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Associations between grit and academic factors

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Associations between Grit and Academic Factors

An Honors College Project Presented to
the Faculty of the Undergraduate
College of Health and Behavioral Studies
James Madison University

by Alexandra Bowen

Accepted by the faculty of the Department of Psychology, James Madison University, in partial fulfillment of the requirements for the Honors College.

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Acknowledgements

Near the end of my thesis, my advisor and I remarked upon how the thesis process really is reflective of Duckworth's conception of grit: a student must persevere through repeated failures and display a consistent interest in their project in order to bring it to completion. I would not have been able to do these things — to stay engaged in my topic and persist through all of my mistakes — without the endless support of my wonderful advisor, Dr. Monica Reis-Bergan. Dr. Reis-Bergan patiently supported me through three complete literature review rewrites, an entire shift in my project's focus, and a much-needed extension for the second phase of my thesis. She was supportive, encouraging, and helpful at every stage of my project, and she provided me with the guidance I needed to finish. I owe her many sincere thanks. In addition, I am very grateful to my wonderful committee, which included Dr. Kethera Fogler and Dr. Phil Frana. Both of them were wonderfully patient with me through many logistical delays in my project, and they provided me with invaluable feedback on how to improve my work. Furthermore, I would like to thank Lucy Malenke for patiently explaining a literature review to me, Colleen Johnson for her witty and helpful feedback on my work, Dr. Brett Gardner for very effectively teaching me how to write a results section, and the James Madison University Psychology Department for enabling me to have this opportunity. Finally, I would like to thank my wonderful family and my sweet roommates for putting up with all of my complaining and commentary about this project.

Associations between Grit and Academic Factors

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Abstract

Grit has been identified as a promising area of research in social psychology for its association with various success outcomes. Given the connection between grit and success, researchers have begun to investigate factors associated with grit to better understand how gritty people achieve their goals. Other researchers have questioned if grit is unique from other related traits, like conscientiousness and self-control. This project sought to explore both of these questions: the factors associated with grit and the discriminant validity of grit. Specifically, this project looked at grit in relation to cognitive failures, fear of failure, and growth mindset to inquire into the associations between these factors and grit, and this project compared the grit scores of participants in the study to their conscientiousness and self-control scores to investigate grit's discriminant validity. Participants completed several self-report surveys on these factors online. Their results indicated that grit is significantly correlated with cognitive failures ($r = -0.45$), but not fear of failure ($r = -0.14$) or growth mindset ($r = 0.14$). In addition, participants' grit scores were significantly correlated with self-control ($r = 0.61$) and conscientiousness ($r = 0.45$), but their grit scores were able to explain a significant amount of variance in their GPAs last semester above and beyond self-control and conscientiousness (R^2 change = 0.03, $F(1, 154) = 4.48$, $p \leq 0.036$). The results of this investigation indicate that grit may still be a useful concept in spite of its correlation with related factors and that grit may be more associated with cognitive ability than previously thought. Future research should look into grit in relation to the wider construct of cognitive control in order to explore grit's connection with cognitive ability further.

Keywords: grit, cognitive failures, fear of failure, growth mindset, self-control, conscientiousness

Associations between Grit and Academic Factors

Why might a student who has an average IQ outperform his or her intellectually gifted counterparts in a classroom setting? Conventional wisdom suggests that more intelligent students will do better in school than intellectually average students; however, this is not always the case. Why might this be?

This question interested Angela Duckworth, a psychologist who studies factors in individuals that predict their success. Duckworth proposed the idea that some students may display a non-cognitive trait called grit, which Duckworth defined as a person's "perseverance and passion for completing long-term goals" and which includes two facets: perseverance of effort and consistency of interest (Duckworth, Peterson, Matthews, & Kelly, 2007, p. 1087). She suggested that students who score higher on the grit scale complete their goals successfully, even if they are not the smartest or most talented students, by enacting passion and perseverance towards their goals (Duckworth, 2016). Since Duckworth's initial conceptualization of grit, it has become a frequent subject of investigation in psychological research (Akos & Kretchmar, 2017; Bowman, Hill, Denson, and Bronkema, 2015; Strayhorn, 2014).

The following project investigates two subsections of the academic conversation surrounding grit: the factors associated with grit and grit's divergent validity. This project seeks to investigate if three specific characteristics (cognitive control, fear of failure, and growth mindset) are associated with grit. Each characteristic is discussed in relation to grit below. In addition, this study seeks to replicate previous research examining the discriminant validity of grit to further investigate if grit is a truly unique construct.

Background on Grit

During the past decade, many researchers have found grit to be associated with several types of positive outcomes, such as academic achievement (Akos & Kretchmar, 2017; Bowman, Hill, Denson, & Bronkema, 2015; Duckworth, Peterson, Matthews, & Kelly, 2007; Strayhorn, 2014). One measure of academic achievement frequently paired with grit is GPA. Several researchers found that grit is correlated with students' GPAs; specifically, grittier students seem to receive higher GPAs. In research conducted on grit, participants' grit scores are often useful in helping to explain variance associated with GPA when controlling for other related factors, like high school GPA (when examining college GPA) and standardized test scores (Akos & Kretchmar; Bowman, Hill, Denson, & Bronkema; Duckworth, Peterson, Matthews, & Kelly; Strayhorn). Akos and Kretchmar (2017) found grit to be associated with academic success both when grit was self-reported and reported by a knowledgeable informant. Moreover, Akos and Kretchmar also found grit to be predictive of first-year college GPA, even when controlling for several variables, including highest test score (ie., SAT or ACT), strength of high school curriculum, and high school grades.

While researchers have found an association between grit and academic achievement, they have also connected grit to people's ability to persevere and achieve in spite of difficult circumstances (Duckworth, Peterson, Matthews, & Kelly, 2007; Robertson-Kraft & Duckworth, 2014; Strayhorn, 2014). Some challenging circumstances explored in the research include being a student who is Black in a predominantly White college (Strayhorn), being a new teacher in a low-income school district (Robertson-Kraft & Duckworth), and taking part in West Point's grueling summer training program (Duckworth, Peterson, Matthews, & Kelly). In these

situations, researchers found that grittier people were more successful at persisting and/or achieving than non-gritty people. Therefore, research supports that grit plays a role in people's success.

