12-2017

Grit as a Predictor of Academic Success for First-Time Undergraduate Students

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The Graduate School

GRIT AS A PREDICTOR OF ACADEMIC SUCCESS FOR FIRST-TIME UNDERGRADUATE STUDENTS

A Dissertation Submitted in Partial Fulfillment
of the Requirements of the Degree of
Doctor of Philosophy

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Department of Leadership, Policy, and Development:
Higher Education and P-12 Education
Higher Education and Student Affairs Leadership

December 2017

This Dissertation by: Sean M. Broghammer

Entitled: *Grit as a Predictor of Academic Success for First-Time Undergraduate Students*

has been approved as meeting the requirement for the Degree of Doctor of Philosophy in College of Education and Behavioral Sciences in the Department of Leadership, Policy and Development: Higher Education and P-12 Education, Program of Higher Education and Student Affairs Leadership.

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ABSTRACT

Broghammer, Sean M. *Grit as a Predictor of Academic Success for First-Time Undergraduate students.* Published Doctor of Philosophy dissertation, University of Northern Colorado, 2017.

A majority of institutions of higher education in the U.S. rely primarily on traditional academic factors of high-school grade point average (HSGPA) and standardized test scores to admit students to undergraduate studies. Recent research has supported the use of noncognitive variables in conjunction with traditional factors in predicting college student success. This study sought to investigate further if the noncognitive variable of grit could predict first-year college grade point average (FYGPA), first semester persistence, and first year retention beyond existing pre-collegiate indicators. Previous studies involving grit on college students were completed at highly selective institutions or highly competitive environments such as military academies. Through a longitudinal study design, this study investigated grit on a sample of 544 first-year students at a regional research university in an effort to add to the literature of grit on a more traditional sample of college students. The grit score was collected utilizing the Grit-S short scale while demographics of ethnicity, PELL eligibility, first-generation status, and gender were collected through institutional research along with HSGPA and standardized test score. Tests of hierarchical multiple regression and binary logistic regression were employed to investigate the amount of variance explained in FYGPA and ability to predict persistence to second semester and retention to second year. This study found with statistical significance that grit did

explain additional variance in FYGPA beyond traditional pre-collegiate indicators while controlling for demographic variables. Grit was also able to explain an equal amount of variance in FYGPA as standardized test score while controlling for demographics and HSGPA. This study did not find grit to be a predictor of persistence or retention. This research showed that grit may be a positive predictor of FYGPA and may increase the probability of predicting college success for students. These findings provide support in questioning the continued use of standardized test scores specifically by less selective institutions. Results of this study can assist enrollment managers and institutions of higher education to inform current admission practices and improve access to post-secondary education through noncognitive variables.

ACKNOWLEDGEMENTS

I wholeheartedly believe that I would not have completed this dissertation without the support of my committee, colleagues, and my family.

I have spent nearly the past decade working toward this achievement. Since I began pursuing this degree, many life moments have come and gone. I have watched my daughter grow into an amazing young woman. I have witnessed a two-year old boy grow into a middle-school student and my third child turned eight in August. How much I have missed and how much I have gained. There are many people to thank and show appreciation for their continued support throughout this journey.

To begin, I want to express my gratitude and appreciation of Dr. Matt Birnbaum serving as my research advisor. Dr Birnbaum continuously challenged me to "lean in" while maintaining high expectations and I am a better scholar and practitioner because of his dedication. Thank you, Matt.

I especially thank Dr. Susan Hutchinson. You are an outstanding faculty member with a commitment to furthering student's educational ambitions and goals. Your support these past eighteen months is immeasurable and I am convinced that you are a primary reason for me achieving this moment. Thank you, Susan.

To the remainder of my committee, Dr. Yakaboski and Dr. Morgan, thank you for your time and support as I navigated each step. In addition, thank you to Dr. Roehrs for serving as my faculty representative the first year of dissertation phase. I hope retirement is treating you well!

To the numerous colleagues both present and in the past; thank you! Special appreciation to the office of admissions at UNC for being understanding and supportive along the way. In addition, a special appreciation to Dana and Ceri for your unwavering support. It was encouraging to have two amazing people to count on. I owe you both.

To my EMSA colleagues (Jennifer, Tammie, Sherri, Jaqueline, Jenna, Larissa, and Tobias), thank you. I especially want to thank Dr. Tobias Guzmán for your mentorship and guidance. I have appreciated your encouragement and for creating a space for me to be challenged and grow as a colleague and professional.

To Dr. Raymond, Dr. Cobb, and Dr. Finley. Each of you has been an inspiration for me. I was able to learn from you and I appreciate your words of wisdom along the way.

I would be lost without the support and love from my family. From my wife Becky and kids Julia, Davis, and Cullen, to my mom Jane, and my in-laws Jim and Marta. These past ten years were possible due to your flexibility, patience, and love. I am proud of what we have accomplished together.

Cullen, I will never forget your words of encouragement. Your thoughtful questions and inquisitive nature is wonderful. I am excited to spend more time with you and we finally have our weekends back!

Davis, your understanding these past few years has been such a relief. It is amazing to think that I started this process when you were just two years old. You have always known me as a graduate student working on school. I look forward to watching you grow and continue to develop into a confident and caring young man. You have much to offer.

Julia, where do I begin? I am so proud of the young woman you have become. This year is a monumental year for you and I cannot wait to hear about your new adventures and the challenges you meet. Nothing has ever slowed you down. I am inspired by your confidence to try anything and succeed, undeterred by the unknown. Keep your eye on the prize and good things are bound to happen.

Finally, to my wife Becky. You have always and I mean always been there for me. When I doubted myself, questioned the value and purpose of this moment, you pushed me. You stood by my side and provided the extra support and motivation to keep going. You would not let me give up. You would not let me settle. I am thankful and fortunate to have someone in my life that cares as deeply as you do. Thank you for your support, your compassion, and your love. Best of wives and best of Women.

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CHAPTER I

INTRODUCTION

> In education, the one thing we know how to measure best is IQ. But what if doing well in school and in life depends on much more than your ability to learn quickly and easily.
>
> --Duckworth, 2013, 1:30

Pat and Terry, two friends from the same neighborhood, enter college for the first time and possess seemingly similar personal and academic backgrounds. They each come from two parent households, they are the same gender, and both attended the same high school and had similar grades, course rigor, and scored the same on standardized testing. They enroll in the same regional college, declare the same major, take the same number of credits their first semester, and experience a similar level of integration and involvement in clubs and organizations. There were no observable differences of note in their personal lives from time of entry to the end of their first year. Based on their individual entering characteristics, enrollment officials at the regional college would expect the two students to perform similarly in college. However, during the first year, Pat was placed on academic probation and makes the decision to not return for following year. Terry is performing exceptionally well and continues to make progress toward degree. Enrollment officials are left wondering why Terry performed better than Pat? Were there additional considerations, perhaps noncognitive, the institution could have identified to predict these different outcomes? Institutions face the dilemma posed by Terry and Pat's two outcomes and this type of dilemma is the basis for this study.

Traditional Measures and Noncognitive Variables

A majority of institutions of higher education in the U.S. rely primarily on traditional academic factors to admit students to undergraduate studies. Traditional factors generally consist of high-school grade point average (HSGPA) and standardized testing (i.e., ACT [formerly American College Test] and SAT [formerly Scholastic Aptitude Test]). While the traditional measures of HSGPA and ACT/SAT scores have been shown to have predictive value for academic success in college as measured by grade point average (Hezlett et al., 2001), research has shown that when traditional measures are combined with other factors the predictive value can be more accurate (Sternberg, Bonney, Gabora, & Merrifield, 2012).

Recent literature has demonstrated the importance of noncognitive skills on assessing student outcomes such as persistence, retention, and graduation (Duckworth, Tsukayama, & May, 2010; C. Peterson & Seligman, 2004; Schmitt et al., 2009). Noncognitive variables are associated with individuals' success and include constructs such as optimism, motivation, resilience, adaptability, conscientiousness, interest in school, and encouragement from parents (Egalite, Mills, & Greene, 2014; Ransdell, 2001). Credé and Kuncel (2008) completed a meta-analysis to examine the predictive validity of 10 study skill constructs and found that study habits and skills improve prediction of academic performance more than any other noncognitive individual difference variable and are approximately as strongly correlated to academic performance as the two most frequently used predictors of academic performance: HSGPA and standardized tests. Although the findings of Credé and Kuncel suggested that consideration of using study habits, skills, and attitudes in admissions is promising, there

has not been enough research into the validity of individual inventories to be consistent across multiple college academic success measures of grades, persistence, and graduation.

In this study, I focused on grit, which is a newer noncognitive construct that Duckworth, Peterson, Matthews, and Kelly (2007) defined as a "passion and perseverance for especially long-term goals" (p.1087). I intended to determine if grit further explains college student academic success beyond traditional factors and contribute findings to the emerging literature on noncognitive research. For the purposes of this study, college student academic success is defined as first-year college grade point average (FYGPA), first semester persistence (FSP), and first-year retention (FYR) to the college. Additionally, the term college is utilized to refer to four-year colleges and universities interchangeably. A definition of terms is provided toward the end of this chapter.

Common Admission Practices

Institutions vary widely in what each requires as part of an admission packet. In addition to traditional requirements of HSGPA and standardized test scores, application materials may include items such as personal statements, topic essays, letters of recommendation, and individual interviews. Admission offices use an array of measures to rate each applicant and identify personal qualities which are often referred to as a holistic review (Rigol, 2003). A holistic review is meant to consider measures of the cognitive traits of academic achievement or academic aptitude such as standardized test score or HSGPA but also to include behavioral and noncognitive factors. But for many

campuses holistic review is not achievable given resource limitations, staffing levels, and potential to delay admission decisions and notification to students.

It is most common for institutions to rely on traditional forms of evaluation such as HSGPA and SAT/ACT (Komarraju, Ramsey, & Rinella, 2013) as a way to sift through the hundreds, if not thousands, of applications received on an annual basis. This practice began as college enrollments grew steadily in the mid-20th century following significant public investment in higher education. Fueled by the G.I. Bill of Rights, colleges began to rely on standardized tests to screen potential applicants (Lemann, 1999). The utilization of standardized test scores gained attention as critics of standardized testing argued that noncognitive skills such as motivation, imagination, and overcoming challenges are not measured by standardized tests and that the tests are biased against students of color and students from low socioeconomic backgrounds (Helms, 2009; Sedlacek, 2004).

Problem with Common Admission Practices

Admission into a college is a privilege for many students who desire to further formal education with the hopes of creating a rewarding future. For many underrepresented populations, admission-based policies focused on HSGPA and standardized test scores can derail hopes for furthering their education and reaching monumental goals. First generation college students often come from lower socio-economic status backgrounds and include a higher percentage of students of color (Bui, 2002; Hertel, 2010; Terenzini, Springer, Yaeger, Pascarella, & Nora, 1996). A 2016 report by College Board indicates a substantial gap in test scores between Black or African American, Hispanic or Latino, and American Indian or Alaska Native students when compared to White students (College Board, 2016). When a college places

emphasis on traditional measures for admission decisions, a large pool of diverse candidates with potential may be excluded from consideration.

Academic performance or grades in college have been found to be the single best indicator of students being retained to graduation (Pascarella & Terenzini, 2005) which makes it important for colleges to identify pre-collegiate academic indicators or student background characteristics that may predict future academic success in college. Examples of prior research into noncognitive measures include the exploration of motivation, self-efficacy, study habits, self-control, leadership, creative thinking, personality, and attitudes (Sommerfeld, 2011). While current admission practices focus attention on traditional factors for predicting academic success in college, there remains inconsistent evidence regarding the relationship of those factors on post-secondary success (Stewart, 2015). A significant portion of unexplained variance remains and further investigation of additional traits of academic success is necessary.

Retention and Graduation Rates

Admission practices can have an impact on future outcomes of students specifically in the areas of retention and graduation. While enrollment in higher education has increased, retention rates for first-year students to their second year of college have remained nearly unchanged in the last decade at nearly 72% (National Student Clearinghouse Research Center, 2016). Nationally, across all four-year institutions, the six-year graduation rate of undergraduate students was near 60% in 2014 (National Center for Education Statistics, Integrated Postsecondary Education Data, 2016) compared to 58% of first time students who graduated in six years in 2000 (Farrington et al., 2012; Komarraju et al., 2013). This increase is promising as institutions of higher

education focus additional resources on retention efforts but remains below acceptable rates of completion.

Since 1990, there has been substantial growth in the numbers of first-generation and students of color attending postsecondary schooling; however, college graduation rates by race and income have remained flat or in some cases widened between underrepresented populations and their White/middle income peers (Bowen, Chingos, & McPherson, 2009). For all four-year institutions, nearly 57.4% of White students graduate within six years while Hispanic or Latino and Black or African American students' six-year graduation rate is 45.0% and 34.2%, respectively (National Center for Education Statistics, Integrated Postsecondary Education Data, 2014). As access improves, it is evident that there remains a significant gap in completion rates by race. Even ignoring the completion rate disparity, the overall rates remain well below acceptable levels. Current admission criteria are not doing an adequate job of predicting academic success across racial identities and additional factors should be explored further.

Access to Higher Education

Funding for higher education has shifted over the last 20 years with students and families increasingly burdened to cover a higher portion of tuition attendance costs (Schuh, 2005). Specifically, public colleges are more tuition dependent than ever with a reduction in percentage of funding derived from government and a higher portion covered by students and families. Nationally, colleges have benefitted from a decade of growth where enrollments at four-year, public, degree-granting postsecondary institutions increased 22% between 2004 and 2014 (National Center for Education

Statistics, Integrated Postsecondary Education Data, 2016). Growth over the last decade has been positive, but from 2014 to 2023, the anticipated annual number of high school graduates shows little to no growth while fluctuating from 2.9 to 3.1 million annually (Prescott & Bransberger, 2012). With the annual number of high school graduates reaching a plateau, the competition for meeting enrollment goals becomes increasingly challenging. As institutions seek to increase headcounts of entering classes the identification of potential factors that influence retention is critical for long-term sustainability. Current admission practices should be evaluated to expand the identification of talented students who may not exhibit traditional indicators of college success.

Attainment of a college degree provides an educated workforce, which benefits individuals and society as a whole. Employers are interested in recruiting talented and skilled employees to meet growing demands in the job market. Three-quarters of the fastest growing occupational sectors in the US require more than a high school diploma; yet barely over half of the US population has the educational qualifications to qualify for these careers (Farrington et al., 2012). Many educational research and philanthropic organizations such as the Lumina Foundation have demonstrated that the U.S. will need to find successful paths to higher education for hundreds of thousands of additional first-generation, minority, immigrant, and rural students in order to grow the economy (Hiss & Franks, 2014). As a greater number of students complete college and personally benefit from acquiring new skills there are also societal gains from an educated workforce.

One segment of the population that greatly benefits from earning a college degree is low-income students who have the highest likelihood of improving their economic

status beyond what is currently attainable without formal education (Engle & Tinto, 2008). The benefit of higher education is significant given the earning potential difference between a high school graduate and a college graduate. The Bureau of Labor Statistics (2015) reported weekly earnings for a person with a bachelor's degree was 67% higher than a person who had obtained a high school diploma.

There are a number of individual benefits from earning a college degree. College graduates have increased income potential (Schmitt & Boushey, 2012) and experience lower unemployment rates and poverty (Baum, Ma, & Payea, 2013). Society benefits with an increased college educated population by increasing workplace productivity, increased tax revenues, and decreased dependency on social programs (Institute for Higher Education Policy, 1998). With the growing needs and demands of an educated workforce, access to higher education and completion of an undergraduate degree must improve to meet individual and societal needs. Institutions that consider additional admission factors, including grit, can potentially enroll a greater number of students with a propensity to persist and graduate which ultimately leads to institutional, individual, and societal advantages.

Horn and Berger (2004) reported college attrition (percent of students who leave an institution) in most cases prevents social mobility and economic success, which for underrepresented and traditionally marginalized populations further exacerbates the divide in socio-economic status within the U.S. It is critical for institutions to reevaluate how students are admitted and identify new factors that predict academic success while placing greater emphasis on better understanding the predictive factors of persistence and the ability to identify those traits during the admission process.

Diversifying Campus Community

A recent report highlights changing demographics facing institutions of higher education. Selingo (2016) shared that the most likely scenario facing higher education enrollment, is ". . . a student body that is much less affluent and less prepared academically for college than the one that propelled the expansion of higher education during the past two decades" (p.2).

Colleges that rely heavily on traditional factors for admission purposes create daunting obstacles for marginalized populations especially admission to selective colleges (Deil-Amen & Tevis, 2010). Students of color have been shown to score lower on standardized tests; account for a larger proportion of first generation students; and often come from lower socio-economic status households (Kaufman, 2010; Nasim, Roberts, Harrell, & Young, 2005). For colleges that value diversity and improving access to higher education, exploring additional factors beyond traditional measures is critical. One way to consider diversifying an incoming class would be to think differently about entry characteristics and the expectations placed on HSGPA and standardized test scores.

Purpose of the Study

There is an abundance of literature that suggests HSGPA and standardized test scores are strong predictors of academic success in college (Moffat, 1993; Wolfe & Johnson, 1995; Zheng, Saunders, Shelley, & Whalen, 2002). Recent studies have suggested that success in college may also be related to predictors beyond cognitive measures of HSGPA and SAT/ACT (Duckworth et al., 2007; Duckworth, Quinn, & Tsukayama, 2012; Hiss & Franks, 2014; Nasim et al, 2005). However, one unanswered

question is; does the use of noncognitive variables in admissions enhance what we know about applicants to better identify and support students from access to completion?

The purpose of this study was to examine the construct of grit on a first-year student's success during the first year of college to predict if an increase in probability of academic success beyond HSGPA and standardized test scores exists. In this research I compared the predictive value of grit to HSGPA and SAT/ACT to determine if grit explains additional variance in academic success in college above HSGPA and standardized measures. The variable of discovery for this study was the grit score, as measured by the Short Grit Scale (Grit-S) survey found in Appendix A (Duckworth & Quinn, 2009) after controlling for students' background characteristics and pre-collegiate academic factors. This study included an analysis on the following student demographics: socio-economic status, gender, ethnicity, and first generation status. Additionally, the construct of grit was explored to identify the relationship between background characteristics, pre-collegiate academic factors, and college academic performance, defined by first-year grade point average, first-year persistence, and first-year retention. Better understanding the role grit has in academic success is increasingly important if U.S. Institutions of Higher Education are to increase retention and graduation rates.

Research Questions

The following research question(s) were examined in this study:

Q1 To what extent does grit predict 1st-year college GPA when controlling for background characteristics and pre-collegiate academic factors?

Q2 To what extent does grit explain retention to second semester when controlling for background characteristics and pre-collegiate academic factors?

Q3 To what extent does grit predict retention to second year when controlling for background characteristics and pre-collegiate academic factors?

Design Overview

This research is a cross-sectional non-experimental design utilizing a survey to collect a grit score and institutional data to collect demographic variables and pre-collegiate academic measures of HSGPA and standardized test scores. Survey research affords investigators the opportunity to administer a survey to a sample or to an entire population of people to describe attitudes, opinions, behaviors, or characteristics of the population (Creswell, 2008). For the purposes of this study, I collected data utilizing the *Short Grit Scale (Grit-S)* developed by Duckworth and Quinn (2009) nested within the *MapWorks® First Year Transition Survey*, which is distributed twice annually at the study site. The Grit-S scale is an 8-item Likert-type survey. Along with Grit-S scores, demographic information for the entire cohort of 2,052 students was collected through the institution's institutional research area as requested through the institution's Institutional Review Board (IRB). To answer the research questions I completed a hierarchical regression technique to determine the increase in observed variance of grit on student grades, first-semester persistence, and first-year retention, while controlling for differences in demographics and pre-collegiate academic factors.

Significance of the Study

There exists a primary assumption that HSGPA and standardized test scores are the best predictors of future success. Habley, Bloom, and Robbins (2012) posited that grade inflation has led colleges and admissions professionals to believe a more academically prepared student class has applied and enrolled whereas in reality preparation remains level while grade inflation can account for the reported increase in

HSGPA. In this study, I aimed to provide additional evidence of support for noncognitive variables to be considered more prominently in admission practices.

A major gap in the literature is the application of grit as an element of admission decisions among traditional college populations. Existing studies were completed at elite private campuses, military colleges, spelling bee competitions, and with adults. Through this study, I researched the explanatory and predictive value of grit on college grades, first-year persistence, and first-year retention at a residential campus of traditional students with more generalizable findings than what has previously been studied.

The study findings will contribute to the emerging literature on the noncognitive factor of grit by comparing the explanatory and predictive value of grit to HSGPA and standardized test scores, both of which are commonly used by colleges to admit students. Although not a part of this study, existing research does suggest that grit is malleable in the childhood period (Alan, Boneva, & Ertac, 2016) and can be taught and nurtured which could lead student service areas to proactively support students once on-campus with new methods (Duckworth et al., 2007). Findings from this study contribute to the existing literature within higher education in the areas of admission requirements, persistence, retention, and potentially address systemic biases.

Limitations of this Study

This study had a number of limitations, which may reduce the generalizability of the results. Limitations include the timing of the survey administration, the potential for non-response bias, and the use of a convenience sample. Each of these limitations has the potential to limit the generalizability of findings. Each limitation is further explained in Chapter V.

Delimitations of this Study

Data for this study utilized a convenience sample on undergraduate students enrolled at one regional research university who entered college as a first-time/full-time student in the fall of 2016. The use of convenience sampling meant that there is a possibility of populations being under or over represented in the data. My findings are only generalizable to similar populations.

Race/Ethnicity Categories

This study will commonly refer to race/ethnicity using the singular label of ethnicity. Ethnicities of the study population and sample will be reported using the host institutions application data and nationally recognized census categories for consistency. Ethnicities included in this sample are: American Indian or Alaska Native, Asian, Black or African American, Hispanic or Latino, Native Hawaiian or Other Pacific Islander, White, or multiracial. Prior research referenced in this dissertation, which refers to student identities and assignment/reporting of ethnicity or race, will be preserved to honor the previous research. The term students of color will be used when referencing American Indian or Alaska Native, Asian, Black or African American, Hispanic or Latino, Native Hawaiian or Other Pacific Islander, or multiracial, collectively. For data anlysis purposes, analyses were often completed and summarized as students of color.

Definition of Terms

The following are terms that are used frequently throughout this document.

American College Testing (ACT) - national standardized test administered by ACT.

First semester persistence (FSP) - refers to students' persistence from first semester to second semester of first year in college.

