

Low GPA and College Attrition Predictive Factors: Using Hierarchical Multiple Linear  
Regression in Predicting Exam Grades of Students in Introduction to Psychology Course

by

Bethany Higgins

A thesis presented to the Honors College of Middle Tennessee State  
University in partial fulfillment of the requirements for graduation  
from the University Honors College

Fall 2021

Thesis Committee:

Dr. Stuart Bernstein, Thesis Director

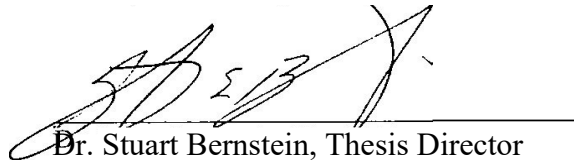
Dr. Catherine Crooks, Second Reader

Dr. Rebekka King, Thesis Committee Chair

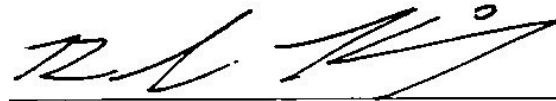
Low GPA and College Attrition Predictive Factors: Using Hierarchical Multiple Linear  
Regression in Predicting Exam Grades of Students in Introduction to Psychology Course

by Bethany Higgins

Approved:

A handwritten signature in black ink, appearing to read 'S. Bernstein', written over a horizontal line.

Dr. Stuart Bernstein, Thesis Director  
Professor, Department of Psychology

A handwritten signature in black ink, appearing to read 'R. King', written over a horizontal line.

Dr. Rebekka King, Thesis Committee Chair  
Associate Professor, University Honors College

## **Abstract**

With the typical college degree completion time expanding four to six years, yet the attrition rate of undergraduate students remaining high, a more in-depth investigation of the reasons of undergraduate extended duration, failure, and success, is needed to understand the problem. The current study used a paper survey to examine how psychological factors (e.g., test anxiety, sleep, and grit) and reading ability (vocabulary and spelling) along with previously measured predictors (e.g., class participation, homework, ACT Reading scores, and online learning) affect success in an Introductory Psychology course. In a hierarchical multiple linear regression model, the predictors and their interactions accounted for nearly half of the overall variance in exam grades. The model introduced test anxiety, the interactions of sleep and test anxiety, sleep and online homework, and test anxiety and ACT Reading scores, as significant contributors to exam performance.

## Table of Contents

Abstract .....	iii
List of Tables .....	v
I. Introduction .....	6
Mental Health, Grades, and College Completion .....	7
Sleep, Grades, and College Completion.....	8
Grit, Grades, and College Completion .....	9
Reading Ability, Grades, and College Completion.....	10
Research Questions .....	11
II. Method .....	12
Participants .....	12
Data Collection.....	13
III. Results.....	15
IV. Discussion.....	18
References.....	22
Appendix A.....	28
Appendix B.....	44
IRB Approval Letter .....	45

## **List of Tables**

Table 1: Descriptive Statistics of the Sample .....	15
Table 2: Test Factors Descriptive Statistics.....	16
Table 3: Correlation Matrix of Test Factors .....	44
Table 4: Model Fit Measures .....	17
Table 5: Model Coefficients for Exam Predictors .....	18

## I. Introduction

Given the importance of an educated workforce for human capital potential, educational institutions supporting the creation and holistic formation of independent learners, and the individual student's health and overall quality of life, attrition rates of undergraduate students are a detriment to multiple levels of society. In the United States, the overall dropout rate for undergraduate college students is 40%, with approximately 30% of college freshman dropping out before their sophomore year (Auerbach et al., 2016). According to Middle Tennessee State University's 2020 Factbook, the six-year graduation rate is 51.2%, meaning roughly half of students entering MTSU will not receive a degree within six years (*Office of institutional effectiveness, planning and research*, 2021). Reasons for dropping out of postsecondary education are vast, complicated, multifactorial, overlapping, and difficult to research due to the former listed.

With the typical college degree completion time expanding from four to six years, yet the attrition rate of undergraduate students remaining high, a more in-depth investigation of the reasons of undergraduate extended duration, failure, and success, is needed to understand the basis of the problem. Undergraduates' failure of degree completion or extended duration of degree completion due to failure is contributed to mental health abnormalities; learning disability; stress caused by academic anxiety and lack of social competency; lower perception of academic control; and maladaptive coping and transition strategies (Carroll et al., 2020; Wei, Russel, & Zakalik, 2005). Major contributions of college success include strong metacognitive skills such as reading comprehension and learning strategies, resilience, interpersonal support, quality

preparatory education, a conventional educational path before entering college, strong internal locus of control, academic confidence (Hall, Smith, & Chia, 2008; Meijer et al., 2019). With high school GPAs and standardized tests (SAT/ACT scores) only accounting for approximately 25% of the variance in academic performance (Robbins et al., 2004), a more holistic approach in analyzing what keeps students in college and attributes to college student's academic success is necessary.

### **Mental Health, Grades, and College Completion**

Mental health abnormality is one of the more significant contributing factors in the high dropout rate of undergraduate students. Concrete pre-university behaviors such as secondary schooling GPA were more predictive of students with higher GPA and completion rates than positive psychological attributions such as self-efficacy and high perceived academic self-control (Meijer et al., 2019; Respondek et al., 2017). Affective factors associated with perceived influence and control allow the student to complete higher education requirements in a timely manner (Hall, Smith, & Chia, 2008).

Mental health disorders often result in a cascade of negative educational, economic, and social outcomes including elevated risk of withdrawal from college prior to completion (Cuijpers et al., 2016). A diagnosis of depression was associated with a decrease in student GPA of 0.49 points, or approximately half of a letter grade (Hysenbegasi, Hass, & Rowland, 2005). 35 percent of students with a diagnosed mental disorder, including learning disabilities, depression and emotional disorders, and other cognitive impairments, who enter a four-year post-secondary institution will complete a postsecondary certificate, associate degree or bachelor's degree, compared to 51 percent

of the general population (Carroll et al., 2020). According to The College Completion Agenda Progress Report of 2011, mental health was not an analyzed factor in college completion rates. Graduation rates were associated with factors of race/ethnicity and institutional control (e.g., public, private) (Michael et al., 2011). Mental health disorders such as depression and anxiety affect GPA and college completion, making it an applicable factor in measuring student achievement at MTSU.

