

SHOULD WE GIVE A GRIT ABOUT MOVEMENT? EXAMINING THE
RELATIONSHIPS AMONG MINDSET, GRIT, SELF-EFFICACY, AND
EXERCISE BEHAVIOR

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ABSTRACT

Researchers and health care professionals agree that living an inactive lifestyle negatively impacts individuals and communities (Centers for Disease Control and Prevention [CDC], 2018; Lee et al., 2012), and ongoing research highlights the benefits for adults achieving a recommended 150 minutes of physical activity (PA) per week (CDC, 2018; US Department of Health and Human Services [HHS], 2018; Warburton, Nicol, & Bredin, 2006). However, despite these benefits, only 20% of individuals comply with these recommendations (American College Health Association [ACHA], 2017; Blackwell & Clarke, 2018; HHS, 2018). A recent area of research to address this issue explores psychological non-cognitive skills in predicting exercise behavior (Orvidas et al., 2018; Walton, 2014; Wilson, 2006; Yeager & Walton, 2011). The current study explored the relationships among college student exercise behavior and non-cognitive skills: exercise self-efficacy, grit, and mindset. In Phase 1 (quantitative portion) of the study, participants ($N = 366$) completed a survey online assessing the above variables as well as collecting various demographic information. In Phase 2 (qualitative portion), participants ($n = 10$) were interviewed to further explore the variables and potentially help explain the quantitative results.

Phase 1 data were analyzed through Pearson correlations, linear and multiple regressions, and MANOVAs. Results showed that Grit (Grit-S), Grit-Perseverance (Grit-P), Mindset (ITF), and Exercise Self-Efficacy (ESE) were significantly positively correlated with college student exercise behavior; however, all correlations were weak, with the exception of ESE being moderately correlated. Grit-Interest (Grit-I) was not significantly correlated. Furthermore, the results of the regression analysis showed only

ESE making a significant contribution to the variance, further suggesting it as a moderately strong predictor of exercise behavior. In terms of the relationship between the variables, results showed that Grit-S was significantly strongly positively related to Grit-P and Grit-I and significantly, but weakly, positively related to ITF and ESE. In addition, ITF and ESE were significantly, but weakly, positively related. Finally, the sample was split into three groups: Insufficiently Active (IA), Active (A), and Highly Active (HA) based on adapted HHS 2018 PA Guidelines. Overall, the groups were significantly different. Specifically, the HA group reported significantly higher Grit, Grit-P, Mindset, and ESE than the IA group. The A group was only significantly different from IA and HA groups for ESE. However, the differences, again, had marginal effect with the exception of ESE.

The current study reinforces the importance of ESE in exercise behavior, which seems to hold true for college students. In addition, it sheds light on the domain-specificity of non-cognitive skills, the need for continued analysis of measurement scales, the uni- or multi-dimensionality of constructs, particularly Grit, and the necessity of further research on the connection between non-cognitive skills and exercise behavior.

Keywords: Grit, mindset, self-efficacy, non-cognitive skills, exercise behavior, college students, perseverance, goal-setting

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TABLE OF CONTENTS

	Page
ABSTRACT.....	iii
ACKNOWLEDGEMENTS.....	v
LIST OF TABLES.....	xii
LIST OF FIGURES.....	xiii
 CHAPTER	
1. INTRODUCTION.....	1
Current Study	7
Statement of Problem	9
Research Questions.....	9
Limitations.....	10
Delimitations.....	10
Definition of Terms.....	11
2. REVIEW OF LITERATURE.....	17
Physical Inactivity.....	17
Non-Cognitive Skills.....	22
Grit.....	26
Mindset/Implicit Theory.....	30
Self-Efficacy/Exercise Self-Efficacy.....	33
Positive Psychology.....	35
Methodological Choices.....	37
Quantitative Choices.....	38

Qualitative Choices	40
3. METHODOLOGY.....	42
Research Design.....	43
Study Timelines.....	43
Participants.....	44
Instrumentation.....	47
Procedures.....	51
Data Analysis.....	53
Bias Statement.....	54
4. RESULTS AND DISCUSSION.....	57
Descriptive Data.....	58
Results of Research Question 1.....	59
Results of Research Question 2.....	62
Results of Research Question 3.....	64
Additional Analysis.....	69
Qualitative Analysis Process.....	72
Discussion of Research Question 1.....	90
Discussion of Research Question 2.....	100
Discussion of Research Question 3.....	104
Discussion of Additional Analysis.....	108
General Discussion.....	110
Limitations.....	115
Recommendations for Practitioners.....	117

Recommendations for Researchers.....	119
5. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS FOR FUTURE RESEARCH.....	123
Conclusions.....	125
Future Research Recommendations.....	126
REFERENCES CITED.....	129
APPENDICES	
A. RECRUITMENT EMAILS.....	156
B. INTERVIEW INQUIRY.....	158
C. GRIT-S SCALE.....	159
D. IMPLICIT THEORY OF FITNESS SCALE.....	161
E. EXERCISE SELF-EFFICACY SCALE.....	162
F. PHYSICAL ACTIVITY VITAL SIGN MEASURE.....	163
G. DEMOGRAPHICS.....	164
H. QUALITATIVE INTERVIEW.....	165

LIST OF TABLES

Table	Page
3.1	Participants – Gender and Race Demographics.....45
4.1	Means and Standard Deviations for Quantitative (Phase 1) and Qualitative (Phase 2) Samples.....58
4.2	Correlations for All Participants Between Non-Cognitive Variables and Total Minutes of PA (PAVS)60
4.3	Summary of Regression Analysis for Variables Predicting PA (minutes).....61
4.4	Correlations Matrix Between All Non-Cognitive Variables.....63
4.5	Means and Standard Deviations for All Variables in adapted HHS 2018 PA Guidelines Groups.....65
4.6	MANOVA Tests of Between-Subject Effects – HHS 2018 PA Guidelines.....66
4.7	Means and Standard Deviations for Variables According to Gender.....70
4.8	Two-Way MANOVA Conducted According to Gender.....70
4.9	Correlations Matrix for All Variables According to Gender.....71
4.10	Descriptive Information for Qualitative Participants (Phase 2).....73
4.11	Qualitative Themes and Representative Meaning Units.....75
4.12	Sample Responses to “What is Grit, and How Gritty Do You Think You Are?”86
4.13	Sample Responses to “What is Mindset, and What is Your Mindset About Physical Activity”?88
4.14	Consistency of Grit and Mindset Answers for HHS PA Levels.....107

LIST OF FIGURES

Figure	Page
4.1 Scatterplot of Multiple Regression ALL Variables Predicting Total PA.....	62
4.2 PAVS Means Across HHS 2018 PA Groups.....	66
4.3 Grit-S Means Across HHS 2018 PA Groups.....	67
4.4 Grit-I Means Across HHS 2018 PA Groups.....	67
4.5 Grit-P Means Across HHS 2018 PA Groups.....	68
4.6 Mindset (ITF) Means Across HHS 2018 PA Groups.....	68
4.7 ESE Means Across HHS 2018 PA Groups.....	69

CHAPTER 1

INTRODUCTION

“If there were a drug that could do for human health everything that exercise can, it would likely be the most valuable pharmaceutical ever developed” (Oaklander, 2016, p. 54). After all, engaging in regular physical activity provides benefits that people may fail to obtain any other way. Regular sessions of moderate-to-vigorous physical activity (MVPA) can prevent numerous non-communicable chronic diseases, improve physical functioning and sleep quality, reduce anxiety and depression, and improve cognition throughout the day (US Department of Health and Human Services [HHS], 2018; Rhodes, Janssen, Bredin, Warburton, & Bauman, 2017; Warburton, Nicol, & Bredin, 2006). Even a single session of MVPA can help, and depending on the current level of physical activity in which an individual is engaging, even if someone is completely inactive, simply moving their body at higher levels than they are currently could prove to be important to overall health and quality of life (HHS, 2018).

One of the main issues is that even with this growing body of knowledge of the benefits, only 20% of Americans engage in recommended levels of physical activity and muscle strengthening per week, and a shocking 80.2 million Americans are entirely inactive (Oaklander, 2016). In fact, less than half of our adult population (48%) engages in recommended levels of daily MVPA aerobic physical activity (HHS, 2018; Kann et al., 2018; Ogden et al., 2014). If we isolate adolescents and young adults from these statistics, nearly 73% of high school students do not reach these recommended daily levels of physical activity (Centers for Disease Control [CDC], 2018; Kann et al., 2018). Perhaps not surprisingly, the population of 20 million college students (United States Department of Education, 2017) from 18-24 years of age nearly mirrors the above

numbers. Currently, approximately 47% of all college students engage in the recommended 150 minutes of physical activity to meet the government's Physical Activity Guidelines for Americans, and nearly 22% had no daily physical activity at all (American College Health Association [ACHA], 2018). Despite this growing knowledge and corresponding evidence that exercise has a powerful positive impact on many areas of our health, there are still severe deficits in physical activity and exercise in our society and, with them, deficits in prevention, intervention, and promotion. The reasons for this lack of compliance are complex such as family influence, genetics, where someone lives, cultural attitudes and differences, illness, disabilities, climate, age, cost, access, knowledge, time, and work, and exploring ways to motivate individuals to be more active has been common. However, it is rare for interventions which encourage physical activity to cause an actual behavior change (beyond the duration of the actual intervention).

Considering all of these barriers, there are numerous reasons why the college population is one that is worthy of further research in the area of physical activity. Not only are the numbers of those who fail to reach the recommended amount of MVPA significant, regardless of age, research also shows that physical activity levels continue to decrease with age, with the most dramatic decrease seen in late adolescence and as students enter college (Judge et al., 2012; Li et al., 2016). In addition, this is also an interesting subgroup, as this population of college students is transitioning into a time of newly found independent living and adopting their own habits in diet and physical activity beyond their family unit (Deng, Castelli, Castro-Pinero, & Guan, 2011). Finally, this is a population that is worth investigating, as the low MPVA engagement seen in high school and recent adolescent population research also shows that students typically

maintain this low level through transition into adulthood (Li et al., 2016). Thus, how they engage in physical activity during the college years often translates to how they will engage later in life. Thus, the time spent on college campuses could be an untapped space in which to further research and encourage MVPA among this population through a variety of studies and possible intervention approaches.

One potential area of research in positively impacting physical activity levels to combat this physical inactivity pandemic is examining individual non-cognitive skills, which have also been labeled as psychological traits, character traits, soft skills, or even competency skills (e.g., self-control, persistence, motivation, hardiness, perseverance, creativity, grit, and mindset). The thinking, perhaps, is that there could be a positive influence of these non-cognitive skills in enduring and overcoming the challenges that come with sustaining positive forms of physical activity. Previously, these non-cognitive skills have been found to be predictive of achievement in completing difficult tasks, above and beyond talent and intelligence (Duckworth & Quinn, 2009). Although this “achievement” has primarily been examined in educational pursuits, there has been research, albeit fairly new, that the concept can be broadened to include non-educational pursuits: athletics, exercise behavior, weight, fitness, and overall health (Burnette, 2010; Orvidas, Burnette, & Russell, 2018; Reed, 2014; Reed et al., 2010). Non-cognitive traits have also been examined more recently to highlight potential predictors of exercise adherence, as well as examining self-motivation and self-efficacy; many of these non-cognitive skills are also believed to be malleable and possibly responsive to interventions (Credé, Tynan, & Harms, 2017).