First-year grade point average (FYGPA) - refers to students' cumulative grade point average at the end of their first year in college.

First-year retention (FYR) - refers to students' retention from first fall semester to second fall semester indicating the student returned for a second year.

High school grade point average (HSGPA) - explains the recorded high school grade point average student's collected officially from the high school transcript and is recorded on a 0.0 to 4.0 scale.

Mountain States University (MSU) - pseudonym for the study location.

NonCognitive Variables (NCV) - used to describe variables that are known as character traits and psycho-social factors such as motivation, commitment, persistence, dealing with adversity, overcoming loss, etc.

Scholastic Aptitude Test (SAT) - national standardized test administered by College Board.

Standard Test Score – Used in data analysis to label test scores from all sources which have been concordant to an ACT composite scale for analyses procedures.

Standardized test scores - interchangeably used in reference to the American College Testing (ACT) and the Scholastic Aptitude Test (SAT) to indicate pre-college standardized testing.

Summary

Chapter I provided an overview of the study and included an introduction to the problem of persistence, retention, and graduation related to admission standards limited scope of focus primarily on pre-collegiate academic factors of HSGPA and standardized test scores. Further explanation was provided to describe the purpose of the study,

research questions, significance of the study, limitations, delimitations, and scope of the study as they applied to academic performance outcomes of undergraduate students.

Chapter II provides an in-depth literature review of pre-collegiate academic factors, persistence and retention theory, introduction to noncognitive research, grit literature, theoretical framework, and background characteristics impact on college success. Chapter III includes research hypotheses, research design and procedures, instrumentation, and data analysis. Chapter IV reports all results from preliminary analysis and analysis for the research questions. Chapter V concludes with discussion, implications for practice, limitations, and implications for future research.

CHAPTER II

REVIEW OF LITERATURE

This chapter begins with a review of the most common pre-collegiate factors evaluated as part of an admission decision: high-school grade point average (HSGPA), standardized test scores (SAT/ACT), and rigor of high-school curriculum. It is important to have a broad understanding of the primary evaluative criteria, predictability of each factor as it pertains to college success, and the rationale that each are relied upon today in college admissions.

This chapter is organized to provide content on pre-collegiate factors, theories on retention and persistence, and existing research on the use of noncognitive variables to predict student outcomes to provide a foundation for exploration of grit. A review of grit and the development of the grit scale, prior research involving grit, and a review of the populations of study and relevant findings is provided. Finally, a brief review of background demographics of interest for this study related to grit is presented which include gender, ethnicity, socio-economic status, and parental education. The four demographics selected as part of this study are researched extensively on college campuses, commonly found in noncognitive research, and are generally reported on an admissions application or to the institution in another form, i.e. Free Application for Federal Student Aid (FAFSA).

Pre-Collegiate Academic Predictors of Success in College

Traditionally, many colleges have primarily used HSGPA and standardized test scores to evaluate a student's application for admission (Harackiewicz, Barron, Tauer, & Elliot, 2002). The use of standardized test scores dates back to the early 1900's. Following the lead of the U.S Army, standardized test scores (IQ tests) grew in popularity as a way to filter intelligence into ranks for military leaders. Beginning in 1928 at the University of Chicago and quickly followed by other institutions, standardized tests such as the College Board SAT were utilized as a way to select and acquire higher quality students (Berger, 2012). Over the next few decades, the use of the SAT expanded to fulfill the purpose of granting students admission to college. The ACT was created in 1959 as a competitor to the SAT (Atkinson & Geiser, 2009). Focused on testing content mastery the ACT assesses different abilities than the SAT, which traditionally assessed inherent intelligence. Each test has experienced negative publicity for socio-economic and racial biases and questions about the predictive value for academic achievement (Douglass, 2012). One way to consider diversifying an incoming class would be to think differently about entry characteristics and the expectations placed on HSGPA and standardized test scores.

In 2015, the State of College Admission annual report cited admission decision factors for first-time freshman, ". . . have been consistent for decades. The No. 1 factor--rated as considerably important by 79 percent of colleges--was grades in college prep courses, followed by strength of curriculum and grades in all courses (each 60 percent), and admission test scores (53 percent)" (National Association for College Admission Counseling, 2015, p. 16). As shared previously, HSGPA and standardized test

scores are strong predictors of academic success in college (Moffat, 1993; Wolfe & Johnson, 1995; Zheng et al., 2002).

The National Association for College Admission Counseling (2015) documents the level of importance attached to common admission requirements as indicated by colleges and universities, which is summarized in Table 1. It is evident admission decisions are focused on traditional factors of HSGPA, rigor of curriculum, and standardized test scores while a majority of other criteria are listed as having moderate to limited or no importance.

High School Grade Point Average (HSGPA)

HSGPA is one of the most studied factors to predict future performance in college. Studies have found that HSGPA is a better predictor for college success than any other single factor (Astin & Oseguera, 2005; Geiser & Santelices, 2007). Geiser and Santelices (2007) studied the relative contribution of high-school grades and standardized admissions tests in predicting students' long-term performance in college, including cumulative grade-point average and college graduation. Surprising to Geiser and Santelices was that in the University of California system, HSGPA actually predicted an increased variance in college GPA after first year from 24.5% to 26.9% the second year to 27.2% the third year. This increased variance meant that HSGPA explained a higher percentage variance of college GPA in the second and third years than the first year. The explained variance declined in the fourth year to 26.2% but still was higher than the explained variance the first year.

Table 1

Percentage of Colleges Attributing Different Levels of Importance to Factors in Admission Decisions: First-Time Freshmen

Factor	*N*	Considerable Importance %	Moderate Importance %	Limited Importance %	No Importance %
Grades in College Prep Courses	231	79.2	13.0	6.9	0.9
Grades in All Courses	229	60.3	31.0	8.7	---
Strength of Curriculum	231	60.2	26.8	10.0	3.0
Admission Test Scores (SAT, ACT)	228	55.7	32.5	7.9	3.9
Essay or Writing Sample	231	22.1	39.0	21.6	17.3
Counselor Recommendation	231	17.3	42.4	27.3	13.0
Student's Demonstrated Interest	231	16.9	33.3	26.8	22.9
Teacher Recommendation	230	15.2	43.5	27.8	13.5
Class Rank	228	14.0	7.7	32.0	16.2
Subject Test Scores (AP, IB)	227	7.0	35.2	32.6	25.1
Portfolio	229	6.6	10.0	30.6	52.8
Extracurricular Activities	231	5.6	43.3	34.6	16.5
SAT II Scores	226	5.3	8.4	23.0	63.3
Interview	229	3.5	23.1	28.4	45.0
State Graduation Exam Scores	228	3.5	11.0	25.4	60.1
Work	230	0.9	21.3	44.8	33.0

Note. Reprinted from "2015 State of College Admission," by M. Clinedinst, A. Koranteng, & T. Nicola, 2015, *National Association for College Admissions Counseling*, p. 17.

Geiser and Santelices shared,

> An explained variance or "Rsquare" of this magnitude is generally considered a strong result in predictive-validity research, where R-squares of 20 percent or even less are usually considered sufficient to "validate" use of a particular selection criterion in college admissions or other "high stakes" educational decisions. (p. 12)

In their study, Geiser and Santelices found support for the utilization of HSGPA as a primary indicator of future success accurately explaining greater than 20.0% of the variance. Additionally, the same study attempted to answer the predictability of long-term goals such as college graduation using seven logistic regression models to analyze the relationship between four year graduation and HSGPA, SAT I (SAT), and SAT II (SAT Subject tests). Across the seven models, HSGPA had the greatest predictive weight of any one variable while controlling for parents' education, family income, and high school academic rank, which is defined as a measure of school quality developed by the California Department of Education. The seventh model had the greatest concordant percentage (64.7%) when all variables were assigned and each accounted for weight in the model (HSGPA = .19; SAT I Verbal = -.02; SAT I Math = .00; SAT II Writing = .16; SAT II Math = -.04; SAT II 3rd test = .03; Parental education = .07; Family income = .03; and School rank = .04). An explanation of concordant percentage applied to this example is stated as the probability that a randomly selected student who graduated will have a higher predicted probability of graduating than a student randomly selected from a sample of non-graduates (Austin & Steyerberg, 2012).

When HSGPA is compared to standardized test scores, HSGPA is a better predictor of academic success in college (Geiser & Santelices, 2007; Hoffman, 2002; Zheng et al., 2002). Geiser and Santelices (2007) argued standardized tests are generally administered over a three-hour period usually during the junior year of high school and are thought to predict success in college but can also be a measurement of, "test preparation, repeat test-taking, and test-wise strategies to boost scores" (p.26). Test preparation and test-wise strategies generally favor students from a higher socio-

economic status further creating a divide and separation of scores by household income and could include other demographic differences (Ravitch, 2016). HSGPA reflects a student's achievement over a prolonged period of time across a variety of subjects, which exhibits other qualities and personal traits such as motivation, perseverance, and personal discipline.

Inequities in high school grade point average. Critics of admission decisions primarily based on HSGPA, observe high school grades are not comparable from one school to the next. High schools offer different curricula, access to technology, and generally are resourced at varying levels from one another. Therefore, it is impossible to compare students from different schools on the same metric of HSGPA (National Association for College Admission Counseling, 2008).

Grade inflation. A national high school transcript study found that between 1990 and 2009, average HSGPA increased from 2.77 to 3.10 for women and from 2.59 to 2.9 for men (Nord et al., 2011). An increase in observed grade point averages challenges admission offices to differentiate students using other predictive indicators. A publication scheduled to print in 2018 by Michael Hurwitz from College Board and researcher Jason Lee found that grade inflation was most prevalent in affluent and primarily White serving high schools (Jaschik, 2017). The report also states that an "A" grade is now the modal grade in high schools with the proportion of students with A averages increasing from 38.9% in 1998 to 47.0% in 2016 (Jaschik, 2017). This more recent study mirrors findings from Woodruff and Ziomek (2004) who found the mean HSGPA for ACT-tested students rose from 2.94 in 1991 to 3.20 in 2003. Collectively, these findings of grade inflation could weaken the predictive validity of HSGPA and makes it more difficult to compare

students and make admission decisions (Godfrey, 2011). Intuitively, higher entry grades would lead colleges to believe a more academically prepared student class has applied and enrolled whereas in reality the level of preparation remains level while grade inflation can account for the reported increase in HSGPA (Habley et al. 2012).

The use of HSGPAs as a primary means for admission to college has been supported by data as the best predictor of future success. Yet, recent studies are beginning to cast doubt on placing too great of importance on HSGPA when attempting to predict completion. While grade point averages have increased in the last 20 years, standardized test scores over the same period have actually decreased (Toppo, 2017). Additionally, with the rise of grade inflation primarily occurring in schools with large numbers of White and affluent families (Jaschik, 2017) the question to ask is: What does the continued use of HSGPA without other variables mean to low income students and students of color?

Standardized Test Scores (SAT/ACT)

Many colleges and universities traditionally rely on HSGPA and standardized test scores (SAT/ACT) as two primary indicators of a student's potential success in college. One benefit of using standardized tests is the ease and efficiency of administration to large numbers of students to provide a standard comparison of students across varying backgrounds and characteristics. This is an attempt to treat each student on his or her own merits and have a system to compare one student to the next.

Colleges have supported the use of standardized test scores in part because standardized scores typically exhibit moderate-to-large correlations with first-year and cumulative college grade point average (Higdem et al., 2016). Moderate to large

correlations would typically equate to a large effect size signifying the strength of the relationship between two variables (Cohen, 1988). Sackett, Kuncel, Arneson, Cooper, and Waters (2009) found a moderate relationship between standardized test scores and college academic performance (r = .44), and the relationship was moderate even after controlling for factors like socioeconomic status (SES). This finding paired with the finding that the SAT has a strong positive relationship to measures of family income and parental education (Geiser & Santelices, 2007) might be a cause for concern. Although the SAT has demonstrated high criterion validities with college GPA, a byproduct is a college may inadvertently (or intentionally) admit students from families with higher incomes and increased levels of parental education. Stated another way, if a college desires to increase access to lower income students but relies heavily on standardized tests, then the goal of improved access may be difficult to achieve.

Effectiveness of standardized test scores. The continued use of standardized test scores and HSGPA by colleges in admissions decisions has raised some reservation and concern (Sackett et al., 2009). Schmitt et al. (2009) found a large portion of unexplained variance in college performance utilizing an empirical clustering method which included biographical data and situational judgments as well as pre-collegiate indicators of test score and HSGPA. Sparkman, Maulding, and Roberts (2012) found that HSGPA and standardized test scores are the best predictors of success, but combined only account for about 25% of variance in a student's college GPA. Tross, Harper, Osher, and Kneidinger (2000) found that HSGPA accounts for 19% of variance in college GPA, standardized test accounts for 18%, while the two predictors together account for 25%.

Critics of standardized test scores suggest the SAT is a weak predictor of college academic success, particularly for nontraditional students (Sedlacek, 2004). A meta-analysis by Credé and Kuncel (2008), found incremental variance in academic performance beyond standardized test scores with use of noncognitive factors and there is some encouragement to expand admission requirements to include noncognitive assessment. Similar to HSGPA, standardized test scores do not measure students equally. NACAC (2008) suggested, ". . . colleges that overemphasize the use of standardized test scores in admissions may in fact be ignoring the disparities among under represented students as test scores are strongly correlated with student and family attributes" (p. 39).

A study on 14,000 students entering 25 four-year and 23 two-year postsecondary institutions in the fall of 2003 sought to track the academic performance, retention, transfer, and degree attainment rates of students over six years (Habley et al. 2012). The researchers developed this design so they could examine the outcomes by blocks of variables beginning with demographic factors, pre-collegiate factors, and selected scales from an ACT student readiness inventory (SRI). Using a hierarchical multiple regression model, Habley et al. (2012) used first-semester and first-year cumulative GPA as criteria for the models. Their research found, as expected, traditional standardized achievement and HSGPA were significant predictors for college GPA and retention in college. Their study also found the psychosocial factor of general motivational measures was predictive of academic performance (college GPA). The two psychosocial factors that were found to be significant for predicting retention after controlling for traditional institution factors were academic discipline and commitment to college. These findings support existing

literature that HSGPA and SAT/ACT are predictive but there remains a large portion of variance in predicting first-year academic performance and retention.

The National Association for College Admission Counseling (NACAC, 2008) questioned the continued use of SAT/ACT scores in undergraduate admissions and encouraged institutions to consider more than standardized test scores when making admission decisions. NACAC offered a few considerations to dissuade campuses from focusing on SAT/ACT including that low income students often do not understand the significance of testing on college options and lack knowledge of and access to critical information about preparing for the tests.

Differences across ethnicity. Grodsky, Warren, and Felts (2008) report that, "racial and ethnic differences in mean standardized test scores are evident from the earliest years of formal schooling, with African American and Hispanic children scoring below non-Hispanic White children" (p.387). The pervasive difference is noticed beginning as early as elementary school and extends through middle and high school, and on to college entrance exams (Grodsky et al., 2008). As of 2016, the SAT score gap is widening by race. The median score for Whites on the SAT reading section was 528 and for Black or African Americans was 430 and in math, the average score for Whites was 533 and for Black or African Americans 425 (Persisting Large Racial Gap, 2016). Additionally in 2015, 49% of white test takers met three or more benchmarks on the ACT, while only 11% of Black or African Americans, 17% of American Indian or Alaska Native, 23% Hispanic or Latino, and 25% Hawaiian Pacific Islander students met three or more benchmarks (ACT, 2016b).

A number of theories and analyses have been posited to explain test score differences across ethnicity. As recent as 2010, critical analysis of SAT test items reported a relationship between item difficulty and differential item functioning (DIF) for Black or African American and White test takers (Santelices & Wilson, 2010). DIF studies attempt to determine how individual items function while statistically removing score distribution between groups (Santelices & Wilson, 2010). Easier items on the test were found to benefit White students while the more difficult items benefitted Black or African American test takers. Although not generalizable to all groups, Santelices and Wilson's findings suggest sufficient evidence to question the validity of SAT verbal scores. As the new Revised SAT was implemented spring 2016, there is no current independent research to report changes to the current test and DIF analyses.

Another explanation for score difference has been connected to stereotype threat. Stereotype threat is defined as, "the pressure that an individual feels when he or she is at risk of confirming, or being seen as confirming a negative stereotype about a category or group to which the individual belongs" (Scherbaum, Blanshetyn, Marshall-Wolp, McCure, & Strauss, 2011, p. 362). The phenomenon of stereotype threat has real consequences in realizing equal educational achievement. In a seminal article on stereotype threat, Steele & Aronson (1995) found that social influence within stereotype threat could play a critical role in racial group difference in scholastic aptitude testing. In this research, Black or African American students and White students were presented a diagnostic of intellectual ability and a non-indicative ability assessment. Strikingly, in the intellectual study White students outperformed Black or African American students whereas in the non-indicative ability assessment, no difference in aptitude were

discovered. The research by Steele and Aronson (1995) leans on stereotype threat as the primary cause for differing outcomes when the only controlled changes in the two diagnostics were the instructions and how each diagnostic was framed to the participants.

A final observation connected to lower academic achievement is observed in funding patterns of school districts and individual schools. The Center for American Progress completed a study in 2009 that researched funding outcomes and return on investment within the education system. The report found that schools in high poverty areas were twice as likely to be among the least productive school districts in terms of school outcomes. Hispanic or Latino students were two times and Black or African American students eight times more likely to be in the least productive school districts than in the most productive school districts (Layton, 2014). This is further evidence of the stratification of the education system and the long-lasting impact that is observed at time of application to college.

As demonstrated above students of color often score lower on cognitive ability tests and these findings are consistent across academic setting. Cognitive scores do not accurately reflect ability or confirm the belief that students of color are incapable of achieving success in higher education. Numerous factors are contributing to lower test scores and the tests themselves may not be equitable. Regardless, students of color show little difference to the majority group on noncognitive assessments of background, motivation, and interests (Hough, 1998; Sackett, Schmitt, Ellingson, & Kabin, 2001). This is an indication that colleges should reconsider standardized testing requirements and expand the application requirements to consider other factors such as Grit that if

found to be predictive of college success, could lead to a larger number of eligible enrolled students.

Optional standardized test scores. Standardized test scores remain a commonly used metric for the purposes of admission to higher education and continued assessment is needed to determine if SAT/ACT scores measure expected outcomes or if different evaluation tools exist that can increase not just access to college, but predict a higher likelihood of success when in college. As of fall 2015, more than 850 accredited, bachelor-degree granting colleges and universities have announced test-optional policies (Simon, 2015). The rationale of the decision for test score optional admission acknowledges "students who have proven themselves quite capable of doing extremely well in college have nonetheless done only marginally well or worse on college entrance examinations" (Ransdell, 2001, p. 358). In a recent study of 33 private and public institutions that implemented test-optional polices, Hiss and Franks (2014) reported approximately 30% of students admitted were non-submitters of standardized tests, and there was no significant difference in graduation rates (0.6% lower for nonsubmitters) or their cumulative college GPAs (2.83 for nonsubmitters to 2.88 with test scores). Data also showed within the study, nonsubmitters are more likely to be first generation, underrepresented minorities, women, Pell grant recipients, and students with learning disabilities (Simon, 2015).

College Preparatory Core and High School Rigor

Retention research has found the predictive value of students' completing the minimum college preparatory core courses in high school. College preparatory core generally refers to a set of courses students should take in high school which include four

years of English, and three years each of mathematics, science, and social science. Noble and Radunzel (2007) tracked approximately 200,000 ACT-tested students to report on academic success (defined as >2.5 college GPA), retention from first year to second, academic progress in number of credits completed, and degree completion. Their findings indicate 70% of students who complete the college prep core achieved above a 2.5 college GPA compared to 59% of students who do not complete the college prep core. Retention to second year was 73% for core completers and 66% for non-core completers while four year graduation rates were 20% for core completers compared to 14% for non-completers. Students who completed the college preparatory core courses out-performed students who had not completed the core in each of three areas measured. These findings suggest that college prep courses have some relationship to college success.

The relationship between individual courses taken by students and college success has also been researched. It has been suggested that the highest level of math in high school can be one of the strongest predictors of college success (Adelman, 2006). Klepfer and Hull (2012) used the Educational Longitudinal Study (ELS) from 2002, which was a nationally representative sample of high school sophomores in the class of 2002 and collected follow-up data from this same group in 2004 as seniors, and again in 2006. From the original sample of over 16,000 students, the ELS looked at 9,060 who graduated from high school, enrolled in a 2-year or 4-year college immediately after high school, and were still enrolled in January of 2006. Similar to Adelman (2006), Klepfer and Hull reported that the higher math course a student completes in high school, the more likely a student is to persist in college, no matter the level of SES or prior academic achievement.

There are many challenges to consider while focusing on individual levels of achievement in math. For instance, the base building for a strong math background begins well before high school. Although Klepfer and Hull (2012) reported significant improvement in college retention rates for students who complete Pre-Calculus or Calculus instead of Algebra I or Geometry across SES, the ability for students to overcome early deficiencies in math may exclude them from achieving this skill level. Although the rate of high school graduates who completed Calculus has increased from 7% in 1990 to 16% in 2009, there still remains many students who do not achieve the level indicated in the prior research and completion of Calculus does not seem feasible to use as part of an admission requirement (National Center for Education Statistics, 2009).

Another way for colleges to assess college readiness is the opportunity to take Advanced Placement (AP) and/or International Baccalaureate (IB) courses. The Center for Public Education found that students who took AP courses were at least twice as likely to graduate college within five years (Center for Public Education, 2012) than students who did not take AP courses. Klepfer and Hull (2012) reported similar results with AP course takers but have interesting findings across SES for students persisting at four year colleges. For a high SES group (61st to 80th percentile), persistence in college increased 6%, middle SES (41st to 60th percentile) group increased by 9%, and for the low SES (21st to 40th percentile) group, persistence increased by 13% over non-AP course takers. These reported increases provide encouragement to all students to challenge themselves in high school but specifically those from lower income households. Klepfer and Hull found no statistically significant difference between how students scored on an AP exam (1-5) and persistence in college. The fact that a student

took the class and attempted the exam showed an increased indicator of success in college over students who did not take AP courses. This suggests that the rigor of AP curriculum improves student persistence in college.