### **Sleep, Grades, and College Completion**

An important control factor for mental health is sleep. According to Taylor et al. (2002), sleep is not only an important component of mental health, but also continues to be a significant predictor of academic performance in college students. Gaultney (2015) conducted a three-year longitudinal study where college students were assessed on their sleep patterns and risk for sleep disorders. The study found that students at risk of a sleep disorder were more likely to withdraw from the institution over the three years. Risks of a sleep disorder also predicted lower GPA at years one and two. Cumulative GPA was negatively correlated with later bedtimes ( $r = -.15$ ), wake times ( $r = -.13$ ), and increased nap taking ( $r = -.10$ ). Greater variability in bedtimes ( $r = -.15$ ), wake times ( $r = -.10$ ), total sleep time ( $r = -.20$ ), sleep efficiency ( $r = -.10$ ), sleep onset latency ( $r = -.09$ ), and nap times ( $r = -.09$ ) also negatively correlated with cumulative GPA. In a hierarchical multiple linear regression model, total sleep time was the strongest single predictor of cumulative GPA ( $\beta = 1.685, p = .029$ ), followed by the quadratic function of total sleep time ( $\beta = -0.826, p = .034$ ) (Taylor, et al. 2002).



The Students Sleep Habits Questionnaire (SSHQ) is a large survey, consisting of eight pages, that measures multiple sleep variables. Wolfson and Carskadon (1998) used a section of the SSHQ to measure sleep/wake behavior problems in a sample of 3,120 adolescents from ages 13-19. The research found that students with more problematic sleep/wake patterns had more behavioral problems such as arriving late to class, feeling tired or dragged out nearly, needing more than one reminder to get up,  $p < .01$ , having higher levels of depressive mood,  $p < .001$ , and greater sleepiness,  $p < .001$ , compared to the students in the adequate sleep group. The study also found that as adolescents get older, sleep/wake patterns become more important in the academic environment with poorer sleep/wake patterns associated with lower GPA and more disruptive behavioral issues (Wolfson & Carskadon, 1998).

### **Grit, Grades, and College Completion**

As defined in Duckworth et al. (2007), grit is the personal attribute of “perseverance and passion for long-term goals” (p. 1087). Grit consists of the ability to maintain interest, persist, and apply effort in long-term goals (Duckworth & Quinn, 2009). Grit has been seen as a consistent and essential quality in high-achieving individuals, including successful college students, and may work as a protective barrier from poor outcomes associated with mental health. Within a study conducted at West Point’s summer training, cadets with one standard deviation higher than the average score on a grit measure were 99% more likely to finish the course, ( $B = 0.69$ ,  $OR = 1.99$ ,  $p < .001$ ). (Duckworth & Quinn, 2009). Grit contributed to West Point cadets’ success in completing the entrance summer training with a coefficient determinant variant ( $R^2$ ) of

0.08, which surpassed West Point's Whole Candidate Score (high school rank, SAT scores, participation in extracurricular activities, and a physical assessment) as a predictor, ( $B = 0.06$ ,  $OR = 1.06$ ,  $p = .64$ ). Within a longitudinal study of high achieving students in 7<sup>th</sup> - 11<sup>th</sup> grades ( $N = 279$ ), scores on the Grit-S predicted GPA 1 year later with a Pearson's  $r$  of .30,  $p < .001$ , after age was controlled.

In the previous studies, grit was measured by the Short Grit Scale (Grit-S). It is an 8-item self-report measurement of grit, involving the constructs consistency of interest and perseverance of effort. Grit will be assessed via the Short Grit Scale or Grit-S, which is an 8-item self-report measurement of grit, involving the constructs of interest and effort. Grit consists of the ability to maintain interest, persist, and apply effort in long-term goals. Participants will respond to the items with the answer that best describes them. The measure uses a 5-point Likert scale on each item (1 being not at all like me to 5 being very much like me). The Grit-S is a reliable and valid instrument for assessing grit in the target population of secondary students and post-secondary students (Duckworth & Quinn, 2009).

### **Reading Ability, Grades, and College Completion**

Reading ability as it pertains to learning ability is another causal factor of both college attrition and college success. Learning disabilities affect self-ratings of academic and creative abilities and psychosocial functioning; reasons for attending college; and expectations for college success (DuPaul et al., 2017). A history of reading difficulties, however, undiagnosed, and therefore not receiving appropriate accommodations, earn lower GPAs, complete fewer credits, and report lower scores across multiple

metacognitive reading and study strategy scales compared to students with no history of reading difficulty (Bergey et al., 2017). The physiopathology of reading disabilities, such as dyslexia, within in the cortical surface area and thickness of the temporal, parietal, occipital and frontal lobes has been established (Gilger et al., 2017). Psychological effects of reading disability include lack of perceived academic control, stronger test anxiety, poor self-confidence, low internal locus of control, poor self-advocacy, cognitive- and physical-based test anxiety, and less resilience (Williams et al., 2020).

Results indicate that students with a history of reading difficulties earn lower grade point average (GPA) and successfully complete fewer credits compared to students with no history of reading difficulty. In students with a history of the reading disability dyslexia, academic success is associated with the use of metacognitive reading strategies and the use of study aids (Bergey et al., 2017). However, without the appropriate accommodations or learning tools necessary to succeed, students with dyslexia are at a disadvantage in class and college completion (DuPaul et al., 2017). In one study, relative reading resiliency significantly correlated to word comprehension or vocabulary with a z-score of .63 ( $p < .01$ ) and morpheme counting with a z-score of .59 ( $p < .01$ ). The overall impact of word comprehension ( $\beta = .34, p < .05$ ) and morpheme counting ( $\beta = .31, p < .001$ ) accounted for .38 of the variance ( $R^2$ ) of a passage understanding (Farris, in progress).