Non-cognitive traits were initially associated most readily with Digman's (1990) "Big Five" five-factor model (FFM) including such personality factors as industriousness and conscientiousness, with these factors being the skills most often associated with health behavior (Reed, 2014). These five-factor model traits (e.g. agreeableness, extraversion, openness, etc.) and others like them are seen as important; however, they are now being seen as not exhaustive of all descriptions of personality (Digman, 1990; Duckworth, Peterson, Matthews, & Kelly, 2007; Reed, 2014). More recent discussions of individual personality connected to success and peak performance have looked at additional traits, such as resilience, hope, self-control, grit, and mindset, as being potential predictors of individual success in various areas (Duckworth, 2009, 2016; Duckworth et al., 2007; Duckworth & Quinn, 2009; Duckworth & Seligman, 2017; Dweck, 2010; Kalia, Fuesting, & Cody, 2019). However, the term "traits" or even "non-cognitive" could both be considered misnomers for these concepts, with research now acknowledging these personality entities with the potential for being developed over time and malleable instead of merely dispositional (Burnette, O'Boyle, VanEpps, Pollack, & Finkel, 2013; Credé, 2017; Duckworth, 2016; Dweck, 2006).

The focus of the current study examined primarily the non-cognitive work of Duckworth and Dweck, as well as Bandura's self-efficacy in the context of exercise behavior. First, both Duckworth's (2016) and Dweck's (2006) bodies of work have examined why some people persevere while others simply give up and move on to other tasks or interests, and they did this examination through the contexts of grit (Duckworth) and implicit theory, also known as mindset (Dweck). Through research, Duckworth and colleagues (2007) postulated that grit could be built and that it could be done so

potentially through interventions that focused on cultivating a growth mindset rather than a fixed one (although growth mindsets are not always positive and fixed mindsets are not always negative) and found strong correlations that suggested this outcome. However, not all research has observed the same strong correlations (Myers, Wang, Black, Bugescu, & Hoeft, 2016; Wilson, 2016).

Grit, mindset, and self-efficacy have shown various levels of predictive capability in areas of intellectual and academic pursuits. But studies have also connected grit, mindset, and self-efficacy to successful performance in spaces such as the military, educational settings, classrooms, marriages, careers, law firms, and even in types of problem solving (Duckworth et al., 2007; Duckworth & Quinn, 2009; Dweck, 2006; Eskreis-Winkler, Shulman, Beal, & Duckworth, 2014; Hogan, 2013; Kalia et al., 2019). It is reasonable to postulate, then, that this predictive capability may also pertain to an individual's ability to begin and maintain the necessary behavior to eventually experience beneficial effects of exercise. According to Reed (2014), “. . . grittier individuals may be more likely to pursue activities such as exercise with subtle intrinsic rewards persistence and effort, but ripe with barriers and setbacks such as boredom, lack of time, and injury” (pp. 400-401). To date, few studies have connected one or more non-cognitive skills to sport, physical activity, and exercise (Orvidas et al., 2018; Reed, 2014; Reed, Pritschet, & Cutton, 2012; Yeager et al., 2014), with the current study being one of the first to examine grit, mindset, and self-efficacy together within the PA context, as well as one of the first to gather qualitative data to capture the experience participants have with non-cognitive skills and PA. Thus, identifying these non-cognitive skills as possible predictors of participation in regular exercise within a college population, and adding

qualitative data, is a novel and important pursuit. Equally novel and important is the current research study's examination of these non-cognitive skills in combination with the well-researched construct of exercise self-efficacy to determine potential connections to exercise behavior and between all variables.

Numerous interventions have been conducted in hopes of increasing MVPA at the individual, small group, and community-wide levels (Howlett, Trivedi, Troop, & Chater, 2018; Rhodes et al., 2017), including on college campuses (Ferrara, 2009). Many interventions have also focused on the role of self-efficacy in the motivation and maintenance of exercise (e.g., Brown & Sherman, 2017; Hutchins, Drolet, & Ogletree, 2010; Maycock & Cassidy, 2016; Neupert, Lachmann, & Whitbourne, 2009). Self-efficacy connected to exercise and fitness has been shown to enhance resiliency and “reinforces interest in and commitment to regular exercise” (Maycock & Cassidy, 2016, p. 2). It has also been debated if self-efficacy is not only likely to mediate the impact of exercise on positive health (Maycock & Cassidy, 2016; Rhodes et al., 2017) but also if it can predict physical activity behavior in healthy adults (Ashford, Edmunds, & French, 2010; Sharma, Sargent, & Stacy, 2005). Self-efficacy has even recently been considered as a non-cognitive skill itself and has been included with grit and mindset as part of a single non-cognitive factor with strong inter-item correlations (Bowman, Miller, Woosley, Maxwell, & Kolze, 2019; Stankov & Lee, 2014). This connection between self-efficacy and exercise was another important concept to explore, as the current research examined connections between not only self-efficacy and physical activity but also the potential connections between self-efficacy, physical activity, grit, and mindset. The current research also examined how grit, mindset, and exercise self-efficacy correlate

with and predict exercise behavior as measured in total minutes per week when the sample was delineated into three groups adapted from the HHS 2018 PA Guidelines (Insufficiently Active [IA], Active [A], and Highly Active [HA]).

In short, what researchers have shown over time is a drastic decline in physical activity and exercise in our society and, with it, neglected prevention and an increase in obese, overfat, and overweight children, adolescents, and adults along with an increase in all-cause mortality, particularly with cardiovascular disease (CDC, 2018; World Health Organization [WHO], 2018). Too many people in the world have had a decline in their daily physical activity. No longer do people move as a significant part of their daily lives, with technology, machines, vehicles, and other advances decreasing the need or desire to move, and forms of movement that once were necessary to function in past generations having been replaced with inactive and insufficiently active lifestyles. In addition, despite the accumulating evidence that these IA lifestyles cause serious chronic health problems, severe economic burdens, and decreases in life expectancy and quality of life, statistics show that people across the globe in every age bracket are still not engaging in physical activity at recommended amounts (CDC, 2018; WHO, 2018). Ultimately, the college population being examined in the current study could be a critical one on which to focus, yet this population tends to be overlooked and under-researched, especially when examining physical activity levels of the larger American public (Nelson, Story, Larson, Neumark-Sztaine, & Lytle, 2008).

Current Study

Grit and mindset have been shown to be predictive of success in a variety of domains; however, these concepts have not been explored readily with exercise self-

efficacy and exercise behavior. This study explored the role of grit and mindset within this context, including gathering both quantitative and qualitative data. Using a positive psychology backdrop, an explanatory sequential mixed-methods study was conducted in which the quantitative data informed selection of the participants for the qualitative data collection. Four major theoretical models guided the study: grit theory, implicit theory/mindset theory, positive psychology, and social cognitive/self-efficacy theory. The purpose of this study was to examine the relationships among the non-cognitive skills of grit, mindset, and exercise self-efficacy and self-reported exercise behavior in a sample of college students. When correlations between grit, mindset, exercise self-efficacy, and/or exercise behavior were found, I examined the non-cognitive skills as possible predictors of this exercise behavior as measured by total minutes per week. Additionally, I explored the perceptions of the concepts of grit, mindset, exercise self-efficacy, and exercise behavior with this sample through structured interviews. Finally, the variables were examined through groups adapted from the HHS 2018 Physical Activity Guidelines: Inactive/Insufficiently Active (IA), Active (A), and Highly Active (HA). The outcomes of this study could provide insight into how non-cognitive skills such as grit, mindset, and exercise self-efficacy could positively influence current and future health and fitness behaviors.

Researchers and health care professionals agree that living a sedentary, inactive lifestyle negatively impacts individuals and communities in a myriad of ways: physically, mentally, emotionally, intellectually, etc. (Gomez-Lopez, Granero Gallegos, & Baena Extremera, 2010). Both beginning and maintaining physical activity at the recommended levels (150 minutes/week) can be challenging, and interventions often seek ways to

encourage individuals and populations to do both. Furthermore personality traits, also known as motivational traits, psychological skills, or more recently known as non-cognitive skills (Borghans, Duckworth, Heckman, & Weel, 2008; Dweck, Walton, & Cohen, 2014; Heckman & Rubinstein, 2001; Zhou, 2016), such as grit and mindset, can be predictive of achievement in difficult tasks above and beyond talent and intelligence. Although this “achievement” has been primarily perceived in educational pursuits, there has been some initial research that the concept can be broadened to include non-educational pursuits (Burnette, 2010; Duckworth et al., 2007; Orvidas et al., 2018; Reed, 2014; Reed et al., 2010). In this study, the “pursuit” was one of regular participation in PA, as well as the examination of the impacts of exercise levels on participant non-cognitive skills of individual grit, mindset, and exercise self-efficacy (Orvidas et al., 2018; Walton, 2014; Wilson, 2006; Wilson & Dishman, 2015; Yeager & Walton, 2011).

Statement of the Problem

The purpose of this study was to explore the relationships among grit, mindset, exercise self-efficacy, and exercise behavior in a college student sample.

Research Questions

The following research questions were examined in this study:

1. Are perceived non-cognitive skills (grit, mindset, and self-efficacy) related to college student exercise behavior?
2. Are perceived non-cognitive skills related to one another in a college student population?
3. Are there differences in non-cognitive skills between college students based on their exercise behavior level (Insufficiently Active, Active, and Highly Active)?

Limitations

The following limitations were present in this study:

1. One potential limitation was bias that may be inherent in participant self-selection into the overall study. There may be inherent characteristics in who chose to opt in and who chose not to opt in that could affect the outcome of the study. Also, a modest sample size and characteristics of students who chose to volunteer for inclusion in the qualitative portion could also be considered a limitation when reviewing results.

2. A second possible limitation was the use of a data collection method utilizing self-report measures that could allow participants to misrepresent themselves (either intentionally or unintentionally) in trying to present an ideal self because they were in a study context, especially questions that asked for information about exercise behaviors.

3. A third limitation was using a non-representative sample. First, access to the student population already connected to campus recreation services was utilized at one large public university in the Northeast. This limited the generalizability to other college populations and to a population who would not choose to willingly register for campus recreation services on a college campus.

Delimitations

The following delimitations were present in this study:

1. One potential delimitation was setting the inclusion and exclusion criteria. In choosing to include student participants who were already connected with campus recreation services on the campus, the results could have been skewed. Also, including solely undergraduate students in both the quantitative and qualitative phases of the study

eliminated potential participants; graduate students, faculty, and alumni who received the recruitment emails were removed.

