average rating increased (statistically) significantly over time, from .63 in childhood to .72 in adolescence and young adulthood. Although one study does not provide enough basis to support this claim, it suggests that an examination of the impact of SCT across the lifespan might be relevant. For young adults, particularly those in college, academic functioning is particularly relevant, although this is a broad term that can include productivity, efficiency, and grades (with the first two concepts referring to the amount of schoolwork completed relative to the amount of time invested; Becker et al., 2014). Academic functioning has been found to negatively relate to SCT symptoms, with an overall *r* value of -0.45 for adults and -0.44 for children (Becker et al., 2016), although again the study of this relationship has focused on younger participants (Langberg et al., 2014; Flannery, Luebbe, & Becker, 2017; Jarrett et al., 2017). Furthermore, studies have rarely addressed the impact of SCT on achievement outcomes such as grades in either age group. For example, we were able to find only one study to address SCT in relation to grade point average in adults (Becker et al., 2014), and only one in children (Langberg et al., 2013). This empirical gap must be addressed to understand how SCT might interfere in particular ways in adulthood, a time in which cognitive demands increase and symptoms

like confusion or slowness of thought can be detrimental to academic performance in environments that require more self-regulation than in elementary or high school education. Given that undergraduate education is also a time in which subjects encounter various challenges and demonstrate heightened levels of symptoms for clinical disorders, in order to assess the true impact of SCT it must be studied with a clear awareness of its key clinical covariates.

SCT and Potentially Overlapping Constructs

Attention Deficit /Hyperactivity Disorder. The SCT symptom cluster shares historical overlap with ADHD, which the National Institute of Health (2019) defines as "an ongoing pattern of inattention and/or hyperactivity-impulsivity that interferes with functioning or development". Of these, symptom overlap with inattention is thought to be greatest (Barkley, 2012; Becker et al., 2016, 2017; Leopold et al., 2016), given SCT symptoms such as disorganization, lack of focus, and tendency for mind-wandering (Becker et al., 2012, 2016). Measures of SCT correlate with ADHD symptomatology, but this overlap has been specifically significant for inattention symptoms, as *r* values for the two constructs range from .72 to .73 in adults (Becker et al., 2016; 2017) and .55 to .89 in children (with correlations becoming stronger as age increases; Becker et al., 2016; Garner et al., 2010; Leopold et al., 2016). In light of this significant overlap, numerous studies have sought to determine whether SCT ought to be considered a component of ADHD or a separate disorder. Additionally, earlier work that sought to differentiate ADHD and SCT did so using items obtained from an ADHD measure to categorize SCT (Barkley, 2012, 2013; Becker et al., 2018; Kamradt, Momany, & Nikolas, 2017); for

example, in the above studies, the measure was the Adult ADHD Rating Scale-IV (Barkley, 2011a).

Despite the similarities between SCT and ADHD, phenomenologically they are separable. Not only do they represent different clinical experiences, but they also have differing implications on the functioning of individuals that exhibit their symptoms. People with SCT report a unique difficulty to work quickly and describe themselves as "a bit slow", rather than lacking accuracy or displaying excessive energy during tasks (Becker, 2017), suggesting that this disorder is more likely to deter reactivity to stimuli and processing speed than is ADHD. Although there is still much to be learned about the conceptual divide between these two conditions, their separability has been empirically proved utilizing two primary approaches: analyses of symptom ratings for both disorders and comparisons of their correlation with outcomes of interest.

Factor analytic studies have derived a factor of SCT that is separable from ADHD symptomatology in adults (Leopold et al., 2015; Becker et al., 2017) and children (Garner et al., 2017; Leopold et al., 2016); although these two factors correlate, they do not do so highly enough to be suspected of reflecting the same construct. Similar results have been obtained in studies with children from different countries, including Spain and South Korea (Belmar et al., 2017; Lee et al., 2018), furthering the evidence for the construct (factorial) validity of SCT outside the United States. The list of symptoms used to measure SCT has varied in size (between 2 and 44 SCT items evaluated), scale (between 2 and 5 total possible points per item), and rating source (predominantly self-report for adult studies, with diverse proportions of teacher rating, parental rating, and assessment for children studies). However, the overall finding validated by a meta-analysis is that

SCT constitutes a construct of its own, with at least 18 items supported at some level by exploratory factor analysis. Thirteen of those 18 items had a mean factor loading >0.70. (Becker et al., 2016). The final set of 10 of those 13 items were selected to constitute a reliable measure of SCT, as they were required not only to relate to a single factor, but also to show divergence from internalizing symptoms and from ADHD-inattention (Becker et al., 2017).

Internalizing Disorders. Besides factor analytic studies, the other important approach used to separate SCT from ADHD has come from identifying its differential relations with external correlates, such as internalizing disorders. For example, participants with comorbid ADHD and SCT tend to suffer from more severe symptoms of anxiety and depression, as well as greater professional and social impairment, than adults with ADHD and without SCT (Kamradt, Momany, & Nikolas, 2017), suggesting that SCT independently contributes to these problems. Given that a research-supported, specific SCT measurement is now available (Becker et al., 2017), the correlation between SCT and ADHD should be reasserted by observing it in an adult population utilizing the validated item list, and accounting for related covariates like demographic characteristics and internalizing disorders.

Dysfunctional patterns of mood can be associated with problems maintaining focus on activities like school, work, social relationships, and other aspects of daily functioning throughout the lifespan (Nigg et al., 2017; Tandon, Cardeli, & Luby, 2011). The potential relation of each of these two disorders with SCT is observed below, both combined and individually.