Unknown Variance in Retention

While the use of pre-collegiate factors is shown to predict future academic success, there remains a high portion of unknown variance. Cognitive ability (prior academic achievement) and academic preparation are important to college success (Adelman, 2006) but there remains significant variation in outcomes of students with similar abilities (Dweck, Walton, Cohen, Paunesku, & Yeager, 2011). In a study at a research university in the Midwest, pre-collegiate characteristics of HSGPA, SAT/ACT, and course rigor explained one-third the variance in students' first-year grades in college (Pike & Saupe, 2002). Johnson (2012) reported that only about 10% of students who leave college early have achieved college GPAs of less than 2.0. This statistic, coupled with the large amount of unknown variance, leaves open the possibility other factors yet unmeasured could be keys in determining student retention and progress to degree. If the reason for departure is less associated with academic ability, then what other factors could be considered to predict future academic achievement?

Early evidence suggests that grit can add incremental support to the variance of predicting first-year GPA and retention, which suggests that the inclusion of noncognitive variables (NCVs) could increase the number of underrepresented populations on four-year college campuses. There are a limitless number of noncognitive traits to consider and explore in an effort to better explain the unpredictable outcomes for student success at the collegiate level. Grit was chosen for this study as it has been differentiated from

other noncognitive traits by focusing on stamina while working toward goals. Grit is comprised of two factors: consistency of interest and perseverance of effort. Duckworth and Quinn (2009) expanded on the differences between grit and other traits as, ". . . grit entails the capacity to sustain both effort and interest in projects that take months or even longer to complete" (p.166). This current research is guided by further exploration of grit and how it interacts and relates to academic progress toward degree, which is highly influenced by first year GPA, persistence, and retention.

Regardless of the differing stance on the use of HSGPA, standardized tests, or high school curriculum rigor as primary indicators for admission, a social justice issue remains that should be considered. Institutions that value a diverse student population and desire to improve access to students across ethnicity, socioeconomic status, and college generational status should think differently about admission criteria and the impact policies have on enrollment and the demographics of the student body.

Retention and Persistence Research

Balancing enrollment and student attrition is a challenging problem facing higher education. Differing opinions exist as to the main cause of student attrition and there remains disagreement over what intervention strategies would help reduce the rate of dropout (Kelly, Kendrick, Newgent, & Lucas, 2007). Improving student persistence and retention is of great significance on many levels including individual, social, and economic reasons (Tinto, 1993). In this section, I will discuss theories that institutions employ to support students post-enrollment in an attempt to prevent attrition. Each theory is open for interpretation and depending on the constructs, may not be relevant for all people, organizations, and situations (Swail, Redd, & Perna, 2003).

Reason, Terenzini, and Domingo (2006) completed a study of nearly 6,700 students and 5,000 faculty members on 30 campuses nationwide. Their study led to the development of seven principles called "Foundational Dimensions" (p. 151) that institutions should strive to promote in order to improve the success and persistence of first-year students. The principle from Reason et al., most closely aligned with this current study is to, "Facilitate appropriate recruitment, admissions, and student transitions through policies and practices that are intentional and aligned with institutional mission" (Reason et al., 2006). This principle is predicated on the belief that the withdrawal/success process begins before students enter the university (Paulsen & St. John, 2002).

Colleges recognize the decision for students to attend and leave an institution is influenced by similar characteristics often unrelated to academic preparedness (Ackerman & Schibrowsky, 2007). The most common reason for students leaving a university is personal reasons, at nearly 59% (Kelly et al., 2007). Grit can potentially help explore this phenomenon. Personal reasons often can be viewed as a challenging life event or dealing with adversity. Overcoming challenges while maintaining focus and completing a long-range goal is at the core of a student's demonstration of grit. Naturally, with such a wide range of variables influencing student persistence, it is reasonable to assume that not all students entering as freshman will be academically successful (Tinto, 1993).

Existing Persistence and Retention Theories

A number of theories exist to help explain student persistence and attrition. Two existing theories that connect to this study are departure theory (Tinto, 1993) and the

geometric model of student achievement and persistence (Swail, 1995). Departure theory (Tinto, 1987) looks at student attrition from pre-determined factors that will influence the persistence of each student. Tinto further explained eight factors that influence student persistence: academic difficulty, adjustment, goals, uncertainty, commitments, integration and community membership, incongruence, and isolation. These factors highlight the challenges of balancing the transition to the university in terms of academic and social involvement. Adjustment specifically addresses the lack of preparedness to make the change. Students do not leave college because they are not able to perform but because they did not make the transition to college smoothly (Tinto, 1987). Without assistance, these students are likely to leave before they learn how to successfully perform college level work.

Another dimension of student persistence focuses on the separation stage of Tinto's theory. The feeling of membership to a group or culture has long been known to come in three distinct stages: separation, transition, and incorporation (Elkins, Braxton, & James, 2000). Tinto (1987) described separation from previous communities such as family and friends as well as high school and church as the introduction to college begins. The separation stage may be difficult for students' that had close family connections and may have found the college experience difficult to navigate and understand. Elkins et al. (2000) found that students who were able to negotiate through the stage of separation were more likely to return for a second semester. Within Tinto's theory, I believe grit is embedded in the ability to persevere and stay focused on long-term goals while dealing with the challenges that transition entails.

A different approach to understanding retention was researched and created by Swail (1995) with a focus on minority student persistence. Swail introduced the Geometric Model of Student Persistence and Achievement. This model is a triangular shape with cognitive, social, and institutional factors labeled on each side (Figure 1).

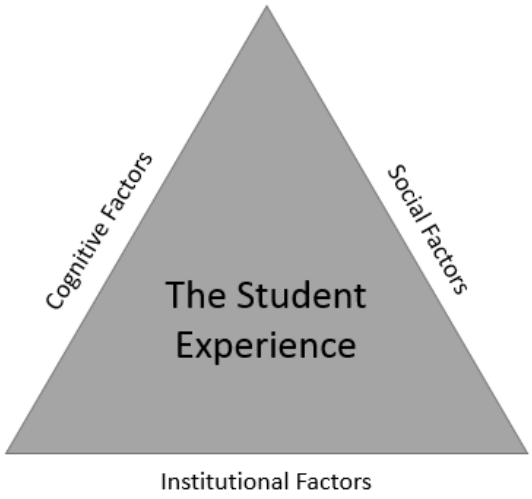

Figure 1. Swail's Geometric Model of Student Persistence and Achievement (Swail, 2014, p. 76).

The model is guided by placing the student experience inside the triangle and describing the three forces that affect student persistence. I believe grit to be present within the social factor domain with close relation to goal commitment, attitude toward learning, and social lifestyle.

Swail (2014) identified a set of attributes that students may possess:

- Attend part-time,
- Have a low GPA,
- Are of non-traditional age (e.g., older),
- Are non-White (with exception of Asian),
- Are first generation,
- Are low income and/or independent,

- Have a variety of risk factors (including having children, being single),
- Delay entry into college,
- Attend an HBCU or HSI,
- Have lower levels of high school mathematics,
- Attend more than one institution (although this can depend), and
- Work more than 20 hours per week. (p. 21)

Swail concluded that these risk factors play a significant part in the predictability of students earning a college degree in six years. Based on his research, in general 66% of first-time college students graduate in six years whereas by possessing just one of the risk factors mentioned above, the graduation rate drops to 44% in six years and students who possess two or more risk factors lower their graduation rate even further to 34% in six years.

As part of the Geometric model (Swail, 1995), the institutional factor contains sub-categories such as Financial Aid, Recruitment and Admissions, Academic Services, Curriculum and Instruction, and Student Services collectively known as a Student Monitoring System. Within the recruitment and admissions domain, Swail et al. (2003) stressed the importance of institutions establishing admissions criteria using a holistic approach for a more comprehensive assessment of students' commitment to college and compatibility with the institution. This recommendation by Swail et al., connected well with this current study and the goal of determining if the use of the grit scale can further enhance and predict student academic success beyond traditional measures.

Noncognitive Predictors of College Success

The concept of noncognitive variables (NCV) for the purposes of admission has grown from the,

> . . . decades of disparity between college acceptance, attendance and completion by non-traditional college students (i.e., students of color, first-generation college students, older students, student with special learning needs, etc.) in comparison to the more traditional college going population (i.e., White, middle to upper-middle class men). (Sommerfeld, 2011, p. 1)

By placing importance on standardized tests for admission, which have shown to be effective at identifying students who will succeed, institutions were criticized for the negative impact that decisions based on standardized tests had on groups that are more diverse. In the following section, I expand on examples of noncognitive research to include noncognitive, predictive ability, college readiness, and holistic review.

Importance of Inclusion of Noncognitive

Research has shown that although standardized test scores and HSGPA have predictive value, these predictions could be stronger when combined with noncognitive factors (Sternberg et al., 2012). Standardized test scores do not provide the psychosocial skills that noncognitive traits can provide when evaluating predictive abilities. The use of noncognitive variables is useful for all students, but these variables have been shown to provide a viable option for fairly assessing the abilities of students of color, international students, students with disabilities, and older students (Sedlacek, 2011). A number of scholars have supported including noncognitive factors in assessments for college readiness as a way to improve the accuracy of selection criteria, casting light on students' abilities to navigate multiple demands of the college environment (Sommerfeld, 2011).

Traditional HSGPA and test score measures in admissions may not be optimal when underrepresented populations are involved (Young & Koplow, 1997). Young and Koplow (1997) studied fourth year students at a mid-Atlantic University. They found that using just precollegiate variables led to an overstatement of the prediction of success for

students of color. They also found that academic predictors can explain about 45% of the difference in cumulative GPA between White students and students of color and another 25% can be explained by a noncognitive variable of academic adjustment. Their research provides support for the predictive validity of the noncognitive variable of academic adjustment.

Predictive Ability

A number of nonability measures have been found to predict a student's potential academic career including personality, motivation, and past experiences (Robbins et al., 2004). Although cognitive ability has been shown to inform us about what a student may be capable of, noncognitive factors help explain what the student may actually achieve (Dee & West, 2011; Jackson, 2012; Komarraju et al., 2013). Noncognitive variables have been researched in a variety of ways related to persistence and retention. Nettles, Theony, and Gosman (1986) and Tracey and Sedlacek, (1982, 1985), have studied noncognitive dimensions which include student aspirations or motivation. There are a number of factors to explore related to noncognitive variables and use for determining a student's disposition to perform at a desired level on a college campus. Post-secondary institutions would benefit from identifying students who are the right fit for the college and have the necessary skills and abilities to be successful and persist.

Three goals have led to increased research into NCVs and their use in admissions as a predictor of future success (Thomas, Kuncel, & Credé, 2007). The three goals are; increasing admissions of students of color, improved prediction of student performance, and increased college student retention of all students, but primarily underrepresented and students of color (Komarraju et al., 2013; Sparkman et al., 2012; Thomas et al., 2007). A

number of researchers have turned to noncognitive variables as a way to explain the differences between students of color and nonminority students on traditional predictors and have found that NCVs are important indicators of success and persistence in college across race, but primarily in students of color (Izaak, 2001; Sedlacek, 2004; Wood, Smith, Altmaier, Tarico, & Franken, 1990).

Schmitt et al. (2009) found by incorporating biodata measures (knowledge and continuous learning similar to noncognitive variables) and situational judgment questionnaires into the admission criteria, the percentage of Hispanic or Latino and Black or African American students in an incoming class increased while students who identified as Asian or White decreased proportionally. This finding suggests that if a campus were to incorporate different measures, specifically a noncognitive assessment, in their admission process, the campus might expect a larger proportion of students of color to be admitted. Additionally in their study, Schmitt et al. (2009) found under the two samples studied (standard cognitive evaluation and standard cognitive with noncognitive measures evaluation), there was no difference in graduation rates while the diversity of the student body increased in number of students of color.

College Readiness

A similar study on cognitive and noncognitive predictors of college readiness found similar value in noncognitive variables. Komarraju et al. (2013) examined three outcomes: (a) differences in college readiness between students who scored in the upper half and lower half on the ACT and those who were above the median and below the median for HSGPA; (b) predictive validity of ACT scores, HSGPA, and academic discipline with regard to college GPA; and (c) a potential mediating relationship between

high school GPA, academic discipline, and college GPA. One of their findings was students with higher HSGPAs appear to be more academically disciplined, determined, and self-confident. These characteristics could lead one to believe that each of the noncognitive factors influenced greater academic success. An interesting belief shared by the authors was of students who scored lower on the ACT, those students may employ noncognitive psychosocial skills to work towards academic goals. In addition, those scoring lower on the ACT but with relatively high HSGPAs may generally possess noncognitive skills including motivation, commitment, and sound study skills which are key factors influencing college completion and may provide encouragement for admissions personnel to reevaluate decision criteria before denying strictly off of lower test scores (Komarraju et al., 2013).

Ting (2001) studied 124 academically high-risk students to determine if cognitive and psycho-social variables could predict academic performance. Findings suggest that standardized test scores along with class rank added 11% of variance to predicting first semester GPA and the psychosocial predictor of long-range goals added 10% variance. Ting concluded that standardized test scores were insufficient predictors of academic success alone and that a combination of cognitive and psychosocial factors may better predict academic success. Adebayo (2008) combined cognitive and noncognitive measures to affect the academic performance and retention of conditionally admitted freshmen who were primarily from underrepresented populations. Abedayo's study was administered to conditional admits (those who were below the generally admissible range of the host institution) and whom the author identified as "at-risk." The findings of the

study suggest for conditionally-admitted students the combination of cognitive and noncognitive factors has some merit to predict future academic success.

Holistic Review

Habley et al. (2012) proposed a single model for bringing together HSGPA, standardized tests, and psychosocial and behavioral factors. To combine the independent variables of cognitive and psychosocial data improves predictive models and intervention strategies (Habley et al., 2012). Research by Habley et al. resulted in the creation of the Student Readiness Inventory (SRI) which met the goal of their research to integrate relevant persistence and motivation theory constructs into a coherent model. I find support to research noncognitive variable from a concluding thought by Duckworth and Yeager (2015) who wrote:

> What is new is the expectation that one can measure, with precision and accuracy, the many positive personal qualities other than cognitive ability that contribute to student well-being and achievement. Quantifying, even imperfectly, the extent to which young people express self-control, gratitude, purpose, growth mind-set, collaboration, emotional intelligence, and other beneficial personal qualities has dramatically advanced scientific understanding of their development, impact on life outcomes, and underlying mechanisms. It is no surprise that policymakers and practitioners have grown increasingly interested in using such measures for diverse purposes other than theory development. (p. 246)

Identifying and researching noncognitive variables for the purposes of predicting college student success has been hypothesized comprehensively over the past 30 years. And yet it remains reasonably unknown within behavioral science what best predicts future behavior and ultimately performance and persistence at the post-secondary level. Further research into the use of noncognitive variables in university admissions could lead to a greater understanding of admission rates, persistence, and graduation and yield

improvements in educational attainment for all students but particularly those from underrepresented backgrounds.

Grit

The construct of grit was first introduced as a trait-level perseverance and passion for long term goals (Duckworth et al., 2007). Initial research showed potential to predict achievement against odds over and above measures of talent. Duckworth et al. (2007) proposed grit is distinct from other noncognitive factors as a skill and is associated with lifetime educational achievement (Duckworth & Quinn, 2009). There is limited research on grit and its effectiveness to predict student success within the academic environment.

Development and Validation of the Grit-O Scale

Duckworth et al. (2007) defined grit as "perseverance and passion for long-term goals. Grit entails working strenuously toward challenges, maintaining effort and interest over years despite failure, adversity, and plateaus in progress" (p. 1087). The authors believed individuals with grit stay the course and their advantage is stamina. Individuals with high grit do not stray from long-term goals in the face of adversity. Duckworth et al. sought to develop a scale as a standalone measure of grit to:

> . . . adolescents and adults pursuing goals in a variety of domains (ie. not just work or school), low likelihood of ceiling effects in high-achieving populations, and most important, a precise fit with the construct of grit. (p. 1089)

Duckworth et al. (2007) embarked on a study to develop and validate scores from a self-report measure of grit in a large sample of adults. In 2004, a website was created to assist with the development of the scale. Over the course of 18 months, nearly 1,545 participants aged 25 and older completed the survey. Originally designing the instrument as a 27-item survey with the goal of exploring the construct of grit, the authors sought to

capture attitudes and behaviors of high achieving individuals. Specifically, they desired to identify traits of individuals with careers such as lawyers, businesspeople, academics, and other professional fields. Two distinct areas emerged in their scale design. Sustained effort was the first area they were interested to better understand. Example questions to determine sustained effort include, “I have overcome setbacks to conquer an important challenge” and “I have achieved a goal that took years of work.” The second area the authors wanted to measure was consistency of interests. Example questions of the subset consistency of interest include “New ideas and projects sometimes distract me from previous ones” and “My interests change from year to year.” The scale was administered as a Likert-type scale with items rated 1-5 with 1 = *not at all like me* to 5 = *very much like me*.

Analysis of the items included item-total correlations, internal consistency reliability coefficients, redundancy, and simplicity of vocabulary which led to 10 items being eliminated (Duckworth et al., 2007). Of the 17 remaining items, an exploratory factor analysis was completed on half the respondents (n = 772) chosen at random. After running a two-factor oblique solution with promax rotation, 12 items were retained with loadings of at least .40. The first factor contained six items indicating consistency of interests and the second factor contained six items indicating perseverance of effort. The two factors were correlated at r = .45. Duckworth et al. (2007) then tested the integrity of the final two-factor solution to ensure the portion of variance not shared by the other factor was larger than the error variance for that factor. A confirmatory factor analysis was completed on the remaining participants (n = 773) which supported the two factors with a comparative fit index (CFI) = .83 and root-mean-square error of approximation =

.11. The authors reported the "resulting 12-item Grit scale demonstrated high internal consistency (α = .85) for the overall scale and for each factor (Consistency of Interests, α = .84; Perseverance of Effort, α = .78)" (p. 1091). When responses to items from the same scale have high internal consistency reliability, this means the items that were proposed to measure the same construct produce similar scores. Furthermore, neither factor was consistently more predictive than the other and in most cases, the two factors together were more predictive than either alone (Duckworth et al., 2007).

Development and Validation of the Grit-S Scale

Modeled after the original Grit Scale, Duckworth and Quinn (2009) embarked on improving the original scale. They cite the model fit (CFI = .83) of the Grit-O scale as evidence for improvement. Duckworth and Quinn applied the short scale version (Grit-S) to four samples originally presented in Duckworth et al. (2007). The Grit-S scale maintained the 2-factor structure with four fewer items and was able to improve psychometric properties, maintain internal consistency, test-retest stability, and predictive validity (Duckworth & Quinn, 2009). The researchers recommended the use of Grit-S over Grit-O due to the "superior psychometric properties, comparable predictive validity, and fewer items relative to the Grit-O" (p. 174). The authors concluded they had developed and validated scores from the Grit-S questionnaire as a more efficient measure of trait-level perseverance and passion for long-term goals. Following the development of the Grit-O and Grit-S scales and validation of inferences from respondents' scores, other researchers have utilized one of these primary scales to explain if grit can predict academic success, persistence in careers, and commitment in long term relationships. The

Grit-O and Grit-S scales are available online (http://angeladuckworth.com/research/) and researchers and educators are welcome to use them for non-commercial purposes.

Controversy Surrounding Grit

When grit was introduced in 2007, there was excitement and interest regarding the potential of a new psychological variable that could increase persistence in careers, education, and relationships. Nearly 10 years later, the shine and excitement has begun to wear off. A Google search for grit will find a number of online blogs that question the construct of grit and specifically its development, purpose, and intentions. Specific to the topic of race and low-income students, grit is being viewed as "an appealing policy target for those who believe that if we could just cultivate 'right' qualities among 'low-achieving' then they would be able to transcend conditions of poverty and other obstacles in their way" (Ravitch, 2014, para. 2).

From the initial introduction of grit in 2007 by lead author Angela Duckworth, challenges to the theory began to surface primarily from social science researchers and K-12 educators. In a recent interview (Dahl, 2016), Duckworth herself in response to hasty curriculum changes and so called "Grit week" challenges stated, "… grit becomes a scapegoat – another reason to blame kids for not doing well, or to say that we don't have a responsibility as a society to help them" (p. 1). The questioning in current research is the belief that grit is not any different than conscientiousness from the Big 5 personality trait research in psychology. While conscientiousness does include the concept of perseverance, the second part of grit known as passion is often less defined.

Credé, Tynan, and Harms (2017) completed a meta-analytic review of grit literature to focus on the structure and relation between grit and other noncognitive and

demographic variables. After reviewing 88 independent samples and a critical review of the existing literature, Credé et al. presented three primary findings: (a) the factor structure appears to result in a loss of ability to predict performance; (b) grit exhibits relations with academic performance and retention although modestly; (c) the incremental value of grit for the prediction of performance is likely to be limited. In support of this current study, Credé et al. reported that grit was successful in predicting retention approximately as well as traditional factors such as cognitive ability and high school grades, which supports continued assessment of grit in educational settings where retention is problematic.

Differentiating Grit from Other Research

A number of studies have looked at grit in an attempt to predict future outcomes across populations including youth, college students, and adults. Related research into other psychosocial variables connected to grit include self-control, motivation, big five inventory of personality traits, deliberate practice, resilience, and persistence in life situations. Grit is unique in that individuals who exhibit a high level of grit typically do not deviate from their goals, even in the presence of distractions or absence of recognition (Duckworth & Quinn, 2009). A unique difference between the Big 5 Conscientiousness and grit is that researchers have categorized conscientiousness as a trait that develops over time and is not trainable whereas grit is recognized as a skill that has shown promise to be developed (Kamenetz, 2016).

Grit Research on College Students

A seminal research study on college students involving the construct of grit was designed and initiated in 2002 that considered predicting performance among high

achievers. This early research by Duckworth et al. (2007) tested whether grit was associated with cumulative GPA among undergraduates at an elite university. The authors also tested if grit could explain variance in GPA over and beyond SAT scores which would be used as a proxy for intelligence. This research fit with the desire of the researchers to establish if grit is more predictive of future outcomes than talent. The sample included 139 undergraduate students (69% women, 31% men) majoring in Psychology at the University of Pennsylvania where the average SAT score of this sample was 1,415 which is achieved by fewer than 4% of all SAT test takers. This research found that grit scores were associated with higher GPAs ($r = .25$, $p < .01$), a relationship that was even stronger when controlling for SAT ($r = .34$, $p < .001$). As shown, grit explained 25% of the variance of GPA and 34% of the variance in GPA when controlling for SAT. SAT scores were also found to be related to GPA ($r = .30$, $p < .001$). This last finding is congruent with existing research on SAT and college GPA. The authors did note an unexpected finding in their research. Grit was associated with lower SAT scores ($r = -.20$, $p < .03$). The authors suggested that smarter students may exhibit less grit than their peers. This finding suggests "among relatively intelligent individuals, those who are less bright than their peers compensate by working harder and with more determination" (Duckworth et al., 2007, p. 1093). Although their study was useful in beginning to understand relationship of grit to college GPA, the sample studied had an academic profile with an average SAT of 1,415, at an institution with an acceptance rate of 21% in 2002. This sample varies greatly from a typical college student at a traditional research university where SAT scores range from 840 - 1190 and an acceptance rate between 75%-90% (ACT, 2016a).