2. A second delimitation was the choice of which non-cognitive variables were included in the study. Examining non-cognitive traits in connection with performance in many domains has become a recent focus of many areas of research: e.g. psychology, education, and business. Choosing specifically grit, mindset, and self-efficacy to examine relationships to exercise behavior was an important choice.

3. A third delimitation was the choice of framing the study with specific theories: positive psychology, grit, implicit theory (mindset), and social cognitive theory, including self-efficacy.

Definition of Terms

Active (A). A category from the Health and Human Services 2018 Physical Activity Guidelines (HHS 2018 PA Guidelines) that defines individuals who engage in the recommended 150 to 300 minutes of at least moderate-intensity activity per week (HHS, 2018). The same definition and label applied to the current study.

Exercise behavior. This is defined as a health-related behavior and is considered a subset of physical activity (Berger, Pargman, & Weinberg, 2007). It can be measured in a variety of ways. In the current study, this construct will be measured by using the Physical Activity Vital Sign (PAVS) assessment that has been used in clinical and research settings (Ball, Joy, Gven, & Shaw, 2016). It assesses the quantity of physical activity (in minutes of PA) a person performs in a typical week (Ball et al., 2016) and is meant to provide an initial identification of individuals not currently meeting the HHS physical activity guidelines (Wald & Garber, 2018).

Exercise self-efficacy (ESE). This is defined as an individual's belief in their ability to undertake and complete a task or goal; in this case, the focused task or goal is related to exercise behavior (Neupert et al., 2009). The brief, nine item Exercise Self Efficacy (ESE) scale will be used as an assessment to measure individual's self-efficacy level for exercising in a variety of situations. The scale was created as a revised version of Bandura's (1997, 2004) original exercise self-efficacy scale (Neupert et al., 2009).

Fixed mindset. A mindset that assumes that our abilities and intellect are static and unable to be changed (Dweck, 2006).

Grit. This can be defined as "perseverance and passion for long-term goals and . . . working strenuously toward challenges, maintaining effort and interest over years despite failure, adversity, and plateaus in progress" (Duckworth et al., 2007, p. 1087) as measured by the Short Grit (Grit-S) scale. After taking this assessment, individuals receive a grit score with a maximum score of five (extremely gritty) and a low score of one (not at all gritty) (Duckworth, 2016).

Growth mindset. A mindset that sees abilities and intellect as malleable, and failure is seen as an opportunity for growth and expansion of current abilities (Dweck, 2006).

Health and Human Services 2018 Physical Activity Guidelines (HHS 2018 PA Guidelines). This is the second edition of the Physical Activity Guidelines for Americans distributed in December 2018. The Guidelines document recommends for adults to engage in 150 minutes per week of at least moderate-intensity physical activity. It also includes a delineation of levels of physical activity categories: Inactive, Insufficiently Active, Active, and Highly Active (HHS, 2018). Specific category definitions are

included alphabetically in this section. For the current study, these categories were condensed into three groups (combining Inactive and Insufficiently Active as being representative of participants falling below 150 minutes of total PA per week).

Highly Active (HA). Category from the HHS 2018 PA Guidelines that defines individuals who exceed the recommended target range of 150-300 minutes/week of total PA. The same definition applies for the current study.

Implicit theory (of intelligence). Implicit theory was the name for the original theory from Dweck and Leggett (1988) that refers to an individual's implicit beliefs concerning whether or not his or her intelligence and overall abilities can be changed. The theory is informed by the social cognitive model and was used initially used to examine intelligence but has since been expanded to look at other abilities. The concept has recently also been called mindset theory. In the current study, the terms were used interchangeably. The current study measured the construct as an implicit theory of fitness (ITF).

Inactive. Category from the HHS 2018 PA Guidelines that defines individuals who do not engage in any physical activity beyond basic daily life activities (HHS, 2018). For the current study, this category was combined with the category "Insufficiently Active" and labeled collectively as IA.

Insufficiently Active (IA). Category from the HHS 2018 PA Guidelines that defines individuals who engage in some PA beyond basic daily activities but still fall below the recommended 150 minutes per week. For the current research, this category was combined with the category "Inactive" and labeled collectively as IA.

Mindset. Considering a typical dictionary definition, mindset is an attitude or lens that predetermines a person's responses to and interpretations of situations. In terms of character research, Dweck (2006) found that the mindset that individuals adopt can have significant implications for how they perceive their own learning and other personal characteristics. Mindset speaks to the plasticity of human personality, characteristics, and skills (Yeager & Dweck, 2012). In terms of mindset research, there are two types of mindsets: fixed and growth (Dweck, 2006; Dweck, Chiu, & Hong, 1995; Molden & Dweck, 2006). In the current study, this construct was measured by a six-item Implicit Theories of Fitness scale (ITF) (known also as the Mindset Fitness Scale) (Burnette, 2010; Orvidas et al., 2018). After completing the assessment, individuals received scores indicating a fixed to malleable mindset regarding the individual's fitness capabilities (higher scores translate to higher growth mindset).

Non-cognitive skills. Non-cognitive skills are often called personality traits, soft skills, or character strengths and include attitudes, behaviors, and strategies which can facilitate success in life. These can include behaviors such as motivation, perseverance, and self-control, and, in the scope of this study, grit, mindset, and self-efficacy. Of the descriptor "non-cognitive", Easton (2013) has described the term as problematic as it is "arguably too broad to be useful [. . .] and seems to imply that there are features of human behavior that are devoid of cognition" (p. 238). Actually, many aspects of personality that are part of academic research are also influenced by cognitive processes and different measures of cognitive ability can be affected by personality factors (Borghans et al., 2008).

Physical activity (PA). The World Health Organization (2018) defines physical activity as “any bodily movement produced by skeletal muscles that requires energy expenditure – including activities undertaken while working, playing, carrying out household chores, travelling, and engaging in recreational pursuits” (Physical activity, para. 1). Physical activity is also examined by the HHS (2018) as including three primary types of movement: aerobic, muscle building, and bone strengthening. Although “exercise” is considered a subgroup of physical activity, the two terms were used interchangeably in the current study, with physical activity measured first by total self-reported movement minutes of the Physical Activity Vital Sign (PAVS) questionnaire (Greenwood, Joy, & Stanford, 2010), which focuses primarily on aerobic physical activity data. Second, physical activity was examined by delineated PAVS scores adapted to the HHS 2018 PA Guidelines categories of IA, A, and HA (see definitions for each). In the current study PA was also discussed as moderate to vigorous physical activity (MVPA).

Positive psychology. Positive psychology is an approach to the scientific study of psychology that focuses on the strengths and weaknesses which enable individuals and communities to flourish. This subfield of psychology seeks to study a more holistic human picture by exploring both assets and deficits of an individual’s behavior and development (Snyder, Lopez, & Pedrotti, 2011). The approach was first encouraged by Martin Seligman (1998) in an address to the American Psychological Association. Concepts of grit and mindset are often placed under the umbrella of this positive psychology approach, and Bandura’s (1997) self-efficacy theory has a direct connection

to positive psychology as well (Bandura, 2008). Positive psychology was one of the theoretical approaches for this study.

Self-efficacy (SE). This is often defined as belief in one's ability to successfully complete a task in a given domain (Bandura, 1997) and is a key component of Bandura's social cognitive theory. Self-efficacy has also often been examined as a predictor of health-related behavior such as recovery from a heart attack or quitting smoking (e.g., deSouto Barreto, 2013; DiClemente, Fairhurst, & Piotrowski, 1995; Dishman et al., 2005; Kennedy & Blair, 2014, Pardavila-Belio et al., 2019). In relation to physical activity, self-efficacy has produced consistent research and applied results revealing an increase in engagement in exercise (Deliens Deforche, De Bourdeaudhuij, & Clarys, 2015; Weinberg & Gould, 2007).

Social cognitive theory (SCT). Bandura's (1977) original learning theory developed into the SCT (Bandura, 1986) and speculates that learning happens within a social context with a complex interaction happening among the person, environment, and behavior. Regarding behavior tied to fitness, SCT also suggests that motivational changes specific to changes in exercise behavior are found by regulating control and reinforcement as influenced by these personal factors (such as personality traits), environmental factors, and aspects of physical activity itself (i.e., the enjoyment of the exercise) (Weinberg & Gould, 2007).

CHAPTER 2

REVIEW OF LITERATURE

Overview

As was detailed in Chapter 1, the current study was to examine the pandemic of physical inactivity, with a specific focus on college students. With physical inactivity at the core of the problem, many researchers are seeking productive and feasible ways to encourage moderate to vigorous physical activity (MVPA) in this population, so students will reap the benefits that come with meeting the recommended amounts. Specifically, the study examined the relationships between physical activity and non-cognitive skills of self-efficacy, mindset, and grit. If relationships existed, further analysis occurred. I also examined the connections between physical activity and self-efficacy in the current sample, as there is arguably a strong direct correlation between self-efficacy and physical activity levels, as self-efficacy has been shown to be both a mediator for and outcome of physical activity (e.g., Kaewthummanukul & Brown, 2006; Sallis, Hovell, Hofstetter, & Barrington, 1992). Finally, structured interviews were conducted to further understand students' perceptions and experiences of these variables and exercise behavior. This review of the literature includes background information on each of these broader concepts.

Physical Inactivity

The ongoing concern with physical inactivity in our culture has been well documented, as illustrated by the already mentioned statistics from the American College Health Association (ACHA) (2018) and Health and Human Services 2018 Physical Activity Guidelines (HHS, 2018) that show the current prevalence of physical inactivity.

Additionally, similar statistics have been found for the college-aged population that also fall below recommended levels of MVPA (ACHA, 2018). One of the most startling statistics was that less than half (47%) of all college students included in the ACHA survey met the recommendation for daily exercise last year (aerobic exercise for at least 30 minutes on five or more days per week) (ACHA, 2018). This National College Health Assessment (ACHA-NCHA) survey is conducted nationally by the ACHA, and it allows colleges to gather data about their students' habits, behaviors, and perceptions regarding many health topics, including weight, nutrition, mental health, sexual health, alcohol and other drug use, and physical activity. The most recent data included information from over 65,000 college students, primarily traditional undergraduates, with an age range from 18-24 (ACHA, 2018).

When isolating the numbers from the transition year between high school and college and through the first full year in college, however, the above insufficient activity data pale in comparison to the mere 9% of students meeting the recommended MVPA amount (Li et al., 2016). This percentage clearly speaks to the decline that can occur when students move onto college campuses. In addition to the ACHA-NCHA data and data gathered by independent researchers, this transition time for incoming college students is regularly captured in the Youth Risk Behavior Surveillance System (YRBSS) data gathered nationally by the CDC to research behaviors that can lead to death and disability in youth and adults and how to best prevent them (Kann et. al, 2018).