Anxiety has a symptom profile that includes restlessness, trouble relaxing, difficulty controlling one's worry about daily aspects of life, fear of possible negative occurrences, a tendency for irritability, among others (Spitzer, Kroenke, Williams, & Lowe, 2003). As a result, anxiety might present similarly to SCT in that it might intervene with the ability of individuals to focus on their tasks and approach daily activities with sufficient physical and mental energy. One study shows that between 25% and 33% of adults with SCT also exhibit an anxiety disorder, independent of the degree of severity of SCT symptoms (Leikauf & Solanto, 2016); factor analyses from various studies have also shown that SCT and anxiety symptoms correlate moderately in adolescents (approximately $r = .43$), a bivariate relationship that remains significant even after accounting for the moderating influence of covariates like ADHD and demographic characteristics (Becker, Luebbe, Greening, Fite, & Stoppelbein, 2014). Anxiety and SCT also correlate strongly in emerging adults ($r = .57$) and even operate together on shared functional outcomes, such that individuals suffering from both anxiety and SCT also demonstrate uniquely significant levels of impairment in functional outcomes; these include like time management, self-motivation, completion of daily social and work tasks, among others (Wood, Lewandowski, Lovett, & Antshel, 2017). Such trend suggests that studies observing the impact of SCT on academic outcomes must consider anxiety as a covariate, although research is yet to compare this correlation with that between SCT and other cofactors in university students; doing so would provide a more nuanced understanding of the relationship between anxiety and SCT.

One additional internalizing disorder that often correlates with anxiety and its effects is depression; about 60% of patients with anxiety have comorbid depression

(Salcedo, 2018). Aside from persistent sadness and apathy, some relevant symptoms of depression include restlessness and difficulty concentrating (National Institute of Health, 2018), which appear similar to certain characteristics of the clinical profile for anxiety. Indeed, anxiety and depression have shared symptoms such as trouble sleeping, agitation, difficulty concentration, and irritability (Gorman, 1997; Roy-Byrne & Katon, 1997). As it would be expected, depression and anxiety correlate together with SCT; in a study comparing individuals based on the severity of their SCT symptoms, these were positively related to depression and anxiety characteristics, with *r* values of .12 to .35 (Kamradt, Momany, & Nikolas, 2017). Self-reported SCT symptoms in youth have strongly predicted depression and anxiety symptoms in populations with functional impairment, including academic problems (Smith, Breaux, & Langberg, 2017).

Given the overlap between anxiety and depression, we aimed to address their common symptoms in function of SCT by measuring positive and negative affect as variables, which evaluates symptoms at the intersection of anxiety and depression. This would grant a unique perspective of the way that comorbidity between these two clinical disorders influences other covariates and outcomes of interest, such as academic achievement. Studies have not so far addressed affect as a covariate of SCT, but research has shown that academic achievement in university students is influenced by patterns of positive and negative affect (Barket et al., 2016), and thus this factor might have a relevant role in predicting GPA alongside its other well-established predictors.

Interim Summary. All clinical and functional covariates described above overlap diagnostically with SCT, which in turn influences them uniquely while remaining statistically separate as a construct. However, much of what we know about these

bivariate correlations has been determined from youth studies, often using measures of ADHD to categorize SCT; in addition, research addressing the relation of SCT with each of these clinical factors (ADHD, anxiety, and depression) has not always accounted for the others, at least not in healthy adult populations. We found only two studies that have considered SCT, ADHD, and anxiety, and depression altogether, one in adults (Leikauf & Solanto, 2017) and one in youth (Smith et al., 2018). The former study found SCT to correlate with internalizing symptoms (e.g. anxiety and depression), regardless of the gravity of SCT symptoms; the latter determined SCT to be separate from internalizing symptoms while accounting for other clinical factors. These findings generally focus on the relationship of SCT with, and its separability from, mood disorders including anxiety, but studies rarely conduct multiple regression that allow to distinguish the unique contribution of each of these factors on relevant outcomes. This study then has the aim of confirming the correlation of SCT with said clinical factors in a sample of undergraduate students, while controlling for relevant clinical covariates.

SCT and Relevant Predictors of Achievement

Math Anxiety. Reading and math are two primary domains of achievement, and the literature shows a special relation between anxiety and mathematics in particular. Richardson and Suinn (1972) define math anxiety as the feelings that some individuals experience that interfere with their use of numbers and solution of math problems in various contexts. The negative effect of math anxiety on math performance seems evident and has been supported by the literature at different ages (Pajares, 1996; Ashcraft, Lrk, & Hopko, 1998; Hopko, Ashcraft, Gute, Ruggiero, & Lewis, 1998; Buelow & Frakey, 2013). The empirical overlap between SCT and math anxiety has not yet been studied,

and this relationship might be relevant given the research suggesting that SCT impacts various domains of achievement in youth (Bauermeister et al., 2012; Becker et al., 2018, Hartman et al., 2004; Tamm et al., 2017). A recent study closely examining math anxiety found that its impact on achievement operates through the reduction of cognitive reflection, or "the ability [of individuals] to reflect on their own performance, and to detect and correct their own errors" (Morsanyi, Busdrahi, & Primi, 2014). Given that SCT, by definition, impairs the pace of cognition during tasks, it might be strongly correlated with math anxiety as a relevant covariate and even a parallel predictor of achievement outcomes.

Self-efficacy. Besides math anxiety, another important predictor of achievement is academic self-efficacy, which correlates moderately ($r \sim .31$) with grade point average (Hattie, 2017; Richardson, Abraham, & Bond, 2011). Academic self-efficacy is the perception an individual has of their own ability to perform well in academic tasks (Lee & Stankov, 2013); this may include studying, completing assignments, and passing examinations. Some studies categorize academic self-efficacy in broad terms (Richardson, Bond, & Abraham, 2012), while others opt for a domain-specific use of the construct, contextualizing it, for example, in terms of math achievement and finding a correlation of $r \sim .51$ with math achievement scores (Lee & Stankov, 2013). The general construct of self-efficacy stands among the 15 strongest predictors of student achievement in a recent, comprehensive list of factors (Hattie, 2017). Although a myriad of studies has approached SCT as a predictor of achievement while controlling for clinical covariates like mood disorders and ADHD (Becker, Luebbe, Greening, Fite, & Stoppelbein, 2014; Wood, Lewandowski, Lovett, & Antshel, 2017), no study has looked

at this collection of variables at any age while controlling for another relevant predictor such as self-efficacy.