West Point, a United States Military Academy, was the site of another early grit study involving college students. Standard admission to West Point depends on a combination of factors but is heavily weighted toward a Whole Candidate Score, which is a weighted average of the SAT, class rank in high school, demonstrated leadership ability, and physical aptitude. Generally, about 5% of new cadets drop out prior to completing the first summer of training. Duckworth et al. (2007) conducted a study in 2004 and expected grit to predict retention over the first summer, military performance score, and academic GPA at the end of the first year. Participants were 1,218 new students with 84% identifying as men, 77% White, and average age of 19.05 years. The grit scale was administered and found to have an internal consistency reliability coefficient of $\alpha = .79$. Internal consistency reliability is when responses to the items on a scale are related and the items are measuring similar aspects of the construct. The higher the internal consistency reliability, the more confidence a researcher can have that the measure is measuring the factors with minimal random measurement error. Grit was found to predict completion of the summer training program more strongly than any other predictor. Using a logistic regression analysis, cadets who were a standard deviation higher in the grit scale were more than 60% more likely to complete the summer training program ($\beta = .48$, OR = 1.62, $p < .001$) as shown with the odds ratio of 1.62. The odds ratio (OR) represents the odds that a specific outcome will occur given a particular exposure (Szumilas, 2010). The Whole Candidate Score used by West Point to admit cadets, did not predict summer retention ($\beta = .09$, OR = 1.09, ns). Grit was not found to be a predictor in GPA or military performance score. The authors noted the “superior prediction” of the whole candidate score to predict military performance score and GPA.

Findings suggest that there may be differences in the psychological traits that propel cadets to stay through the rigorous summer training program compared with those who score high in GPA or military performance score. Grit was specifically introduced with a definition of perseverance and passion for long-term goals. Did the trait of grit present itself differently in regards to admission to West Point, possibly confounded in the high school grade point average while college GPA was viewed as a necessary requirement to maintain toward the ultimate goal of graduation?

Grit and Persistence in Life Situations

As the literature around grit continues to grow, a number of studies have been completed to assess grits impact on life circumstances. Eskreis-Winkler, Duckworth, Shulman, and Beal (2014) found in a series of studies that individuals with higher grit scores were less likely to drop out of their respective life commitments. Eskreis-Winkler et al., shared that,

> Gritty soldiers were more likely to complete three weeks of a grueling Army Special Operations Forces training; gritty sales representatives were more likely to remain at their jobs three months later; gritty high school juniors were more likely to graduate from high school one year later; and gritty men (but not women) were more likely to remain married (p. 14).

These findings suggest a commitment level exists that could help predict retention in life events. In the realm of athletics, grit was found to be a significant predictor in exercise programs (Reed, Pritschet, & Cutton, 2013). Cross (2014) found that doctoral students with higher grit had a more positive association with grades and weekly hours studying. In the field of education, teachers with higher grit scores were less likely to leave midyear (Duckworth & Quinn, 2009). I believe these findings support continued research into the predictability that grit has on a more representative college sample

specifically in the areas of academic success. It would seem reasonable to believe that retention could potentially be attributed to higher levels of grit.

Theoretical Framework for the Study

Psychological research includes countless examples of theories predicated on the predictive capabilities of a social construct to identify and account for an observed behavior. The research on grit is still evolving and with this research, I provide a new view on how grit fits into existing literature and theoretical models while also serving a unique purpose within the current literature around psychosocial variables. Initial grit research has found similarities or even overlaps to other theories. I believe grit connects aspects of existing theories to form the construct of grit. As shown in Figure 2, I believe grit connects with existing psychosocial theories in the form of persistence, adversity, engagement, and time. The following section provides a brief review of each psychosocial theory and how each connects with grit.

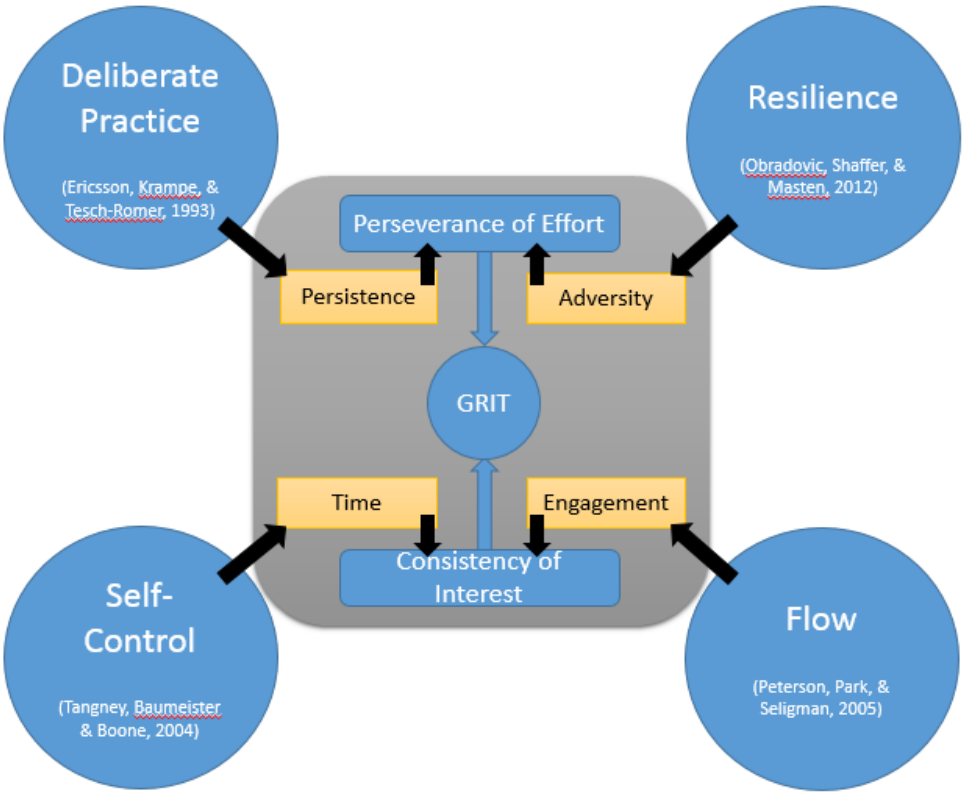

Figure 2 The construct of grit displayed from multiple facets of four related but differing theories.

The following section expands on the research and makes connections to grit and how further exploration is necessary.

Deliberate Practice

Grit has been linked to deliberate practice, which is defined as effortful activities designed to improve performance (Ericsson, Krampe, & Tesch-Romer, 1993). In a study focused on spelling bee finalists, researchers attempted to test if spellers with higher grit scores were more likely to engage in deliberate practice, and their cumulative time devoted to this activity explains their superior performance (Duckworth, Kirby, Tsukayama, Berstein, & Ericsson, 2011). Duckworth et al. (2011) invited 274 finalists to participate, of whom 190 responded. Participants did not differ from nonparticipants on

gender, age, or spelling performance. Their study utilized the Short Grit Scale (Duckworth & Quinn, 2009) and had an internal consistency reliability of $\alpha = .82$. The findings of Duckworth et al., (2011) confirmed that spellers with higher grit scores accumulated more deliberate practice while deliberate practice in turn predicted spelling performance. A test of the specific indirect effect confirmed that deliberate practice mediated the effect of grit on spelling performance. This finding was encouraging because deliberate practice and grit have common themes, specifically maintaining a perseverance and passion for long-term goals which through deliberate practice may become possible.

Resilience

Research into resilience began over 50 years ago with primary focus on children who were at risk due to disadvantage and adversity (Yates, Tyrell, & Masten, 2015). Primarily researching youth who faced difficult odds on development and nurturing due to tragedy or absent parental influences, researchers sought to explain how some individuals performed well when dealing with adversities compared to others who experienced a less successful outcome (Masten, 2013). Ledesma (2014) defined resilience as, "the ability to bounce back from adversity, frustration, and misfortune" (p. 1). Resiliency has been studied in a number of life domains including human development (Werner & Smith, 2001), change management (Conner, 1993), psychiatry (Flach, 1988), and social sciences (Henderson & Milstein, 1996). Each model characterizes the impact resiliency has on the given domain while sticking closely to the basic understanding of resilience being concerned with individual variations in response to risk (Yates et al., 2015). From resilience research, the concept of "thriving" was

developed Nishikawa (2006) which defined as a cognitive shift in response to a challenge. I believe adversity is a common trait between resilience and grit which Obradović, Shaffer, and Masten (2012) stated are negative contexts that have potential to disrupt adaptive functioning and development. Stated differently, resilience is overcoming immediate challenges while remaining optimistic (adversity) to succeed when others fail while grit is sticking with a particular task or goal over a prolonged period of time in light of setbacks. The connection between these two is dealing with adversity while the primary difference is the time set of the accomplishment.

Self-Control

Comparisons have been made between self-control and grit. Self-control is defined as "the capacity to regulate attention, emotion, and behavior in the presence of temptation" (Duckworth & Gross, 2014, p. 3). Self-control aligns actions with valued goals when the existence of more rewarding options becomes available (Tangney, Baumeister, & Boone, 2004). An example of self-control might be when a student chooses to study the night before a test, instead of acting on an invitation to a social gathering. The valued goal is performing well on the test and in the class but the more rewarding immediate option would be to hang out with friends. This would demonstrate self-control. Grit is defined as "working diligently toward a goal through difficulties and despite setbacks over a prolonged period of time" (Duckworth & Gross, 2014, p. 3). An example of grit may be a student's graduation from college after six years, dealing with the loss of a parent and changing majors multiple times.

Moffit et al. (2011) reported that self-control and grit predict successful outcomes over and above intelligence while Duckworth et al. (2007) found the two factors highly

correlated (r_s = .6). Duckworth et al. also reported in two separate studies (student retention at West Point and performance in the National Spelling bee) grit predicted retention and performance when controlling for self-control, but self-control did not predict these outcomes when controlling for grit. Although self-control and grit have similarities, they operate in different ways and more importantly at different time scales (Duckworth & Gross, 2014).

Flow/Engagement

Von Culin, Tsukayama, and Duckworth (2014) completed a study to explore the motivational orientation correlates of the character strength of grit and its two component facets: perseverance of effort and consistency of interests over time. Their study specifically examined associations among three different orientations of happiness (engagement, meaning, and pleasure) and the personality trait of grit. C. Peterson, Park, and Seligman (2005) connected the orientation of happiness engagement with the contemporary research of flow which means the "state of complete absorption and full mastery in highly challenging, highly skilled activities" (Von Culin et al., 2014, p. 2). Of the three happiness orientations, engagement was found to be the happiness orientation most closely aligned with grit as its definition is associated with "flow-producing activities to be especially likely to sustain effort toward long-term goals" (Von Culin et al., 2014, p. 1). Von Culin et al. found that individuals who pursued happiness through engagement were had higher grit scores (β = .34, p < .001). Grit related less to the happiness orientation of meaning (β = .15, p < .001) and even lower to the happiness orientation of pleasure (β = -.10, p < .001). Von Culin et al. (2014) found the pursuit of engagement, as opposed to pleasure, comprised motivational correlates of grit.

Section Summary

The inclusion of the four theories above to grit is meant to provide a background and describe how existing theories are being explored in connection to grit. Deliberate practice, resilience, self-control, and engagement have all been researched and fit into the proposed model by Duckworth et al. (2007) based on mediating terms of persistence, adversity, engagement, and time. Research suggests that grit offers something unique that is not captured by these other constructs. This section provided further evidence of the development of grit and a visual presentation of the fit within theory.

Background Characteristics' Impact on College Success

In this study, I focused on determining if grit can assess outcomes for college students during the first year beyond traditional measures of cognitive ability. It is important to identify a number of student background characteristics that also play an important role in the success of a college student. This study controlled the following background demographics to isolate the effectiveness that grit has on predicting future academic success. The characteristics of interest for this study include gender, ethnicity, socio-economic status, and parental education. Each of these variables is discussed in greater details below and the relevance to this study is shared.

Gender

A complicated issue facing colleges and impacting college admissions is inconsistent outcomes of men and women at the college level. A study by Corbett, Hill, and Rose (2008) found that women attend and graduate from college at higher rates than men. Graduation rates have been reported as being 20% higher for women than men (Hagedorn, 2005). It is also well recognized in the literature that women persist at greater

rates than men (Reason, 2009). Keels (2013) reported that women make up a majority of enrollment in higher education at 57% compared to men but ratios vary depending on type of campus. For example, highly selective campuses tend to have nearly equal representation of men and women while liberal arts and less selective colleges are more heavily skewed toward women (Keels, 2013).

Although research has shown the effect of SAT/ACT scores and HSGPA on predicting academic performance, outcomes vary based on gender (Chee, Pino, & Smith, 2005). There currently is not enough evidence to make the same claim about grit and gender. How grit interacts with gender in predicting future behavior is unknown at this time. I question the extent that proactive support could be implemented if differences were found. Of course, admissions decisions cannot be based on gender but the information could be useful from a campus perspective.

Race/Ethnicity

Grit has grown in prominence in K-12 education and curriculum and policies have been created and developed based on grit literature (Almeida, 2016). Research has shown the probability of degree completion (DesJardins, Ahlburg, & McCall, 2002) and the effect of SAT/ACT scores and HSGPA have on predicting college performance (Culpepper & Davenport, 2009) varies based on race. It is important to critically assess the value of reporting differences in race and grit while managing not to explain the differences with a deficiency thinking mindset. A main purpose of the current study was to draw further attention to the inequities of access to higher education with the continued use of metrics that marginally explain success in higher education. As of this writing,

only one study by Strayhorn (2013) specific to grit, race/ethnicity, and college student performance has been identified.

Strayhorn (2013) collected data for a study in 2008 to determine if grit could help predict academic success for Black males at a predominantly White institution (PWI). A survey was administered to 140 Black males who were enrolled full time at a large, PWI, in the southeastern region of the country. Sixty-one percent of participants were first generation. The survey consisted of a researcher developed instrument called the Black Male Student Success Questionnaire (BMSSQ) and the Short Grit scale (Grit-S). The study found that Black males with higher grit scores earned higher grades in college than their same-race male peers with lower grit scores. Although Strayhorn's (2013) study findings were positive, I am uncertain about the contributions to literature if grit is found to affect academic outcomes differently by race/ethnicity.

Socio-Economic Status

Access to higher education is often confounded in the ability to pay for education. Fortunately, often aid packages are geared towards students from low-income households with limited means. For institutions that have a large proportion of Pell-eligible students, this variable is worth investigating further to determine grit levels for overcoming challenges and dealing with adversity.

In a meta-analytic inquiry to categorize and test psychosocial study skill factors and traditional factors on academic performance and retention behavior, Robbins et al. (2004) found that socio-economic status (SES) had a small but statistically significant correlation as a predictor of retention (r = .212) and was an equally minimal predictor of college GPA (r = .155). Sternberg et al. (2012) posited that if colleges make decisions

largely on test scores (which are highly correlated to SES), then the chances of maintaining an equitable admissions process are reduced. Klepfer and Hull (2012) identified SES as a highly predictive factor when looking at college persistence. Students at four-year institutions from the highest SES quintile persisted at 94% compared to students from the lowest SES quintile who persisted at 79% (Klepfer & Hull, 2012). While potentially eliminating the reliance on standardized test scores for purposes of admissions, the correlation between HSGPA and SES is also high (Zwick & Green, 2007) which further confounds the impact that SES has on access to college. Studies on grit have not considered or reported on the influence that SES has on academic achievement and the potential for providing predictive ability across socioeconomic status.

First-Generation Status

Research to connect grit as a mediating factor to parental education and student success is limited. In a study by Black (2014), grit did not mediate the relationship between parent education and college GPA. The belief of Black was, "parents may not have socialized their students toward positive grit beliefs and behaviors, leading to a lack of protection for students of less educated parents" (p. 32). I would like to examine if students who are first-generation college students has an effect on the level of grit observed in participants across demographics and academic success.

Section Summary

The four demographic variables included in the current study represent segments that have not been thoroughly researched within grit literature. The current study was designed to provide additional insight on each segment and importance of considering

additional factors in admission that would provide a more equitable review to improve access for marginalized populations. Further research of each of these sub-populations will contribute to the existing literature on grit.

Summary

Chapter II provided a review of the literature in four key areas. A section on pre-college academic indicators provided the basis for current practice, and offered some challenges that continuing the same practices place on higher education, specifically in the fair and equitable review of admission applications for diverse populations. A review of noncognitive variables research was provided. There is value to consider and include NCVs in admission as a way to acknowledge skills and talents in an applicant that traditional cognitive measures ignore. These characteristics have been shown to predict student success as well as or equal to traditional measures while diversifying the applicant pool. A section on grit provided a background on the development and validation of the construct and an overview of existing literature was reviewed.

A major gap in the literature is the applicability of using grit on a more traditional college population. Existing studies have been completed at elite private campuses, military colleges, spelling bee competitions, and on adults. The current study examined the predictability of grit at a traditional campus that would be more representative of college students and a population similar to future expected growth in higher education. The final section offered a review of demographics and connection to grit and concluded with current research on grit and college students. A gap in the literature exists due to limited reporting on differences in grit within populations across demographics.

Higher education institutions use a range of criteria to evaluate candidates for admission. As shown above, the primary indicators of HSGPA and standardized test scores alone predict a fraction of the potential outcomes for students. A large portion of unexplained variance exists when predicting first-year success, retention, and graduation. Further research is necessary to determine if grit could be utilized as an admission criterion with increased predictive ability of students.

CHAPTER III

METHODOLOGY

Purpose of the Study and Research Questions

The purpose of this study was to explore if *grit,* a noncognitive variable, predicted academic success beyond standardized test scores (i.e., American College Test [ACT] and Scholastic Aptitude Test [SAT]) and high school grade point average (HSGPA). For the purposes of this study, academic success is defined as first-year college grade point average (FYGPA), first semester persistence (FSP), and first-year retention (FYR) to the college. The following research questions were addressed in this study:

Q1 To what extent does grit explain 1st-year college GPA when controlling for background characteristics and pre-collegiate academic factors?

Q2 To what extent does grit predict retention to second semester when controlling for background characteristics and pre-collegiate academic factors?

Q3 To what extent does grit predict retention to second year when controlling for background characteristics and pre-collegiate academic factors?

Research Hypotheses

The literature review provided examples of a relationship between grit and college success for specific populations; however, it is unclear as to the importance of the relationship and how grit and academic success may be connected to students' background characteristics. This study was conducted with the following hypotheses:

H1 There will be a positive relationship between grit and first semester persistence while controlling for students' background characteristics of gender, socio-economic status, race/ethnicity, parental education and pre-collegiate academic factors. Individuals with a higher grit score will have a greater likelihood of first semester persistence.

H2 There will be a positive relationship between grit and first-year college GPA while controlling for students' background characteristics of gender, socio-economic status, race/ethnicity, and parental education and pre-collegiate academic factors. Individuals with a higher grit score will have a higher first-year college GPA.

H3 There will be a positive relationship between grit and first-year retention while controlling for students' background characteristics of gender, socio-economic status, race/ethnicity, parental education, and pre-collegiate academic factors. Individuals with higher grit scores will have a greater likelihood of first-year retention.

H4 There will be a positive relationship between HSGPA and academic performance (FYGPA, FSP, and FYR) while controlling for students' background characteristics of gender, socio-economic status, race/ethnicity, and parental education. Individuals with higher HSGPA will have higher likelihood of first-year persistence, higher first-year GPA, and higher likelihood of first-year retention.

H5 There will be a positive relationship between standardized test scores (SAT/ACT) and academic performance (FYGPA, FSP, and FYR) while controlling for students' background characteristics of gender, socio-economic status, race/ethnicity, and parental education. Individuals with higher standardized test score will have higher likelihood of first-year persistence, higher first-year GPA, and higher likelihood of first-year retention.

Research Design and Procedures

The research questions were designed to determine if grit can be a predictive variable to better understand persistence, retention, and college academic performance. This research was conducted as a longitudinal non-experimental design utilizing a survey to collect a mean grit score. Student demographic variables, pre-collegiate academic indicators, and college success metrics were collected using institutional data provided by the college's institutional research department. Survey research affords investigators the

opportunity to administer a survey to a sample or to an entire population of people to describe attitudes, opinions, behaviors, or characteristics of the population (Creswell, 2008).

Pinsonneault and Kraemer (1993) identified three distinguishing features of survey research. The first is that survey research is used to quantitatively describe specific aspects of a given population often times examining the relationships among variables and/or differences between groups. The second is that the data are subjective because they are collected from people and the third feature is that survey research uses a selected portion of the population from which the findings can later be generalized back to the population. Survey research can be primarily used to identify relationships between variables or by projecting the findings of a sample toward a greater population (Pinsonneault & Kraemer, 1993).

Study Site

The study site was a mid-size public institution, categorized by the Carnegie 2015 classification as a Doctoral University located in the western region of the U.S. The institutional undergraduate profile consists of 37% first generation students, 30% identified as students of color, 28% low income (Pell eligible), and 88% enrolled full-time. The academic profile of the most recent entering cohort from high-school had a mid-50% GPA range of 3.0 to 3.8, ACT composite scores of 19 to 24, and SAT composites of 940 to 1180 for the math and critical reading sections on the old SAT. The site of the current study is unique to this type of study as prior research has primarily been focused on private, highly selective institutions such as University of Pennsylvania,

University of Miami, and West Point Military Academy. For the purposes of this study, the host institution will be known as Mountain States University (MSU).

Participants

The accessible population for this study was from the cohort entering college for the first time in fall 2016. This cohort was selected to identify if grit has predictive value in first-year college GPA, retention to second semester, and retention to second year. Invitations to participate were sent to all first time students entering in the fall of 2016 regardless of their current enrollment status. Respondents include students who are currently enrolled at the study site as well as students who left during or at the completion of the first semester. In an effort to better understand the implications of grit across demographics related to the research questions, it was desired to sample the entire 2016 entering cohort. This study intentionally included the entire cohort instead of a sample with the desire to collect enough responses to find significance across a number of demographic variables. Additionally, the use of an existing survey distributed to the entire cohort was convenient to achieve the desired response rates and number of responses. Prior research on grit utilizing a similar measure has primarily focused on White, non-first-generation students, from highly selective academic institutions. This research will help fill a void in the current literature related to a more diverse population.