Equipped with an abundance of information from the ACHA-NCHA survey and YRBSS data about the physical inactivity prevalence, researchers and colleges can then seek ways to implement various interventions, policies, and intentional enhancements to

built environments to assist in increasing PA and combat the physical inactivity issue. Unfortunately, there is insufficient current evidence to show that college-based interventions increase physical activity. Additionally, the available evidence suggests that exercise motivation programs within a college context may increase exercise levels in the short-term, as with most interventions, but gains fade over time (Hivert, Langlois, Berard, Cuerrier, & Carpentier, 2007). Thus, the need to examine integrating approaches beyond interventions and to consider cultivating individual character skills like exercise self-efficacy, mindset, and grit, could also be critical in determining what will motivate college students to not only increase their daily levels of physical activity, but also to sustain these levels after the program or planned intervention has concluded. Clearly, engaging in physical activity today has long-lasting positive effects that can persist across the lifespan (HHS, 2018; Ng & Popkin, 2012). These benefits can include: prevention of chronic diseases (e.g., cancer, obesity, depression, osteoporosis, and even premature death), ability to engage in daily living activities, enhanced brain health, and a decrease in levels of depression and anxiety (CDC, 2018; HHS, 2018). College and university commitment to physical activity and to promotion of these benefits is an investment in the future of students and in our future society.

The majority of colleges already recognize this important role and need for commitment, creating opportunities for physical wellness in their residential spaces, initiating student activity programming, and offering campus recreational sports. Furthermore, many schools spend millions of dollars on exercise facilities to encourage students to stay healthy by maintaining a level of physical activity while balancing academics and social life, as well as to fulfill the institution's desire to retain students and

maintain competitiveness in an extremely competitive battle for student tuition dollars (Henchy, 2013). Utilizing these resources and building healthy habits can add up to successful outcomes both inside and outside of the classroom. Furthermore, the power of regular physical activity is so compelling because it can also aide in the management of stress, anxiety, and depression, to increase students' self-esteem and self-efficacy, to fight feelings of fatigue and low energy, and to increase cognitive functioning (Knight, Fisher, & Patel, 2016; Weinberg & Gould, 2007). Opportunities for further physical activity promotion are available to students, and the potential positive relationship between overall college student health and well-being with physical activity are indisputable (Das & Horton, 2012). Thus, why the disconnect? Why aren't more students utilizing these resources or choosing to be physically active? The answers are complex.

Compounding the arguably shocking current levels of physical inactivity and insufficient activity numbers and the connection to overarching health issues and obesity, the numbers are expected to increase to a nearly 51% adult obesity rate by 2030 (Finkelstein et al., 2012). To add even more urgency to the issue, even higher rates of inactivity can be expected as more and more physical education and activity programs are being erased from all levels of education, including colleges (Cardinal, Sorensen, & Cardinal, 2012). This loss of curricular requirements (and even recess at lower educational levels) at the college or university level, shows steep declines and are now at an all-time low, with recent estimates at less than 39% of four-year institutions having physical activity requirements (Cardinal et al., 2012). In a direct response to this decline, Harvard professor Daniel Lieberman advocated for the importance of physical activity

and the possibility and necessity of reconsidering a physical activity curricular requirement to aid in the growing inactivity issue (Shaw, 2016).

Considering this argument to reinstate curricular forms of physical movement, plus the recent recommendations and support by such entities as Nike and its partners, the American College of Sports Medicine (ACSM), American Heart Association (AHA), ACHA, and CDC, through their designedtomove.com initiative, there is a powerful case for the urgent investment in physical activity and the life-long benefits that come with it; these sponsoring entities have initiated a plan for collective action for America, including within educational systems (Ng & Popkin, 2012). It is important to not only ask what role colleges play in this investment in helping students live healthier, longer lives, but to also hold colleges and universities accountable to this investment.

In contemplating this investment, we must take note that faculty and administrators work with students faced with seemingly endless lifestyle choices during this transitional time in their lives. We must also note that our students are unfortunately and inadvertently encouraged to spend much of their days inactive or insufficiently active as the environment and education system dictate this through studying, computer work, functioning with technology, sitting in class, etc., and many students are preparing to leave campuses to engage in even more sedentariness through their future commutes, work, and families (Sparling, 2003). Despite these challenging factors, it is also exciting to consider that we have millions of students on our campuses, and statistics have shown that 81-85% of them continue the exercise behaviors in which they engage during college, especially toward the end of their time on a campus (Ferrara, 2009; Leslie, Sparling, & Owen, 2001; Sparling, 2003). In addition, once they leave the college world,

exercising adults have more consistent work attendance when compared to non-exercisers (Flynn, Piazza, & Ode, 2009). Thus, colleges can positively influence the formation of healthy habits regarding physical activity while a student is on campus, thus impacting their lives during and beyond the college years in ways that could prove monumental.

Again, colleges and universities arguably play a crucial role in developing an environment to assist students in adopting active healthy lifestyles that become lifetime habits and developing into contributing members of the workforce and society beyond the college years. Thus, colleges have an exciting opportunity and perhaps even a responsibility to continue to examine how to encourage students to get moving and meeting the minimum PA recommendations in order to have them receive the benefits of doing so, including numerous benefits that could assist them in being successful academically, emotionally, physically, and socially.

Non-Cognitive Skills

Non-cognitive skills have often also been called character traits, psychological skills, soft skills, etc., and while the terminology may be fluid, along with lack of agreement about their fixed or teachable nature, a focus on non-cognitive skills is not new. Borghans and colleagues (2008) called these non-cognitive skills “patterns of thought, feelings, and behavior” (p. 974), concepts that have not been connected with “success” in the past. Whereas success has often been equated with intellectual ability and general intelligence, there is a growing belief across numerous disciplines (education, business and economics, social sciences, etc.) that other factors, abilities, traits, and skills are equally as important, are necessary for success in life, and may be missed by standard testing (Davidson, 2014; Heckman & Kautz, 2012; Humphries & Kosse, 2017).

Duckworth and Yeager (2015) and Duckworth (2009) have highlighted that the term for this set of skills is definitely less important than the clarity around the constructs, measures, and practices; thus, “non-cognitive” stands, even though all of the concepts included in the current study, specifically grit, mindset, and self-efficacy in this study, have cognitive components.

According to Soutter and Seider (2013) “character education played an integral role in the original version of both K-12 and postsecondary education in the United States. . . [and] Thomas Jefferson cited the development of children’s character as a key motivation for the establishment of public schools” (p. 351). Unfortunately, the importance of character education faded as programs required schools and teachers to validate student learning through testing and academic performance (specifically on standardized testing, and more recently the Common Core Curricular Standards). Building character was acceptable, but the important business of learning math and science and intentional focus on the educational ties to the economy usurped it (Soutter & Seider, 2013). The arguable failure of test-focused school efforts and stagnant U.S. rankings on international assessments dating back to the passage of No Child Left Behind (Laursen, 2015) have made at least some of these “new” approaches with recognizable roots worth exploring. The fact that many of these new approaches were bringing the science to support the concepts further warranted the buzz.

Researchers then began to look at emerging discrepancies where students who were the most academically prepared did not fare well when they transitioned to a post-secondary experience (Duckworth et al., 2007; Tough, 2013). What they found was that in addition to cognition, the traits that also mattered in predicting and measuring success

in education were traits that predicted high levels of achievement and performance, like grit and self-control (Soutter & Seider, 2013). During the current phase of grit and self-control research, numerous articles and prolific teams of researchers (e.g. Duckworth, 2019c; Duckworth, Milkman, & Laibson, 2019; Duckworth, Tasker, Eskreis-Winkler, Galla, & Gross, 2019) are expanding upon the original Duckworth et al. (2007) and Duckworth and Quinn (2009) findings, exploring how such concepts of grit, self-control, and mindset impact a variety of populations: i.e. military personnel, doctoral students, medical students, workers, and, yes, college students (e.g., Arouty, 2015; Chang, 2014; Dweck, 2006; Dweck, 2019; Dweck & Yeager, 2019; Eskreis-Winkler et al., 2014; Ray & Brown, 2015; Stewart, 2015; Suzuki, Tamesue, Asahi, & Ishikawa, 2015). This interest in non-cognitive skills has been spurred by researchers like Heckman and Kautz (2014), Duckworth and colleagues (2007, 2009), and Tough (2013) and has already been adapted by some schools in curriculum design (i.e. Knowledge is Power [KIPP] public charter schools) (Gleason, Tuttle, Gill, Nichols-Barrer, & Teh, 2014; Nichols-Barrer, Gleason, Gill, & Tuttle, 2015). Even the U.S. Department of Education (2013) has proposed viewing the importance of measurable non-cognitive abilities like grit and mindset, in addition to cognitive factors, as a clear direction in which to head next, implying that it may be a viable way to elevate educational performance and success while simultaneously addressing equity and access issues.

Both the promises and limitations of the above approach should be considered and will be highlighted here. It can't be overstated that the potential is intriguing and has been indirectly observed in programs like KIPP. However, like other concepts that end up being casually incorporated into education discourse, what is often overlooked is that

much of the underlying research about these non-cognitive abilities has focused on groups of individuals in unique educational environments, such as the cadets at the elite West Point military academy, participants in the Scripps National Spelling Bee, and undergraduate students at selective universities (Duckworth et al., 2007; Duckworth & Quinn, 2009).

The primary focus of examining non-cognitive skills (specifically in the conversation of grit and mindset) has been in classrooms, and findings throughout this body of research suggest that non-cognitive skills are predictive of achievement in completing difficult tasks, above and beyond talent and intelligence (Duckworth & Quinn, 2009). Some of the positive results may be because non-cognitive skills could be more responsive to direct intervention than cognitive ability, including with adolescents (West et al., 2016). However, as previously discussed in Chapter 1, the predicted “achievement” has primarily been examined in educational pursuits, with only initial research that the concept can be broadened to include non-educational pursuits, such as exercise behavior, weight, and fitness (Burnette, 2010; Burnette & Finkel, 2012; Orvidas et al., 2018; Reed, 2014). More recently, non-cognitive traits have also been examined to highlight potential predictors of exercise maintenance, as well as the already established predictor, self-efficacy. In addition, and worth repeating here, many non-cognitive characteristics have been responsive to interventions (Credé et al., 2017). The current study sought to add to this exciting line of research by establishing a relationship between grit, mindset, and exercise behavior in a sample of college students and further explore the understanding of grit, mindset, exercise self-efficacy, and physical activity.