SCT and Academic Achievement

In addition to the conceptual issues above, it is important to consider how SCT relates to functional outcomes with a significant impact on quality of life. For young adults in college, one key domain is academic achievement. Defined in this study in terms of grades obtained by participants while enrolled in educational institutions, academic achievement is a crucial predictor of well-being that correlates with a wide range of positive outcomes across the lifespan (Datu, Yuen, & Chen, 2018; Pertegal & Oliva, 2017). There is ample discussion regarding the factors that affect achievement in college students. The ability to perform in mathematics and reading is a fundamental cognitive skill that individuals exercise in response to the demands of their learning environment. Although college is not the first life experience in which individuals encounter such academic tasks, it does represent a less structured and more demanding pace of performance than previous environments, like high school systems. This could increase the effort required for a student to regulate their own behavior in pursuit of good grades.

SCT, in leading to a slow and interrupted thought process, might reasonably impair the ability of students to focus on academic tasks and obtain good grades. While achievement is a broad concept, as overall grades are an average of performance in various subjects, a construct like SCT is expected to be differentially related to mathematics and reading, the basic components of achievement. Identifying factors that promote achievement is important in its own right, but doing so can also provide further

information about the separability of SCT from closely related constructs (such as ADHD, anxiety, and depression), particularly in adult populations for which less is known about the relationship between theses constructs and SCT.

Very little is known about the correlation between SCT and grade point average, although the few studies that have approached this have revealed a significant link between the two. A study on the relationship between SCT and achievement in college students reported a negative bivariate correlation of SCT to cumulative high school grade point average, r = -.17, and academic performance, r = -.30 (Becker et al., 2014). For children, a strong correlation exists as well between GPA and three teacher-reported SCT symptoms: "slow/daydreamy", r =.57, "sleepy/sluggy", r =.57, and "low initiation", r =.71, though parent-rated SCT symptoms did not relate with GPA as significantly, ranging from r = -.22 to .15 (Langberg et al., 2013). Notwithstanding that teachers and parents see children in different contexts, another reason for the magnitude difference between adult and child correlations might be the measurements used in each study; while Becker et al. (2014) used an ADHD battery and designated 9 items as SCT symptoms, Langberg et al. (2014) used an SCT measure developed in a previous study (Penny et al., 2009) and selected six composite items (three parent-rated and three teacher-rated) that factor analyses had identified as valid. Although there is now an SCT inventory developed based on a meta-analysis (Becker et al., 2016) and validated in a later study (Becker et al., 2017), it is yet to be utilized to assess outcomes of interest like academic achievement in relation to well-established SCT symptoms. It is vital to not only expand on the knowledge about these relationships, but also to do so relying on the most appropriate measurements available. There is also a need to explore these

correlations while accounting for other known predictors of achievement, such as ADHD; studies that have approached academic functioning and controlled for these covariates have found that the influence of SCT remains significant (Becker et al., 2013, 2014, 2017; Jarrett, Rapport, Rondon, & Becker, 2017; Wåhlstedt & Bohlin, 2010; but see Becker & Langberg, 2012), although these studies have mostly been conducted with children populations.

The Present Study

The above review demonstrates that SCT is measurable, and although it overlaps with a variety of clinical symptomatology and is nonetheless separable from these other disorders. It has also been found to correlate with a variety of functional impairments, including achievement, though this relation is understudied, particularly in adults, and in doing so, needs to be contextualized among other well-known predictors of academic outcomes. Therefore, the overall aim of this study was to extend validity data regarding SCT in adults through four main aims. The first aim is to reassert the construct validity of SCT utilizing a validated, construct-specific adult inventory. The second aim is to confirm the magnitude of the correlations between SCT and generalized anxiety, math anxiety, and positive and negative affect. The third aim is to evaluate the effect of SCT symptoms on academic achievement, and the fourth aim is to evaluate the significance of this effect while accounting for constructs related to SCT as well as established predictors of academic success. Our hypotheses for this study were as follows:

1. We hypothesize that SCT symptoms will cluster into a single factor, based on prior work mainly with children, with a mean factor loading value of approximately .70.

2. We hypothesize that SCT will significantly relate to other symptoms clusters, including ADHD, anxiety, and affect. We expect these relations to be moderate, though stronger for ADHD (approximating .40), than for anxiety and affect (closer to .30).

3. We hypothesize that SCT will be a significant zero-order correlate of achievement, with at least a moderate effect expressed as an r value of ~.40.

4. We hypothesize that SCT will account for significant unique variance in achievement, after considering its potentially overlapping constructs, as well as considering a range of known predictors of achievement including sociodemographic characteristics, self-efficacy, and prior achievement. In the context of these variables, an otherwise moderate effect of SCT on achievement might decrease yet still yield statistically significant unique predictive power.

There are several potential implications of this study. First, in seeking to confirm the construct validity of SCT in a sample of undergraduate students, it is expected to grant solidity to it as a clinical concept for future research. Second, it would validate what is known about the correlation of SCT with various factors by examining these relationships in a demographically diverse sample, a feature that has not always characterized previous studies. Third, it would provide insight into these correlations within the scope of an adult population while examining a formerly neglected outcome variable, grades; results will allow to determine whether grades are an aspect of functioning that SCT impacts alongside other clinical factors, and whether higher education institutions should consider SCT as a relevant element of personal and academic dimensions of students' lives.

Method

Participants.