The fall 2016 cohort had 2,052 first time, full-time students. A survey was administered in February 2017 to 1,807 (88.1%) students enrolled at MSU in the spring of 2017 and to 245 (11.9%) students no longer enrolled. Of the fall 2016 cohort, 544 students completed the grit short scale survey for an overall response rate of 26.51%. Students who were enrolled in spring 2017 accounted for 513 (94.3%) respondents. This

sample was predominantly female (*n* = 409; 75.2%), White (*n* = 372; 68.4%), not Pell eligible (*n* = 387; 71.1%), and not first generation (*n* = 348; 64.0%). The sample had an average HSGPA of 3.47 (*SD* = .441) and a standardized test score of 23.11 (*SD* = 4.04) on the ACT. The following sub-sections provide further detail regarding the specific demographics of the sample.

Table 2 shows frequency by gender, ethnicity, Pell eligibility, and first generation status for the population and sample. To determine if the students completing the grit scale differed from the full cohort on key demographic characteristics, I conducted χ^2 tests of independence. A χ^2 tests of independence is used to test statistical independence between two or more variables (Wagner, 2016). An alpha level of .05 was utilized for chi square tests of independence. When comparing the differences between the two groups (responders and non-responders), the χ^2 tests of independence identified that females were over-represented while students of color, Pell eligible, and first generation students were under-represented in the sample. Additional descriptive statistics are shown in Table 3 for the 513 responders who were enrolled at MSU at time of Grit-S completion and the 31 responders who were no longer enrolled at MSU at time of Grit-S completion. As shown in Table 3, the proportion of responders were weighted heavily toward students enrolled in the spring semester. This proportionate difference ended up having an influence on the analysis and is described in detail in Chapter IV.

Table 2

Demographics of Sample by Gender, Ethnicity, Pell Status, and First-Generation Status

	Cohort Fall 2016		Grit	
	(*N* = 2,052)		(*n* = 544)	
Variable	*n*	%	*n*	%
Gender				
Female	1,315	64.1	409	75.2
Male	737	35.9	135	24.8
Ethnicity				
American Indian	11	.5	7	1.3
Asian	47	2.3	13	2.4
Black/African American	71	3.5	9	1.7
Hispanic or Latino	472	23.0	107	19.7
Multiracial	110	5.4	31	5.7
Native Hawaiian	9	.4	2	.4
Non-resident Alien	16	.8	2	.4
Unknown	4	.2	1	.2
White	1,312	63.9	372	68.4
Students of Color				
Yes	720	35.1	157	28.9
No	1,332	64.9	348	64.0
Pell Eligibility				
Yes	708	34.5	157	28.9
No	1,344	65.5	387	71.1
First Generation				
Yes	886	43.2	194	35.7
No	1,150	56.0	348	64.0
Unknown	16	.8	2	.4

Table 3

Demographics of Sample Responders by Enrollment Status

	Enrolled Spring 2017		Non-Enrolled Spring 2017	
	(*n* = 513)		(*n* = 31)	
Variable	*n*	%	*n*	%
Gender				
Female	388	75.6	21	67.7
Male	125	24.4	10	32.3
Ethnicity				
American Indian	5	.5	2	6.5
Asian	13	2.5	0	0.0
Black/African American	9	1.8	0	0.0
Hispanic or Latino	101	19.7	6	19.4
Multiracial	29	5.7	2	6.5
Native Hawaiian	2	.4	0	0.0
Non-resident Alien	1	.2	1	3.2
Unknown	1	.2	0	0.0
White	352	68.6	20	64.5
Students of Color				
Yes	159	31.0	10	32.3
No	354	69.0	21	67.7
Pell Eligibility				
Yes	147	28.7	10	32.3
No	366	71.3	21	67.7
First Generation				
Yes	183	35.7	11	35.5
No	329	64.1	19	61.3
Unknown	1	.2	1	3.2

Gender. Gender was collected on a binary scale of male and female due to the application for admission being restricted. For the overall cohort, 64.1% (n = 1,315) of the students were female and 35.9% (n = 737) were male. When examining the sample of students who responded to the Grit-S survey, 75.2% (n = 409) were female and 24.8% (n = 135) were male. Females were over-represented among responders by about 11%. The proportion difference between the grit sample and the 2016 fall cohort population showed a statistically significant difference between the sample and population by gender (χ^2 [1, N = 2,052] = 39.63, p < .001).

Ethnicity. The ethnicity of the cohort was 63.9% (n = 1,312) White, 23.0% (n = 472) Hispanic or Latino, 5.4% (n = 110) multiracial, 3.5% (n = 71) Black or African American, 2.3% (n = 47) Asian, .5% (n = 11) Native American, .4% (n = 9) Native Hawaiian, and 1.0% (n = 20) reported non-resident alien or unknown. When considering grit responders, the ethnicity was 68.4% (n = 372) White, 19.7% (n = 107) Hispanic or Latino, 5.7% (n = 31) multiracial, 1.7% (n = 9) Black or African American, 2.4% (n = 13) Asian, 1.3% (n = 7) Native American, .4% (n = 2) Native Hawaiian, and .6% (n = 3) reported non-resident alien or unknown. White students were over-represented in the population of responders by about 4.5%. The proportion difference between the grit sample and the 2016 fall cohort population showed a statistically significant difference between the sample and population by students of color (χ^2 [1, N = 2,052] = 5.26, p = .022).

Pell eligibility. Pell eligibility is defined as anyone who is Pell eligible according to federal expected family contribution guidelines. For the cohort group, 34.5% (n = 704) students were Pell eligible while 65.5% (n = 1,344) were not Pell eligible. Of the students

who completed the grit scale, 28.9% (n = 157) were Pell eligible while 71.1% (n = 387) were not Pell eligible. Non-Pell eligible students were over-represented in the population of responders by nearly 6%. The proportion difference between the grit sample and the 2016 fall cohort population showed a statistically significant difference between the sample and population by Pell eligibility (χ^2 [1, N = 2,052] = 10.43, p = .001).

First-Generation status. First generation status was collected through a self-report item at time of application to the University. For the fall cohort, 43.2% (n = 886) reported being a first generation student while 56% (n = 1,150) reported not being a first generation student. Grit responders who identified as first generation were found to be 35.7% (n = 194) of the sample while 64.0% (n = 348) were not first-generation students. First-generation students were under-represented in the population of responders by 7.5%. The proportion difference between the grit sample and the 2016 fall cohort population showed a statistically significant difference between the sample and population by first generation status (χ^2 [1, N = 2,036] = 17.93, p < .001).

Procedures

To begin the research, I submitted a research proposal to the institution's Institutional Review Board (IRB). This research had limited foreseeable risks to the participants and was categorized as an expedited review which involves minimal risk defined by the IRB as, "Minimal risk means that the probability and magnitude of harm or discomfort anticipated in the research are not greater in and of themselves than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests" (Office of Sponsored Programs, 2014, p. 10). The type of data collected was not of a sensitive nature and should not create concern.

MapWorks® First-Year Transition Survey

One form of data collection for this research study was the use of *MapWorks® First Year Transition Survey* that is administered on an annual basis by the MSU's housing office. The Grit-S survey was attached to the end of the MapWorks® survey and sent to all students who were currently enrolled at MSU from the fall cohort (n = 1,807). Included with the questionnaire was a copy of the consent form for participation. The decision to integrate the Grit-S scale into an existing survey was based on allowing the greatest opportunity of achieving a high response rate. There was concern about administering a separate survey around the same general timeline of MapWorks® and not receiving a high enough response rate to facilitate the necessary data analysis of this study. It is important to establish a high response rate in survey research to support generalizable findings (Creswell, 2008; Groves et al., 2009).

The housing office at MSU administered the MapWorks® survey with the additional eight Grit-S questions attached to all first-year students from the 2016 cohort who were still enrolled in the second semester. Recipients included students who were living in the residence halls and students living off-campus. Distribution of the survey began the fourth week of classes in the spring semester and concluded the sixth week of classes. The survey was web-based and students received instructions and an invitation to participate through an email from the director of their living community. Housing staff worked diligently to accomplish a high response rate including pre-survey advertisements in all forms (word of mouth, electronic, poster, etc.). The survey was expected to take between 30 and 45 minutes to complete depending on individual responses, which may lead to additional branching questions. The grit specific questions were expected to take

between three and five minutes. Students received several reminders both in-person and electronically about completing the survey within the first week of administration. All students were required to sign a consent form, which indicated how the data will be used, who has access to the data, and that the student will receive additional follow-up from housing staff. Of the 1,807 survey recipients still enrolled at MSU, 578 completed the MapWorks® survey, of which 512 (88.6%) completed the Grit-S scale. Obtaining an 88.6% completion rate for the grit-s scale from students who began the MapWorks® survey was encouraging. The utilization of long surveys can sometimes lead to survey fatigue and can have a negative effect on the responses resulting in increased numbers of skipped questions or straight-line responses (Lavrakas, 2008). There was no indication of survey fatigue from the completed MapWorks® respondents who answered the grit-s scale questions. All students who completed the MapWorks® survey were given the opportunity to review the aggregate results of the survey. Once the survey closed, the collected responses for the Grit-S scale items were requested from the MapWorks® site administrator along with a unique identifier and imported into an Excel spreadsheet to indicate enrolled students living on and off campus.

Qualtrics Survey Administration

The second form of data collection occurred through the creation of an electronic questionnaire and distributed using the survey tool Qualtrics. This survey was administered to 245 students from the fall 2016 entering cohort who were no longer enrolled at MSU. This survey contained only the eight-item Grit-S scale. Included with the questionnaire was a copy of the consent form for participation and the collection of institutional data. I worked with the university institutional research office to identify the

entering cohort no longer enrolled and selected the prospective student email address as a unique identifier to link the grit scale score with institutional data of demographics, pre-collegiate academic factors, and first semester persistence.

Utilizing a design recommended by Creswell (2008), attention was focused on achieving a high response rate through the use a the three-phase survey administration. This administration occurred over the course of six weeks with three total contacts. As recommended by Creswell (2008), the first phase included an invitation to participate in the study emailed to participants through their prospective personal email address shared at time of application to the University with a link to complete an online survey. The first invitation went out in March 2017. The second phase included a second email sent to all non-responders two weeks later. After another two weeks, the third phase was a final email reminder. The survey remained open for two weeks after the last reminder email. The period of time from the first initial invitation to participate to the end of the collection period was a total of six weeks. It was expected that the survey would take less than five minutes to complete. There was an incentive to complete the survey by providing five $20 gift cards drawn randomly at the completion of the study. When the Qualtrics survey to non-enrolled students closed, collected responses of 32 students were exported from the survey tool (Qualtrics) and joined with responses from the Mapworks® collection and combined into an Excel spreadsheet with an identifier of non-enrolled.

Collection Periods

Data collection occurred over the course of four time periods. The first period took place in January 2017 and involved the collection of the grit scale score using the

Mapworks® survey administration for students who were enrolled in spring 2017. This administration went out to 1,807 students from the fall 2016 cohort who returned to the institution for the spring 2017 semester.

The second collection period occurred in March 2017 with institutional research providing contact information for 245 students who did not return to the university for spring 2017. This list included primary email address, pre-collegiate academic factors of HSGPA and standardized test scores, demographic variables of gender, ethnicity, first generation status and Pell eligibility, and the students fall term grade point average. This list was used to survey non-enrolled students in an effort to obtain their grit scale score. Administration of the Qualtrics survey to the 245 students who were not enrolled for spring 2017 commenced and data collection concluded in April 2017.

In May 2017, institutional research provided a complete fall 2016 cohort file of the 1,807 students enrolled as of census in spring 2017. This file included demographic variables of gender, ethnicity, first generation status, and Pell eligibility; pre-collegiate academic factors of HSGPA and standardized test scores; and college academic metrics of fall 2016 grade point average and spring 2017 grade point average. The final period of data collection occurred in September of 2017 with the collection of retention data for the fall 2016 cohort and indicated which students returned to the university for their second year.

Instrumentation

To operationalize this study, demographic data, pre-collegiate academic factors, and college academic success variables were collected through institutional research while grit was gathered utilizing the eight item Grit-S scale developed by Duckworth and

Quinn (2009). To help ensure a response rate that produced the necessary data for analysis, the eight items were attached as the last set of questions on the *MapWorks*® *First Year Transition Survey*, which is an existing survey administered by Mountain States University (MSU). Both surveys are discussed in greater detail below.

Dependent Variables

Dependent variables (DV) for this study include first-year college GPA, first-semester persistence, and first-year retention and are referred to as college academic success factors. Each variable was obtained through the institution's institutional research office. First-year college GPA and first semester persistence was collected at the end of spring semester and first-year retention data was collected at census date of the fall 2017 semester.

Demographics

For the purposes of this study, four demographic variables were collected through institutional research and are among the independent variables in the current study. Data were institutional data that had been self-reported by each student to the institution at time of application and include ethnicity, gender, and first generation college student status. Socio-economic status was collected through institutional data by identifying if a student was Pell eligible. To determine which students were Pell eligible, institutional research provided a "Y" indicator for any student who met the requirements to be considered Pell eligible and was recorded as: Y = Yes and N = No. Ethnicity was collected using federal values and recorded as: 1 = American Indian or Alaska Native, 2 = Asian, 3 = Black or African American, 4 = Hispanic or Latino, 5 = Native Hawaiian or Other Pacific Islander, 6 = White, 7 = Multiracial, 8 = Non-resident Alien, or 9 =

Unknown. Gender was limited to a binary variable on the application and included female and male and was recorded as: F = female and M = male. The binary option was a limitation as analysis of students who do not identify as either were forced into answering on the binary scale. To identify if a student was a first-generation college student, responses were collected to a question from the admission application that asked each applicant at time of application if either parent had completed a college degree and was recorded as: N = No and Y = Yes.

Pre-Collegiate Academic Factors

High school grade point average (HSGPA) and standardized test scores, which served as two of the independent variables in the current study, were requested and provided by institutional research. HSGPA was reported on a 4.0 scale and based on admission records from time of admission to the institution. Standardized test scores include either the ACT, SAT (test taken prior to March 2016), or the Revised SAT (test taken after March 2016) and were requested and provided by institutional research. The ACT score was reported as a composite score with a range of 12 to 34 for the sample. The SAT was reported as a combined score for the SAT math and SAT verbal sections for tests taken prior to March 2016 with a range of 590 to 1470 and a combined score of the Revised SAT Evidence Based Reading and Writing and Revised SAT Math for tests taken after March 2016 with a range of 880 to 1350.

For data analysis purposes, a new field (standard scale) was computed to standardize test scores across testing service and concordant to the comparable ACT composite score (ACT Research & Policy, 2009). Redesigned SAT scores (RSAT) do not have a concordance to ACT as of the writing of this dissertation. Of the 12 students who

submitted a RSAT score, 10 also submitted either an ACT or SAT score. The 2016 first year cohort consists of 2,052 students of which a concordance test score for 2,036 (99.2%) was available for analysis.

College Academic Success Factors

Three academic success measures, which were the dependent variables for the current study, were collected and include: (a) persistence from first semester to second semester, (b) first-year college grade point average, and (c) retention from first fall enrollment to second fall enrollment. If a student persisted to spring semester, institutional research reported a "Y" for each student which was recorded as: Y = Yes and N = No. If a student was retained to the second year, a "Y" was provided and coded as: Y = Yes and N = No. A fall grade point average was provided for all students who recorded a first-semester grade point average. A cumulative grade point average of the entire first year was collected for students who completed their first year of study.

Grit

I utilized an existing measure developed by Duckworth and Quinn (2009) titled the Short Grit Scale (Grit-S) which is a Likert-type measure to measure the primary independent variable of interest: grit. The general construct of grit is defined as, "perseverance and passion for long-term goals" (Duckworth et al., 2007, p. 1087). The intended purpose of the instrument is to determine if incremental value could be found to illustrate personal characteristics of individuals to stick with an activity or interest for a long period of time in overcoming challenges and adversity. The result of the Grit-S scale combined with traditional application requirements such as high school grade point average (HSGPA) and standardized test scores can be more accurate measures of

predicting a student's success (Duckworth et al., 2009). Examples of existing research that utilized the Grit-S scale with published response rates are first-year West Point cadets (99.6%; Duckworth et al., 2007), high-achieving students at an Ivy League college (39.7%; Duckworth et al., 2007), contestants in the national spelling bee (64%; Duckworth et al., 2007), and Black males at a predominantly White institution (51%; Strayhorn, 2013).

The Grit-S scale is a revised version of the Grit scale and consists of eight items. Duckworth and Quinn (2009) conducted a confirmatory factor analysis (CFA) on the Grit-S scale tested on four samples engaged in a variety of challenging domains across differing age groups which included West Point students, national spelling bee participants, ivy league undergraduates, and predictive validity for career changes among adults. They reported that their analysis on the Grit-S scale showed adequate internal consistency with Cronbach's alpha ranging from .73 to .83 across the four samples. Consistency of Interest was reported with an internal consistency for alphas ranging from .73 to .79 while Perseverance of Effort reported alpha values ranging from .60 to .78. Scores on the revised Grit-S research supported a two factor structure in which Consistency of Interest and Perseverance of Effort were moderately intercorrelated, $r = .59$, $p < .001$ (Duckworth and Quinn, 2009). In a separate longitudinal study of high-achieving, middle and high school students, Duckworth and Quinn reported a test-retest stability coefficient of the Grit-S as $r = .68$ one-year after the original test with an internal consistency at both the 2006 and 2007 assessments of αs = .82 and .84, respectively. The psychometric analyses conducted by Duckworth and Quinn (2009) were tested on four samples to validate the Grit-S scale.

The response format of the Grit-S scale is a Likert-type scale (1-5) with the response options ranging from very much like me, mostly like me, somewhat like me, not much like me, and not at all like me. There are eight individual items on the Grit-S scale that consist of statements like, “Setbacks don’t discourage me” and “I finish whatever I begin.” It is important to note that half of the items are reverse coded and are further discussed later. The scores are summed and divided by the number of items to develop a mean grit score with possible scores ranging from 1 to 5. This grit score was used in the analysis to determine if grit can predict the outcome variables. Permission to utilize the Grit-S scale is granted through the creator’s website for non-commercial uses.

Data Analysis

Prior to merging data from all sources (grit scale and institutional data), individual student records were coded by response population: (a) assigned to respondents enrolled in spring 2017 and (b) assigned to respondents no longer enrolled at Mountain States University as of spring 2017. Demographic information (variables of gender, ethnicity, 1st-generation status, and Pell eligibility), persistence data for first semester and first-year college GPA at the end of the spring semester was requested from Institutional Research and joined into the data set using the unique variable.

Once the Grit-S responses and the demographic data were joined, the data were analyzed using SPSS version 24.0 to review descriptive statistics and frequency distributions. This is an important step to verify that data were entered correctly and make necessary corrections to the data set. At this point, item transformation was completed to recode reverse worded items, create dummy variables, and compute the mean of the grit items to develop a composite grit score.

Ethnicity data were entered into SPSS by ethnicity group and coded into a new category of "Student of Color" (SOC). The combined category of SOC include students from ethnicities of American Indian or Alaska Native, Asian, Black or African American, Hispanic or Latino, Multiracial, and Native Hawaiian. For the category SOC, dummy variables were created and coded as "1" for students of color and "0" for all others including White, non-resident alien, and unknown. Pell eligible students were entered into SPSS as a "Y" or "N" for group membership and dummy coded "1" for Pell eligible and "0" for not Pell eligible for regression analysis. First generation status was entered into SPSS as a "Y" or "N" for group membership and dummy coded "1" for first generation and "0" for not first generation for regression analysis.

Prior to computing the grit mean, I ran reliability and item analysis using Cronbach's alpha. Because this was an existing measure with evidence of reliability and validity in other samples, I did not expect there to be reliability or item analysis concerns in the current sample which would require dropping items to improve reliability; however, as with any type of descriptive statistic for sample responses, I estimated reliability for the current sample. Tests of significance used alpha of .05 throughout this study in statistical analysis. This is a common significance level for social science research that states with a 95% confidence level that the observed outcome would happen again.

Confirmatory Factor Analysis

While a confirmatory factor analysis had been previously conducted on data from the Grit-S scale (Duckworth & Quinn, 2009), I also performed a confirmatory factor analysis (CFA) to observe if the demonstrated factor structure maintained on this sample.

Recommendations of sample size range from 50 participants to 300 or more to conduct a CFA (Furr, 2011). I used LISREL 8.8 to conduct the CFA. This analysis was chosen to determine if the measure is compatible with the sample and determine whether or not the latent variables are correlated and if items load on each latent variable in the expected pattern. To test the factor structure, I performed the CFA by selecting the two latent variables of consistency of interest and perseverance of effort from Duckworth and Quinn (2009) and specifying the eight items on the two factors (four items each) according to the hypothesized factor structure. It is important to determine construct validity of the model to ensure it is measuring the two factors as theory suggests.

The next step was to assess the goodness of fit using a Comparative Fit Index (CFI, Bentler, 1990). Values range from 0 to 1 and a value of .95 or higher suggests a good fit (Bentler, 1990). Additional measures of fit include the chi-squared test and a test of residuals. A chi-squared probability greater than or equal to a .05 would have an acceptable model fit (Suhr, 2006). To assess the residuals in the model, a Root Mean Square Error of Approximation (RMSEA) was examined. Suhr (2006) shared that values range from 0 to 1 with a smaller RMSEA value indicating a better level of fit. An acceptable model fit for RMSEA values is less than .06 (Hu & Bentler, 1999). Additional fit indices exist and could be considered such as Incremental Fit Index (IFI) and Non-normed Fit Index (NNFI; Furr, 2011). Furr (2011) also noted that dismissal of chi-square findings for CFA is fairly common while incremental fit indices may be more appropriate depending on sample size. The results from the CFA are shared in Chapter IV.