Grit

Similar to the concept of non-cognitive skills, grit is not a new concept. Over a century ago William James (1907) discussed the tendency of a person to live “within his limits; he possesses power of various sorts which he habitually fails to use. He energizes below his maximum, and he behaves below his optimum” (Duckworth, 2016, p. 23). As Duckworth (2016) explained, James was reflecting on his own flux in effort to achieve his goals. Today, regardless of what domain is being discussed, grit has been defined as “working strenuously toward challenges, maintaining effort and interest over the course of years despite failure, setbacks, adversity, and plateaus in progress and is strongly associated with academic achievement and life success and may also be associated with health outcomes and behaviors” (Guerrero, Dudovitz, Chung, Dosanjh, & Wong, 2016, p. 275). Grit is defined even more specifically by Duckworth and her colleagues as the psychological trait of “perseverance and passion for long-term goals” (Duckworth et al., 2007, p. 1088), breaking the concept into two primary concepts of passion/interest and long-term persistence toward a given task or drive (Duckworth et al., 2007; Duckworth & Quinn, 2009). Both dimensions are deemed equally important in the original research. According to Peterson and Seligman (2004) perseverance can be considered as engaging in:

a goal-directed action in spite of obstacles, difficulties, or discouragement. Simply measuring how long someone works at a task does not adequately capture the essence of perseverance because continuing to perform something that is fun or rewarding does not require one to endure and overcome setbacks. (pp. 229-230)

Thus, perseverance is the result of challenges and hurdles, while interest or “passion” is perhaps the ability to sustain this perseverance over the long-term, and perhaps signaling an emotional component of grit. According to Duckworth (2016), the gritty individual

approaches achievement similarly to the approach of running a marathon. The preparation and deliberate practice required to achieve a challenge of this type in addition to having an intentional hierarchical goal system is something that the gritty individual sees as an opportunity for achievement and growth. Setbacks, disappointments, or boredom just as readily cause less gritty individuals to detour from the course, abandon goals, and ultimately fail to achieve the attempted task (Duckworth, 2016).

Results from numerous studies (e.g., Hodge, Wright, & Bennett, 2017; Jin & Kim, 2017; Meyer, Markgraf, & Gnacinski, 2017; Wolters & Hussain, 2015) add to the findings of Duckworth et al. (2007) and Duckworth and Quinn (2009) that grit “positively predicts achievement in challenging domains over and beyond mere talent” (p. 7). In addition, studies from Duckworth and others have shown that grit can predict success in various domains, over and beyond intellectual quotient and talent. Even Duckworth articulated her surprise by some of these findings, stating that what had been most surprising was within “the West Point data set, as well as other data sets; grit and talent either aren't related at all or are actually inversely related” (Perkins-Gough, 2013, p.16).

The most notable grit research, upon which the rest of the studies have branched off of, is the collection from Duckworth and her colleagues. Though not the first article hinting at the power of grit, Duckworth et al. (2007) were the first to define grit as this concept of perseverance over the long term, despite setbacks or obstacles, as an individual difference beyond intellect that could be measured to predict intellectual achievements, more readily than a basic IQ score. The researchers' primary question was “Why do some individuals accomplish more than others of equal intelligence?”

(Duckworth et al., 2007, p. 1087). Over the course of six studies, Duckworth et al. (2007) examined what made one individual grittier and have more self-control than another. They also explored possible relationships between a concept like grit, which was merely considered a fixed personality trait, and intelligence, a comparison that had not been made at the time. The studies led to the development and validation of a self-report Grit Scale, which was then used along with verbal IQ testing to study populations ranging from national spelling bee participants and West Point cadets, to Ivy League undergraduates and medical students. What they found was encouraging. Upon reviewing the six studies, “individual differences in grit accounted for significant variance in success outcomes over and beyond that explained by IQ” (Duckworth et al., 2007, p. 1098). However, the limitations noted in the article were significant: use of self-report questionnaires to measure grit, measures investigating past behavior rather than observation of current behavior, examining select populations that have already relatively high IQ scores, and that findings failed to show how grit related to other non-cognitive traits could be in play here (mindset, optimism, self-efficacy, hope, etc.). Other researchers immediately wondered the implications of this early article regarding the power of non-cognitive traits to predict success in education, as well as in numerous other domains. The findings stimulated more research seeking connections between non-cognitive skills and success.

However, with all of the positive findings and the buzz in popular culture around grit as a concept and a foundation for policy creation in some educational settings, it has not come without criticism and speculation. Some researchers have said that the impact of grit is exaggerated and the effect sizes, including within Duckworth’s original

research, could be considered overstated and misleading (Credé et al., 2017). Also, the use of grit as a policy foundation has also been criticized as premature, as the research is still in such an early stage, and Duckworth doesn't disagree (Credé et al., 2017). In addition, recent articles (Guo, Tang, & Xu, 2019; Kalia, Fuesting, & Cody, 2019) have discussed the need to treat the two grit subscales (Grit-Perseverance and Grit-Interest) separately, and that combining the two is "not empirically justifiable" (Guo et al., 2019, p. 3938). Other findings contradict that the subscales should be separated, but do suggest that the current version of the full Grit-S scale (used in the current study, along with the two subscales) measures perseverance more readily than it does consistency of interest (Jachimowicz, Wihler, Bailey, & Galinsky, 2018). Within Duckworth's work (2016) and in the current study, it can be observed through mean scores and from differences in correlations that perseverance and interest are, indeed, measuring two distinct skills. Perhaps the problem lies in what this second skill actually is, that is being measured; is it interest/passion or something else? It may be that interest/passion is getting lost, and thus, a re-evaluation of the construct and the subscale may be warranted (Jachimowicz et al., 2018). According to Jachimowicz et al. (2018), a possible alternative to the current scale is to add a "combination of the [current] Grit-S scale with a measure that [more] accurately assesses passion attainment" (p. 9983), as these researchers see this as the only way to fully measure grit's predictive power. Finally, it could be argued that the operational definition of passion and the operational definition of interest within the grit definition actually could lack the congruence that is currently assumed by many. The increased research in this area can only enhance the overall understanding of grit, as

studying the subscales separately can give novel validity for performance outcomes (Disabato, Goodman, & Kashdan, 2018).

Regardless of the recent subscale and overall grit measure debate, the findings on grit have consistently been applied to areas primarily within education, the military, and business, but have also been considered, although only minimally, in relation to exercise behavior and to exercise adherence. More specifically, research by Reed and colleagues (2010) generated initial indications of possible connections between grit and exercise behavior. As the research on grit has expanded, so too has the concept of grit from potentially a personality trait or characteristic to an entity that could be developed, more so a skill than a dispositional trait (Duckworth, 2016). In addition, connections are being explored between grit and another key non-cognitive skill which will be discussed here, mindset, with even Duckworth discussing the possibility of upcoming projects with Dweck to examine the relationship (Hochanadel & Finamore, 2015; Perkins-Gough, 2013). The current study explored the connection between grit, mindset, exercise self-efficacy, and exercise behavior, as well as investigated the relationships between grit, mindset, and self-efficacy, specifically within a college population.

Mindset/Implicit Theory

The concept of mindset/implicit theory has grown and developed over the course of nearly four decades of research (Dweck, 2019; Dweck & Yeager, 2019) and has been defined in a number of studies as the belief that human abilities are malleable (Sisk, Burgoyne, Sun, Butler, & Macnamara, 2018). Dweck and colleagues initially sought to understand how students' views of themselves as learners impacted their overall academic achievement (Dweck & Leggett, 1988), as well as how people respond to

failure (Dweck, 2019). Examining closely Bandura's (1986) work and reflecting his ideas of self-efficacy, Dweck realized that achievement, specifically in academics, could be developed depending on how the individual viewed their own learning and goals (Garofalo, 2016). As stated previously, mindset was originally developed and discussed as implicit theory, which included two diverse ways individuals view themselves, specifically regarding intelligence (Dweck & Leggett, 1988). The first orientation is a fixed or entity view of reality. Individuals subscribing to this view believe that how they learn is fixed, and that this trait is not capable of being further developed. For example, believing that one is either good at math or not and nothing can be changed, end of story, would be exhibiting a fixed view or entity view. In contrast, the second orientation is one of malleability or an incremental view of reality. Individuals subscribing to this second view believe that how they learn is fluid and can be developed through effort and help from others, and ability can be grown over time through deliberate practice (Dweck & Leggett, 1988; Dweck et al., 1995; Hochanadel & Finamore, 2015). For example, believing that someone can improve their math ability would be exhibiting an incremental view. More recently, the terminology has shifted from "implicit theory" to the term "mindset", with fixed or growth mindset as the current language for the two orientations (Dweck, 2006).

The findings from interventions-based research over the years have continued to show that individuals who adopt a fixed mindset are less likely to continue when they face challenges, as they do not believe they are capable or that effort matters; whereas individuals who adopt a growth mindset are more likely to see failure and obstacles as opportunities for growth, believe they are able to overcome them, and act accordingly

(Blackwell, Trzesniewski, & Dweck, 2007; Claro, Paunesku, & Dweck, 2016; Dweck, et al. 1995; Dweck, 2010). According to Bedford (2017), “the result of teaching students about intelligence and how intelligence grows has improved student self-efficacy and self-regulation” (p. 437). Results have also coincided with recent research on brain neuroplasticity, which shows that our brain pathways are actually initiated, shaped, and altered by our own beliefs, behaviors, and environments; thus, our brain pathways can essentially create a growth mindset for achieving goals (Sarrasin et al., 2018); thus, Dweck’s theory of mindset is supported by neuroscience.

As for the relationship with other non-cognitive, personality skills, Dweck’s theory of mindset has been connected with Duckworth’s theory of grit (a theory that has also been backed by neuroscience) (Myers et al., 2016) through strong correlational data (Duckworth, 2016). This is one reason why these two concepts were studied simultaneously in the current study. Duckworth (2013) stated that she and Dweck are “investigating the link between grit and growth mindset, which refers to the implicit belief that intelligence is malleable rather than fixed” (p. 2). In addition, Yeager and Dweck (2012) found a connection between the development of mindsets and resilience, the ability to sustain beyond setbacks; the related construct of resilience has also been tied to the construct of grit and recently to the study of physical activity through physical education (Tudor, Sarkar, & Spray, 2019). The current study was designed to add to the evidence in this area as the relationship between mindset and grit, as well as the grit subscales, were examined in a sample of college students.

More recently, fixed and growth mindsets have been tested through interventions in areas that have direct connection to the current study, namely weight and fitness

(Burnette, 2010; Orvidas et al., 2018). The findings from these initial studies seem to support a connection between growth mindset and physical activity behavior. The current study was also designed to add to the evidence in examining the relationships among grit, mindset, and exercise behavior, not only statistically but even further in depth through qualitative interviews and analysis.

Social Cognitive Theory/Self-Efficacy

Social cognitive theory was introduced and explicated by Albert Bandura in 1986, and the theory and its constructs (such as self-efficacy) have been used successfully in many behavioral interventions. The most widely used constructs in research and applied attempts to alter behavior have been those that increase participants' self-regulation and self-efficacy (Kennedy & Blair, 2014).