### **Research Questions**

The current study examines how mental health, reading ability, and test readability affect success in a single college course – Introductory Psychology. Previous

studies have examined the relatively long-term effects of mental health and reading skills on degree completion and GPA. The current study will examine the more immediate, short-term relationships between mental health, reading skills, and achievement on actual exam items and subsequent exam grades in a particular class. The analyses will measure correlations between predictive factors and academic test performance on an exam in Introduction to Psychology. The research questions to be pursued are exploratory. A hierarchical multiple linear regression model will examine the effects of person level factors from the survey (e.g., test anxiety, sleep, grit, and reading ability) as well as previously measured effects (e.g., class participation, homework, ACT scores, and online learning) on overall exam performance. Interactions and correlations will also be used in the model.

## **II. Method**

### **Participants**

Introduction to Psychology (PSY 1410) students in fall semester of 2021 were evaluated using the following measures in a paper format with the following tests for test anxiety, grit, sleep, and reading ability. Reading related abilities were measured with tests from a related study (Bernstein, in progress). Participants and their age, gender, first language, and family and self-history of reading comprehension were accounted for. Through school records, ACT scores, class participation, learning curve, and homework completion were collected.

## **Data Collection**

A paper survey was generated, and the response data was collected using the measures below in three classes of Introduction to Psychology (PSY 1410). Students were told at the Introduction to Psychology professor's discretion that participation in the survey results in two extra point credits for the class. 161 participant surveys were used in analysis, omitting the surveys that were incomplete and surveys of participants who withdrew from the class.

Participant characteristics will be measured with a battery of tests and cognitive tasks. These tests were administered in paper format to students during scheduled class times, and the test array lasted about 20 minutes. See Appendix A for survey.

***Demographics.*** Given that college students come from a variety of socioeconomic backgrounds, especially at large and diverse universities such as MTSU, with some students being dependent on parental income and others being independent and reliant on personal income, the measure does not fit the scope of the survey and would extend the survey to an unreasonable time. The following questions were asked to determine the student's demographics (age and gender) and history of language as it pertains to the study: 1) Is English your first language? 2) Did you experience difficulty learning to read? 3) Does anyone in your family have a history of difficulty learning to read? 4) Asking participants for consent via their M-number regarding using their 1410 exam scores, college entrance exam scores (ACT scores), and D2L information on homework, class participation, and learning curve in the study.

**Test Anxiety.** A simple questionnaire of five items named the Short Test Anxiety Inventory (STAI) (Taylor & Deane, 2002) was administered for the test anxiety measure

of the survey. The participants were asked to rate each of the five items in terms of how they feel during a test or exam based on a scale of strongly disagree, disagree, neutral, agree, or strongly agree.

**Sleep.** Students were assessed on sleep via the sleep/wake cycle section of the SSHQ. The sleep/wake behavior problems scale includes 10 items asking frequency of indicators of inconsistent sleep/wake behaviors over the course of the last 2 weeks. The items are on a 5-point Likert scale from everyday to never (5 = everyday, 4 = several times, 3 = twice, 2 = once, 1 = never). The sleep/wake behavior scale has a coefficient alpha or reliability of .75 for sleep/wake behaviors (Wolfson & Carskadon, 1998).

**Grit.** Grit was assessed via the Short Grit Scale or Grit-S. Participants were asked eight items related to interest and effort in long term goals and will proceed to answer with the rate that best describes them. That ratings of the items are as follows beginning with score one to score five: not at all like me, slightly like me, somewhat like me, mostly like me, and very much like me. The Grit-S is a reliable and valid instrument for assessing grit in the target population of college students (Duckworth & Quinn, 2009). The published reliability of this test within a sample of 139 Ivy League undergraduates was .83 (Duckworth & Quinn, 2009).

**Vocabulary.** Vocabulary was assessed with the reading vocabulary test from the Woodcock Johnson Tests of Achievement, 4<sup>th</sup> edition (WJ-4; Schrank, Mather, & McGrew, 2014). This consists of the synonym and antonym subtests. The published reliability of this test is .92 for adults.

**Spelling.** Knowledge of print to sound relationships was measured with the spelling subtest of the WJ-4. Published reliability of this test is .92 for adults. Spelling is

rooted in phonological decoding and word identification, which serve as a measure of code knowledge and unlike a test of word identification.

### III. Results

#### Descriptive Statistics

Table 1 provides descriptive statistics on the participants. Gender, reading history, and native language are presented. Age of the sample ranged from 18 to 35 ( $M = 19.10$ ,  $SD = 2.23$ ).

Table 2 provides descriptive statistics for the test factors within the survey as well as class participation, learning curve (online interactive homework), ACT best reading score, and written homework.

**Table 1.**  
*Descriptive statistics for the sample*

---

<b>Gender</b>	
Male	70
Female	90
Other	3
 <b>Reading History</b>	
No history of reading problems	105
Self-history of reading problems	21
Family history of reading problems	22
 <b>Native Language</b>	
English	148

---

**Table 2.**  
*Test Factor Descriptive Statistics*

Test Factor	N	Missing	Mean	95% Confidence Interval		SD
				Lower	Upper	
Spelling	163	47	25.61	24.89	26.34	4.70
Vocabulary	163	47	20.14	19.29	20.99	5.53
STAI	163	47	7.89	7.28	8.50	3.96
SGS	163	47	23.04	22.19	23.88	5.52
SSHQ	163	47	15.26	14.21	16.31	6.84
Class participation	202	8	10.64	10.40	10.88	1.73
Homework	202	8	26.73	25.63	27.82	7.92
Learning curve	202	8	15.65	14.83	16.48	6.00
ACT Reading	144	66	24.53	23.72	25.35	4.99
Other			14			

*Note.* STAI = Short Test Anxiety Inventory; SGS = Short Grit Scale; SSHQ = Short Sleep Habits Question

### ***Hierarchical Multiple Linear Regression***

Table 3 in Appendix B provides the correlation matrix of test factors, class participation, ACT reading score, learning curve, homework, and exam scores. Results from Pearson product correlations (Pearson's  $r$ ) and its corresponding  $p$ -values are reported. Following Cohen (1988),  $r$  values between 0-.01 are negligible, .02-.09 are small, .1-.24 are moderate, and .25-1.00 are large.