Factors Related to Grit and Its Outcomes

Given that researchers have found an association between grit and several positive results, there may be additional factors that help explain why gritty people display these results. Specifically, there may be behaviors or characteristics demonstrated by people high in grit that help them achieve successful outcomes. An investigation into these factors is valuable because researchers could potentially gain a fuller picture of the characteristics that enable people to succeed if they are able to learn about additional traits that help people achieve the success outcomes associated with grit. To explore this question, researchers have begun to identify characteristics displayed by people high in grit that may help to explain how they succeed. Some of these characteristics include traits like cognitive control, fear of failure, and growth mindset.

Cognitive Control. One characteristic researchers have found people high in grit to display is an affinity towards deliberate, challenging practice (Duckworth, Kirby, Tsukayama, Berstein, & Ericsson, 2010; Ralph, Wammes, Barr, & Smilek, 2017; Wolters & Hussain, 2015). People high in grit seem more interested than their non-gritty peers in selecting difficult, goal-directed behaviors (Duckworth, Kirby, Tsukayama, Berstein, & Ericsson, 2010; Ralph, Wammes, Barr, & Smilek, 2017; Wolters & Hussain, 2015). In addition, they have demonstrated a higher degree of effort physiologically when completing a mental-effort task in a laboratory setting (Silvia, Eddington, Beaty, Nusbaum, & Kwapil, 2013).

Specifically, Duckworth, Kirby, Tsukayama, Berstein, and Ericsson (2010) found that people high in grit are more likely to engage in study techniques that are more effective, even if the techniques are difficult and not enjoyable. Duckworth et al. recruited 190 finalists from the Script's National Spelling Bee to fill out several self-report surveys. These items included an estimate of how much time participants had spent engaging in quizzing activities or deliberate practice (defined as practicing and memorizing words alone) for the previous four weeks, and the participants' rated the effort, enjoyment, and relevance of these study tactics (Duckworth et al., 2010). The participants' final round achieved in the bee and score on the Short Grit Scale (Duckworth & Quinn, 2009) were also recorded. Duckworth et al. found that the amount of time participants spent deliberately practicing was a better predictor of National Spelling Bee performance than quizzing was, and they found that gritty participants engaged in deliberate practice more frequently than non-gritty participants. In this study, gritty participants were willing to select challenging, tedious behaviors to successfully complete their goals.

Wolters and Hussain (2015) found that a student's performance on the grit task helped predict if they would engage in self-regulated learning (SRL). Self-regulated learning is a construct that looks at the extent to which students take an active role in regulating their own education (Wolters & Hussain, 2015). The authors had 213 college students take an online survey that included the Short Grit Scale (Duckworth & Quinn, 2009), seven measures of self-regulated learning, and indicators of past and present academic achievement. They found that the persistence of effort component of grit was associated with several SRL indicators, some of which included displaying self-efficacy, placing value on school work, employing cognitive and metacognitive strategies, using motivational strategies, and refraining from procrastination.

Similar to in the previous study, Wolters and Hussain also found that gritty participants were more likely to exert the effort necessary to engage in SRL, which tends to facilitate academic success.

Ralph, Wammes, Barr, and Smilek (2017) found that people high in grit were less likely to engage in mind wandering, especially spontaneous mind wandering, and other types of cognitive distraction, such as absentmindedness. The authors had 100 undergraduates complete the 12-item Grit Scale (Duckworth, Peterson, Matthews, & Kelly, 2007) and several mind wandering scales. They found that participants' grit scores were negatively correlated with their tendency to mind wander. Since mind wandering can disrupt people from goal-related behaviors, gritty people's tendency to engage in them less supports the idea that these individuals self-select actions that will facilitate the completion of their goals.

One possible explanation for how these findings fit together is that they all represent examples of the successful implementation of cognitive control. Cognitive control is a construct that describes how people can flexibly select behaviors that support their goals, especially when their habitual response styles are inadequate for the situation in which they find themselves (NIMH; Mackie, Van Dam, & Fan, 2013; Badre, 2008). Perhaps people high in grit are able to regulate their study behaviors (Wolters & Hussain, 2015), choose difficult but effective study habits (Duckworth, Kirby, Tsukayama, Berstein, & Ericsson, 2010), and focus their attention against distractions (Ralph, Wammes, Barr, & Smilek, 2017) because they have a strong degree of cognitive control, or an ability to select behaviors that will support their goals. If people high in grit display cognitive control, it might provide an explanation for how they are able to persevere in completing their long-term goals.

Grit has often been conceptualized as a construct that is independent of cognitive ability (Crede et al., 2016; Duckworth et al., 2007; Duckworth & Quinn, 2009). However, Ralph and colleagues (2017) found an association between grit and attention in their research on mind wandering; therefore, they suggested that future research should seek to investigate the relationship between grit and cognitive control, as their findings may suggest that there is a greater relationship between grit and cognitive ability than researchers have previously thought. Ralph and colleagues cautioned that cognitive control is a broad, multifaceted psychological construct, so it is challenging to pinpoint which precise aspects of cognitive control may be associated with grit.

The National Institute of Mental Health (NIMH) identified three main sub-constructs of cognitive control: performance monitoring, goal selection, and response selection. Because of the broad nature of cognitive control, my research focused on goal selection. The NIMH reported that one of the main behaviors associated with goal selection is distractibility; therefore, my research will provide further insight on if grit is associated with distractibility and inattention, which could in turn provide some preliminary evidence that grit may be associated with a person's level of cognitive control. This research used the Cognitive Failures Questionnaire (Broadbent, Cooper, Fitzgerald, & Parkes, 1982) to measure inattention and distractibility, as researchers have found it to be a suitable measure of everyday inattention and have found it to have a distractibility factor (Bridger, Johnsen, & Brasher, 2013; Kass, Beede, & Vodanovich, 2010; Rast, Zimprich, Boxtel, & Jolles, 2009).

Fear of Failure. Another factor that researchers have identified in relationship to grit is failure. People high in grit seem to respond differently to failure both behaviorally and

affectively (DiMenichi & Richmond, 2015; Lucas, Gratch, Cheng, & Marsella, 2015).