A total of 400 undergraduate Psychology students at a Southern public university in the United States participated in this study, for which all variables addressed were measured using an online survey. Subjects were eligible to participate if they were 18 and 25 years old and provided consent electronically prior to completing the survey. To increase confidence for the validity of the results in this study, participant data was only used if it met the following inclusion criteria: 1) Subject had to have reported their current university GPA by typing a three-digit, two-decimal number that did not exceed the maximum GPA scale; 2) Subject had to have taken at least five minutes to complete the study; and 3) Subject had to have correctly responded to each of the two "check questions" that were included in the survey. These were sentences, placed among rating-scale items of clinical measures, that directed the participant to rate them with a specific value (e.g. "Please select 'Not at all' for question 14") to confirm that their completion of the survey was done in a deliberate and conscientious manner. After applying these criteria, a final sample of 275 student subjects was used. Table 1 contains academic background and demographic data for the subjects. Differences between completers and non-completers are described below.

Table 1

Participant academic background and demographic information

Characteristic	N (%)
Total	275
Gender	
Female	219 (79.6%)
Male	52 (18.9%)
Other	1 (0.4%)
Not reported	3 (1.1%)
Race	
American Indian/Alaska Native	1 (0.4%)
Asian	78 (28.4%)
African American	36 (13.1%)
Caucasian	54 (19.6%)
Hispanic/Latino	80 (29.1%)
Mixed race	23 (8.36%)
Other	3 (1.09%)
Classification	
Freshman	15 (5.4%)
Sophomore	101 (36.7%)
Junior	72 (26.2%)
Senior	86 (31.3%)
Not reported	1 (0.4%)
Academic history	
High school to current university	152 (55.3%)
Transfer to current university	118 (42.9%)
Gap before current university	5 (1.8%)
Perceived SES	

1-2	4 (1.4%)
3-4	32 (11.6%)
5-6	99 (36.1%)
7-8	118 (42.9%)
9-10	17 (6.2%)
Not reported	5 (1.8%)

Measures

Demographics. Variables collected included age in years, gender, race/ethnicity, undergraduate classification, and self-perceived socioeconomic status (SES). The latter was measured using a question that indicated participants to rate the perceived socioeconomic status of their family on a scale that ranged from 1 to 10.

Academic Background. To account for the variability of scholarly backgrounds present in our sample, we recorded academic experience prior to current university enrollment. Participants reported whether they began their higher education immediately after high school, transferred from another institution, or enrolled at their current university after a time gap during which they were not pursuing a degree. The cumulative number of years spent at a higher education institution at the time of participating in the study was also recorded.

Adult Concentration Inventory **(ACI; Becker, Burns, & Willcutt, 2015).** The ACI is an adult self-report measure of SCT. The items of this scale were developed based on a SCT meta-analysis that yielded a total list of 16 significant symptoms (Becker, Leopold, et al., 2016), of which 10 were demonstrated to have convergent and discriminant validity in a later study, correlating to the SCT Factor with r values of .64 to

.84 (Becker et al., 2017). The survey used in this study employed all 16 items originally considered by Becker et al., but utilized only the 10 that have been validated for analysis. Participants rate all items on a four-point scale (0 = "Not at all", 1 = "Sometimes", 2 = "Often", 3 = "Very often") referring to the past six months. The ACI was adapted to be used online without modifying its fundamental content. For the calculations performed in this study, the scale was converted such that numerical values ranged from 1 to 4. The Cronbach alpha value for these 10 items in this study was 0.89.

Adult ADHD Self-Report Scale (ASRS-v1.1) Symptom Checklist (Schweitzer et al., 2001). ADHD symptoms were measured with the ASRS. This scale consists of eighteen questions created based on each of the DSM-IV-TR criteria for this disorder, and includes two subsets of symptoms: Inattention and Hyperactivity/Impulsivity. It uses a 5-point response scale composed of the options "Never", "Rarely", "Sometimes", "Often", and "Very Often", which were coded in this study with a numerical scale from 1 to 4. The ASRS-v1.1 has high validity and reliability (Adler et al., 2006), and it has been proved reliable for assessing symptoms of ADHD in higher education students (Gray et al., 2015). The Cronbach alpha value for the ASRS-1 in this study was 0.89 overall, 0.87 for the Inattention cluster, and 0.82 for the Hyperactivity/Impulsivity cluster. The scale was adapted to be used online without modifying the fundamental content.

Academic Achievement. Participants typed numerical values to self-report a variety of previous and current achievement factors, including their student high school GPA, previous higher education institution GPA (if applicable), current cumulative university GPA, and standardized test results (SAT and/or ACT) were self-reported. To account for the diversity of previous academic experiences in our sample, participants

used a drop-down list to select the scale of their high school GPA and the version of the SAT for which they reported their results. Relative high school achievement was calculated by dividing high school GPA by its grading scale. Although the survey allowed to report previous higher education institution GPA in case a significant number of participants lacked a current university GPA, ultimately most participants reported a current university GPA and thus this was the value used to operationalize academic achievement in statistical analyses for the study.

It is relevant to mention that a potential challenge of any study on achievement in undergraduate students, including one assessing the correlation between SCT and achievement, is the decision to utilize self-reported grades. However, a meta-analysis on the subject concluded that, while self-reported grades are less convergent with actual grade point average than it might be expected, these two variables still predict outcomes to a very similar extent (Kuncel, Crede & Thomas, 2006), and reiterated that self-reported grades are even good predictors of future grade point average (Baird, 1976). Thus, the observation of achievement outcomes in university students using self-reported grades is considered sensible.

Generalized Anxiety Disorder Scale (GAD-7; Spitzer et al., 2006). This measure is a self-report questionnaire composed of 7 items requiring respondents to rate how often they have been bothered by certain anxiety symptoms over the past 2 months. It uses a 4-point response scale, with options being 0 = "Not at all sure", 1 = "Several days", 2 = "Over half the days", and 3 = "Nearly every day". Lowe et al. (2008) confirmed the reliability and validity of the GAD-7 to measure anxiety in the general

population. The Cronbach alpha value for the GAD-7 in this study was 0.90. The scale was adapted to be used online without modifying the fundamental content.