Self-efficacy is typically defined as an individual's belief in their ability to succeed in a particular domain or to achieve goals within that domain; it is considered as a vital component of Bandura's social cognitive theory (SCT) and focuses on how people adapt to environments (Bandura, 1991, 1993b, 1997). Bandura (1997) also describes general self-efficacy as a way to stimulate resilience and flexibility when an individual is faced with challenges and obstacles:

People's beliefs about their abilities have a profound effect on those abilities. Ability is not a fixed property; there is a huge variability in how you perform. People who have a sense of self-efficacy bounce back from failure; they approach things in terms of how to handle them rather than worrying about what can go wrong. (p. 101)

This is defined as belief in one's ability to succeed in specific situations or to accomplish a task (Bandura, 1997) and has also been used to predict behavior in various health-related situations such as weight loss, quitting smoking, and recovery from heart attack

(deSouto Barreto, 2013; DiClemente et al., 1995; Dishman et al., 2005; Kennedy & Blair, 2014; Maddux, 2009; Pardavila-Belio et al., 2019). In relation to exercise, self-efficacy has produced some of the most consistent results in predicting and catalyzing an increase in participation in exercise (Deliens, et al., 2015; Weinberg & Gould, 2007). The Self-Efficacy Theory (Bandura, 1997) suggests that self-efficacy beliefs predict one's behaviors, through patterns and motivation. Bandura (1993a) further spoke of self-efficacy as a way to influence college student outcomes in areas of motivation and persistence. Self-efficacy in relation to college students has been primarily examined in the classroom, measuring student's belief of confidence in completing tasks tied to overall academic success (Gore, 2006; Faust, 2017). Thus, the research suggests the potential connection between self-efficacy and resilience, which is related to grit, which was also examined in the current study.

As stated above, self-efficacy has been used to predict behavior in various health-related situations such as weight loss, quitting smoking, and recovery from heart attack. It has also been shown to predict both adoption and maintenance of physical activity behavior in healthy adults (e.g., Ashford et al., 2010; Kaewthummanukul & Brown, 2006; Sharma et al., 2005). In terms of physical activity, the benefits of adhering to an exercise routine are not immediately obvious; instead, it often requires a level of ability to stick with the behavior until positive change is apparent, and self-efficacy is developed. According to Maddux (2009), self-efficacy can influence positive health in a reciprocal way: elevated self-efficacy can increase health-related behavior, and self-efficacy can help to change an individual biologically (such as through endorphin release and the dulling of pain) (Bandura, 1997) and potentially to help them enjoy better health

across the lifespan. Frankly, in relation to exercise, self-efficacy has produced some of the most consistent results, revealing time and again an increase in participation in exercise (e.g., Jackson, 2010; McCauley et al., 2013; Weinberg & Gould, 2007).

For the current study, exercise self-efficacy was examined among college students both as a full sample and when the sample was split into three groups by exercise level. In this exercise context, self-efficacy was seen as the belief in an individual's ability to successfully perform a given activity tied to some form of physical activity or exercise (Fletcher & Banasik, 2001). According to Bandura (1997, 2004) and his social cognitive model, self-efficacy can be considered an important determinant of physical activity at the recommended levels (Deliens et al., 2015; Neupert et al., 2009).

Positive Psychology

As defined previously, positive psychology is an approach to the scientific study of psychology that focuses on the strengths and weaknesses that enable individuals and communities to thrive. This subfield of psychology seeks to study a more holistic picture of human functioning by exploring both assets and deficits of an individual's behavior and development (Snyder et al., 2011). The approach was first encouraged by Martin Seligman (1998) in an address to the American Psychological Association. Concepts of grit (a clear connection as Duckworth studied with Seligman) and mindset are often placed under the umbrella of this positive psychology approach. Likewise, Bandura's (1997) self-efficacy theory has a direct connection to positive psychology as well (Bandura, 2008). Because of the focus of non-cognitive skills on uncovering ways to help individuals and communities succeed and positively perform at enhanced levels, the connection between them and positive psychology is warranted. In short, the field looks

to remove a deficit mentality in how humans function and to seek a more balanced, complete view of human behavior and development (Snyder et al., 2011). Considering the already discussed definitions of grit (individual's passion and perseverance toward long-term goals), mindset (belief that individuals can continue to adapt and grow and our brains are malleable), and self-efficacy (belief in an individual's ability to successfully complete a targeted task), it can be argued that all seek to understand how to assist people to thrive. Thus, positive psychology was determined to be an appropriate overarching theoretical approach for this study (as an umbrella to grit theory, implicit mindset theory, and social cognitive/self-efficacy theory).

In addition, positive psychology has recently been used as a framework to research how to help college students thrive both inside and outside of the classroom (Schreiner, 2018). The research to decipher the many paths to student success has often been connected to academic determination and having an overall positive perspective. According to Schreiner (2018), using a positive psychology approach to student success can also assist students with non-cognitive skill building, such as resilience and growth mindset, early in their college tenure. Positive psychology can also be a relevant framework as current and future research also examines overall student well-being (mental, physical, emotional, etc.).

To dig in even further, positivity is powerful, as it can aid with our emotions, especially with managing these emotions within the context of our physical health (Fredrickson, 2009). According to O'Brien (2015), positivity can fuel resilience, bolster our optimistic mindset, and increase our motivation. However, an important area of research focuses on positive psychological factors (such as the non-cognitive variables

examined in the current study), and if they can or do play a protective role against our physical health risks (including physical inactivity) (Park et al., 2016). In addition, research that includes positive interventions (including growth mindset, self-determination, and self-efficacy interventions) can lead participants to not only feel better about themselves and their lives but to also behave in positive, healthy ways (Park et al., 2016; Peterson, 2000).

More specifically, this positive and healthy behavior of physical activity is a crucial component of human behavior that can help people to thrive. But we have to believe this is true. In short, physical activity participation is congruent with the principles and approaches of positive psychology (Faulkner, Hefferon, & Mutrie, 2015; Mutrie & Faulkner, 2004), and the non-cognitive skills that are under the positive psychology umbrella could be keys to progress in this area.

Methodological Choices

The current study utilized an explanatory sequential mixed method approach. Mixed method approaches like this are generally thought to have the potential to overcome the limitations of utilizing solely quantitative or qualitative research methods. In addition, Creswell (2014) argues that, “this ‘mixing’ or blending of data . . . provides a stronger understanding of the problem or question than either by itself” (Creswell, 2014, p. 215). In this specific type of mixed method, quantitative data and then qualitative data are collected and analyzed, leading then to interpretation (Creswell, 2014). This strategy is useful because it allows for the qualitative data to assist in understanding and explaining the quantitative data. In newer areas of research, as the current study

investigated, this more in-depth understanding of the variables was particularly important.

Quantitative Choices

The current study relied heavily on correlational research methods to initially answer the research questions. Correlational methods were used to establish whether relationships existed between variables and assessed the potential to make predictions about those variables based on those relationships (Jackson, 2015). Due to the emerging nature of this field of research, it was essential to first establish if grit, mindset, and exercise self-efficacy were related to exercise behavior in college students, in addition to examining their relationships with one another. Furthermore, once correlations were established, the next step was to determine if predictions could be made about one variable using another variable. For example, once there was a confirmed correlation between grit and exercise behavior in college students, the question became what ability does grit have to predict exercise behavior? Thus, if we know someone's grit score, could we then predict their current PAVS score/exercise behavior as measured in minutes per week? Thus, I analyzed the data to further interpret the correlational relationships, and the findings helped establish a relationship between the variables for this specific sample. Without this information, interventions to improve these variables (grit, mindset, and/or self-efficacy) with the intent of increasing an outcome, in this case, exercise behavior, would be difficult.

In order to answer research question three, differences between groups were investigated (Jackson, 2015). In this case, the method was also initially correlational, such that participants were grouped into physical activity categories based on their

current or existing PAVS score, with three groups or levels: Inactive/Insufficiently Active (IA) (falling below 150 minutes/week), Active (A) (meeting recommended 150-300 minutes/week), and Highly Active (HA) (exceeding 300 minutes/week). The purpose of this project was not to intervene to manipulate these levels of exercise behavior, but rather to assess what levels of physical activity in which participants engaged and to at least compare these existing groups on measured variables: grit, mindset, and exercise self-efficacy. These types of comparisons, while not causal, helped to build an understanding of the chosen variables and population (Jackson, 2015). A one-way between subjects MANOVA was conducted to determine if the HHS 2018 PA Guidelines groups (IA, A, HA) differed on Grit-S, Grit-P, Grit-I, ITF, and/or ESE scores.

The measures for the proposed study were chosen based on their established validity and reliability, popularity in previous research, and/or clear match to the theoretical framework and definition of each variable being studied. The Grit-S Scale (Duckworth & Quinn, 2009) was chosen because Duckworth, the original researcher who defined grit, developed it based on her definition and the fact that much of the research on grit has utilized this scale. This was used both as the full Grit-S scale measure as well as through use of the two subscales (Perseverance of Effort [Grit-P] and Consistency of Interest [Grit-I]). The newly developed ITF scale (Orvidas et al., 2018), which measures the implicit theories of/mindset for fitness, was chosen due to its development being closely tied to Dweck's (2006) mindset of intelligence scale and its application to the behavior of interest, namely physical activity. The ESE scale (Neupert et al., 2009) was chosen due to its development being closely tied to Bandura's original self-efficacy definition and scales and its application to exercise behavior. The PAVS (Physical

Activity Vital Sign measure) (Ainsworth & Buchholz, 2017), also sometimes called the Exercise Vital Sign measure in the literature, was chosen primarily due to its use by the American College of Sports Medicine and American Medical Association, its promotion by the Exercise is Medicine initiative, as well as the brevity of taking the measure (approximately one minute). In addition, the scale provides a clear measure of the minutes per week of physical activity to identify what exercise category (IA, A, or HA) students were in based on these self-reported minutes.

Qualitative Choices

The interviews were transcribed and analyzed using an explanatory sequential approach. In this specific type of mixed method, explanatory sequential, quantitative data are collected and analyzed followed by the collection and analysis of qualitative data leading then to interpretation (Creswell, 2014). This strategy was useful because it allowed for the qualitative data analysis to assist in understanding, explaining, and even contradicting the quantitative data analysis. In novel fields of research, or more accurately old fields with a new twist, such as non-cognitive skills like grit, mindset, and exercise self-efficacy being connected to a specific behavior, this more in-depth understanding of the variables was particularly important.

The data were then interpreted through a thematic analysis approach (TA). This approach gave me flexibility while also requiring active choices about how to interact with the data, identify patterns, and interpret these data (Braun & Clarke, 2006; Braun, Clarke, & Weate, 2016). In short, this TA approach, like many qualitative approaches, acted as a tool in the current study to uncover potential for “nuanced, complex, interpretive analysis” (Braun et al., 2016, p. 191) through creation of higher-order

themes, lower-order themes, and representative meaning units. Higher-order are overarching themes, followed by lower-order subthemes, and representative meaning units which express how these themes are seen through the participant responses and data.

The qualitative portion of the study was utilized to further answer the research questions and can best be understood within an interpretivist paradigm. Williams (2000) defines interpretivism as “those strategies which interpret the meanings and actions of actors according to their own subjective frame of reference” (p. 210). This study sought to hear from college students through their own interpretations, understandings, and meanings of their experience of the variables being investigated. The purpose, then, of the qualitative interview was to dig deeper into how the participants understood and experienced their own grit, mindset, self-efficacy, and exercise behavior. The approach asked questions about the variables both directly and indirectly. These deeper reflections allowed for a more profound discussion of the quantitative findings. Thus, the questions written for the qualitative interview were derived with the goal of pulling this information out of the participants.