A hierarchical multiple regression was run to determine the extent to which psychological factors, reading abilities, and academic measures contribute to student exam grades, and results are contained in Table 4. The overall set of predictors accounted for 49.0% of the variance in exam grades ( $M = 201$ ,  $SD = 63.6$ ,  $n = 194$ ). In the first block, class participation, homework, and learning curve significantly explained 30.3% of



the variance in exam grades,  $F(3, 139) = 20.1, r^2 = .303, p < .001$ . These predictors were entered first to control for any present effects of the class's learning environment. In the second block, ACT Reading, vocabulary, and spelling were added to account for reading ability. The second block significantly explained an extra 10.3% of variance in exam grades,  $F(6, 136) = 15.4, r^2 = .406, p < .001$ . The third block consisted of grit, sleep, test anxiety, the interaction of sleep and learning curve, the interaction of ACT Reading and test anxiety, and the interaction of sleep and test anxiety. These factors were added to the model to account for psychological factors and their possible interactions associated with academic success. The third approach significantly contributed another 8.4% of the variance in exam grades,  $F(12, 130) = 10.4, r^2 = .490, p < .001$ .

**Table 4.**  
Model Fit Measures

Model	$r^2$	Adjusted $r^2$	RMSE	Overall Model Test			
				$F$	df <sub>1</sub>	df <sub>2</sub>	$p$
1	0.303	0.288	51.1	20.1	3	139	< .001
2	0.406	0.379	47.1	15.5	6	136	< .001
3	0.490	0.443	43.7	10.4	12	130	< .001

Each variable's individual impact on exam grades can be estimated from the standardized beta values ( $\beta$ ) as depicted in Table 5. The largest variables that significantly contributed to the model were class participation ( $\beta = 0.43, p < .001$ ), homework ( $\beta = 0.46, p = .006$ ), vocabulary ( $\beta = 0.21, p = .006$ ), test anxiety ( $\beta = -1.39, p < .001$ ), the interaction of ACT Reading and test anxiety ( $\beta = 1.16, p = .001$ ), and the

interaction of sleep and learning curve ( $\beta = -0.42, p = .046$ ), and the interaction of sleep and test anxiety, ( $\beta = 0.60, p = .01$ ).

**Table 5.**  
Model Coefficients for Exam Predictors

Predictor	$\Delta r^2$	B	SE	<i>t</i>	<i>p</i>	$\beta$
Intercept <sup>a</sup>		54.79	66.80	0.820	0.414	
Step 1	.303***					
Classparticip		16.47	3.40	4.84	< .001	0.43
Learncurve		-0.15	0.75	-0.20	0.844	-0.02
Homework		4.65	1.65	2.81	0.006	0.46
Step 2	.103***					
ACT_reading		-3.82	1.98	-1.93	0.056	-0.31
Spelling		0.91	0.93	0.97	0.332	0.07
Vocab		2.56	0.93	2.77	0.006	0.21
Step 3	.084***					
STAI		-22.04	6.28	-3.51	< .001	-1.40
SGS		-0.62	0.85	-0.73	0.468	-0.05
SSHQ		-1.72	1.94	-0.89	0.377	-0.19
SSHQ*Learncurve		-0.18	0.09	-2.02	0.046	-0.42
STAI*ACT_reading		0.68	0.21	3.28	0.001	1.16
STAI*SSHQ		0.39	0.15	2.63	0.010	0.60

<sup>a</sup> Represents reference level

#### IV. Discussion

As anticipated, class related factors (class participation, online interactive homework, and written homework) contributed the most to exam performance. These factors were entered in the first block because of their known impact on class performance and to control for the rest of the model. In the first model, class participation was the single largest contributing factor in predicting exam performance, followed by homework, which was also significant. Learning curve (the online interactive homework)

was found to be nonsignificant as an overall effect in the model but did enter into significant interactions.

The next step added factors related to individual differences in reading abilities. Differences in reading comprehension (ACT reading) was a moderate predictor, just missing significance at  $p = .056$ . However, the standard estimate was negative, meaning that as ACT Reading scores increase, exam performance tends to decrease. This was unexpected because of the literature behind standardized test scores and college performance as well as the weight they hold in college entry (Robbins et al., 2004; Meijer et al., 2019; National Center for Education Statistics, 2012). This negative direction could be a suppressor effect in the regression model. Along with ACT Reading scores, the second block consisted of other factors related to reading ability. Reading ability has proven an important predictor in a variety of academic successes across primary, secondary, and post-secondary schooling (DuPaul et al., 2017; Bergey et al., 2017). Vocabulary was the largest and only significant predictor in the second model, adding more to the overall variance in exam performance than ACT Reading and spelling.

Socio-emotional factors were entered in the final step of the model. Grit, sleep, test anxiety, the interaction of sleep and online learning, the interaction of ACT Reading and test anxiety, and the interaction of sleep and test anxiety, were added to the third block. Grit was not related to exam performance. Although studies have shown that grit is related to college completion (Duckworth, et al., 2007; Lee, 2017), it may be too distant of an estimate and involve outcomes beyond success at a few tests in one class. Sleep had significant impact on the model in interactions but not when considered by itself. Test

anxiety was found to be significant and the largest contributing factor in the third model and overall model.

What was interesting about third step of the model were the significant interactions and test anxiety factor. The high unstandardized estimates of the interactions mean the predictors play off one another and produce a new effect in their contribution to exam performance. With the ACT Reading and test anxiety interaction, lower ability students could experience more anxiety. The interaction of sleep and the online homework activity could have potential memory consolidation effects where students who complete the online assignments and have healthier sleep patterns remember more for exams. The interaction of test anxiety and sleep could mean that higher test anxiety leads to poorer sleep behavior or vice versa. Higher test anxiety may be mediated by the effects of better sleep patterns. It is impossible to know from the current study how these interactions occur, but future studies may consider how and why these factors interact in the prediction of exam performance.