Specifically, Lucas et al. (2015) found that gritty participants were less likely to give up when completing a difficult task, and they were willing to sacrifice monetary rewards for the sake of persisting with a task at which they were not succeeding. The authors had participants complete an intentionally challenging series of anagrams (21 extremely challenging and 16 unsolvable) in which correct anagram solutions were entries for participants to win \$100 (Lucas et al., 2015). The authors found that gritty participants were less likely to give up on anagrams when failing at them than less gritty participants were (Lucas et al., 2015). Also, the participants who persisted at challenging individual problems sacrificed the option to gain more entries from easier problems (Lucas et al., 2015).

In another study, the authors had participants complete several rigged game tasks and the Short Grit Scale (Duckworth & Quinn, 2009; Lucas et al., 2015). When participants scoring high in grit were in the losing condition, they increased the effort they exerted as compared to their baseline, and they did so more than non-gritty participants did (Lucas et al., 2015). Furthermore, Lucas et al. found that people high in grit expressed more positive emotions about the difficult task they were completing. In this study, gritty participants were motivated to persist by failure, and they even expressed enjoyment when completing challenging tasks (Lucas et al., 2015).

In another study on grit and failure, DiMenichi and Richmond (2015) found that encouraging participants to think about their failures helped them both get higher scores on the grit task and make less errors on a difficult cognitive task. The authors recruited undergraduate college students and had them write about a time they persevered and succeed or persevered and failed (DiMenichi & Richmond, 2015). They found that participants who reflected on their

failures scored higher on the grit task than participants who reflected on their successes, and they accrued less errors than the success group on the Sustained Attention to Response Task (SART), a long, tedious test that requires sustained attention for completion (DiMenichi & Richmond, 2015).

These findings suggest that there could be a relationship between grit and failure. Reflecting on failure seems to help people act in a more precise and gritty manner (DiMenichi & Richmond, 2015), and grit may help people persevere and even enjoy completing difficult, failure inducing tasks (Lucas, Gratch, Cheng, & Marsella, 2015). One possible explanation for gritty people's behavior when confronted with failure is that people high in grit are less afraid of failure, as Lucas et al. (2015) suggested. If people high in grit are less afraid of failure, they may be better able to persist in completing their long-term goals when encountered with failure. In addition, people high in grit perhaps view failures as a normal part of completing goals, as failures often occur along a person's path to success. Therefore, perhaps people high in grit are able to maintain this orientation towards failure because they are less afraid of it than their less gritty counterparts. The current study examined this question by administering the Short Grit Scale (Duckworth & Quinn, 2009) and the Performance Failure Appraisal Inventory (Conroy, Willow, & Metzler, 2002) to participants to measure if there is any association between their grit and fear of failure scores.

Growth Mindset. Growth mindset refers to a person's perception of failure as an opportunity for learning and development rather than a sign of incompetence (Paunsdku et al., 2015). People who have a growth mindset often perceive traits like intelligence as malleable rather than fixed; therefore, they see challenging tasks as opportunities to improve, not as

activities that could demonstrate their limitations (Paunsdku et al., 2015). Growth mindset and grit are similar conceptually. As illustrated by Hong and colleagues (1999), people who have a growth mindset tend to attribute failures to a lack of effort, not a lack of ability. They are consequently more likely to exert a greater amount of effort to ameliorate an unsuccessful performance than people without a growth mindset (Hong et al., 1999).

In comparison to people who have a growth mindset, people high in grit have the passion and perseverance to achieve their long term goals, and part of completing long-term goals is overcoming the challenges and failures that inherently arise while working towards them (Duckworth et al., 2007). Therefore, like with people who have a growth mindset, people high in grit must be willing to respond proactively to challenges to reach their goals (Duckworth et al., 2007). People high in grit and people who have a growth mindset both appear to respond in an effortful, active manner to setbacks (Duckworth et al., 2007; Hong et al., 1999). Perhaps part of the reason people high in grit can complete their goals is because they view intelligence as malleable, enabling them to believe that increasing their effort towards a task can improve their result.

A few researchers have begun to look at growth mindset and grit to investigate if they both can function in tandem as success indicators (Dixson, Roberson, & Worrell, 2017; Phillips-Martinez, 2018). For example, Phillips-Martinez (2018) and Dixson, Roberson, and Worrell (2017) both assessed high school students to see if grit or growth mindset were associated with academic success. However, these researchers did not find either grit nor growth mindset to be significantly related to academic success in their research.

In contrast, Tucker-Drob, Briley, Engelhardt, Mann, and Harden (2016) measured both incremental mindset (another term for growth mindset) and grit in children from the Texas Twin Project through self-report measures. They found that grit and incremental mindset were both significantly correlated with each other and with several performance-based assessments of academic achievement. Given that there is some inconsistency in the literature regarding these traits' relationship to each other, further research could be useful to continue investigating if they are connected.

The present study sought to investigate the association between grit and several factors that could potentially help to explain the outcomes achieved by gritty people. Specifically, this study measured fear of failure with the the Performance Failure Appraisal Inventory (Conroy, Willow, & Metzler, 2002), cognitive failures with the Cognitive Failures Questionnaire (Broadbent et al., 1982) and growth mindset with the Implicit Theories of Intelligence Scale (Dweck, 1999). These characteristics are conceptually related with grit, so it is possible that participants' scores on the Short Grit Scale (Duckworth & Quinn, 2009) and on these scales will be correlated. If these characteristics are related to grit, it may be beneficial for future research to investigate the possibility that they function as mediators that help gritty people complete their goals.

Other Constructs Related to Grit: Grit's Discriminant Validity

As discussed at the beginning of this piece, many researchers agree that grit is associated with a variety of positive outcomes. However, some researchers have begun to dispute if grit is the best predictor of these factors (Credé, Tynan, & Harms, 2016; Muenks, Wigfield, Yang, O'Neal 2017; Ivicevic & Brackett, 2014). According to a meta-analysis conducted by Credé et al.

(2016), grit may not be the most effective or unique construct available in terms of predicting perseverance and passion-related outcomes. In their meta-analysis, Credé and colleagues compared 584 effect sizes from 88 independent samples. They found that grit is related to the big five characteristic conscientiousness, and they concluded that grit is only moderately correlated with long-term outcomes like performance and retention in various settings (Credé, Tynan, & Harms, 2016).

In addition, Muenks et al. (2017) suggested that some other traits related to some self-regulation and engagement characteristics are correlated with grit and perhaps even better predictors of behavior than grit. Specifically, they conducted a study in which they had high school and college students complete a variety of self-report surveys including the Short Grit Scale (Duckworth & Quinn, 2009). They found the perseverance of effort subscale of grit to overlap significantly with the trait self-control in both high schoolers and college students (Muenks, Wigfield, Yang, O'Neal, 2017).