Mathematics Anxiety Rating Scale (MARS-30; Suinn & Winston, 2003). Math anxiety was assessed with the MARS-30. This 30-item self-report measure requires participants to rate their degree of anxiety in each of a series of situations related to the use of mathematics (examples include "Taking an examination (final) in a mathematics course" and "Figuring out your monthly budget"). Its 5-point report scale ranges from "Not at all" to "Very much". The MARS-30 has been found to have significant internal and test-retest reliability, as well as high concurrent validity in comparison with its longer, 98-item version (Suinn & Winston, 2003). The Cronbach alpha value for the MARS-30 in this study was 0.96.

Positive and Negative Affect Scale (PANAS; Watson, Clark, & Tellegen, 1988). Degrees of affect and mood were measured using the PANAS, a self-report questionnaire of 10 items reflective of either positive or negative mood scales. Each item is a single word and respondents rate it by selecting the extent to which they have felt the mood it describes in the past 2 months. The measure uses a 5-point response scale, with options being 1 = "Very slightly or not at all", 2 = "A little", 3 = "Moderately", 4 = "Quite a bit", and 5 = "Extremely". In addition to having robust internal validity (r between .52 and .75) and reliability (average r value of .695), the external validity of the PANAS as a measure of negative affect is demonstrated in its significant diagnostic correlation with well-established measures of depression, including the Hopkins Symptom Checklist (HSCL, r between .64 and .75) and the Beck Depression Inventory

(BDI; r between .56 and .58; Watson, Clark, & Tellegen, 1998). In this study, the PANAS had a Cronbach alpha value of 0.90 for the Positive Affect cluster and 0.77 for the Negative.

Academic self-efficacy. Academic self-efficacy was measured using two general academic self-efficacy scales. The reason for including two different measures was the limited number of items in each, although both measures used in this study are based on the same theoretical definition of self-efficacy, described in more detail in the Introduction.

The first academic self-efficacy measure was the *Academic Efficacy subscale in the Patterns of Adaptive Learning Scales* (PALS; Midgey et al., 2000). This measure is composed of 5 items that gauge the respondent's sense of self-reported academic competence, with items such as "I can do almost all the work in class if I don't give up". The scale uses a 5-point response scale, ranging from 1 = "Not at all true," to 3 = "Somewhat true," and 5 = "Very true.". Aside from having an alpha value of 0.78 in the original manual (Midgey et al., 2000), the convergent validity PALS has been asserted using structural equation modeling to compare its results with those yielded by another well-established self-efficacy measure, the Achievement Goals Questionnaire or AGQ (Hackel, Jones, Carbonneau, & Mueller, 2016; Huang, 2012). The Cronbach alpha value for the PALS in this study was 0.87. The PALS measure was adapted to be used online without modifying its fundamental content.

The second academic self-efficacy measure was the *Perceived Competence Scale* (PCS; Deci & Ryan, 2018). This scale is composed of 4 items and, like the PALS, is intended to measure perceived self-competence regarding academic goals. It includes

items such as “I feel confident in my ability to learn this material,” and uses a 7-point response scale (1 = “Not at all true”, 4 = “Somewhat true”, 7 = “Very true”). The measure was adapted to be used online, and wording has been slightly modified to focus the questions on general academic performance rather than performance on a particular course. The PCS has yielded alpha values of 0.80 in studies that have utilized it (Wiliams & Deci, 1996; Williams, Freedman, & Deci, 1998), and in this study this value was 0.93.

The correlation between the two self-efficacy measures was $r = .80$, further supporting their combination. Therefore, after obtaining scaled values for both these measures of self-efficacy, they were combined by calculating a standardized average. This average was used to operationalize self-efficacy in the analyses for this study.

Procedure

Subjects were recruited during the Fall of 2018 via institutional email and enrolled through SONA, an online research management system. The data for this study was collected between the months of October and December of 2018 through a digital survey powered by Qualtrics. Participants followed a simple process to complete the study: after finding its listing in the SONA system, they enrolled and were provided the link to the survey associated with the project. The first component of the survey was a cover page containing all IRB-mandated information about the project. Subjects consented to take part in the study (and verified their age eligibility) by “clicking” a button at the bottom of the cover page; this action granted access to the rest of the survey. Subjects were compensated for their time with an institutionally-approved portion of extra credit available to be applied towards a Psychology course of the student’s choosing. Although the principal investigator for this study had access to the names of

participants through the SONA system, which made it possible to confirm completion of the survey and approve the provision of credit for each subject, all survey data was collected through Qualtrics with no connection to any identifying information whatsoever. Observations were assigned a randomly-generated identification code. After the data collection period ended, the survey was made unavailable and all information was analyzed using MPLUS (Muthén & Muthén, 1998-2017) and SAS software (SAS Institute, 2018).

Analysis

Prior to running analyses, study data was filtered applying exclusion criteria to the initial sample (see Participants). The Kolmogorov-Smirnov statistic was utilized to check assumptions of normality; this test assesses whether a variable distribution shows substantial deviation from normal distribution. Some variables showed relatively skewed distributions, including those that skewed towards higher values (ADHD-Inattention, self-efficacy and current GPA) and those that skewed more negatively (generalized anxiety, negative affect, and SCT); skewed variables had Kolmogorov-Smirnov statistics of $D(275) = .07$ to $.10$, $p < .01$. The more normally distributed variables (ADHD-Hyperactivity, math anxiety, and positive affect) had Kolmogorov-Smirnov statistics of $D(275) = .04$ to $.05$, $p < .15$. Age was significantly skewed due to some outliers, which made the variable distribution positive, $D(241) = .11$, $p < .01$. These distributions, while showing moderate trends, were considered appropriate for analysis. After the survey data was downloaded from Qualtrics as an Excel file, this file was imported into SAS and a series of steps were followed to assess the validity of the data. Observations from participants who did not complete the study were eliminated. Variables were created for

the calculated averages of each measure used in the survey, including each of the two ADHD subsets. A collective mean of both self-efficacy measures was also created to merge these into a single variable.