The current study is one of few to study the relationships between mental health components, reading ability factors, and their relationship with concrete exam performance. Rather than a distal measurement of GPA or graduation rates, exam performance provides a more proximal measurement of predictive factors and their relationship to test achievement in college students. Predicting success in college is not a simple task and reflects the interrelationship of many variables (Hall, Smith, & Chia, 2008). In the current study, the chosen predictors tried to cover the immediate influences of exam performance through reading ability, test anxiety, and sleep/wake patterns, while other chosen predictors like grit, cover the more distal factors associated with both exam

performance and college attrition. Because grit is related to perseverance and effort in long term goals, its impact on immediate exam performance in an introductory class may not be a sufficient measure in predicting exam performance.

In-depth factor representation was not achievable due to time constraints and the scope of the study. A succinct survey is necessary for practicality of data collection and analysis as well as motivating the participation of students. Although the current study covers multiple factors that contribute to college failure, the survey does not consider variables such as socioeconomic status, the many various mental health aspects that affect college students, and the item-level difficulty of exam questions themselves. The power or effect sizes of the model were also small, but the study was exploratory in nature, so it is not surprising. Overall, the model introduces the interaction of sleep and test anxiety and rules out grit as a powerful predictor in exam performance.

## References

- Auerbach, R. P., Alonso, J., Axinn, W. G., Cuijpers, P., Ebert, D. D., Green, J. G., Hwang, I., Kessler, R. C., Liu, H., Mortier, P., Nock, M. K., Pinder-Amaker, S., Sampson, N. A., Aguilar-Gaxiola, S., Al-Hamzawi, A., Andrade, L. H., Benjet, C., Caldas-de-Almeida, J. M., Demyttenaere, K., & Florescu, S. (2016). Mental disorders among college students in the world health organization world mental health surveys. *Psychological Medicine*, *46*(14), 2955–2970.  
<https://doi.org/10.1017/s0033291716001665>
- Bergey, B. W., Deacon, S. H., & Parrila, R. K. (2017). Metacognitive Reading and Study Strategies and Academic Achievement of University Students With and Without a History of Reading Difficulties. *Journal of Learning Disabilities*, *50*(1), 81–94.  
<https://doi.org/10.1177/0022219415597020>
- Bernstein, S. E., Flipse, J. L., Jin, Y., & Odegard, T. N. (2020). Word and sentence level tests of morphological awareness in reading. *Reading and Writing*, *33*(6), 1591–1616. <https://doi.org/10.1007/s11145-020-10024-6>
- Carroll, J. M., Pattison, E., Muller, C., & Sutton, A. (2020). Barriers to Bachelor's Degree Completion among College Students with a Disability. *Sociological Perspectives*, *63*(5), 809–832. <https://doi.org/10.1177/0731121420908896>
- Cuijpers, P., Cristea, I. A., Ebert, D. D., Koot, H. M., Auerbach, R. P., Bruffaerts, R., & Kessler, R. C. (2016). Psychological Treatment of Depression in College Students: A Metaanalysis. *Depression & Anxiety (1091-4269)*, *33*(5), 400–414.  
<https://doi.org/10.1002/da.22461>

- Duckworth, A. L., Peterson, C., Matthews, M. D., & Kelly, D. R. (2007). Grit: Perseverance and passion for long-term goals. *Journal of Personality and Social Psychology, 92*(6), 1087–1101. <https://doi.org/10.1037/0022-3514.92.6.1087>
- Duckworth, A. L., & Quinn, P. D. (2009). Development and validation of the short grit scale (grit–s). *Journal of Personality Assessment, 91*(2), 166–174. <https://doi.org/10.1080/00223890802634290>
- DuPaul, G. J., Pinho, T. D., Pollack, B. L., Gormley, M. J., & Laracy, S. D. (2017). First-year college students with ADHD and/or LD: Differences in engagement, positive core self-evaluation, school preparation, and college expectations. *Journal of Learning Disabilities, 50*(3), 238–251. <https://doi.org/10.1177/0022219415617164>
- Gaultney, J. F. (2016). Risk for sleep disorder measured during students' first college semester may predict institutional retention and grade point average over a 3-year period, with indirect effects through self-efficacy. *Journal of College Student Retention: Research, Theory & Practice, 18*(3), 333–359. <https://doi.org/10.1177/1521025115622784>
- Gilger, J. W., Bayda, M., Olulade, O. A., Altman, M. N., & O'Boyle, M. (2017). Preliminary Report on Neuroanatomical Differences Among Reading Disabled, Nonverbally Gifted, and Gifted-Reading Disabled College Students. *Developmental Neuropsychology, 42*(1), 25–38. <https://doi.org/10.1080/87565641.2016.1256402>

- Graesser, A. C., McNamara, D. S., Louwerse, M. M., & Cai, Z. (2004). Coh-Metrix: Analysis of text on cohesion and language. *Behavior research methods, instruments, & computers*, 36(2), 193-202.
- Hall, C., Smith, K., & Chia, R. (2008). Cognitive and personality factors in relation to timely completion of a college degree. *College Student Journal*, 42(4), 1087–1098.
- Hysenbegasi, A., Hass, S. L., & Rowland, C. R. (2005). *The impact of depression on the academic productivity of university students*.  
[http://www.icmpe.org/test1/journal/issues/v8pdf/8-145\\_text.pdf](http://www.icmpe.org/test1/journal/issues/v8pdf/8-145_text.pdf)
- Lee, W. W. S. (2017). Relationships among grit, academic performance, perceived academic failure, and stress in associate degree students. *Journal of Adolescence*, 60, 148. <https://doi.org/10.1016/j.adolescence.2017.08.006>
- Measuring socioeconomic status and subjective social status. (2015, May).  
<https://www.apa.org>. <https://www.apa.org/pi/ses/resources/class/measuring-status>
- Meijer, E., Cleiren, M., Dusseldorp, E., Buurman, Hogervorst, R. M., & Heiser, W. J. (2019). Cross-Validated Prediction of Academic Performance of First-Year University Students: Identifying Risk Factors in a Nonselective Environment. *Educational Measurement: Issues & Practice*, 38(1), 36–47.  
<https://doi.org/10.1111/emip.12204>
- Michael, J., Edwards, K., Menson, R., Rawls, A., & College Board Advocacy & Policy Center. (2011). *The college completion agenda: 2011 progress report*. College Board Advocacy & Policy Center. 45 Columbus Avenue, New York, NY.