CHAPTER 3

METHODOLOGY

The purpose of this study was to examine the relationship among the traits of mindset, grit, exercise self-efficacy, and exercise behavior. In addition, the aim was to determine how student perceptions measured through analyzed interview responses correlated with overall quantitative statistics. This section will focus on the framework, research questions, and research design. It discusses the research methods selected and applied for the study, how participants were chosen, and how data were collected and analyzed. The study focused on a sample of college students who completed questionnaire items, including demographics and scale instruments used to assess grit, mindset, exercise self-efficacy, and self-reported exercise behavior. In addition, the study examined these variables within the context of both the full sample and the following categories of minutes per week of PA as designated by the HHS 2018 Guidelines: Inactive (not receiving PA beyond basic daily life activities), Insufficiently Active (doing some PA beyond basic daily life activities but still falling below the recommended 150 minutes per week), Active (target range of doing the equivalent from 150 to 300 minutes of at least moderate-intensity activity per week), and Highly Active (doing more than 300 minutes of at least moderate-intensity activity per week) (HHS, 2018). For the current research, the categories were condensed into three groups that closely match how these guidelines are applied in the literature and in practice: Inactive combined with Insufficiently Active (failing to meet recommended 150 minutes/week) (IA), Active (achieving recommended 150-300 minutes/week) (A), and Highly Active (reaching more than 300 minutes/week) (HA). The study also utilized a qualitative

approach in order to provide a nuanced understanding of how college students think about and experience grit and mindset in the realm of fitness.

Research Design

The study used an explanatory sequential mixed method approach, consisting of quantitative and qualitative research methods. Data analysis included standard descriptive, correlational, and parametric statistics (linear regression, multiple regression, one-way ANOVA, and one-way MANOVA) to examine online questionnaire data. Qualitative research techniques were utilized to obtain and analyze interview responses, including using Thematic Analysis approach with higher-order themes, lower-order subthemes, and representative meaning units (Braun et al., 2016).

Study Timelines

Phase 1 Quantitative Data Collection. The quantitative data portion of the study required four weeks from initial recruitment email to closing of the questionnaire. There was an initial email and two reminder emails sent to the approved listervs with separate email blasts approximately 10 days apart. The initial recruitment questionnaire of Phase 1 took approximately eight minutes for participants to fully complete.

Phase 2 Qualitative Data Collection. The qualitative data collection was completed in three weeks. Ten participants were randomly chosen according to three total physical activity groups (IA, A, and HA) that were adapted from the HHS 2018 Physical Activity Guidelines for Americans. There were four participants interviewed from the IA group, three from the A group, and three from the HA group. Once participants were randomly chosen for the qualitative interview, contact was made via email with a deadline for response. If the individual did not respond, the next randomly chosen

individual in the same HHS Guidelines group was contacted. A total of 24 students were contacted through this process to ultimately secure 10 confirmed participants. Once confirmed, the 10 participants completed the quantitative questionnaire a second time and were then scheduled for an interview time. The 10 qualitative interviews took place over a three-week period and took approximately an additional 30 minutes for the interview and questionnaire.

Participants

All participants were current undergraduate students who were registered with campus recreation services at a large, Division I, research institution in the Northeast. Phase 1 participants included 366 current undergraduate students, an 11.4% response rate of the viable current undergraduate student population receiving the recruitment email. These students identified as 181 females, 181 males, 3 non-binary, and 1 chose not to answer. The percentages of females and males in the sample were identical (49.4%) making up 98.9% and non-binary or participants selecting choose not to answer made up just over 1% of the sample. The largest percentage of the sample identified as White (76.6%), while the smallest percentage of the sample identified as Native Indian or Alaska Native (.3%). Of the undergraduate students who expressed interest in the interview phase ($N = 366$), there were 10 chosen for Phase 2, qualitative interviews. Although not directly representative of the overall population of the university, there was considerable diversity in the Phase 1 and Phase 2 samples (see Table 3.1 for further demographic information).

Table 3.1. Participants – Gender and Race Demographics

Demographic	Quantitative		Qualitative	
	Frequency	Percent	Frequency	Percent
Gender				
female	181	49.5%	6	60.0%
male	181	49.5%	4	40.0%
non-binary	3	.8%	0	0.0%
choose not to answer	1	.3%	0	0.0%
Race				
asian american	36	9.9%	2	20.0%
black/african american	11	3.0%	1	10.0%
latino	13	3.6%	0	0.0%
native hawaiian or pacific islander	3	.8%	0	0.0%
native indian or alaska native	1	.3%	1	10.0%
white	279	76.6%	5	50.0%
I do not identify	14	3.8%	1	10.0%
I choose not to answer	7	1.9%	0	0.0%
missing answer	2	.5%	0	0.0%

Note: Quantitative $N = 364$, Qualitative, $n = 10$

The sample was recruited through two separate, third party listservs used by campus recreation services to communicate with the university community. The listservs include current students, alumni, faculty, administrators, former students, etc. who have had contact with campus recreation services. Thus, students who registered with campus recreation services at some point to potentially participate in intramural or club sports at the university received the recruitment email (See Appendix A). While anyone who received the email could participate and complete the Phase 1 questionnaire, there was specific inclusion and exclusion criteria for being included in the current study's sample and data analysis. Specifically, participants had to be current undergraduate students who were registered with campus recreation services to potentially participate in intramural or club sports in the 2018-2019 academic year. Students who were a member of any Division I intercollegiate athletic team and/or anyone not a current undergraduate student were excluded from participating. On average, 12,236 people (students, alumni, faculty, and administrators) received each of the three emails, with an average of 3200 of these being viable current undergraduate students receiving the email each time. 506 students started the initial questionnaire, and of those, there were 406 completed questionnaires. After correcting for exclusions (former students, non-undergraduates, alumni, faculty, administrators, intercollegiate participants), there were 366 fully completed questionnaires. For Phase 2, participants were recruited through the questionnaire link, as students were asked if they wanted to participate in a follow-up interview (See Appendix B).

Participants who fully completed Phase 1 had the opportunity to opt in for random incentive gift card drawings. Five \$20 and two \$50 gift card winners were randomly

chosen. Winners were emailed and were asked to meet with the student researcher or her designee to pick up and sign for the gift card. All gift cards were picked up and signed for in the departmental suite of the student researcher. For the qualitative portion, only those undergraduate students who checked the “interested” box and submitted their email address were included in the potential selection pool for interviews. From those students, 10 were randomly chosen based on the HHS Guidelines as discussed previously. The 10 who responded and completed the interview received \$15 gift cards for participating in Phase 2.

Instrumentation

Short Grit Scale (Grit-S). The Grit-S scale was developed as an efficient measure of two primary dimensions of grit, “trait-level perseverance and passion for long term goals” (Duckworth & Quinn, 2009, p. 172). The Grit-S scale has eight items rated on a five-point Likert scale ranging from 5 indicating “very much like me” to 1 indicating “not like me at all”, with higher scores indicating a higher level of grit (Duckworth & Quinn, 2009). The scores are added and then averaged. After taking this assessment, individuals receive a grit score with a minimal score of 1 (not at all gritty) and a high score of 5 (very gritty) (Duckworth, 2016). The Grit-S scale is also multidimensional and can be and often is measured by examining two internal subscales: Perseverance of Effort subscale [Grit-P] (sum and average of questions 2, 4, 7, 8 with reverse scoring), and Consistency of Interest subscale [Grit-I] (sum and average of questions 1, 3, 5, 6). The total global Grit-S scale and the two subscales were examined in data analysis. The scale has been shown to have internal consistency with an Alpha score range of .73-.83 (Duckworth & Quinn, 2009). “Consistency of interest and perseverance of effort . . . were also inter-

correlated, $r=.59$, $p<.001$ ” (Duckworth & Quinn, 2009, p. 172). See Appendix C. The reliability of the Grit-S scale was measured in the current study based on standardized items, and Cronbach’s Alpha was .74. The subscale reliability was also measured for Grit-P and Grit-I and Cronbach’s Alpha was .70 and .69 respectively.

Implicit Theories of Fitness scale (ITF). An adapted version of the Implicit Theories of Fitness (ITF) scale (known also as Mindset Fitness Scale) (Burnette, 2010; Burnette & Finkel, 2012; Orvidas et al., 2018) was used to measure mindset of fitness. The unidimensional scale is based on Burnette’s (2010) scale that assessed individual implicit theories of weight, but was more recently adapted to measure fitness rather than weight (Orvidas et al., 2018). With Dweck’s (2006) mindset of intelligence scale as the origin, the scale elicits a self-reported reflection of an individual’s beliefs and attitudes toward the fixed or malleable nature of a personal quality, in this case, fitness. It consists of six items on a seven-point Likert scale that assists in determining what type of fitness mindset a person possesses with answers ranging from 1 = “Strongly Disagree” to 7 = “Strongly Agree” (questions 1, 2, 4 with reverse scoring) (Orvidas et al., 2018). The scores are added together. After completing the assessment, individuals have scores ranging from a fixed to a malleable/growth mindset regarding the individual’s perceived fitness capabilities. The higher the score, the more malleable the participant’s mindset, with ranges in scoring from 7 to 49. The scale has been shown to have internal consistency with an Alpha score of .67 (Orvidas et al., 2018). See Appendix D. The reliability of the ITF score was measured in the current study based on standardized items, and Cronbach’s Alpha was .83.

Exercise Self-Efficacy scale (ESE). The Exercise Self-Efficacy scale is an assessment used to measure an individual's self-efficacy level for exercising in a variety of situations. The scale was created as a modified version of Bandura's (1997, 2004) original exercise self-efficacy scale (Neupert et al., 2009). This tool is brief, with nine items on a four-point Likert scale that assesses an individual's perceived exercise self-efficacy when faced with numerous barriers. Answers range from 1 = "Not at All Sure" to 4 = "Very Sure" (Neupert et al., 2009). The first question of the survey has been altered for the current study to reflect current HHS 2018 PA Guidelines of 150 recommended minutes/week for adults, changing the question from "exercising regularly 3 times a week for 20 minutes" in the original scale to "exercising regularly 3 times a week for 50 minutes". The scores are added together. After completing the assessment, individuals receive scores ranging from lowest self-efficacy (score = 9) to highest self-efficacy (score = 28). The reliability of mean score across the nine items = coefficient alpha of .88 (Neupert et al., 2009). See Appendix E. The reliability was measured in the current study based on standardized items, and Cronbach's Alpha was .90.