After producing frequency tables for all factors, it was found that 50 participants did not have a valid reported current GPA, either because this value was missing or because it was reported incorrectly. In addition, 52 participants had a survey completion time of less than five minutes, and 51 failed to respond the two "check" questions correctly (see Participants). These three issues were thus determined exclusion criteria and the 125 corresponding observations were removed from the dataset, leaving a usable sample of 275 observations. Utilizing a general linear model to compare the excluded participants from the corrected sample, it was found that these groups did not show significant differences from one another in terms of SCT, ADHD, general anxiety, math anxiety, self-efficacy, or affect characteristics (all $p > .05$). Therefore, no additional modifications were made to the experimental sample.

Four demographic variables were assessed as possible covariates in this study: age, gender, academic history (status prior to enrollment at current university), and perceived socioeconomic status. Age distribution for the sample was skewed, though was related to GPA, $r = -.33$, $p < .001$. Perceived socioeconomic status was normally distributed and did not correlate with GPA, $r = 0.01$. No significant difference was found in GPA by gender, but in terms of academic history, students who enrolled at their current university immediately after high school had better grades than those who transferred from a previous higher education institution, $F(1,269)=18.37$, $p < .0001$. As a

result of this, age and academic history were selected as relevant demographic predictors to be considered in further analyses.

For the primary analysis, the first step was a confirmatory factor analysis for the items of the Adult Concentration Inventory, which was used to assess the construct validity of SCT for Hypothesis 1. Hypothesis 2 used correlation analysis to address the degree of overlap between SCT factor scores (from Hypothesis 1) and each covariate of interest; each correlation was tested for significance and individually compared to the other correlations. The third step (for Hypothesis 3) also used correlation to estimate the relation of SCT symptomatology to achievement. Lastly, Hypothesis 4 extended the findings of the third step by conducting multiple regression analyses to effect of SCT on achievement over and above generalized anxiety, math anxiety, depression, self-efficacy, ADHD symptomatology, and while controlling for gender, and age. Regression analyses were preceded by a thorough evaluation of the main four assumptions of regression: homoscedasticity, linearity, normality, and independence of residuals.

Results

Table 2 summarizes descriptive statistics for all the variables addressed in the analysis for this study. The sample demonstrated a relatively high average GPA with a mean value of 3.28 on a 4.00 scale. The measures used in this study yielded mean values that approximated those obtained in the previous studies used to validate such measures in average populations; for example, the values for SCT, ADHD-Hyperactivity, and math anxiety symptoms were within one tenth of the values obtained in previous research, with similar standard deviations (Becker et al., 2017; Schweitzer et al., 2001; Spitzer et al., 2006). ADHD-Inattention, negative affect, and self-efficacy demonstrated relatively high

values, between .4 and .6 higher than those obtained in previous validating studies (Schweitzer et al., 2001; Midgey et al., 2000; Watson, Clark, & Tellegen, 1988). Mean positive affect was about .4 lower than the mean obtained by Midgey et al. (2000). After having obtained the descriptive statistics for all independent variables, and examining them for normality, results were found for each of the four steps of the analysis for this study.

Table 2

Descriptive statistics for study variables

	Mean	SD	Range	Skew	Kurtosis
SCT	2.12	0.63	1 – 4	0.43	-0.22
ADHD-IN	2.60	0.75	1 – 5	-0.03	-0.16
ADHD-HI	2.28	0.69	1 – 5	0.44	0.36
GA	1.99	0.74	1 – 4	0.62	-0.37
PA	2.85	0.84	1 – 5	-0.08	-0.47
NA	2.07	0.73	1 – 4.5	0.51	-0.48
MA	2.33	0.79	1 – 5	0.48	0.37
SE	4.86	0.87	2.25 – 6	-0.55	0.51
GPA	3.28	0.52	1.4 – 4.0	-0.84	-0.55

SCT = sluggish cognitive tempo, ADHD-IN = ADHD inattention, ADHD-HI = ADHD hyperactivity/impulsivity, GA = generalized anxiety, PA = positive affect, NA = negative affect, MA = math anxiety, SE = self-efficacy, GPA = grade point average.

Step 1. SCT Confirmatory Factor Analysis

The first analytical step was the only one approached utilizing both SAS and MPLUS software. As summarized in Table 3, 8 of the 10 SCT symptoms (ACI items 3, 4, 5, 8, 9, 10, 12, and 13) had standardized factor loadings above .62, and all research-supported 10 items of the Adult Concentration Inventory (ACI) were above .40 (see table 3). To evaluate fit, we examined chi-square values as well as other measures. First, the standardized root mean square residual (SRMR) was considered; this value is the standardized difference between the observed correlation and the predicted correlation. A well-fitting model generally requires an SRMR value as close to zero as possible, with .05 being a common cutoff (Hu & Bentler, 1999). The root mean square error of approximation (RMSEA) was assessed; this is a value that revises differences between the hypothesized model and the population covariance matrix. RMSEA values range between 0 and 1, with acceptable values preferably below .08 or .05 (MacCallum, Browne, & Sugawara, 1996). The Comparative Fit Index (which assesses the discrepancy between the hypothesized model and the data, while adjusting for issues of sample size) values for appropriate model fit range above .90 (Bentler, 1990).