- National Center for Education Statistics. (2012). *Improving the measurement of socioeconomic status for the national assessment of educational progress: A theoretical foundation*. National Center for Education Statistics. Available From: Ed Pubs. P.O. Box , Jessup, Md 4-. Tel: 877-433-; Web Site: [Http://Nces.Ed.Gov/](http://Nces.Ed.Gov/)-11-00.
- Nelson, J. M., Lindstrom, W., & Foels, P. A. (2015). Test Anxiety Among College Students With Specific Reading Disability (Dyslexia): Nonverbal Ability and Working Memory as Predictors. *Journal of Learning Disabilities, 48*(4), 422–432. <https://doi.org/10.1177/0022219413507604>
- Office of institutional effectiveness, planning and research*. (2021). [https://www.mtsu.edu/iepr/factbook/Factbook\\_2020.pdf](https://www.mtsu.edu/iepr/factbook/Factbook_2020.pdf)
- Respondek, L., Seufert, T., Stupnisky, R., & Nett, U. E. (2017). Perceived academic control and academic emotions predict undergraduate university student success: Examining effects on dropout intention and achievement. *Frontiers in Psychology, 8*. <https://doi.org/10.3389/fpsyg.2017.00243>
- Robbins, S. B., Lauver, K., Le, H., Davis, D., Langley, R., & Carlstrom, A. (2004). Do psychosocial and study skill factors predict college outcomes? A meta-analysis. *Psychological Bulletin, 130*(2), 261–288. <https://doi.org/10.1037/0033-2909.130.2.261>
- Saunders-Scott, D., Braley, M. B., & Stennes-Spidahl, N. (2018). Traditional and psychological factors associated with academic success: Investigating best predictors of college retention. *Motivation and Emotion, 42*(4), 459–465. <https://doi.org/10.1007/s11031-017-9660-4>

- Schrank, F.A., Mather, N., & McGrew, K.S. (2014). *Woodcock-Johnson IV Tests of Achievement*. Rolling Meadows, IL: Riverside.
- Stack-Cutler, H. L., Parrila, R. K., & Torppa, M. (2015). Using a Multidimensional Measure of Resilience to Explain Life Satisfaction and Academic Achievement of Adults With Reading Difficulties. *Journal of Learning Disabilities, 48*(6), 646–657. <https://doi.org/10.1177/0022219414522705>
- Taylor, D. J., Vathauer, K. E., Bramoweth, A. D., Ruggero, C., & Roane, B. (2013). The role of sleep in predicting college academic performance: Is it a unique predictor? *Behavioral Sleep Medicine, 11*(3), 159–172. <https://doi.org/10.1080/15402002.2011.602776>
- Taylor, J., & Deane, F. P. (2002). Development of a short form of the test anxiety inventory (TAI). *The Journal of General Psychology, 129*(2), 127–136. <https://doi.org/10.1080/00221300209603133>
- Wei, M., Russel, D. W., & Zakalik, R. A. (2005). Adult Attachment, Social Self-Efficacy, Self-Disclosure, Loneliness, and Subsequent Depression for Freshman College Students: A Longitudinal Study. *Journal of Counseling Psychology, 52*(4), 602–614.
- Williams, S. C., Militello, M., & Majewski, D. (2020). Sorting out important elements for successful college transition and completion for students with learning differences. *Preventing School Failure, 64*(4), 326–338. <https://doi.org/10.1080/1045988X.2020.1776671>

Wolfson, A. R., & Carskadon, M. A. (1998). Sleep schedules and daytime functioning in adolescents. *Child Development*, 69(4), 875–887. <https://doi.org/10.1111/j.1467-8624.1998.tb06149.x>

## Appendix A

### Paper Survey of Measures

### Reading Comprehension and Exam Scores

#### Part I: Demographic Information

Credit is granted for this study using your M number. We will also use your M number to look up your 1410 exam scores, college entrance exam scores (ACT scores), and GPA in the study.

Write your M# here \_\_\_\_\_

What is your age: \_\_\_\_\_

I identify my gender as: \_\_\_\_\_

Is English your first language?

yes

no

Did you experience difficulty learning to read?

no

yes

Does anyone in your family have a history of difficulty learning to read?

no

yes

## Spelling Test Answer Sheet

The investigator will speak the items for a dictation spelling test. Please wait for them to begin and write your answers in the numbered spaces here.

22.	42.
23.	43.
24.	44.
25.	45.
26.	46.
27.	47.
28.	48.
29.	49.
30.	50.
31.	51.
32.	52.
33.	53.
34.	54.
35.	55.
36.	56.
37.	57.
38.	58.
39.	59.
40.	60.
41.	

**Short Test Anxiety Inventory** (Taylor & Deane, 2002)

Please rate each item below in terms of how you feel during a test or exam.

**1. During tests I feel very tense.**

Almost never	Sometimes	Often	Almost always
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**2. I wish examinations did not bother me so much.**

Almost never	Sometimes	Often	Almost always
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**3. I seem to defeat myself while working on important tests.**

Almost never	Sometimes	Often	Almost always
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**4. I feel very panicky when I take an important test.**

Almost never	Sometimes	Often	Almost always
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**5. During examinations I get so nervous that I forget facts I really know.**

Almost never	Sometimes	Often	Almost always
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Short Grit Scale** (Duckworth & Quinn, 2009)

Please respond to the following questions as it best describes you.