Duckworth and Gross (2014) responded to some criticisms of grit's discriminant validity in an article that explained the difference between grit and self-control. They noted that self-control involves a shorter timescale than grit, and they explain that self-control involves resisting alluring alternatives in the moment, whereas grit involves working towards a single goal through setbacks (Duckworth & Gross, 2014). However, this explanation did not test this difference; rather, it only illustrated how the two traits differ conceptually (Duckworth & Gross, 2014). Because of the uncertainty in the literature regarding if grit is the best non-cognitive predictor of success outcomes, grit could benefit from further scrutiny into its unique predictiveness.

The present study sought to replicate previous research that investigates the discriminant validity of grit by measuring it in conjunction with the big five trait conscientiousness, which is a measure of a person's dependability, diligence, and discipline (John & Srivastava, 1999), and self-control, which is a measure of a person's ability to inhibit unconstructive impulses and actively select beneficial, adaptive behaviors (Tangney, Baumeister, & Boone, 2004). Previous research has found that grit is highly correlated with these measures (Credé, Tynan, & Harms, 2016; Muenks, Wigfield, Yang, O'Neal 2017); this study sought to investigate if these findings remain consistent upon further replication.

The Present Study

As described above, the present study investigated factors that may be associated with people's grit scores, which in turn could potentially introduce avenues for future research to explore if these traits function as mediators for the outcomes associated with grit. In addition, this study replicated previous research into the discriminant validity of grit by measuring the conscientiousness and self-control of participants in addition to their grit scores. These scores were analyzed to investigate how correlated the measures are to each other and to evaluate if grit explained a significant amount of the variance in participants' outcome variables above and beyond their conscientiousness and self-control scores.

This study analyzed grit in relation to a number of outcome variables. These variables included GPA, number of majors, number of major changes, number of minors, number of courses with a W on their transcript, the number of AP classes taken in high school, number of AP tests taken, and highest SAT and ACT scores. The variable GPA was the outcome variable of greatest interest because it is an established measure of success outcomes in the literature

surrounding grit (Akos & Kretchmar, 2017; Bowman, Hill, Denson, and Bronkema, 2015; Duckworth, Peterson, Matthews, & Kelly, 2007; Strayhorn, 2014).

Research Questions

1. *Are cognitive failures, fear of failure, or growth mindset associated with participant's grit scores?*

In regard to this research question, I predicted that people who displayed high levels of grit would report a growth mindset, a lesser fear of failure, and fewer cognitive failures (e.g., less distractibility and inattention).

2. *Do the results of this study provide further evidence for the idea that grit is significantly correlated with conscientiousness and self-control?*

In accordance with the findings of Muenks and colleagues (2017), I predicted that grit would be significantly correlated with self-control and conscientiousness, which would indicate that grit may not be an entirely unique, independently useful construct.

Method

Participants

I recruited 165 participants from the JMU psychology participant pool (75.8 percent female; 92 first-years, 53 sophomores, 12 juniors, and 8 seniors). The psychology participant pool consists of PSYC 101 and 160 students, so the participants were undergraduate students at JMU. Individuals had to be at least 18 years old in order to sign up for the study, and they received one point in SONA credit for participating in the study.

Measures

The participants took several assessments online. These scales are outlined below:

Short Grit Scale (Grit-S). The Short Grit Scale (Grit-S) is a eight question version of the grit scale that uses a five-point likert scale to measure responses (Duckworth & Quinn, 2009). The scale asks participants to rate how closely they think a sentence describes them, and the responses ranges from *Not like me at all* to *Very much like me* (Duckworth & Quinn, 2009). It has four questions on the consistency of interest subscale and four on the perseverance of effort subscale (Duckworth & Quinn, 2009). All four consistency of interest questions are reverse coded. Duckworth and Quinn (2009) have found this scale to have good internal consistency with the scale having a Cronbach's alpha level ranging from .73 to .83 depending on the sample; they also found participants grit scores to be stable over time and to not differ between genders. My sample generated a Cronbach's alpha of 0.71 for the overall measure, 0.67 for the consistency of interest scale, and 0.65 for the perseverance of interest subscale.

The Cognitive Failures Questionnaire. The Cognitive Failures Questionnaire (CFQ) is a 25 question, self-report assessment that measures the number of errors a person has made recently in memory, motor skills, and perception (Broadbent et al., 1982; Kass, Beede, & Vodanovich, 2010). It's coefficient alpha level has been reported from 0.79-0.92, and it has been used as a measure of inattention in previous literature (Bridger, Johnsen, & Brasher, 2013; Kass, Beede, & Vodanovich, 2010). According to Rast et al. (2009), this scale contains several subscales, including a distractibility subscale. The Cronbach's alpha for this scale in my study was 0.89 and the subscale was 0.71.

The Performance Failure Appraisal Inventory Short Form. The Performance Failure Appraisal Inventory Short Form (PFAI) is a five item self-report measure that produces an

overall fear of failure score for participants (Conroy, Willow, & Metzler, 2002). The inventory has strong cross validity with the 25-item longer version of the inventory, and it has received a coefficient alpha of 0.72 (Conroy, Willow, & Metzler, 2002). The Cronbach's alpha generated in my research was 0.76.

The Implicit Theories of Intelligence Scale 1999. The Implicit Theories of Intelligence Scale (ITIS) is an eight-item, self-report metric that assesses the extent to which individuals hold an incremental (growth) or entity (fixed) mindset (Dweck, 1999). The scale has four incremental questions and four entity questions, and all of the incremental questions were reversed scored (Dweck, 1999). The scale has demonstrated coefficient alpha levels of 0.82-0.97 (De Castella & Byrne, 2015). This scale received a Cronbach's alpha of 0.93 in my study.

The Ten Item Personality Inventory. The Ten Item Personality Inventory (TIPI) is a short metric of the big 5 personality characteristics that has a subscale for each trait, including conscientiousness (Gosling, Rentfrow, & Swann, 2003). The subscales of the TIPI correlate significantly with the subscales of the Big-Five instrument, a longer and well-established metric of the big five personality characteristics, and the TIPI elicited a strong test-retest correlation ($r = 0.72$) when participants completed the measure twice with a six week gap (Gosling, Rentfrow, & Swann, 2003). In my research, a Cronbach's alpha of 0.64 was generated for this scale overall, and the conscientiousness subscale received an alpha of 0.61.