Regression Diagnostics

The data collected were tested for problems that may affect findings using various diagnostic techniques for regression. Within regression, there are a number of assumptions to assess prior to interpreting the results. According to Osborne and Waters (2002), there are four assumptions to be aware of in regression analysis. The first assumption is that residuals are normally distributed. This can be checked by visual inspection of normal probability plots and/or histograms of residuals and review of skew and kurtosis values to identify non-normality. A second assumption is that a linear relationship exists between dependent and independent variables. One way to determine if non-linearity exists is to observe scatterplots of residuals versus predicted values (Osborne & Waters, 2002). A third assumption is that variables are measured without error. The effects of less than perfect reliability become more complex as additional independent variables are added to the model (Osborne & Waters, 2002). Osborne and Waters (2002) reported that when variance is not apportioned correctly as additional independent variables are added to the model, the potential for Type II errors increases for variables with poor reliability and Type I errors for other variables in the equation. And finally there exists the assumption of homoscedasticity which means that all independent variables have the same variance of errors across all levels of the independent variables. One way to observe this assumption is through a scatterplot of standardized residuals versus predicted values to look for random scattering to suggest the assumption has been satisfied. Diagnostics that were utilized to assess the assumptions include an examination of normality of residuals with a histogram and P-P plot and the review of a residual scatterplot. The residual scatterplot helped to diagnose

homoscedasticity and linearity of the residuals. Neither the assumption of normality of the residuals nor the assumption of homoscedasticity appeared to be violated.

Binary Logistic Regression Diagnostics

Either logistic regression or probit regression are analysis options for dichotomous variables in large samples as each analysis tends to give similar results (Kline, 2016). A logistic regression has different assumptions than ordinary least squares regression. The assumptions for a binary logistic regression are that the dependent variable is binary, the model is fitted correctly, the error terms need to be independent, linearity of independent variables, and large sample sizes (Remler & Van Ryzon, 2011). For the purposes of this research, the dependent variable was dichotomous as persistence was defined as persist/retain versus did not persist/was not retained. The independent variables contained both continuous and categorical values. The Hosmer and Lemeshow test (HL) of goodness of fit was performed to examine model fit. When the p-value for the HL test is less than .05, the null hypothesis is rejected meaning that the observed and predicted values are in fact different which suggests poor model fit. A model with an HL p-value less than .05 would indicate a lack of model fit and the unlikely ability to accurately predict retained or not retained. A model HL p-value test of significance should be above .05 to indicate the predicted values matched the observed values indicating adequate model fit for predicting retained or not retained for the purposes of this study.

In addition to assumptions, multicollinearity and outliers need to be assessed. Multicollinearity was assessed through an examination of variance inflation factors (VIF) and tolerance values. As long as collinearity statistics remain below 10 for the VIF and

above a .1 for tolerance, there is no evidence of extreme collinearity. Outliers in the data were identified as having standardized residuals greater than ±3.0. For outliers that exceeded an observed Cook's D value greater than 1.0, analyses were run with and without the outliers to determine if any cases exerted influence on the regression and assess exclusion in the dataset.

Analyses of Research Questions

Research question 1. To answer the first research question, I completed a hierarchical multiple regression analysis to explain the relationship between grit and students' first-year college GPA while controlling for differences in pre-collegiate academic factors of HSGPA and standardized test scores and demographic variables of ethnicity, gender, first generation status, and Pell eligibility. Vogt (1999) referred to a hierarchical regression analysis as a, "method of regression analysis in which independent variables are entered into the regression equation in a sequence specified by the researcher in advance" (p. 129). This type of analysis reduces the chance of making a type I error by yielding a more conservative estimate of statistical relationships (Strayhorn, 2013). For the purposes of this study, I entered the demographic variables of Pell eligibility, race/ethnicity, 1st-generation status, and gender into the model first in an effort to control the effect of these variables on the desired outcome variable of first-year college GPA.

After the demographic variables were entered, a second set of variables was entered which included pre-collegiate academic factors (HSGPA and ACT/SAT composite scores), and then finally grit was added to the model at the third step to determine if grit explains any additional variance when controlling for demographics and

pre-collegiate factors. The rationale for testing the variables in this order is to attempt to control for variance explained by demographic characteristics and to isolate the level of variance explained by grit. Prior research supports entering demographic and pre-collegiate academic variables into the hierarchical model before grit. Research has shown that there is a relationship between demographic variables and pre-collegiate factors on predicting college academic performance (Chee et al., 2005; Culpepper & Davenport, 2009; Zwick & Green, 2007).

The following information from the computer output of the hierarchical multiple regression was examined. The R^2 and associated F tests at each step of the hierarchical analysis indicated how much variance was explained by the variables entered at each step and whether or not the increments in explained variance are statistically significant. In addition, the regression coefficients and statistical significance of those coefficients were used to identify which specific variables entered at each step of the analysis explained a unique portion of the variance in GPA.

Research questions 2 and 3. To answer research questions two and three related to retention and persistence, I utilized a binary logistic regression. Both of these research questions have dependent variables that are dichotomous, meaning either a success or non-success (retained/not retained or persisted/not persisted). Pedhazur (1997) noted the use of logistic regression to answer research questions with a dichotomous (binary) dependent variable.

I started by reviewing the binary logistic regression output first for the fit of the model at each step of the hierarchical analysis based on a likelihood ratio χ^2 test. This test indicates if one or more variables entered into the model at that step improve(s) the fit of

the model significantly. Then, if the likelihood ratio test was statistically significant, I reviewed the output to determine the statistical significance of each independent variable along with their corresponding odds ratios. The odds ratio can be interpreted as the odds to be retained or odds to persist where the reverse is the odds of not being retained or persisting.

Summary

This chapter described the methods and procedures executed for this study to determine if grit does explain college persistence to second semester, predict retention to second year, and predict first-year college GPA. The purpose of the study, hypothesis, research design and procedures, instrumentation, and data analysis were included. The next chapter addresses the answers to the research questions.

CHAPTER IV

RESULTS

The purpose of this study was to examine if grit could predict an increase in probability of academic success of first year college students beyond HSGPA and standardized test scores. Collecting extensive biographic and demographic data, I was able to compare grit scale scores across a variety of diverse segments of the sample. This chapter details the study's findings and is organized into the following sections: preliminary analysis, data analysis for the three research questions, and concludes with a brief summary. The three questions examined in this study are:

Q1 To what extent does grit predict 1st-year college GPA when controlling for background characteristics and pre-collegiate academic factors?

Q2 To what extent does grit explain retention to second semester when controlling for background characteristics and pre-collegiate academic factors?

Q3 To what extent does grit predict retention to second year when controlling for background characteristics and pre-collegiate academic factors?

The previously described analyses are presented and I conclude with a summary of findings.

The department of institutional research at Mountain States University (MSU) provided demographic data for this study. The demographic variables collected include ethnicity, gender, first generation status, and Pell eligibility along with pre-collegiate

academic factors of high school grade point average (HSGPA) and standardized test scores (ACT or SAT). Additional data in the study included college success indicators of fall 2016 college GPA, spring 2017 college GPA, first year cumulative college GPA, persistence from fall 2016 to spring 2017, and retention from fall 2016 to fall 2017.

Mountain States University is primarily a regional-serving institution with 84% of students enrolling from the institution's home state. The home state has a contract with ACT to administer statewide testing to public high school students in the spring of their junior year. Due to access to statewide testing of the ACT and institutional status as a regional university primarily serving home state students, a high percentage of test score senders submitted ACT scores (94.35%). The distribution of test scores by provider is shown in Table 4.

Table 4

Test Score Submission by Provider for Entire Cohort

Variable	*n*	*M*	*SD*	Range
ACT Composite	1,921	22.34	3.98	12-34
SAT Composite (CR and M)	243	1039.42	154.82	590-1470
Redesigned SAT Composite (EBRW and M)	12	1128.33	144.84	880-1350
Standard Scale	2,036	22.33	3.98	12-34

Note. CR = Critical Reading component from SAT test; M = Math component from SAT and RSAT test; EBRW = Evidence Based Reading and Writing component score from RSAT

Table 5 illustrates pre-collegiate academic characteristics for the fall 2016 cohort, by grit response or non-response. As a reminder, standard test score is the concordant score of all standardized tests collected (SAT, RSAT, and ACT) to an ACT composite scale to define test results consistently. An independent samples t-test was conducted to

compare HSGPA and standard test score between grit respondents and non-respondents. There was a statistically significant difference between grit responders and non-responders in both HSGPA and standard test score. These results suggest that students who responded to the Grit-S survey possessed higher HSGPA and standard scores than non-responders and may not accurately represent the population. It remains unknown why grit responders were statistically different in HSGPA and standard test score from nonresponders. Without speculating too much, students who are performing well may be better connected to campus and having a positive experience which leads to greater response to complete a survey. This would mimic the findings of other studies that have shown that students with higher grade point averages and self-ratings of academic ability are more likely to respond to surveys (Sax, Gilmartin, & Bryant, 2003).

Table 5

Pre-Collegiate Academic Indicators by Grit Response

	HSGPA			Standard Test Score		
Sample	*n*	*M*	*SD*	*n*	*M*	*SD*
Grit-S Nonresponders	1,504	3.28**	.504	1,492	22.04**	3.92
Grit-S Responders	544	3.47**	.441	544	23.11**	4.04

* $p < .05$, ** $p < .01$, *** $p < .001$

Additional descriptive statistics are shown in Table 6 that compares Grit-S respondents based on enrollment status at time of Grit-S completion. There is no statistical difference in the mean scores of HSGPA, standard test score, or Grit-S scale score between the two groups of Grit-S respondents.

Table 6

Pre-Collegiate Academic indicators and Grit-S Score by Enrolled Status

	Enrolled Spring 2017		Not Enrolled Spring 2017	
	(n = 513)		(n = 31)	
Variable	*M*	*SD*	*M*	*SD*
HSGPA	3.48	.44	3.37	.46
Standard Test Score	23.15	4.10	22.58	2.77
Grit-S Score	3.49	.57	3.32	.56

* $p < .05$, ** $p < .01$, *** $p < .001$

First-semester college grade point averages were compared within groups by gender, students of color, Pell eligibility, and first generation status for the entire cohort of 2,052 students. Table 7 displays means and standard deviations, along with results of statistical tests, for first-semester GPA and grit scale scores across each of the four demographic variables. Differences for ethnicity are reported individually and collectively as students of color.

Table 7

First-Semester GPA and Grit-S Scores by Demographics

	Cohort Fall GPA (*n* = 2,052)			Grit Scale Scores (*n* = 544)		
Variable	*n*	*M*	*SD*	*n*	*M*	*SD*
Gender						
Female	1,313	2.80***	1.08	409	3.52***	.53
Male	737	2.41	1.12	135	3.34	.66
Ethnicity						
American Indian	11	2.55	1.12	7	3.38	.60
Asian	47	2.65	1.13	13	3.39	.62
Black/African American	71	2.29	.91	9	3.50	.30
Hispanic or Latino	472	2.42	1.14	107	3.52	.55
Multiracial	110	2.53	1.04	31	3.37	.53
Native Hawaiian	9	2.27	.97	2	3.06	.09
Non-resident Alien	16	3.25	.68	2	3.21	.30
Unknown	4	3.46	.79	1	3.50	
White	1,312	2.70	1.10	372	3.48	.58

Table 7 (continued)

	Cohort Fall GPA (*n* = 2,052)			Grit Scale Scores (*n* = 544)		
Variable	*n*	*M*	*SD*	*n*	*M*	*SD*
Students of Color						
Yes	720	2.44***	1.10	169	3.48	.55
No	1,332	2.78	1.10	375	3.48	.58
Pell Eligibility						
Yes	708	2.50***	1.14	157	3.48	.55
No	1.344	2.75	1.09	387	3.47	.58
First-generation						
Yes	886	2.43***	1.12	194	3.46	.57
No	1,150	2.83	1.07	348	3.48	.57
Unknown	16	3.25	.68	2	3.21	.30
Total	2,052	2.66	1.11	544	3.48	.57

*$p < .05$, **$p < .01$, ***$p < .001$.

First-year college grade point averages were compared between groups by gender, students of color, Pell eligibility, and first generation status. Table 8 displays means and standard deviations, along with results of statistical tests, for first year GPA and grit scale score across each of these four demographic variables. Statistically significant differences were found in first-year college GPA within gender, students of color, Pell eligibility, and first generation status. Females earned statistically significantly higher GPAs than males while Pell eligible students earned statistically significantly lower average grades than non-Pell eligible students. Students of color earned statistically significantly lower grades than non-students of color and first generation students earned statistically significantly lower first year college GPA than non-first generation students.

Grit scale scores were compared between groups by gender, students of color, Pell eligibility, and first generation status. Of the four demographic variables, only gender was found to be significant with females reporting a grit scale score statistically significantly higher than males. The remaining demographic characteristics of students of color, Pell eligibility, and first generation status did not demonstrate difference in mean grit scores.

Table 8

First-Year GPA and Grit-S Scores by Demographics

	Cohort First-year GPA (*n* = 1,807)			Grit Scale Scores (*n* = 513)		
Variable	*n*	*M*	*SD*	*n*	*M*	*SD*
Gender						
Female	1,165	2.94***	.91	388	3.53**	.52
Male	642	2.56	.94	125	3.33	.66
Ethnicity						
American Indian	9	2.41	1.04	5	3.50	.68
Asian	43	2.81	.95	13	3.39	.62
Black/African American	65	2.35	.85	9	3.50	.30
Hispanic or Latino	399	2.59	.97	101	3.54	.55
Multiracial	95	2.69	.90	29	3.35	.55
Native Hawaiian	8	1.97	1.09	2	3.06	.09
Non-resident Alien	13	3.11	.81	1	3.43	
Unknown	4	3.10	.97	1	3.50	
White	1,171	2.91	.91	352	3.49	.58

Table 8 (continued)

	Cohort First-year GPA (n = 1,807)			Grit Scale Scores (n = 513)		
Variable	*n*	*M*	*SD*	*n*	*M*	*SD*
Students of Color						
Yes	619	2.59***	.95	159	3.48	.55
No	1.188	2.88	1.04	354	3.48	.58
Pell Eligibility						
Yes	613	2.63***	1.00	147	3.50	.54
No	1,194	2.89	.89	366	3.48	.58
First-generation						
Yes	762	2.60***	.95	183	3.47	.56
No	1,031	2.95	.90	329	3.50	.57
Unknown	14	3.11	.78	1	3.43	
Total	1,807	2.80	.94	513	3.49	.57

*p < .05, **p < .01, ***p < .001.

Preliminary Analysis

As reported in Chapter III, reliability analysis utilizing Cronbach's alpha was completed on the Grit-S scale items and a confirmatory factor analysis (CFA) was conducted on this sample for model fit. Each of these analyses are presented in detail followed by analysis for the research questions and diagnostics.

Confirmatory Factor Analysis

A confirmatory factor analysis was conducted to test the model with this sample and verify model fit using LISREL 8.8. The model used listwise deletion of missing data that removed records with any missing items. The eight-item grit scores for 526 respondents were analyzed on a two-factor model of Consistency of Interest and Perseverance of Effort. Items one, three, five, and six loaded on the Consistency of Interest factor with standardized factor loadings ranging from .42 to .65 while items two, four, seven, and eight loaded on the Perseverance of Effort factor with standardized loadings ranging from .23 to .75. The factor loadings follow the expected relationship based on prior theory associated with the grit-s scale and seem to be acceptable as each item was found to be statistically significant ($p < .05$) by reviewing z-scores with all values above ±2.00. Kline (2016) recommended reviewing chi-square fit, RMSEA, CI of RMSEA, CFI, and Standardized Root Mean Square Residual (SRMR) to determine model fit. As a reminder, each statistic was discussed in Chapter III. The model χ^2 fit indexes for the Grit-S suggested a good fit for the sample, χ^2 (19, N = 526) = 53.09, $p <$ .001; RMSEA = .060 (90% confidence interval [CI] = .042 - .079), CFI = .98, and Standardized RMR = .040.

Internal Consistency Reliability

Analysis of the eight-item Grit-S scale demonstrated acceptable internal consistency reliability, with an alpha reliability estimate of .75. Gliem and Gliem (2003) suggested a reasonable goal to achieve an alpha of .8 or higher. As shown in Table 9, this sample maintains similar internal consistency reliability estimates as previous studies using the Grit-S have demonstrated (Duckworth & Quinn, 2009). Each item was evaluated through item analysis and was found that removing item (2), "Setbacks don't discourage me," would increase Cronbach's alpha to .78. No other items would increase alpha if removed and the decision was made to keep all items in analyses.

Table 9

Internal Consistency Reliability for the Grit-S Scale, Factor 1: Consistency of Interest and Factor 2: Perseverance of Effort

Sample	*N*	Grit-S	Consistency of Interest	Perseverance of Effort
West Point 2008 (Duckworth et al., 2007)	1,218	.73	.73	.60
West Point 2010 (Duckworth et al., 2007)	1,308	.76	.74	.65
Ivy League undergraduates (Duckworth et al., 2007)	139	.83	.79	.78
Current Grit-S Study	524	.75	.66	.65

After thoughtful review of the internal consistency reliability and the CFA, the decision was made to utilize the total grit score in the current study and keep all eight items in the remainder of analysis. This decision was informed by the difference in the consistency reliability between the total grit score and the subscale scores as shown in Table 9.

Results for Research Questions

Hierarchical multiple regression was utilized to answer research question one while logistic regression was used to answer research questions two and three. This section contains relevant diagnostics and an analysis for each research question.

Diagnostics for Regression

According to Osborne and Waters (2002), there are four assumptions to be aware of in regression analysis. The assumptions are: 1) residuals are normally distributed, 2) a linear relationship exists between dependent and independent variables, 3) variables are measured without error, and 4) residuals are homoscedastic. Initial review of a scatterplot between standardized residuals and predicted values exhibit a random scatter of points with similar spread across most levels. The plot shows residuals falling randomly with no strong tendency to be either greater or less than zero. The random pattern suggests that the linearity and homoscedasticity assumptions are satisfied. Through the review of a histogram for model residuals, the distribution appears to follow a normal distribution. Further review of the P-P Plot displays some skewness in the data; however, most points fall near the line. There is sufficient evidence to suggest that the normality assumption was satisfied. As shown above, the grit-s scale exhibited a reliability of $\alpha = .75$ which is acceptable as common reliabilities of many measures in behavioral sciences are found to be in the .7 - .8 range (Pedhazur, 1997).

In addition to the aforementioned diagnostics for assumptions, it is also important to assess for potential multicollinearity among the explanatory variables. This diagnostic is important as it identifies when variables might be highly correlated, meaning they are measuring the same thing. Two statistics used to determine collinearity issues are

tolerance and the variance inflation factor (VIF). To identify a collinearity issue, Kline (2016) identified tolerance values < .10 or VIF values > 10.0 as exhibiting a concern for extreme collinearity. Table 10 provides the collinearity diagnostics for the regression model. No VIF value exceeds 10.0 and the tolerance values exceed .10 indicating no concern for severe collinearity.

Table 10

Collinearity Information for Diagnostics

		Collinearity Statistics	
Model		Tolerance	VIF
1	(Constant)		
	SOC	.896	1.116
	Gender	.912	1.096
	Pell	.894	1.118
	First Gen	.838	1.193
	HSGPA	.696	1.437
	Test Score	.715	1.398
	Grit Mean	.931	1.074

The final diagnostic was to observe Cook's D in the data for potentially influential outliers in the dataset. Figure 3 illustrates the Cook's D values in the data set.

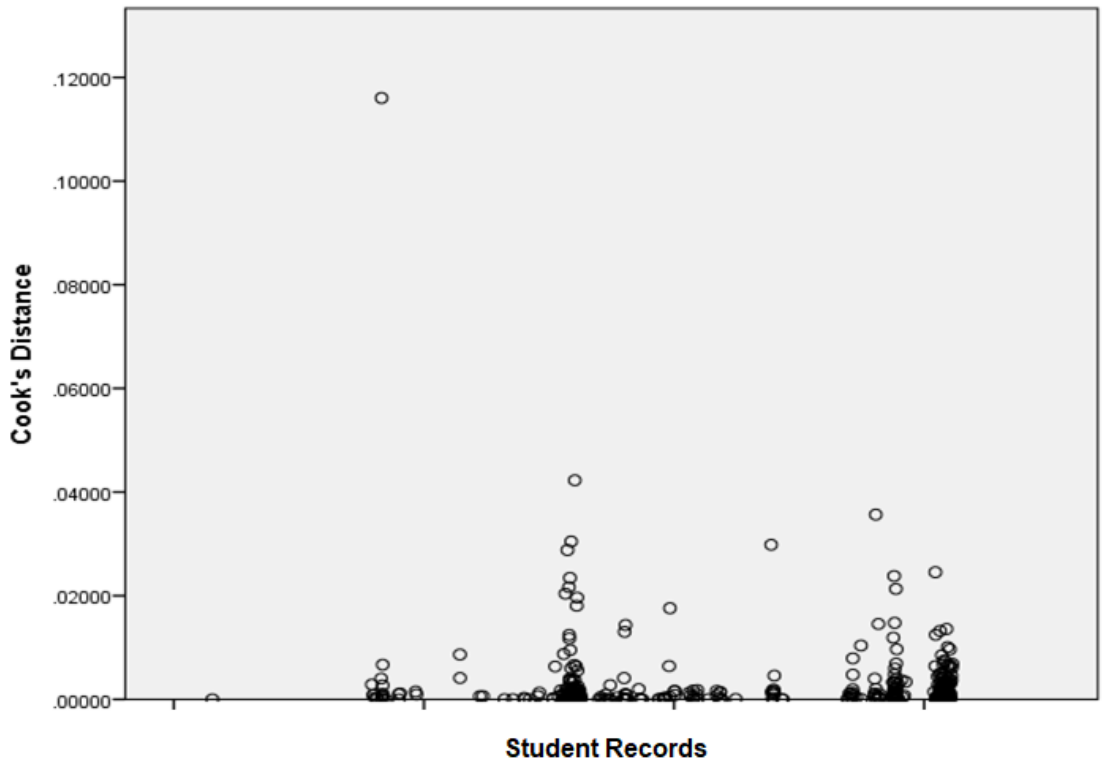

Figure 3. Cook's D Measure of Influence.

Review of Cook's D identified one potential outlier in the dataset that was analyzed further. Following the recommendation of Pedhazur (1997), regression analyses were completed to assess potential influence of an outlier and present relevant findings. Based on analysis of all cases and an analysis with the one outlier removed, it does not appear the case made a difference in findings or conclusions; therefore, results are based on the full sample and reported below. For the analysis of first-year grade point average, only students who completed their first-year in college are included in the data analysis regarding research question one.