	<b>Not at all like me (1)</b>	<b>(2)</b>	<b>(3)</b>	<b>(4)</b>	<b>Very much like me (5)</b>
<b>1.</b> New ideas and projects sometimes distract me from previous ones	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>2.</b> Setbacks don't discourage me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>3.</b> I have been obsessed with a certain idea or project for a short time but later lost interest.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>4.</b> I am a hard worker.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>5.</b> I often set a goal but later choose to pursue a different one.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>6.</b> I have difficulty maintaining my focus on projects that take more than a few months to complete.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>7.</b> I finish whatever I begin.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>8.</b> I am diligent.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**School Sleep Habits Questionnaire (Wolfson & Carskadon, 1998)**

*In the last 2 weeks how often have you... [please circle one for each]*

**A. Arrived late to class because you overslept**

Everyday      several times      twice      once      never

**B. Fallen asleep in a morning class**

Everyday      several times      twice      once      never

**C. Fallen asleep in an afternoon class**

Everyday      several times      twice      once      never

**D. Stayed up until at least 3 am.**

Everyday      several times      twice      once      never

**E. Stayed up all night**

Everyday      several times      twice      once      never

**F. Slept in past noon**

Everyday      several times      twice      once      never

**G. Felt tired, dragged out, or sleepy during the day**

Everyday      several times      twice      once      never

**H. Needed more than 1 reminder or alarm to get up in the morning**

Everyday      several times      twice      once      never

**I. Had an extremely hard time falling asleep**

Everyday      several times      twice      once      never

**J. Gone to bed because you could not stay awake any longer**

Everyday      several times      twice      once      never



**Vocabulary Test.** The final portion of the study has 45 questions. In each question you are presented with five words and asked to select two that have the same meaning. It is better to select "don't know" if you don't know the correct answers than to get an answer wrong.