The overall fit of this model was poor, $\chi^2(35) = 215.92$, $p < .001$, RMSEA = .137, SRMR = .063, CFI = .858. MPLUS suggests modification indices that decrease the overall chi-square and improve model fit. In the present case, four correlated residuals were added

suggested that four pairs of the 10 ACI items shared error variance. This improved the model fit, $\chi^2(31) = 91.22$, $p < .001$, RMSEA = .084, SRMR = .047, CFI = .953. Although this reduces generalizability of this particular model, the factor loadings for individual items were similar to the original model. In addition, the factor scores outputted correlated highly with the raw score values, which suggests that the modifications did not alter the SCT measurement fundamentally.

Table 3

Confirmatory Factor Analysis for Sluggish Cognitive Tempo (SCT) Symptoms from the 10 validated items of the Adult Concentration Inventory (ACI)

ACI Item	Standardized Factor Loading	R-square
ACI3	.783	.613
ACI4	.634	.402
ACI5	.640	.410
ACI7	.422	.178
ACI8	.724	.524
ACI9	.642	.412
ACI10	.621	.385
ACI12	.626	.391
ACI13	.850	.722
ACI16	.580	.337

Step 2. Confirmation of SCT correlation with variables of interest

Correlation analyses were used to obtain estimated bivariate relationships between each of the variables of interest in the present study. Table 4 summarizes the correlation, probability, and significance values for these relationships. Strong r values were found between SCT and ADHD-inattention, $r = .62$, $p < .001$; generalized anxiety, $r = .55$), $p < .001$; and negative affect, $r = .47$, $p < .001$; while moderate correlations were obtained for SCT with ADHD-hyperactivity/impulsivity, $r = .41$, $p < .002$ and math anxiety, $r = .37$, $p < .001$. The three negative correlations found for SCT were also the weakest ones: positive affect, $r = -.32$, $p < .001$; self-efficacy, $r = -.27$, $p < .001$; and GPA $r = -.12$, $p = .055$, respectively. In contrast, *r* values related to current GPA and positive affect were small and not significant. It appeared as though SCT correlated more highly with ADHD-Inattention scores than with ADHD-Hyperactivity scores.

Table 4.

Correlations between study variables

	1	2	3	4	5	6	7	8
1. SCT	--							
2. ADHD-IN	0.62**	--						
3. ADHD-HI	0.41**	0.61**	--					

4. GA	0.55**	0.49**	0.46**	--				
5. MA	0.37**	0.41**	0.28**	0.44**	--			
6. PA	-0.32**	-0.22	-0.01	-0.18	-0.11	--		
7. NA	0.47**	0.42**	0.41**	0.73**	0.35**	-0.03	--	
8. SE	-0.27**	-0.32**	-0.24**	-0.28**	-0.29**	0.27**	-0.27**	--
9. GPA	-0.12	-0.19	-0.13	-0.15	-0.15**	0.08	-0.06	0.22*

*$p < .05$, **$p < .001$

SCT = sluggish cognitive tempo, ADHD-IN = ADHD inattention, ADHD-HI = ADHD hyperactivity/impulsivity, GA = generalized anxiety, MA = math anxiety, PA = positive affect, NA = negative affect, SE = self-efficacy, GPA = grade point average.

Step 3. Correlations of study variables with achievement.

The bivariate correlations generated to address hypothesis 2 (see Table 3) were also used to address hypothesis 3, as the latter was meant to evaluate the zero-order correlation between SCT and achievement. Results showed that, while there was a negative correlation between SCT and GPA, it was weak and not significant (r -0.12, p > .05). In fact, GPA was weakly related to all variables of interest, with its relation to self-

efficacy being the only one significant ($r = 0.22$, $p < .05$). Although this finding previews the finding for hypothesis 4, the fourth step of the analytical plan for this study was still conducted and the findings described.

Step 4. Prediction of achievement by SCT in context of overlapping predictors.

Hypothesis 4 was addressed using a multiple regression analysis, preceded by a thorough evaluation of the main four assumptions of regression. Homoscedasticity was assessed with the White Test (White, 1980), which graphed residuals for all predictors of the model and allowed to visually confirm the normality of the distributions of such residuals. Linearity was assessed based on the bivariate correlations obtained for the second step of analysis for this study, as well as a variable scatter plot through which the linear aspect of these variables was confirmed visually; no variable appeared curvilinear or was distributed following any noticeable pattern. Normality of residuals was assessed with a standard linear regression run for current GPA, with independent variables including age, ADHD inattention and hyperactivity/impulsivity, generalized anxiety, math anxiety, self-efficacy, positive and negative affect, and SCT. This assumption was fulfilled for generalized anxiety, math anxiety, positive affect, and SCT, while the plots for ADHD inattention, ADHD hyperactivity/impulsivity, and positive affect showed a moderate bias to the left, age showed a significant bias to the left, and self-efficacy showed a moderate bias to the right. Normality was also observed for the manifest frequency distributions of each individual variable; overall, normal distributions were found for all independent variables. Lastly, collinearity diagnostics were obtained to observe four main characteristics: condition index, proportion of variation, tolerance, and variance inflation. According to all these criteria, there was low collinearity among

independent variables overall, suggesting that this combination of variables was appropriate for regression analyses.

Table 5 displays the values found for this analysis. The overall model was significant, $R^2 = .25$, $F(10,230) = 7.34$, $p < .001$. Academic history was no longer significant in the final model, and did not predict unique variance in achievement. The only two significant predictors of GPA were age ($\beta = .27$ $p < .005$, 4% unique variance) and math anxiety ($\beta = .18$ $p < .05$, 2% unique variance). Notably, SCT was not a significant unique predictor of GPA, contributing no unique variance to the model.

Table 5.