The Brief Self-Control Scale. The Brief Self-Control Scale (BSCS) is a 13-item, self-report measure of self-control (Tangney, Baumeister, & Luzzo Boone, 2004). It has elicited Cronbach alphas of 0.83 and 0.85 upon investigation, and it appears to be a suitably valid measure of self-control, as indicated by its association with several related characteristics like

GPA, fewer problem drinking patterns, perspective taking, and attachment styles (Tangney, Baumeister, & Luzio Boone, 2004). The Brief Self-Control Scale received a Cronbach's alpha of 0.85 in my study.

Outcome Variables

I measured the following self-reported factors as indicators of academic success and consistency: number of times participants have returned to a summer job or internship, GPA, number of majors, number of major changes, number of minors, number of courses with a W on transcript, number of AP courses taken, and number of AP tests taken highest SAT score, and highest ACT score.

Procedure

Once the participants consented to participate in this study, they took the measures listed above through the online platform Qualtrics. The order in which the participants received the surveys was randomized. After the participants completed these measures, they answered several questions about the outcome variables listed above. Finally, the participants completed the study by filling out a demographic survey.

Results

I completed two separate analyses to investigate the research questions in my study. I explained the analyses I employed for each research question in their respective sections, but the descriptive statistics for both the research questions and all of the outcome variables are listed in Table 1 and Table 2.

The six measures in my study (the Short Grit Scale, the Cognitive Failures Questionnaire, the Performance Failure Appraisal Inventory Short-Form, the Theories of Intelligence, the Ten-Item Personality Inventory, and the Brief Self-Control Scale) used Likert scale response styles. For the sake of my analyses, I scored the scales by averaging participants' responses to the items across each survey, and I reverse coded items as appropriate. The "Items' Range" column in Table 1 depicts the range of values in my scoring scheme possible for each question in the scales.

Table 1
Descriptive Statistics for Both Research Questions

Construct	N	Items'		M	SD
		Range			
Factors of Interest					
Grit Average Overall	165	1 - 5		3.33	0.53
Perseverance Subscale Average	165	1 - 5		3.71	0.62
Consistency Subscale Average	165	1 - 5		2.94	0.68
Cognitive Failures Average Overall	165	1 - 5		2.86	0.53
Distractibility Subscale Average	165	1 - 5		3.00	0.58
Fear of Failure Average	165	1 - 5		3.21	0.80
Growth Mindset Average	165	1 - 6		4.01	0.99
Discriminant Validity Factors					
Self-Control Average	165	1 - 5		3.04	0.66
Conscientiousness Average	165	1 - 7		5.56	1.21

Table 2
Descriptive Statistics for Outcome Variables

Outcome Variables	N	M	SD
Number of Times Returned to Summer Job	137	2.37	1.42
Cumulative GPA	160	3.08	0.40
GPA Last Semester	158	3.11	0.50
Number of Majors Currently Declaring	165	0.98	0.22
Number of Major Changes During College	164	0.48	0.76
Number of Minors	162	0.53	0.66
Number of Ws on Transcript	161	0.29	0.64
Number of AP or IB Classes Taken	163	3.78	2.89
Number of AP or IB Exams Taken	164	2.79	2.43
Highest SAT Score (on 1600 Scale)	121	1191	193.23
Highest ACT Score	72	25	4.77

Throughout the results section, higher scores of the Short Grit Scale corresponded to “gritter” participants, higher scores on the Cognitive Failures Questionnaire indicated participants who experience more cognitive failures, higher scores on the Performance Failure Appraisal Inventory indicated participants who are more afraid of failure, higher scores on the Theories of Intelligence Scale correspond to participants who have more of a growth mindset, higher scores on the Ten-Item Personality Inventory Conscientiousness Subscale indicated participants who are more conscientious, and higher scores on the Brief Self-Control Scale corresponded with participants who display more self-control.

I conducted correlational analyses to determine which outcome variables were significantly correlated with the participants’ grit scores in the sample. The results of this analysis are summarized in Table 3. I used this analysis to pick the outcome variables I would

focus on for my subsequent analysis. I used the Bonferroni correction to control for Type I error, and I had 33 correlational analyses, so the p-value I used to test for significance was 0.002 (0.05/33).

Table 3
Correlations Between Outcomes Variables and Participants' Grit Scores

Outcome Variables	N	Grit Overall	Consistency	Perseverance
			Subscale	Subscale
Number of Times Returned to Summer Job	137	0.14	0.10	0.11
Cumulative GPA	160	0.27*	0.13	0.32*
GPA Last Semester	158	0.30*	0.15	0.37*
Number of Majors Currently Declaring	165	0.06	-0.01	0.12
Number of Major Changes During College	164	-0.04	0.01	-0.07
Number of Minors	162	0.12	0.11	0.09
Number of Ws on Transcript	161	-0.24*	-0.21	-0.18
Number of AP or IB Classes Taken	163	0.14	0.05	0.19
Number of AP or IB Exams Taken	164	0.16	0.12	0.14
Highest SAT Score (on 1600 Scale)	121	0.13	0.10	0.11
Highest ACT Score	72	0.26	0.23	0.20

*Indicates the correlation is significant at $p \leq 0.002$

The outcome variables “GPA Last Semester” and “Number of Ws on Transcript” were both significantly correlated with participants’ grit scores overall at the 0.002 level or below, so I used these two outcome variables in my analyses. I also thought these were valuable outcome variables for the analysis because GPA is often investigated in relation to grit in the literature, and Ws on a transcript could potentially provide insight on grit in relation to a consistency marker.

Research Question One

For my first research question (RQ1), I calculated correlation coefficients between the grit average scores, the two grit subscale scores, the fear of failure average scores, the cognitive failures average scores, the distractibility subscales scores, and the growth mindset average

scores. I ran these correlations to ascertain if there is a significant relationship between grit and any of these variables of interest within my participants' responses. I used the Bonferroni correction to control for Type I error in my correlations. I had 12 correlational hypotheses, so the p-level I required for significance was below 0.004 (0.05/12).