1. Select the two words that can mean the same thing.

- tiny
- faded
- new
- large
- big
- don't know

2. Select the two words that can mean the same thing.

- shovel
- spade
- needle
- oak
- club
- don't know

3. Select the two words that can mean the same thing.

- walk
- rob
- juggle
- steal
- discover
- don't know

4. Select the two words that can mean the same thing.

- finish
- embellish
- cap
- squeak
- talk
- don't know

5. Select the two words that can mean the same thing.

- recall
- flex
- efface
- remember
- divest
- don't know

6. Select the two words that can mean the same thing.

- implore
- fancy
- recant
- beg
- answer
- don't know

7. Select the two words that can mean the same thing.

- deal
- claim
- plea
- recoup
- sale
- don't know

8. Select the two words that can mean the same thing.

- mindful
- negligent
- neurotic
- lax
- delectable
- don't know

9. Select the two words that can mean the same thing.

- quash
- evade
- enumerate

- assist
- defeat
- don't know

10. Select the two words that can mean the same thing.

- entrapment
- partner
- fool
- companion
- mirror
- don't know

11. Select the two words that can mean the same thing.

- junk
- squeeze
- trash
- punch
- crack
- don't know

12. Select the two words that can mean the same thing.

- trivial
- crude
- presidential
- flow
- minor
- don't know

13. Select the two words that can mean the same thing.

- prattle
- siren
- couch
- chatter
- good
- don't know

14. Select the two words that can mean the same thing.

- above
- slow
- over
- pierce
- what
- don't know

15. Select the two words that can mean the same thing.

- assail
- designate
- arcane
- capitulate
- specify
- don't know

16. Select the two words that can mean the same thing.

- succeed
- drop
- squeal
- spit
- fall
- don't know

17. Select the two words that can mean the same thing.

- fly
- soar
- drink
- peer
- hop
- don't know

18. Select the two words that can mean the same thing.

- disburse
- perplex
- muster

- convene
- feign
- don't know

19. Select the two words that can mean the same thing.

- cistern
- crimp
- bastion
- leeway
- pleat
- don't know

20. Select the two words that can mean the same thing.

- solder
- beguile
- distant
- reveal
- seduce
- don't know

21. Select the two words that can mean the same thing.

- dowager
- matron
- spank
- fiend
- sire
- don't know

22. Select the two words that can mean the same thing.

- worldly
- solo
- inverted
- drunk
- alone
- don't know

23. Select the two words that can mean the same thing.

- protracted
- standard
- normal
- florid
- unbalanced
- don't know

24. Select the two words that can mean the same thing.

- admissible
- barbaric
- lackluster
- drab
- spiffy
- don't know

25. Select the two words that can mean the same thing.

- related
- intrinsic
- alien
- steadfast
- pertinent
- don't know

26. Select the two words that can mean the same thing.

- facile
- annoying
- clicker
- obnoxious
- counter
- don't know

27. Select the two words that can mean the same thing.

- capricious
- incipient

- galling
- nascent
- chromatic
- don't know

28. Select the two words that can mean the same thing.

- noted
- subsidiary
- culinary
- illustrious
- begrudge
- don't know

29. Select the two words that can mean the same thing.

- breach
- harmony
- vehement
- rupture
- acquiesce
- don't know

30. Select the two words that can mean the same thing.

- influence
- power
- cauterize
- bizarre
- regular
- don't know

31. Select the two words that can mean the same thing.

- silence
- rage
- anger
- victory
- love
- don't know

32. Select the two words that can mean the same thing.

- sector
- mean
- light
- harsh
- predator
- don't know

33. Select the two words that can mean the same thing.

- house
- carnival
- yeast
- economy
- domicile
- don't know

34. Select the two words that can mean the same thing.

- depression
- despondency
- forswear
- hysteria
- integrity
- don't know

35. Select the two words that can mean the same thing.

- memorandum
- catalogue
- bourgeois
- trigger
- note
- don't know

36. Select the two words that can mean the same thing.

- fulminant
- doohickey



- ligature
- epistle
- letter
- don't know

37. Select the two words that can mean the same thing.

- titanic
- equestrian
- miserly
- promiscuous
- gargantuan
- don't know

38. Select the two words that can mean the same thing.

- stanchion
- strumpet
- pole
- pale
- forestall
- don't know

39. Select the two words that can mean the same thing.

- yearn
- reject
- hanker
- despair
- indolence
- don't know

40. Select the two words that can mean the same thing.

- introduce
- terminate
- shatter
- bifurcate
- fork
- don't know

41. Select the two words that can mean the same thing.

- omen
- opulence
- harbinger
- mystic
- demand
- don't know

42. Select the two words that can mean the same thing.

- hightail
- report
- abscond
- perturb
- surmise
- don't know

43. Select the two words that can mean the same thing.

- fugacious
- vapid
- fractious
- querulous
- extemporaneous
- don't know

44. Select the two words that can mean the same thing.

- cardinal
- pilot
- full
- trial
- inkling
- don't know

45. Select the two words that can mean the same thing.

- fixed
- rotund

- stagnant
- permanent
- shifty
- don't know

## Appendix B

### Table 3

Correlation Matrix for Test Factors and Age

Correlation Matrix

		exams	age	spell	vocab	stai	sgs	sshq	classparticip	homework	learncurve	ACT_READ_Best
exams	Pearson's r	—										
	p-value	—										
age	Pearson's r	0.047	—									
	p-value	0.560	—									
spell	Pearson's r	0.215	0.177	—								
	p-value	0.007**	0.025*	—								
vocab	Pearson's r	0.266	0.222	0.330	—							
	p-value	<.001***	0.005**	<.001***	—							
stai	Pearson's r	-0.011	-0.243	-0.156	-0.157	—						
	p-value	0.894	0.002**	0.047*	0.046*	—						
sgs	Pearson's r	0.033	-0.219	-0.003	0.168	0.237	—					
	p-value	0.685	0.005**	0.967	0.033*	0.002**	—					
sshq	Pearson's r	-0.217	-0.169	-0.200	-0.154	0.232	0.145	—				
	p-value	0.007**	0.032*	0.010**	0.049*	0.003**	0.065	—				
classparticip	Pearson's r	0.452	0.076	0.206	0.068	-0.045	0.028	-0.207	—			
	p-value	<.001***	0.350	0.010**	0.403	0.575	0.726	0.010**	—			
homework	Pearson's r	0.373	0.022	0.150	-0.114	0.024	-0.202	-0.129	0.534	—		
	p-value	<.001***	0.790	0.062	0.157	0.764	0.012*	0.110	<.001***	—		
learncurve	Pearson's r	0.386	0.088	0.077	-0.036	0.040	-0.240	-0.057	0.395	0.596	—	
	p-value	<.001***	0.282	0.341	0.655	0.619	0.003**	0.481	<.001***	<.001***	—	
ACT_READ_Best	Pearson's r	0.384	-0.115	0.339	0.481	-0.126	0.237	-0.129	0.209	0.114	0.134	—
	p-value	<.001***	0.172	<.001***	<.001***	0.132	0.004**	0.123	0.012**	0.176	0.111	—

**IRB**  
**INSTITUTIONAL REVIEW BOARD**  
 Office of Research Compliance,  
 010A Sam Ingram Building,  
 2269 Middle Tennessee Blvd  
 Murfreesboro, TN 37129  
 FWA: 00005331/IRB Regn. 0003571



**IRBN001 - EXPEDITED PROTOCOL APPROVAL NOTICE**

Monday, August 23, 2021

Protocol Title **Reading Comprehension and Exam Scores**  
 Protocol ID 21-2101 7q (Amended to collect in person data)

Principal Investigator **Stuart P. Bernstein (Faculty)**  
 Co-Investigators **Bethany Higgins (bjh6x) and Michelle Martinez (mkn7p)**  
 Investigator Email(s) **stuart.bernstein@mtsu.edu**  
 Department **Psychology**  
 Funding **NONE**

Dear Investigator(s),

The above identified research proposal has been reviewed by the MTSU IRB through the **EXPEDITED** mechanism under 45 CFR 46.110 and 21 CFR 56.110 within the category (7) *Research on individual or group characteristics or behavior*. A summary of the IRB action is tabulated below:

<i>IRB Action</i>	<b>APPROVED for ONE YEAR</b>		
<i>Date of Expiration</i>	<b>1/31/2022</b>	<i>Date of Approval:</i> 1/28/21	<i>Recent Amendment:</i> 8/23/21
<i>Sample Size</i>	SIX HUNDRED (600)		
<i>Participant Pool</i>	<i>Target Population:</i> Primary Classification: <b>Healthy Adults (18 or older)</b> Specific Classification: <b>MTSU Psychology SONA Research Pool</b>		
<i>Type of Interaction</i>	<input type="checkbox"/> Virtual/Remote/Online Interaction <input checked="" type="checkbox"/> <b>In person or physical Interaction – Mandatory COVID-19 Management</b>		
<i>Exceptions</i>	1. Emily Farris and Tim Odegard are allowed to provide expert assistance. 2. Audio recording is permitted. 3. Contact information and M numbers can be recorded for the described purpose. 4. Online consent and survey administered by a non-Qualtrics platform is approved. 5. Retention of participant details to comply with MTSU SONA policy is allowed.		
<i>Restrictions</i>	1. <b>Mandatory ACTIVE Informed Consent.</b> 2. <b>Other than exceptions listed above, identifiable data/artifacts, such as, audio/video data, photographs, handwriting samples, personal address, driving records, social security number, and etc., MUST NOT be collected. Recorded identifiable information must be deidentified as described in the protocol.</b> 3. <b>Mandatory Final report (refer last page).</b> 4. <b>The protocol details must not be included in the compensation receipt.</b> 5. <b>CDC guidelines and MTSU safe practice must be followed</b>		
<i>Approved Templates</i>	<i>IRB Templates:</i> Signature Informed Consent and SONA Recruitment Script <i>Non-MTSU Templates:</i> Debriefing statement		
<i>Research Inducement</i>	Course Credit (2 credits)		
<i>Comments</i>	NONE		