Research Question One

To answer research question one, hierarchical multiple regression was completed to investigate if grit was able to predict first year college grade point average beyond pre-collegiate characteristics of HSGPA and standardized test scores while controlling for demographics of gender, ethnicity, Pell eligibility, and first generation status. For the hierarchical multiple regression, demographic variables of gender, student of color, Pell eligibility, and first generation status were entered into the model in the first block, followed by pre-collegiate indicators of HSGPA and standardized test scores in block 2, and concluded by adding grit mean score in block 3. As demonstrated in Table 11, the first block collectively explained a statistically significant amount of variance in first-year GPA, R^2 = .132, adjusted R^2 = .125, $F(4, 507) = 19.23$, $p < .001$. This indicated demographic variables together explained 13.2% of the variance in first year college GPA. Of the four demographic variables, gender (b = .46, $p < .001$), student of color (b = -.19, p = .02), and first generation status (b =-.43, p < .001) were significant. The results indicate that females and non-first generation students, on average, outperformed their classmates on first year GPA by approximately a half a letter grade, .46 and .43, respectively, on a 0 to 4.0 GPA scale. Students not of color also earned higher first year GPAs than students of color with an average difference of .19. Pell eligibility (b = -.06, p = .516) was not significant in the model.

Table 11

Results from Hierarchical Multiple Regression Model 1 (Demographics)

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	*t*	*p*
1	Constant	2.905	.08		35.60	< .001
	SOC	-1.9	.08	-.10	-2.31	.02
	Gender	.46	.08	.23	5.48	.00
	Pell	-.06	.08	-.03	-.65	.52
	First Generation	-.43	.08	-.24	-.533	<.001

Note: SOC = Students of color; First-Gen = First generation students

Block 2 added pre-collegiate academic indicators of HSGPA and the standard score to represent standardized test scores. Standard scores (b = .04, p < .001) and high school GPA were statistically significant, resulting in a cumulative of R^2 = .403, adjusted R^2 = .396, $F(6, 505) = 56.81$, p < .001. By adding HSGPA and standardized test scores, the explained variance in first year college GPA increased significantly beyond what was explained by demographic variables, ΔR^2 = .271, $F(2, 505) = 114.74$, p < .001. This means that HSGPA and standardized test scores added an additional 27.1% of explained variance in first year college GPA. Table 12 provides complete results for model 2.

Table 12

Results from Hierarchical Multiple Regression Model 2 (Demographics and Pre-Collegiate)

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	*t*	*p*
2	Constant	-1.00	.27		-3.74	<.001
	SOC	-.04	.07	-.02	-.53	.60
	Gender	.25	.07	.12	3.40	.001
	Pell	-.08	.07	--.04	-1.113	.26
	First-Gen	-.22	.07	-.12	-3.17	.002
	HSGPA	.90	.08	.46	11.18	<.001
	Standard Score	.04	.01	.17	4.07	<.001

Note: SOC = Students of color; First-Gen = First generation students; HSGPA = High school grade point average

In the final model, grit mean score was added in the third block. The addition of grit was statistically significant, resulting in a 2% increase in the amount of explained variance in first year college GPA, after controlling for demographic characteristics, HSGPA, and standardized test scores, $\Delta R^2 = .020$, $F(1, 504) = 17.42$, $p < .001$. Table 13 provides the regression analysis for the third block of the model. In model 3 grit ($b = .22$, $p < .001$) was statistically significant indicating higher grit scores were associated with higher first year GPAs.

Table 13

Results from Hierarchical Multiple Regression Model 3 (Demographics, Pre-Collegiate Characteristics, and Grit-S Mean Score)

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	*t*	*p*
3	Constant	-1.532	.29		-5.24	<.00
	SOC	-.05	.07	-.02	-.67	.50
	Gender	.22	.07	.11	3.00	.003
	Pell	-.08	.07	-.04	-1.22	.22
	First-Gen	-.22	.07	-.12	-3.20	<.001
	HSGPA	.84	.08	.42	10.37	<.00
	Test Score	.04	.01	.17	4.13	<.00
	Grit	.22	.05	.15	4.17	<.00

Note: SOC = Students of color; First-Gen = First generation students; HSGPA = High school grade point average

The results of the hierarchical multiple regression suggest grit adds to the model and provides additional explained variance beyond traditional factors of HSGPA and standardized test scores while controlling for demographic variables. The findings of this study indicate that women scored higher in college grade point average than men, first generation students achieved a college GPA lower than non-first generation students, students of color earned a GPA below White students, and Pell eligible students earned a GPA below non-Pell students on average. While Pell eligibility was not found to be

statistically significant, it was kept in the final model. Table 14 provides the summary for all three steps in the model testing.

Table 14

Hierarchical Regression Model Summary

			Change Statistics			
Model	R^2	Adj. R^2	SE Est	R^2 Δ	F Δ	p for F Δ
1[a]	.132	.125	.814	.132	19.23	<.001
2[b]	.403	.396	.676	.271	114.74	<.001
3[c]	.423	.415	.666	.020	17.42	<.001

[a] Predictors: (Constant), First Gen, Gender, SOC, Pell
[b] Predictors: (Constant), First Gen, Gender, SOC, Pell, HSGPA, Standard Test Score
[c] Predictors: (Constant), First Gen, Gender, SOC, Pell, HSGPA, Standard Test Score, Grit

Supplementary Analysis

While not part of the research questions, a number of supplementary analyses were completed. The first supplementary analysis was to determine what amount of variance in first-year College GPA did grit explain when HSGPA and standard test score were removed from the model. Table 15 reports the regression analysis for the full model.

Table 15

Hierarchical Regression Model Summary (Grit Only)

			Change Statistics			
Model	R^2	Adj. R^2	SE Est	R^2 Δ	F Δ	p for F Δ
1[a]	.132	.125	.814	.132	19.23	<.001
2[b]	.191	.183	.787	.059	37.03	<.001

[a] Predictors: (Constant), First Gen, Gender, SOC, Pell
[b] Predictors: (Constant), First Gen, Gender, SOC, Pell, Grit

The first supplementary analysis indicates that grit explained 5.9% of the variance in first-year College GPA after controlling for demographics and was statistically significant. This finding will be discussed further in Chapter V.

A second supplementary analysis was completed to determine the statistical significance of swapping standardized test score and grit mean score within the model. This additional analysis was to determine if there was sufficient evidence to support the possibility of including grit in lieu of standardized test score. The first block contained demographics and remained unchanged from the analyses reported in the primary model. In the second block, HSGPA and grit were entered simultaneously, and standardized test score entered into the third block. Table 16 reports the model summary of the supplementary analysis.

Table 16

Hierarchical Regression Model Summary (Supplementary Analysis)

			Change Statistics			
Model	R^2	Adj. R^2	SE Est	R^2 Δ	F Δ	p for F Δ
1[a]	.132	.125	.814	.132	19.23	<.001
2[b]	.403	.396	.676	.272	114.99	<.001
3[c]	.423	.415	.666	.020	17.05	<.001

[a] Predictors: (Constant), First Gen, Gender, SOC, Pell
[b] Predictors: (Constant), First Gen, Gender, SOC, Pell, HSGPA, Grit
[c] Predictors: (Constant), First Gen, Gender, SOC, Pell, HSGPA, Standard Test Score, Grit

Initial preliminary analysis shows that the addition of HSGPA and grit scores to the model at block 2 is statistically significant, $\Delta R^2 = .272$, $F(6, 505) = 56.912$, $p < .001$. By entering HSGPA and grit in the second block, the supplementary analysis on model 2 was almost identical to the original model when HSGPA and standardized test scores were entered simultaneously. Grit performed just as well as standardized test scores in predicting first-year college grade point average.

Table 17 provides the Pearson correlation coefficients for the full model. This table illustrates how the variables used in this regression model are associated with one another. A positive value indicates a positive association when the value of one variable increases another variable also increases linearly. A negative value indicates a negative association between the two variables. For example, in Table 17, HSGPA and FYGPA have a moderately positive correlation.

Research Question Two

Given the dependent variable for research question two is persistence (persist/did not persist), a hierarchical logistic regression was used to assess the likelihood of student persistence to spring semester. The sample includes all students who completed the Grit-S survey (N = 544). Of the fall cohort, 88.1% persisted to spring semester. To begin, the four demographic independent variables were entered into the model in the first block. This process mirrored the order of variable entry in the regression model to determine if grit strengthened the model for explaining the likelihood of a student's persisting for spring semester. Block 1 contained four demographic variables of gender, student of color, Pell eligibility, and first generation status. Block 2 consisted of the two pre-collegiate academic indicators of HSGPA and standardized test scores. The third and final block included the mean grit score.

The step 1 model was found not statistically significant, χ^2 (4, N = 542) = .758, p = .944 meaning that the four demographic variables did not contribute to the model for predicting retention to spring semester for this sample. Additionally, no individual variables were found to be statistically significant in the model as shown in Table 18.

The step 2 model was also found not statistically significant, χ^2 (6, N = 542) = 1.765, p = .604. No individual variables were found to be statistically significant in the model as shown in Table 19.

Table 17

Pearson Correlation Coefficients

Variable	FYGPA	SOC	Gender	Pell	First Gen	HSGPA	Test Score	Grit
FYGPA	1.00							
SOC	-.17**	1.00						
Gender	.19**	-.05*	1.00					
Pell	-.13**	.30**	.03	1.00				
FirstGen	-.19**	.30**	.03	.32**	1.00			
HSGPA	.57**	-.16**	.27**	-.05*	-.16**	1.00		
Test Score	.40**	-.28**	-.001	-.18**	-.29**	.46**	1.00	
Grit	.28**	-.01	.15**	.02	-.03	.24**	.09*	1.00

N = 512

* Correlation is significant at the .05 level (2-tailed), ** Correlation is significant at the .01 level (2-tailed)

Table 18

Logistic Regression Analyses Summary Table for Demographic Variables (Step 1)

Variable	B	S.E.	*p*	Odds Ratio
SOC	-.051	.414	.902	.950
Gender	.277	.414	.503	1.320
Pell	-.213	.424	.615	.808
First Generation	.020	.419	.962	1.020
Constant	2.710	.399	<.001	15.035

Note. Variables entered on step 1: Students of Color, Gender, Pell, and First Generation status.

Table 19

Logistic Regression Analyses Summary Table for Variables Associated with Student Persistence (Step 2)

Variable	B	S.E.	*p*	Odds Ratio
SOC	-.002	.421	.997	.998
Gender	.199	.431	.644	1.221
Pell	-.216	.425	.611	.806
First Generation	.104	.431	.809	1.110
HSGPA	.361	.483	.455	1.435
Standardized Test Score	.016	.055	.765	1.016
Constant	1.110	1.639	.498	3.035

Note. Variables entered on step 2: High School Grade Point Average and Standard Test Score.

The third step of the model was found not statistically significant, χ^2 (1, N = 542) = 1.325, p = .250. No individual variables were found to be statistically significant in the model as shown in Table 20. The final model was found not statistically significant, χ^2 (7, N = 542) = 3.090, p = .877. The model does not show grit or any of the other predictors contributing to prediction of persistence to second semester. One of the issues that may be present in this analysis is the disparity in the unequal group sizes.

Table 20

Logistic Regression Analyses Summary Table (Full Model)

Variable	B	S.E.	*p*	Odds Ratio
SOC	-.013	.421	.975	.987
Gender	.146	.435	.737	1.157
Pell	-.222	.424	.601	.801
First Generation	.100	.428	.816	1.105
HSGPA	.252	.495	.610	1.287
Standardized Test Score	.017	.054	.757	1.017
Grit	.387	.334	.247	1.473
Constant	.200	1.816	.913	1.221

Note. Variable(s) entered on step 3: Grit.

Research Question Three

Similar to research question two, a hierarchical logistic regression was used in order to determine whether grit increases the likelihood of predicting retention to second year beyond demographic characteristics and pre-collegiate indicators of HSGPA and standardized test scores. The sample includes all students who completed a grit survey and were enrolled in spring semester (N = 512). Step 1 consisted of entering the four

demographic variables into the model which was found to be significant, χ^2 (4, N = 512) = 10.70, p = .030; however, Table 21 indicates that no individual variables were found significant in step 1.

Table 21

Logistic Regression Analyses Summary Table for Demographic Variables (Step 1)

Variable	B	S.E.	*p*	Odds Ratio
SOC	-.432	.257	.093	.649
Gender	.507	.262	.053	1.660
Pell	-.322	.269	.231	.724
First Generation	-.137	.265	.604	.872
Constant	1.569	.256	<.001	4.801

Note. Variables entered on step 1: Students of Color, Gender, Pell, and First Generation status.

At step 2, pre-collegiate factors of HSGPA and standard test scores were entered which showed statistical significance, χ^2 (2, N = 512) = 17.97, p < .001. As shown in Table 22, the only variable in the model that shows significance at step 2 is HSGPA (b = 1.111, p < .001) which indicates no other variable is influencing the likelihood of being retained beyond chance.

The final step added grit to the model and does not indicate statistical significance, χ^2 (1, N = 512) = .005, p = .944, with HL p-value of .477, Cox & Snell R^2 = .054, and Nagelkerke R^2 = .092. Table 23 provides the regression analysis for the full model. The full model with all variables did indicate significance, χ^2 (7, N = 512) = 28.67, p < .001. The only individual variable that was statistically significant in the model was HSGPA with an odds ratio (OR) = 3.027, p < .001. This OR is the odds a

student will be retained for each unit increase in HSGPA. An example would be a student with a 4.0 HSGPA has six times greater odds of being retained to the second year than a student with a 2.0 HSGPA. The remaining variables did not show statistical significance in the model.

Table 22

Logistic Regression Analyses Summary Table for Variables Associated with Student Persistence (Step 2)

Variable	B	S.E.	*p*	Odds Ratio
SOC	-.318	.266	.232	.728
Gender	.266	.279	.340	1.305
Pell	-.386	.275	.160	.680
First Generation	.087	.278	.754	1.091
HSGPA	1.111	.313	<.001	3.027
Standardized Test Score	.025	.035	.471	1.026
Constant	-2.708	1.084	.012	.067

Note. Variable(s) entered on step 2: High School Grade Point Average and Standard Test Score.

Table 23

Logistic Regression Analyses Summary Table (Full Model)

Variable	B	S.E.	*p*	Odds Ratio
SOC	-.318	.266	.231	.727
Gender	.264	.281	.347	1.303
Pell	-.386	.275	.160	.680
First Generation	.087	.278	.754	1.091
HSGPA	1.107	.318	<.001	3.027
Standardized Test Score	.025	.035	.471	1.026
Grit	.016	.223	.944	1.016
Constant	-2.747	1.219	.024	.064

Note. Variable(s) entered on step 3: Grit.

Summary

This chapter contained a comprehensive account of the findings of this research beginning with a review of the characteristics of the sample, preliminary analysis including reliability and confirmatory factor analysis, and initial results related to the research questions. This study relied on ordinary least squares regression and logistic regression to answer the research questions. It was found that grit does indeed add to the understanding of first year college grade point average beyond traditional factors of HSGPA and test scores for this sample. However, data analysis did not reveal that grit made a significant contribution in predicting persistence or retention for students in this sample. Chapter V provides a summary of methods, summary of results, implications for practice, limitations, implications for future research, and conclusion.

CHAPTER V

DISCUSSION

The purpose of this study was to examine if grit can be used to explain or predict first year college student success defined as first year college grade point average, persistence to second semester, and/or retention to second year beyond traditional measures of admission criteria. Through this study, I sought to expand the current literature by investigating if a non-cognitive variable, grit, is able to predict college performance beyond traditional measures, which could lead to a change in how institutions admit and enroll students in the future. Guiding this study were three research questions:

Q1 To what extent does grit predict 1st-year college GPA when controlling for background characteristics and pre-collegiate academic factors?

Q2 To what extent does grit explain retention to second semester when controlling for background characteristics and pre-collegiate academic factors?

Q3 To what extent does grit predict retention to second year when controlling for background characteristics and pre-collegiate academic factors?

Summary of Results

To answer the research questions, dependent variables of first year college GPA, persistence to second semester based on being retained or not retained, and retention to second year based on being retained and not retained were used. Variables used in the model as predictors (independent variables) were gender, whether or not a student identified as a student of color, Pell eligibility, first generation status, HSGPA,

standardized test score, and a grit mean score from the Short Grit Scale (Grit-S) developed by Duckworth and Quinn (2009).

Research Question 1

Q1 To what extent does grit predict 1st-year college GPA when controlling for background characteristics and pre-collegiate academic factors?

Evaluating the results for research question one, I expected to find that grit was predictive of college GPA. Hierarchical multiple regression indicated that grit did add to the model when attempting to explain variance in first year college GPA. Demographic variables statistically predicted first-year college grade point average. The addition of pre-collegiate factors of HSGPA and standard test score added to this prediction. Most important to this study, when demographics and pre-collegiate academic factors were statistically accounted for, grit also explained unique variance in students' first-year college grade point average. These findings support my hypothesis that grit scores have a positive relationship with first-year college grade point average. This finding mirrors prior research of grit scores being predictive of grade point average (Duckworth et al., 2007; Duckworth & Quinn, 2009; Strayhorn, 2013) while contradicting other research where grit did not predict first year college GPA (Chang, 2014)

Research Question 2

Q2 To what extent does grit explain retention to second semester when controlling for background characteristics and pre-collegiate academic factors?

I anticipated that grit would be successful in predicting persistence to second semester. Logistic regression was utilized to answer research question two. Statistical analysis did not find significance of grit explaining any additional probability of predicting students who would persist to second semester than traditional admission data.

The overall model was not statistically significant and no individual items in the model were significant predictors for spring persistence on this sample. This finding was not expected as prior research involving grit has found a positive relationship of grit and persistence (Duckworth et al., 2007). The timing of the study and data collection may have overly influenced the findings in the current study. Grit data should have been collected prior to prediction of persistence to spring semester. Logically, you cannot predict something that has occurred in the past and this is a significant limitation to the study.

Research Question 3

Q3 To what extent does grit predict retention to second year when controlling for background characteristics and pre-collegiate academic factors?

I expected to find that grit was predictive of retention to second year. Similar to research question two, logistic regression was used to answer research question three. The sample for analysis was all students who were enrolled in spring semester and completed the Grit-S scale. The full model did indicate statistical significance, which means that there is an ability of the variables to predict retention to the fall semester. Of the seven variables, HSGPA was the only variable statistically significant in the model. The remaining variables did not show significance in the model.

It was a surprise to find that grit did not predict student retention to second year. This is in conflict with existing research that found grit to predict retention in educational settings (Duckworth et al., 2007; Eskreis-Winkler et al., 2014) and life situations like work place and marriage (Eskreis-Winkler et al., 2014). The findings of the current research again could be limited by a number of issues including nonresponse bias, time of data collection, and level of positive experience at the host institution (Sax et al., 2003).

Supplementary Analysis

Included in this study was a supplementary analysis to assess two additional outcomes. The first was to determine the amount of variance that grit predicted in first year college grade point average while controlling for demographics and without HSGPA and/or standard test score in the model. Grit was statistically significant in explaining a portion of variance in first year college grade point average although not to a level that would give institutions confidence to utilize grit on its own merit for predictive purposes. HSGPA clearly far outweighs the use of grit on its own.

A desired second outcome of supplementary analysis was to determine if there was a difference for variance explained in first year college grade point average between standardized test score and grit. A hierarchical multiple regression was used to analyze the amount of variance in first year GPA explained when replacing standardized test score with grit and adding standardized test score to block three as a single predictor. Replacing standardized test scores with grit resulted in near identical outcomes of variance explained in first year college GPA by each variable. These results are intriguing as more and more colleges further evaluate the continued use of standard test scores contributing to admission decisions.

Section Summary

Based on the above reported findings it would seem plausible that grit has a place in predictive situations of future academic outcomes such as academic performance and retention. Defined as a perseverance and passion for long-term goals (Duckworth et al., 2007), grit did show usefulness toward predicting academic success in the form of College GPA but was not significant in predicting persistence or retention. Most

important to the current study was the finding that grit equally predicted College GPA as standardized test score. This finding has significant implications for the continued use of standardized test scores in admissions and will discussed further in the implications section.

Implications for Theory

Student development theories are commonly referenced as a way to explain a phenomenon that exists within college student culture. Theories abound regarding topics such as student involvement, student transition, and persistence and retention. This study sought to connect retention and persistence theories of Swail and Tinto to grit and continue to expand the theoretical basis of grit and noncognitive research. Additionally, an attempt was to connect grit to existing theories of resilience, deliberate practice, flow, and self-control. The following sections expand on this topic.

Retention and Persistence Theories

Tinto's separation stage of departure theory (Tinto, 1987) describes transition periods that begin just prior to matriculating to college. The eight items that make up the grit scale and specifically the factor of perseverance of effort lean on the findings of Tinto and the ability to deal with adversity. Item 7 from the grit scale which is, "I finish whatever I begin", is a strong indication of a characteristic trait that symbolizes finishing a task regardless of difficulty, challenges, or bumps along the way. Elkins et al. (2007) found that students who could negotiate the stage of separation were more likely to return for a second semester.

In the current study, grit was not predictive of persistence to second semester or retention to second year. I anticipated that grit would indicate statistical significance to

predict retention outcomes. There is a possibility that the period of one semester or one year does not fit the defined construct of grit that is focused on achievement of long-term goals. This result leads me to believe that future research directed at establishing a longitudinal study over a four to six year timeframe would be valuable to the continued evaluation of grit as a predictor of student success.

Swail et al., (2003) stressed the importance of institutions establishing admissions criteria using a holistic approach for a more comprehensive assessment of students' commitment to college and compatibility with the institution. As shown in the current study, grit was a more equitable evaluation across demographics when compared to standard test scores and the observed explanation of first year college grade point average. Colleges and students would benefit from an expansion of admission requirements to consider alternative characteristics of talent that have been shown to be predictive of student success. Holistic admissions eliminates a number of barriers to college and removes systemic disadvantages for students from underrepresented populations. The use of noncognitive assessments make the admission process more equitable and encourage students to pursue higher education at selective institutions.

Grit Research within Existing Theories

As shown in Chapter II, I expected to find that grit demonstrated a role within existing research related to prediction of student outcomes. Grit was presented as a connection between resilience (Obradović et al., 2012), deliberate practice (Ericsson et al., 1993), self-control (Tangney et al., 2004), and flow/engagement (C. Peterson et al., 2005). Grit seemed to be a collection of a multitude of existing psychosocial theories

with overlapping connections to one another focused on the achievement of goals through adversity, persistence, engagement, and regulation of time.