Regression analysis: predictive values of independent variables for academic achievement

Source	b	Standard Error	t value	ß value	*p*	Squared Semi-partial Correlation
Age	-0.065	0.019	-3.52	0.27	0.001	0.043
Academic History	-0.104	0.074	-1.40	0.10	0.162	0.007
ADHD-IN	-0.078	0.061	-1.27	0.12	0.204	0.006
ADHD-HI	-0.030	0.057	-0.53	0.04	0.596	0.001
SCT	-0.048	0.066	-0.72	0.06	0.474	0.002

G.A.	-0.015	0.067	-0.22	0.02	0.822	0.000
PA	-0.011	0.039	0.99	0.02	0.779	0.000
NA	0.060	0.061	-0.28	0.09	0.323	0.003
MA	-0.115	0.044	-2.57	0.18	0.011	0.023
SE	0.049	0.038	1.27	0.09	0.205	0.006

SCT = sluggish cognitive tempo, ADHD-IN = ADHD inattention, ADHD-HI = ADHD hyperactivity/impulsivity, GA = generalized anxiety, MA = math anxiety, PA = positive affect, NA = negative affect, SE = self-efficacy, GPA = grade point average.

Discussion

This study had the overall goal to contribute to the understanding of sluggish cognitive tempo (SCT) as a construct, including its structure and relation with potentially overlapping variables, including ADHD and generalized anxiety symptomatology; the study also aimed to explore the impact of SCT on academic achievement. The first hypothesis was that the 10-item SCT measure would fit a single-factor structure, which was supported. Hypothesis 2 was that SCT would relate moderately to several potentially overlapping constructs, which it did, yet not to a degree that the constructs would be considered the same, so this hypothesis was also supported. The last two hypotheses evaluated the relation of SCT to achievement, alone, and in the context of the above

variables. These hypotheses were not supported by the data, suggesting that the predictions of this study do not hold true in a sample of undergraduate students.

These findings are meaningful for a number of reasons, beginning with the similarities and differences in comparison with previous studies about SCT. The factor analytic results were generally convergent with previous work, although this prior work is mostly in children populations and with a variety of measurements and methods (Becker et al., 2016). This study extends these results in a diverse young adult population utilizing a SCT-specific measure (Becker et al., 2017).

The bivariate relationships obtained in this study between SCT and relevant clinical constructs either matched the previous literature or contributed a new perspective to it. For example, SCT and ADHD, as well as SCT and generalized anxiety, were found to correlate moderately and significantly for adults in similar proportion to how they correlate in children (Becker et al., 2016, 2017; Becker et al., 2016; Becker, Luebbe, Greening, Fite, & Stoppelbein, 2014; Garner et al., 2010; Leopold et al., 2016). As for correlations that had not been explored before, the moderate to weak correlations of SCT with math anxiety, with self-efficacy, and with affect were significant and thus built onto what was previously known about the overlap of SCT with other clinical phenomena. SCT having a significant negative correlation with math anxiety and self-efficacy, but not with GPA, seems to suggest that SCT worsens the symptoms of disorders that intervene with students' perception of their own efficiency, although these perceptions do not seem to translate into lower grades; it is possible that adults are better able to manage their own symptoms of anxiety and thoughts of self-doubt in academic environments than their

younger counterparts with SCT would, which is opposite of the prediction on which this study was based.

Although little research has examined the correlation of SCT with academic achievement, the present study yielded divergent findings in comparison with those few other studies. However, the lack of a significant bivariate correlation between SCT and grades is consistent with previous work showing weak relations in this regard (the *r* value for this relationship was -.17 in Becker et al. (2014); the value in the present study was -.12, despite using a different measure. Interestingly, in Becker et al. (2014), SCT was a unique predictor in their regression analysis. Another study (Langberg et al., 2013) showed a similar pattern, with low bivariate correlations between SCT and GPA but significant predictive value for SCT as part of regression analysis. These two studies had different sample sizes from the present study, suggesting that intercorrelations among measures appear different across the three studies, and warrants closer examination in future studies.

Given that this study supported the literature in some ways and diverged from it in others, it is worth considering possible explanations for hypotheses that were not supported. For example, it is possible that the measure of SCT used was inadequate. However, our sample size was large and diverse, and exhibited adequate factor loadings and fit a unitary model, and also correlated similar to outside constructs, so it seems unlikely that our findings were due to such issues. It is also unlikely that our results were due to inadequate power given the size of the sample, considering that several aspects of SCT and the way it related to other variables showed concordance with previous

research. It may be the case that our measure of academic achievement, as operationalized by grade point average, was an issue, and is discussed next in limitations.

Limitations

Though important, the present study had some limitations that need to be considered. All measures required self-report, which increases the possibilities that certain scores might have been inflated or deflated by subjects, whether deliberately or due to inaccurate estimations. GPA in particular was an unpredictable variable to use in a population with a significant fraction of transfer students and freshmen who may be completing their first semester at their current university, and therefore have a current GPA calculated based on very few classes, or students may have predicted performance in school courses that were not yet completed. Some transfer students might have even reported GPA scores from their previous institutions, despite survey instructions indicating otherwise. In addition, the fact that the data was obtained and managed through an online survey leaves the possibility that some participants might have completed the study in a state of distraction, hurry, or disinterest, even though participants taking very little time were excluded. Future research approaching the relationship of SCT with achievement, or with any other covariate or functional outcome in adults, should aim for a more structured and verifiable way of collecting data, such as in-person sessions for participants to complete digital surveys in designated laboratory computers; and to verify results, it would be most effective to retrieve official academic records from administrative sources, such as Registrars' offices.

Conclusion

This study provides a new level of understanding about SCT and achievement in undergraduate students. We were able to demonstrate the structure of SCT, and verify its relations with overlapping variables, in a manner consistent with past work. However, the primary finding was disappointing in that SCT is unrelated to academic achievement as measured here. The most important next step is to evaluate whether in a similar population, SCT symptomatology is related to actual (not self-reported) grades, test scores, or performance measures of achievement in reading and/or math or writing.

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