I list the results of my correlational analysis in Table 4. Nine of the twelve correlations I conducted were statistically significant. Overall, the grit scores were not significantly correlated with fear of failure or growth mindset, but they were significantly correlated with cognitive failures and distractibility. Specifically, participants' grit scores overall were most correlated with cognitive failures and distractibility, and participants' scores on the consistency subscale were more correlated with these two factors than their perseverance scores were.

Table 4
Correlations Between Participants' Grit Scores and RQ1 Variables of Interest (N = 165)

	Grit Overall	Consistency Subscale	Perseverance Subscale
Fear of Failure	-0.14	-0.05	-0.20
Cognitive Failures Overall	-0.45*	-0.39*	-0.34*
Distractibility Subscale	-0.42*	-0.39*	-0.28*
Growth Mindset	0.14	0.08	0.16

*Indicates the correlation is significant at $p < 0.004$

I also computed partial correlations for the variables while holding self-control, conscientiousness, and both self-control and conscientiousness constant. I conducted these partial correlations in order to take into account the questions about the distinction between grit and self-control/conscientiousness raised in literature. I used the Bonferroni correction again to control for Type I error, so the new p-value I required for significance was again below 0.004 (0.05/12).

The results of my partial correlation analysis is listed in Table 5. Five of the twelve partial correlations in the section that held conscientiousness constant were significant. In this section, most of the significant partial correlations occurred between the grit scales and the cognitive failures scales, as was the case in the bivariate correlations. However, the participants' perseverance subscale scores were not significantly correlated with the cognitive failures variables when controlling for conscientiousness (Credé, Tynan, & Harms, 2016). For the other two sections in which self-control and both self-control and conscientiousness were held constant, none of the partial correlations were significant.

Table 5

Partial Correlations Between Participants' Grit Scores and RQ1 Variables of Interest (N = 165)

Controlling for Conscientiousness	Grit Overall	Consistency	Perseverance
		Subscale	Subscale
Fear of Failure	-0.18	-0.06	-0.25*
Cognitive Failures Overall	-0.33*	-0.32*	-0.19
Distractibility Subscale	-0.32*	-0.33*	-0.15
Growth Mindset	0.11	0.05	0.13
Controlling for Self-Control			
Fear of Failure	-0.04	0.05	-0.12
Cognitive Failures Overall	-0.19	-0.18	-0.09
Distractibility Subscale	-0.14	-0.19	-0.01
Growth Mindset	0.09	0.02	0.12
Controlling for Conscientiousness and Self-Control			
Fear of Failure	-0.08	0.04	-0.18
Cognitive Failures Overall	-0.16	-0.18	-0.05
Distractibility Subscale	-0.13	-0.19	0.01
Growth Mindset	0.08	0.02	0.11

*Indicates the correlation is significant at $p < 0.004$

Research Question Two

For my second research question (RQ2), I started by calculating the correlations between the participants' grit scores and the two discriminant validity variables: conscientiousness and self-control. I ran these correlations to investigate the strength of association between the participants' grit scores and these related variables. The results of this analysis are summarized in Table 6. I used the Bonferroni correction to control for Type I error, so the new p-value I required for significance was 0.008 (0.05/6). As depicted in this table, all of the correlations between these variables were significant. The positive correlations between these variables suggest that grittier participants displayed higher levels of conscientiousness and self-control.

Table 6

Correlations Between Grit Scores and Discriminant Validity Variables (N = 165)

	Grit Overall	Consistency Subscale	Perseverance Subscale
Conscientiousness	0.45*	0.27*	0.49*
Self-control	0.61*	0.47*	0.52*

*Indicates the correlation is significant at $p < 0.008$

After computing the correlations between the participants' grit scores and conscientiousness and self-control, I conducted a series of multiple linear regressions to investigate if grit is useful in predicting my two selected outcome variables (the participants' GPA last semester and the number of Ws on their transcripts) above and beyond self-control and conscientiousness in the regression models. I ran multiple regressions for each outcome variable. Therefore, I separate out the analyses for these variables into two sections.

Participants' GPA last semester. For this outcome variable, I first ran a multiple linear regression to predict the participants' GPA last semester based on their scores on the

conscientiousness subscale. The results of this regression indicated that conscientiousness explained a significant portion of the variance in participants' GPAs last semester, $R^2 = 0.08$, $F(1, 156) = 13.01$, $p < 0.000$, which suggests that the participant's conscientiousness scores help to explain their GPAs last semester.

I conducted a second analysis to assess if participants' grit scores predicted their GPA last semester above and beyond their conscientiousness scores. Grit was able to explain a significant amount of the variance in the participants' GPAs last semester after taking into account conscientiousness, R^2 change = 0.04, $F(1, 155) = 6.65$, $p \leq 0.011$, which suggests that including grit in the model helps explain a greater amount of variance in the participants' GPAs than taking just conscientiousness into account does. When controlling for the other predictors in the model, the partial correlations between the factors in the second model and the participants' GPA last semester were the following: conscientiousness = 0.16 and grit = 0.20.

Next, I conducted a multiple linear regression to evaluate if participants' self-control scores predicted their GPAs last semester. This regression suggested that participants' self-control scores did significantly predict their GPA last semester, $R^2 = 0.06$, $F(1, 156) = 10.28$, $p \leq 0.002$. Then, I conducted a second analysis to investigate if participants' grit scores could significantly predict their GPAs last semester over and above self-control. The model suggested that grit was able to predict participants' GPA last semester above and beyond self-control, R^2 change = 0.04, $F(1, 155) = 6.03$, $p \leq 0.015$. Thus, taking into account participants' grit scores should explain more of the variance in participants' GPAs than self-control alone. The partial correlations for this model were the following: self-control = 0.08 and grit = 0.19.

After conducting these two sets of regressions, I was interested if participants' grit scores could predict their GPAs above and beyond both self-control and conscientiousness. Therefore, I ran a multiple linear regression and found that grit was able to significantly predict participant's GPAs above and beyond self-control and conscientiousness, R^2 change = 0.03, $F(1, 154) = 4.48$, $p \leq 0.036$, which indicates that accounting for participants' grit scores accounts for more variance in their GPAs than accounting for only self-control and conscientiousness. For this model, the partial correlations between the predictors and participants' GPA last semester were the following: self-control = 0.02, conscientiousness = 0.14, and grit = 0.17.