In the current study, the findings leave a number of questions unanswered. Grit was predictive of first year grade point average but failed to predict persistence and retention. As shown in Figure 2 (p. 51), it was anticipated that through connections to existing literature, grit would likely predict long-range goals such as retention to second year. Grit did not perform as predicted related to persistence and retention and a primary issue may be the period of time in which data was collected within the student life cycle and/or the short period of time from start of academic term to measurement of first outcome (persistence to second term). The length of observation and measurement may not have been long enough to effectively capture the usefulness of grit in predicting what is defined as long-range goals such as retention to second year and beyond. This implication is further discussed in the future research section.

Implications for Practice

The purpose of this study was to examine whether grit could predict college success outcomes beyond existing demographic and pre-collegiate variables. While a body of literature exists to support the continued use of traditional academic factors of HSGPA and standardized test scores (Geiser & Santelices, 2007; Habley et al., 2012; Hoffman, 2002), the utilization of non-cognitive variables in addition to traditional criteria may improve the prediction of college outcomes (Credé & Kuncel, 2008; Sedlacek, 2011; Thomas et al., 2007). The current study supports these findings.

This section will expand on benefit to colleges and implications in future practice.

Current Practice

Current admission standards are a relic of an outdated and elitist process that has yet to transition to a new age of economic and societal needs, which continues to create unnecessary barriers to access higher education. While this study found similar indications that high school GPA is the best predictor of academic success in college (Astin & Oseguera, 2005; Zheng et al., 2002), there remains a large portion of unknown variance in first year college grade point average. The findings of the current study suggest that high school GPA remain a priority for consideration in admission criteria.

One of the more controversial implications is to suggest a greater consideration of test-optional admission practices. The National Association for College Admission Counseling (NACAC, 2008) questioned the continued use of SAT/ACT scores in undergraduate admissions and encouraged institutions to consider more than standardized test scores when making admission decisions. Findings of the current study support critically reviewing standardized tests use among admission criteria. The amount of time, resources, and unnecessary stress on students to complete a standardized test that nominally predicts first year grade point average beyond HSGPA and equal to a noncognitive variable of grit is concerning. This finding should lead to further consideration of a change in policy or practice.

The National Association of College Admission Counseling offered a few considerations to dissuade campuses from focusing on SAT/ACT including that low income students often do not understand the significance of testing on college options and lack knowledge of and access to critical information about preparing for the tests. Potentially in response to criticism, College Board has partnered with Khan Academy to

provide free instruction and practice to students in an effort to improve preparation for standardized tests. Colleges are often slow to change especially from a standard metric that has served as a trusted indicator of predictive value in future academic success.

Beyond admissions, implications exist related to financial aid and the allotment of merit aid based on standardized test scores. Many campuses have admission-based scholarships that are awarded to students who meet minimum grade point averages and test scores. If colleges would consider a more holistic review and include grit or other noncognitive variables into scholarship award models, students may be better served and benefit in the awarding of valuable aid dollars.

Usefulness of Test Scores for Less Selective Institutions

Grit research has primarily focused on student populations enrolled at highly selective institutions or within competitive educational environments. What value does grit have in selective institutions or is there greater potential of using of grit and noncognitive variables at less selective colleges? Grit may be most useful to less selective colleges as an alternative to standard test scores. Less selective colleges often struggle for enrollment and have performance outcomes that are below selective institutions in areas of retention and graduation and have higher admittance rates. Many regional colleges operate with less selectivity including the host institution for this study. The use of grit and/or noncognitive variables in admissions could be extremely advantageous in identifying talented students who currently do not meet established test score minimums.

Evidence has been provided that highlights the continued inequality of standardized tests on low-income students with high correlations of SAT scores to family income (Sackett et al., 2009; Zwick & Green, 2007) as well as the SAT being ethnically

biased based on question selectivity (Rosner, 2012). As shown in the current study, test scores were statistically different between ethnicities, SES, and first generation status whereas grit scores showed no statistical difference across demographic groups. The use of grit or noncognitive assessments would clearly apply a more fair evaluation of applicants and improve access without relying on an instrument that only marginally predicts academic success beyond HSGPA.

Less selective colleges have missions that often focus on providing access and education but differ in competitiveness and academic credentials for entrance than larger selective colleges. MSU currently requires a high school transcript and standardized test scores for determining an admission decision. Institutions like MSU could benefit from removing the standardized test score requirement and may in fact experience positive benefits in enrollment, diversity of students, and student outcomes. Campuses that implement noncognitive variables in their admissions process should expect to have stronger predictions of student outcomes (Sternberg et al., 2012).

The use of noncognitive variables has been shown to benefit all students but primarily students of color, international students, and older students (Sedlacek, 2011). Most importantly to counter any argument lessoning selectivity or admission standards, Schmitt et al., (2009) found that students who were evaluated using standard cognitive and noncognitive measures increased the numbers of ethnically diverse students while achieving the same rate of graduation when compared to an admission process that relied solely on standard cognitive measures. Campuses should examine existing practices and implement policy changes to create a more inclusive application and admission process.

Grit Outcomes

As mentioned in the previous section, the grit score was not statistically significantly different across SES, parental education, or ethnicity. This is critical in the advancement of grit research and providing equality in access to college. Additionally, the finding that grit scores were equally predictive of first year GPA as standardized test scores is important. This finding alone supports further exploration of grit and noncognitive assessments to more fairly evaluate students.

Does grit measure what it says it does? Grit provided a small explanation of variance beyond HSGPA in this sample. However, what if grit is primarily a product of HSGPA and confounded in other variables? The supplementary analysis confirmed that 3.9% of the variance that grit explained in first year college grade point average was already explained by HSGPA. HSGPA may in fact be as strong of an indicator in predicting future academic success due to the overlap of the qualities one must possess to achieve a high GPA such as determination, motivation, and resilience.

Students must maintain consistency in their studies and persevere through life challenges. Each of these experiences draws from noncognitive traits and may present at varying levels through HSGPA. The current study provided evidence that grit (and potentially other noncognitive variables) may be used more effectively and with greater inclusion of student differences to evaluate potential students for admissions. This is a significant finding that could make the admissions process more equitable.

Limitations

This study had a number of limitations, which may reduce the generalizability of the results. When this research began, the focus was to provide increased awareness of

the changing demographics of students pursuing higher education and attempt to explore and challenge the use of traditional pre-collegiate factors to gain access to higher education through admissions requirements. Most of the prior research on grit has been limited to populations that do not accurately reflect traditional college students. Examples include participants from highly selective institutions, predominantly White, and often in upper level college courses. As demonstrated in prior sections, academic outcomes and noncognitive variables are often times influenced by confounding variables of SES, ethnicity, and first generation status. Through this study, I sought to provide a wider and more reflective sample to evaluate the concept of grit.

Grit Measurement

I believe a limitation in this study is the grit scale itself and the connection to measuring what the survey is intended to do. Grit has been researched over the last ten years in a myriad of ways from educational outcomes to life situations. This current study found marginal improvement over existing measures for college academic success. This finding supports sentiment by Credé et al., (2017) who suggested the incremental value of grit for the prediction of performance is likely to be limited.

Although the scale has met generally accepted metrics for reliability, numerous concerns exist regarding the measurement of the grit scale. The factor structure is tenable at best (Credé et al., 2017) and grit has been viewed as a policy target and a fix-all for underrepresented populations to cultivate the right qualities (Ravitch, 2014). These concerns begin to cast doubt and question the use of the existing scale in high stakes situations.

Survey Administration

A primary limitation of this study was timing of data collection and ability to predict specific outcomes. Data were collected in the spring semester of students' first year in college. This method posed a challenge with generalizability as the analysis showed there was a significant difference in responders and non-responders to the grit measure on almost all variables included in the study. By initiating the survey collection in the spring semester, nearly 12.0% of the fall cohort were no longer enrolled at the university and were not equally represented in the sample results. Of all Grit responders, 94.3% were enrolled in spring semester, which represented a disproportionate sample causing challenges in data analysis with groups differing so greatly in size. Collecting data in the fall semester or prior to enrollment would potentially yield different results and provide a more holistic picture of the effects grit has on predicting college outcomes.

A secondary limitation to the survey administration timing was the effectiveness of capturing the prediction of grit on outcomes measured in short succession. Following the definition of Duckworth et al. (2007), it would seem plausible that persistence and retention to second semester or even second year does not link directly with a perseverance and passion for long-term goals but may predict retention to third year or graduation. The timing of data collection and outcomes could have played a significant role in the findings.

Non-response Bias

Online survey response rates remain a challenge with an average response rate for email surveys of 24.8% (Fluidsurveys, 2014). Students who completed the grit-s scale (26.5%) were statistically different from non-responders in HSGPA, standardized test

scores, first semester college grade point average, and first year college grade point average. This sample did yield a large sample size (N = 544), which should help alleviate concerns of non-response bias; nevertheless, it exists and needs to be considered.

Additionally, with the discrepancy in response rates overall and the disproportionate response of students enrolled in spring semester, it is possible that this contributed to the ineffectiveness of predicting probability of enrollment patterns. By improving the response rate and expanding the representation within the sample, it is possible to believe a different outcome in the results of the study may be attained.

Convenience Sample

This research only considered students who enrolled at one four-year University from a non-random sample of respondents. Results may not be representative of samples from other institutions with different institutional and student characteristics. With convenience sampling, it is possible to conceptualize a population that the sample represents in research as long as caution is applied on the generalizability of the findings (Gall, Gall, & Borg, 2007). This research involved a population and sample that was accessible and convenient.

Future Research

Researchers are encouraged to replicate this study on similar populations to determine if results are consistent in regards to first year GPA, persistence to second semester, and retention to second year. In addition, other interests may be worthwhile to explore if grit has influence on college success.

Collection of Grit-S Scores

An idea for future research would be to collect grit scores on an entire incoming class through an orientation program or similar and have the data prior to the academic year commencing. It would be valuable to have a larger sample size and duplicate the analysis from this current study in an effort to predict persistence, retention, and first year grade point average. Additionally, research could determine how grit is moderated by demographics and observe interactions within outcomes to expand what is known. The results of a full study on the entire cohort would potentially yield promising results in persistence and retention data on the target population. The purpose of this study on this sample was to have a more representative sample of college bound students than prior research. A sample representing a more traditional college student cohort would be promising to determine if grit has value in prediction of student success.

Community Privilege Influencing Outcomes

As mentioned previously, grade inflation is transforming the stratification of applicants to college. Research has shown that White and affluent families benefit the greatest from grade inflation (Jaschik, 2017). School resources play a role in student outcomes. Schools and districts from lower resourced areas perform lower on academic achievement than better-resourced schools (Layton, 2014). So colleges should ask, what does the continued use of HSGPA without other variables mean to low income students and students of color? It means that some low-income students and students of color are not being given a fair opportunity in college admissions. A system is controlling their path and further exacerbates existing oppression and eliminates opportunity for certain

populations. Can grit offer an alternative pathway for students who are continuously disadvantaged by existing processes?

Grit and other noncognitive variables may indeed offer a solution for students to be treated equitably in a process that favors privilege and social capital. The use of grit or noncognitive variables could assist in differentiating students and providing some level of stratification in assessment of potential students and create less reliance on HSGPA. Future research could begin to assess the implications of grit on outcomes and further explore differences across ethnicity and SES.

Interchangeability of Standardized Test Score and Grit

This study did illuminate a difference in the sample within marginalized populations (students of color, low SES, and first generation) and entering standardized test score. Test scores were correlated and had significance by students of color, SES, and first generation status. Those differences did not exist when comparing marginalized populations (students of color, low SES, and first generation,) and grit as grit was not significant or correlated with students of color, SES, or first generation status. It should be noted that males and females were not significantly different in test score but were significantly different on grit scale with males reporting lower grit scales than females. This finding provides credibility that grit may be a more unbiased view of potential in applicants than a test score. Based on findings in research question one, grit may be a suitable replacement (explaining nearly equivalent variance in first year college GPA) for standardized test scores on this sample.

Future research should further investigate the potential impact of grit on populations that have been systematically denied access to higher education and the

differences in entering test scores. Time spent on preparation by students, cost to administer standardized tests, and the high stakes implications of underperforming on standardized tests, leaves open the possibility for an alternative evaluation of potential to succeed at the college level. Critics will argue that an eight-item grit scale would be prone to abuse and that students will know how to answer the questions to "game the system." Although an 8-item Likert-type scale may be easy to respond to in an untruthful manner, there remains clear support to continue to think of ways to holistically evaluate students at time of admission utilizing more than HSGPA and test scores.

Qualitative Exploration of Grit

It may be important for institutions of higher education to understand the experiences that shaped an individual's level of grit. Initial research suggested grit may be malleable and not definitive, always changing based on life circumstances (Alan et al., 2016). Olson (2017) completed a qualitative content analysis study on a first-year seminar course and found that intentional assignments could facilitate the development of grit, which could lead to greater persistence and retention in college. Colleges should explore if teaching grit in first-year seminars is worthwhile and improves the chances of students being retained and improving completion rates.

A number of quantitative studies have researched grit utilizing the original grit scale or the short grit scale. An area that has not been explored is a qualitative review of grit and diving deeper into a pool of responders to better gain an understanding of where and how grit may or may not be developed. An example could be a cohort study to track across time through graduation or dropout and contact students at various points to begin to learn the qualitative side of grit. I think this research would illuminate the differences

in how different populations view grit and score on the grit scale. This could be valuable for a better understanding of the construct and future use of grit in educational environments.

Additional Populations to Consider Exploring

Grit has grown in popularity and exploration continues to shape what is known about the noncognitive characteristic. A population to consider that I have not found in the research would be transfer students. Specifically, research could be conducted on transfer students enrolled at a community college and designed as a longitudinal study to determine if grit predicts students who successfully complete an associate's degree and transfer to a 4-year college and graduate. This population consists of a diverse population of students from differing backgrounds including academic preparation, socio-economic status, first generation, and ethnicity. As the cost of higher education continues to rise, the pool of candidates eligible to transfer to four-year colleges will increase and it would be valuable for an admissions office to have a holistic review of transfer students beyond transfer GPA and high school transcript. Community colleges would also benefit from learning more about their student body and provide focused intervention to improve success rates of community college students.

A final population to consider researching grit would be adult students. Admission offices often receive applications from students who are 25 years of age or older and the admission requirements are typically different due to the amount of time that has passed since high school. Often students do not have standardized test scores, and rely heavily on high school transcripts to support admission to the university. This population may also include larger numbers of veterans who may not have performed

well in high school, chose military as an option, and now wish to enroll in a four-year university. Adding a holistic review that includes noncognitive assessment would be beneficial and provide greater knowledge of candidates to support admission to the college.

Conclusion

I am not fully convinced that the value of grit in admissions has been demonstrated in this study or existing research. There remains an obligation on the part of enrollment managers and institutional leaders to improve access to higher education and move beyond traditional measures of evaluation in college admissions. Demographics are changing dramatically across the U.S. The current higher education systems in admissions has persisted for decades without disruption. Higher education is in the midst of a significant disruption, as incomes have remained flat or with little increase and the cost of education has increased substantially in the past ten years alone. While aid programs are primarily dedicated toward low income families, both low income and middle-income families are being priced out of education.

Many public institutions of higher education were founded under the Land Grant initiative, which focused on inclusion, opportunity, and success. The opportunity to change the trajectory of an individual and potentially a family's way of life. Colleges are struggling to meet enrollment goals while dealing with ever-growing expectations from state legislators, board of trustees, and the public. Unfortunately, this is the new normal for higher education. Dwindling resources, expanding accountability, and an increasingly critical consumer base who question the value of a college degree has changed the recruitment landscape.

Are noncognitive variables the answer? I believe grit and other noncognitive variables provide an approach for expanding how to identify traits and predictive qualities of students for success in college. The high school graduating population is growing in two areas that should cause concern for colleges; less prepared academically and lower ability to pay for college (Selingo, 2016). These two segments of the population typically have not gone to college or been limited in options for post-secondary education. Less selective colleges could benefit from determining how to identify talent in an effort to boost enrollment and not be restricted to traditional measures of pre-collegiate achievement.

I began this study with a desire to explore and expand what is known about the use of noncognitive variables and specifically grit in regards to college admissions. While grit added a small amount of additional explanation in first year college grade point average, additional exploration is necessary. Although this study controlled for four demographic factors and pre-collegiate academic indicators, other factors remain unknown. Opportunity, privilege, culture, economic situation, and social capital all play a role in a person's academic and career trajectory. The exploration of social science research is necessary and in the case of college outcomes, any attempt at narrowing in on predictors of future college success, especially for marginalized populations, is worth the time and effort.

In summary, this research shows that grit may be a positive predictor of first year college grade point average and may increase the probability of predicting college success for students. Results of this study can assist enrollment managers and institutions

of higher education to inform current admission practices and improve access to post-secondary education through noncognitive variables.

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APPENDIX A

GRIT-S SHORT SCALE

Short Grit Scale

Directions for taking the Grit Scale: Here are a number of statements that may or may not apply to you. For the most accurate score, when responding, think of how you compare to most people--not just the people you know well, but most people in the world. There are no right or wrong answers, so just answer honestly!

1. New ideas and projects sometimes distract me from previous ones.*

   Very much like me
   Mostly like me
   Somewhat like me
   Not much like me
   Not like me at all

2. Setbacks don't discourage me.

   Very much like me
   Mostly like me
   Somewhat like me
   Not much like me
   Not like me at all

3. I have been obsessed with a certain idea or project for a short time but later lost interest.*

   Very much like me
   Mostly like me
   Somewhat like me
   Not much like me
   Not like me at all

4. I am a hard worker.

   Very much like me
   Mostly like me
   Somewhat like me
   Not much like me
   Not like me at all

5. I often set a goal but later choose to pursue a different one.*

   Very much like me
   Mostly like me
   Somewhat like me
   Not much like me
   Not like me at all

6. I have difficulty maintaining my focus on projects that take more than a few months to complete.*

   Very much like me
   Mostly like me
   Somewhat like me
   Not much like me
   Not like me at all

7. I finish whatever I begin.

   Very much like me
   Mostly like me
   Somewhat like me
   Not much like me
   Not like me at all

8. I am diligent.

   Very much like me
   Mostly like me
   Somewhat like me
   Not much like me
   Not like me at all

Scoring:

1. For questions 2, 4, 7 and 8 assign the following points:
   5 = Very much like me
   4 = Mostly like me
   3 = Somewhat like me
   2 = Not much like me
   1 = Not like me at all

2. *For questions 1, 3, 5 and 6 assign the following points:
   1 = Very much like me
   2 = Mostly like me
   3 = Somewhat like me
   4 = Not much like me
   5 = Not like me at all

Add up all the points and divide by 8. The maximum score on this scale is 5 (extremely gritty), and the lowest score on this scale is 1 (not at all gritty).

Grit Scale citation:
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. Retrieved from http://www.sas.upenn.edu/~duckwort/images/Duckworth%20and%20Quinn.pdf

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APPENDIX B

INSTITUTIONAL REVIEW BOARD APPROVAL

UNIVERSITY OF
NORTHERN COLORADO

Institutional Review Board

DATE:	January 9, 2017
TO:	Sean Broghammer
FROM:	University of Northern Colorado (UNCO) IRB
PROJECT TITLE:	[1001445-2] Grit as a predictor of academic success for first year college students
SUBMISSION TYPE:	Amendment/Modification
ACTION:	APPROVED
APPROVAL DATE:	January 8, 2017
EXPIRATION DATE:	January 8, 2018
REVIEW TYPE:	Expedited Review

Thank you for your submission of Amendment/Modification materials for this project. The University of Northern Colorado (UNCO) IRB has APPROVED your submission. All research must be conducted in accordance with this approved submission.

This submission has received Expedited Review based on applicable federal regulations.

Please remember that informed consent is a process beginning with a description of the project and insurance of participant understanding. Informed consent must continue throughout the project via a dialogue between the researcher and research participant. Federal regulations require that each participant receives a copy of the consent document.

Please note that any revision to previously approved materials must be approved by this committee prior to initiation. Please use the appropriate revision forms for this procedure.

All UNANTICIPATED PROBLEMS involving risks to subjects or others and SERIOUS and UNEXPECTED adverse events must be reported promptly to this office.

All NON-COMPLIANCE issues or COMPLAINTS regarding this project must be reported promptly to this office.

Based on the risks, this project requires continuing review by this committee on an annual basis. Please use the appropriate forms for this procedure. Your documentation for continuing review must be received with sufficient time for review and continued approval before the expiration date of January 8, 2018.

Please note that all research records must be retained for a minimum of three years after the completion of the project.

If you have any questions, please contact Sherry May at 970-351-1910 or Sherry.May@unco.edu. Please include your project title and reference number in all correspondence with this committee.

Institutional Review Board

Researcher: Sean Broghammer, M.Ed., Higher Education and Student Affairs Leadership (HESAL) 970-351-2806

Research Advisor: Dr. Matthew Birnbaum, Higher Education and Student Affairs Leadership, 970-351-2598.

This past year you enrolled at the University of Northern Colorado as a first-year student. In an effort to better understand the pre-collegiate indicators of students, I am interested to assess your level of grit. I am a graduate student in UNC's Higher Education and Student Affairs Leadership doctoral program and this survey is designed to find out how grit is associated with future academic success in college, specifically predicting college grade point average, persistence to second semester, and retention to second year.

This survey takes most students only about 5 minutes and contains eight questions that may or may not apply to you. By clicking "Finished" at the end of this survey, you are giving your consent to participate.

I will not have any contact with you other than this email. When responses are submitted electronically they cannot be guaranteed secure and therefore confidentially cannot be guaranteed. However, the name of participants will not appear in any report of this research and your name will not appear anywhere on the survey, so your answers will remain anonymous. There are no foreseeable risks associated with you completing this survey. Although there are not likely to be any direct benefits to you, your responses will be useful to the Admissions department at UNC and potentially offer greater opportunities for students to gain access to higher education.

Please feel free to call me if you have any questions or concerns about this research. Thank you for your participation.

Sean Broghammer
Graduate Student at UNC
970-351-2806

Participation is voluntary. You may decide not to participate in this study and if you begin participation you may still decide to stop and withdraw at any time. Your decision will be respected and will not result in loss of benefits to which you are otherwise entitled. Having read the above and having had an opportunity to ask any questions please complete the questionnaire if you would like to participate in this research. By completing the questionnaire, you give me the permission to link your grit scores to institutional data including demographic, first-year college grade point average, persistence and retention data. You may keep this form for future reference. If you have any concerns about your selection or treatment as a research participant, please contact the Office of Sponsored Programs, Kepner Hall, University of Northern Colorado Greeley, CO 80639; 970-351-1907.

Click “Next” to get started.