Number of Ws on Transcript. For this outcome variable, I first ran a multiple linear regression to determine if conscientiousness could significantly predict the number of Ws on a participant's transcript. I also included the participants' year at school (ie. first-year, sophomore, junior, or senior) because an one-way ANOVA analysis indicated that there is significant difference in the number of Ws on participants' transcript based on their year at school, $F(3,157) = 5.99$, $p \leq 0.001$. Therefore, I wanted to take this variable into account in the model. According to the regression, conscientiousness and year in school did significantly predict number of Ws on a transcript, $R^2 = 0.16$, $F(2, 158) = 14.57$, $p \leq 0.000$.

Next, I wanted to determine if grit could predict the number of Ws on a participants' transcript over and above conscientiousness and year in school. Therefore, I ran a multiple linear regression, and the regression suggested that grit did predict number of Ws on the participants' transcripts over and above year in school and conscientiousness, R^2 change = 0.02, $F(1, 157) = 3.98$, $p \leq 0.048$, which suggests that including grit in this model explains significantly more variance in the number of Ws on the participants' transcripts than year in school and

conscientiousness alone. The partial correlations for this model were as follows: grit = -0.16, year in school = 0.32, and conscientiousness = -0.18.

After completing these two analyses, I wanted to compare this outcome variable to grit and self-control. In order to carry out this analysis, I first conducted a multiple linear regression to determine if self-control and year in school could significantly predict number of Ws on a participant's transcript. According to the regression, year in school and self-control did significantly predict number of Ws on transcript, $R^2 = 0.14$, $F(2, 158) = 12.86$, $p \leq 0.000$.

Second, I completed a multiple linear regression to determine if grit could predict number of Ws on a transcript above and beyond self-control and year in school, and the regression revealed that grit does not significantly predict number of Ws beyond self-control and year in school, R^2 change = 0.02, $F(1, 157) = 3.58$, $p \leq 0.060$. The new model does approach significance, though. This result indicates that taking participants' grit scores into account does not significantly increase the amount of variance in this outcome variable explained above simply taking self-control and year in school into account. Since grit was not a significant predictor in this model over and above self-control and year in school, I did not regress conscientiousness, self-control, year in school, and self-control all together. The partial correlations for this regression were as follows: grit = -0.15, self-control = -0.11, year in school = 0.31.

Discussion

Research Question One

For this question, I investigated if the factors of interest in my study (cognitive failures, fear of failure, and growth mindset) were associated with the participants' grit scores. I predicted

that participants who displayed more grit (through self-report) would exhibit higher levels of growth mindset and lower amounts of cognitive failures and fear of failure. As discussed in the results section, higher scores on the Grit Scale and the Cognitive Failures Questionnaire corresponded with participants who display higher levels of these factors. Similarly, higher scores on the Performance Failure Performance Inventory and the Implicit Theories of Intelligence Scale corresponded with participants who display higher levels of these factors.

Cognitive Failures and Grit. In regard to cognitive failures, there were significant bivariate correlations between all three grit scores (the full scale score, the consistency subscale score and the perseverance subscale score) and both sets of cognitive failures scores (the full scale score and the distractibility subscale score) (see Table 4). These correlations remained significant in the grit scale overall and the consistency of interest subscale even when controlling for conscientiousness. Given that the correlation between participants' grit scores and cognitive failures scores were negative, these results suggest that people who display high levels of grit report experiencing cognitive failures less frequently. These findings provide support for my hypothesis that there would be significant, negative association between participants' grit scores and their tendency to experience cognitive failures, like mind wandering.

These results support the findings of Ralph and colleagues (2017), who identified a significant relationship between participants' grit scores and their tendency to mind wander. In particular, Ralph and colleagues noted that participants' scores on the consistency of interest subscale were able to predict their tendency to spontaneously mind wander over and above conscientiousness, but that their perseverance subscale scores could not. I found similar results in that grit overall and consistency remained significantly correlated with cognitive failures when

controlling for conscientiousness, but perseverance did not. This finding is quite interesting because many researchers have found the perseverance subscale of grit to have a stronger association with success outcomes than the consistency subscale (Credé, Tynan, & Harms, 2016). However, in both my study and Ralph et al's work, the consistency scale was a better marker of participants' tendency towards cognitive failures than perseverance was. As echoed in Ralph et al's work, perhaps consistency has been overlooked in grit research because psychologists have not been asking the right questions to showcase its value.

Overall, as articulated by Ralph and colleagues (2017), the association between grit and cognitive failures challenges the notion that grit is independent of cognitive ability (Duckworth et al., 2007). If people who display more grit report fewer cognitive failures, perhaps something about their perseverance and consistency in long-term goals impacts their cognition. Or conversely, perhaps something in their cognition impacts their perseverance and consistency in completing long-term goals. Since this study relied on correlation data, it is difficult to parse out the true nature of this relationship. These findings simply seem to suggest that there may be some type of association between grit and cognitive failures.

Furthermore, the National Institute of Mental Health lists distractibility, a subtype of cognitive failure measured in the CFQ, as a behavior associated with cognitive control. Distractibility is just one behavior involved with one of the sub-constructs of cognitive control (goal selection), so it is not representative of the entire cognitive control construct. However, since there is a significant correlation between grit and distractibility (and cognitive failures overall) in this study, it may be interesting for future research to investigate if there are any relationships between grit and other components of cognitive control.

Fear of Failure and Grit. Contrary to my findings concerning cognitive failures, there were no significant bivariate correlations between participants' scores on the Short Grit Scale and the Performance Failure Appraisal Inventory. Thus, this finding did not support my prediction regarding the association between these factors. This result is quite surprising considering the current literature looking at grit and fear of failure. DiMenichi & Richmond (2015) and Lucas and colleagues (2015) both found associations between grit and failure-relevant behaviors (completing a failure inducing task and reflecting on failure, respectively). Both of these studies, though, investigated grit in relation to participants' *behaviors* toward failure. I looked at grit in conjunction with participants' self-reported fear of failure. Perhaps the discrepancy between my results and those authors' findings arose because of the difference between self-report and behavior-based data. People could report, and even feel, that they are terrified of failure, but still respond proactively and productively to failure in real life. An interesting question for future research could be to look at grit in conjunction with both self-report and behavior-based metrics of people's responses to failure to investigate if there is a discrepancy in how gritty people feel and act towards failure.

Interestingly, a significant partial correlation emerged between fear of failure and the perseverance subscale of grit when conscientiousness was held constant. This finding is somewhat unexpected because past researchers have found that conscientiousness often explains much of the same variance in various outcome variables as grit does (Credé, Tynan, & Harms, 2016). Therefore, it is intriguing that this correlation would turn up when holding participants' conscientiousness constant. Perhaps participants' variance in conscientiousness can work to mask some of the relationship between grit and fear of failure. Also, the Cronbach's alpha for the

conscientiousness subscale used in this research was a somewhat low. Thus, perhaps issues with the internal consistency of the conscientious measure (which only had two questions) disrupted significant correlations that could have arisen between grit and fear of failure if the conscientiousness measure had not been adding noise to the data. Given that higher scores on the grit scale corresponded with gritter participants, the negative partial correlation between the perseverance subcomponent of grit and fear of failure implies that as participants become more gritty, they became less afraid of failure. This finding would support my initial hypothesis that participants' who display more grit are less afraid of failure; however, this significant correlation cannot carry too much weight in the context of the non-significant bivariate correlational findings.

Growth Mindset and Grit. Similar to my findings concerning fear of failure, there were not significant correlations between participants' scores on the Grit Scale and the Implicit Theories of Intelligence Scale. Therefore, my prediction concerning the association between grit and mindset was not supported. This result is consistent with the findings of Dixson, Roberson, and Worrell (2017), who found only a moderate association between the perseverance subscale of grit and growth mindset and no significant association between the consistency subscale of grit and growth mindset. This result does seem relatively surprising, however, given the conceptual similarity between grit and growth mindset. Both factors seem to involve some amount of perseverance and proactive response to failures, as found by Hong and colleagues (1999) for growth mindset and suggested by Duckworth et al (2007) for grit. Yet perhaps different mindsets are present in people who display high amounts of grit and people who have a growth mindset. People who exhibit grit may persevere through their long-term goals without

viewing their intelligence as malleable. In fact, perhaps they even think they are capable of persevering through their goals because they believe they have a “fixed” competence in their chosen domain.

Research Question Two

For this question, I investigated a theme that is very prominent in the grit literature: the discriminant validity of grit. Specifically, I looked at conscientiousness and self-control, which are two factors that researchers have identified as having significant overlap with grit (Credé, Tynan, & Harms, 2016; Muenks, Wigfield, Yang, O'Neal 2017). I investigated these factors in conjunction with a eleven outcome variables, but I narrowed down the outcome variables in my regression analyses to two because many of the outcome variables did not correlate significantly with grit (see Table 3).

I selected the outcome variables “number of Ws on a participant’s transcript” and “GPA last semester” because they both were significantly correlated with at least one of the grit scores. High scores on the grit scale correspond to people displaying high amounts of grit; thus, gritty participants displayed higher GPAs and fewer Ws on their transcripts. Also, number of Ws on a participant's transcript seemed like an interesting outcome variable because it seems conceptually as if it could have an association with consistency, and GPA is an established success variable paired with grit in the literature (Akos & Kretchmar, 2017; Bowman, Hill, Denson, & Bronkema, 2015; Duckworth, Peterson, Matthews, & Kelly, 2007; Strayhorn, 2014).

In order to investigate the discriminant validity of grit, I computed correlations between grit and self-control/conscientiousness. I predicted that there would be a significant correlation between grit and both self-control and conscientiousness. My findings supported my prediction,

as my results showed significant correlations between all the grit scores and both self-control and conscientiousness (see Table 6). This finding therefore provides further evidence for the idea that there is a high degree of overlap between grit and both conscientiousness and self-control.

That being said, I also ran several regressions that investigated if grit can explain variance in participants' scores on the outcome variables above and beyond self-control and conscientiousness, and in many of these models, grit was able to significantly explain variance above and beyond these two factors. Specifically, grit was a significant predictor in my models for GPA last semester above and beyond conscientiousness, self-control, and both factors together. In addition, grit was a significant predictor in my models for number of Ws on a transcript above and beyond conscientiousness (but not self-control, though grit did approach significance in that model). Furthermore, though the correlations between grit and both self-control and conscientiousness were significant, some of these correlations were only of medium strength. (see Table 6). And even the correlations that were of large strength did not seem so huge as to indicate that the scales were functionally indistinguishable. These findings suggest that although there is a significant correlation between grit and these two factors, grit may still be usefully associated with people's success outcomes beyond conscientiousness and self-control.

Limitations. This study contained a variety of limitations that impact that strength of its findings. First, it relied on self-report data, which is often not the most reliable or accurate form of data collection. Second, it had a small sample size, particularly for the outcome variables, as many participants did not answer all of the outcome variable questions. This sample size likely makes the findings in this study less generalizable to the wider population. In a similar vein,

some of the scales in my research generated rather low reliability statistics (especially the grit subscales and the TIPI), which impacts the reliability and thus also the generalizability of this data. Third, the data was all collected at one time point. Many of these findings would be more interesting if they were based on outcome variables collected at multiple time points, as then I could potentially analyze grit as a predictor for these outcome variables or one of the factors of interest as a mediator for grit's outcomes. As it stands, I can only investigate the association between grit and these variables. Finally, the results of this study are correlational. Thus, I cannot determine the nature of the relationships (ie. causal) between the variables in this study: I can only determine that they are associated in my sample.

Future Research. Despite these limitations, this research does raise a number of questions that would be interesting for future research to explore. For example, it would be interesting for future researchers to look at other components of cognitive control and grit together to see if more aspects of this construct are associated with grit. In addition, given my findings concerning the association between grit and cognitive failures, researchers down the line could investigate if cognitive failures potentially works as a mediator for grit's outcomes. Also, based on the findings between grit and fear of failure, future researchers could investigate the manner and extent to which gritty people differ in how they self-report their response to failure and how they actually behave in response to failure. This research could shed more light both on the construct of grit and the discrepancy between what people self-report and how they behave.

Based on these findings, it seems that grit is still a rich area for future research. It is strongly associated with conscientiousness and self-control, but it appears that it potentially could still be useful in learning about success outcomes beyond these variables. Therefore, and

since grit is frequently paired with positive outcomes and success in general, researching grit has the potential to help psychologists learn about the factors that help people succeed. And such research could be used eventually to help people experience positive outcomes and greater success in life.

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