The Physical Activity Vital Sign questionnaire (PAVS). The Physical Activity Vital Sign (PAVS) questionnaire, also sometimes called the Exercise Vital Sign (EVS) in the literature, is a physical activity assessment tool used primarily in clinical practice but also sparingly in scholarly work (Ainsworth & Buchholz, 2017). It was originally created and validated through a joint effort of the American College of Sports Medicine and American Medical Association (Greenwood et al., 2010; Sallis, 2011) and is promoted by the Exercise is Medicine initiative. This tool is a very brief, two- or three-question measure, and is intended to be administered as part of a "vital sign" assessment

and takes approximately 30 seconds to administer (Ball et al., 2016; Greenwood et al., 2010). It assesses the quantity of physical activity minutes (from moderate to vigorous) a person performs in a typical week (Ball et al., 2016), as well as days of muscle strengthening (also part of the HHS 2018 PA Guidelines) and is meant to do an initial identification of persons not meeting the national physical activity guidelines (HHS, 2018; Wald & Garber, 2018). Scores are calculated by multiplying Question 1, “on average how many days each week [during the semester] do you engage in MVPA (at least the level of a brisk walk)” and Question 2, “on those days, on average, how many minutes per day do you engage in this level of physical activity” (Wald & Garber, 2018). For this study, scores among participants ranged from 0 to 840 minutes/week. Question 3 of the PAVS assessment is an optional one when used clinically but was included in the current study and asks “how many days a week during the semester do you perform muscle strengthening exercises, such as bodyweight exercises and resistance training” (HHS, 2018; Wald & Garber, 2018). Answers to this question ranged from 0 to 7 and were included in some aspects of data analysis discussed further in Chapter 4. The PAVS shows strong initial construct and predictive validity (Coleman et al., 2012; Greenwood et al., 2010; Wald & Garber, 2018). See Appendix F.

When examining the PAVS questions in comparison to other very brief measures of physical activity (e.g., Godin’s Leisure Time Exercise Questionnaire, the Stanford Brief Activity Survey), the PAVS includes face validity while also allowing for alignment with the HHS PA Guidelines (Greenwood et al., 2010; HHS, 2018). Also, the use of the PAVS is relatively new, especially in a non-clinical setting, to measure individuals falling below recommended 150 minutes, and reliability data on the measure

are meager. However, reliability was measured in the current study based on standardized items and Cronbach's Alpha was .69.

Demographics questionnaire. Through the questionnaire, basic demographic information was collected, including age, gender, race, current role (e.g., undergraduate student, graduate student), number of semesters and credits completed, current GPA, major, and current and predicted physical activity participation (e.g. intramurals, club-sports). See Appendix G.

Qualitative Interview. The qualitative interview included 24 questions to explore college student experiences in exercise behavior, grit, mindset, and exercise self-efficacy in greater depth. See Appendix H.

Procedures

Phase 1

Prepared email scripts were sent to the liaison administrator in campus recreation services to send as a recruitment email to students to be part of Phase 1 of the study. All potential participants received the identical recruitment email and initial questionnaire through a third party email server used by campus recreation services at the institution. There were three total emails received by potential participants with an initial recruitment email and two reminder emails.

Potential participants received the recruitment email explaining the study, the responsibilities of participating, and the survey link. If participants clicked the survey link, they were asked first to review the consent form. If they did not want to participate and selected the "do not agree" option, they were taken to an exit screen in Qualtrics. If they did want to participate and selected the "agree" option, they were then taken to the

beginning of the survey. Participants completed the questionnaire in this order: Grit-S, ITF (mindset), ESE, PAVS, and Demographics. Then they were given the opportunity to sign up for gift-card eligibility (a random drawing for five \$20 gift cards and two \$50 gift cards conducted at the conclusion of the study for those who fully completed Phase 1). Finally, they were then asked if they wanted to take part in an interview for Phase 2 of the research.

Phase 2

Of those students who expressed interest in participating in Phase 2, they were categorized into three groups, adapted from the HHS 2018 PA Guidelines: IA, A, and HA groups, based on their Physical Activity Vital Score (PAVS). I then randomly selected four students from the IA group, three students from the A group, and 3 students from the HA group, for a total of 10 students, to invite them to participate further in the research. Potential participants then received an email from me to set up a time for their participation in Phase 2 of the research. At the time, location and platform decided, participants were again asked to click a link to complete the initial questionnaire (again including Grit-S, ITF, ESE, PAVS, and Demographics) and consent for both the interview and to have the interview recorded. Once the questionnaire was completed, the participants then took part in the interview. The interview was recorded using an iPhone and transcribed. Once this process was completed, the Phase 2 participants were compensated \$15 for their time through receipt of a gift card. Participants met with me or my designee to pick up and sign for the gift card. All 10 gift cards were picked up and signed for.

Data Analysis

Quantitative data analysis encompassed standard descriptive, correlational, and parametric tests. These parametric tests (multiple regression, one-way ANOVA, MANOVA, etc.) come with certain assumptions regarding the collected data being analyzed and tend to be more sensitive to changes between groups and group sizes. Descriptive statistics were utilized to describe the participants through frequencies, means, etc. Pearson correlations were conducted to determine if relationships existed between the variables of interest, namely grit, mindset, exercise self-efficacy to determine exercise behavior. When correlations were found to be significant, simple linear regression and multiple linear regression were used to determine the predictive ability of grit, mindset, and self-efficacy on exercise behavior and the variables with one another. In addition, participants were categorized based on their current exercise behavior into groups in accordance with the 2018 HHS guidelines: IA, A, and HA. Correlations were then conducted to determine the relationship between the variables when considering these HHS Guidelines group delineations. A one-way between-groups univariate analysis of variance (ANOVA) was conducted to determine if different levels of physical activity affected levels of grit, mindset, and exercise self-efficacy. In addition, a one-way multivariate analysis of variance (MANOVA) was conducted to test the hypothesis that there would be one or more mean differences between the three PA groups and non-cognitive variables.

Qualitative interviews were done using a sequential explanatory approach. Interviews were recorded, transcribed, and analyzed for emergent themes. Concepts of interest were then defined along the lines of the definitions of terms found in Chapter 1.

The data were considered line-by-line for fit into each concept. The data were then interpreted through a Thematic Analysis approach (TA). This approach gave me flexibility while also requiring active choices about how to interact with the data, identify patterns, and interpret this data (Braun & Clarke, 2006; Braun et al., 2016). In short, this TA approach, like many qualitative approaches, acted as a tool used in the current study to uncover potential for “nuanced, complex, interpretive analysis” (Braun et al., 2016, p. 191) through creation of higher-order themes, lower-order themes, and representative meaning units. Higher-order themes are overarching themes, followed by lower-order subthemes, and representative meaning units, which express how these themes are seen through the participant responses and data.

Bias Statement

The study was designed to explore the relationships between physical activity and non-cognitive skills of self-efficacy, grit, and mindset among undergraduate students at a specific, Research I, large institution in the Northeast. The institution is one where I have worked both as an administrator for over three years and served as a graduate student and teaching assistant. While I was an administrator, I worked with residential services and facilitated many programs within a wellness model. With this background, I had certain knowledge about the education programs and the students this institution serves, as well as having colleagues across the institution who could assist with access to the students and to other historical health and wellness data. Unfortunately, this knowledge and background could have also biased my ability to be objective in what I observed and heard about the student experience, so I remained cognizant of this lens.

Furthermore, my primary goal in returning to the institution to work on my doctoral degree was specifically to examine and combat the facts behind the national

statistics that over half of the American population, including college students, do not meet the recommended amounts of physical activity. I want students I work with to thrive. Thus, I stayed continually aware of my strong desire to find ways to intervene in their overall health, including this physical inactivity, as I did not want this desire to blur my own capability to see the results in an impartial way. In other words, I avoided seeing data through a lens of positive results simply because of a desire for these positive results to come to fruition.

Additionally, it was critical for me to do everything in my power to maintain an objective stance while studying the exercise behavior, self-efficacy, grit, and mindset of college students during the research period. In order to accomplish this, I allowed the data to reveal themselves without reading into the information I gathered from the initial quantitative data and individual interviews and without hoping for certain results. Also, I acknowledged other possible biases that could come into play: in deciding the sample through inclusive and exclusive criterion, in choosing questions and during interviews, and in choosing procedures or even in how the information was reported after the study's data collection was completed.

In the end, my knowledge of the institution and its students, as well as my own roles as a past administrator and current doctoral student served me well and allowed me to view the research questions and the collected data through these lenses. In addition, my strong connections across campus allowed me to tap into these multiple resources, as I gained possibly easier access to the chosen sample of the population. In all, these were strengths for me as a researcher, as I stayed cognizant of these and other potential biases

that could influence the outcome, and I adjusted accordingly. I enjoyed the overall approach I took to this challenge and feel that I managed potential biases effectively.

CHAPTER 4

RESULTS AND DISCUSSION

The purpose of this study was to examine the relationships among the non-cognitive character skills of grit, mindset, and exercise self-efficacy, and self-reported exercise behavior in a population of college students (utilizing access to students who were registered for functions through campus recreation services at a large, Division I institution in the Northeast). A mixed-method approach was utilized, specifically an explanatory sequential design, divided into two phases: Phase 1 which included quantitative data collection, and Phase 2, which included an identical collection of quantitative and qualitative data from structured interviews of a smaller sample (10 participants randomly selected according to adapted HHS 2018 PA Guidelines). Once correlations between grit, mindset, exercise self-efficacy, and exercise behavior were found, I also examined grit, mindset, and exercise self-efficacy as possible predictors of this reported exercise behavior to interpret the data in another way. Assumptions of normality, linearity, homoscedasticity, and absence of multicollinearity were checked throughout the process of data collection. Ultimately, the outcome of this study provided additional insight into how skills such as grit and mindset may influence current and future health and fitness behaviors of college students. In addition, it examined the relationships between exercise self-efficacy, which has been readily confirmed as having a positive correlation to physical activity/exercise behavior (e.g., Jackson, 2010; McAuley et al., 2011; McAuley, Wraith, & Duncan, 1991; Neupert et al., 2009), and the other variables of grit and mindset. Finally, it sought to add a qualitative element to the

reported grit and mindset levels with the experience of college students engaging in and maintaining recommended levels of exercise, as compared to those who do not.

Descriptive Data

The descriptive data for both Phase 1 and Phase 2 samples are presented first. Then results for each research question are reported, first by presenting analysis of quantitative data followed by analysis of qualitative data. The results for individual research questions are discussed, as well as additional analyses of gender beyond the stated research questions. The research questions are discussed in order, with a general discussion pulling evidence together, and finally, recommendations are made for researchers and applied practitioners who may influence client, student, athlete, and/or patient health.

Table 4.1. Means and Standard Deviations for Quantitative (Phase 1) and Qualitative (Phase 2) Samples

Measure	PHASE 1		PHASE 2	
	M	SD	M	SD
Total Minutes of PA	259.65	168.87	219.00	201.15
Muscle Strengthening	2.45	1.77	2.20	2.10
ESE	24.25	6.84	23.60	9.97
Academic Credits	59.56	36.66	75.60	38.58
GPA	3.40	.49	3.17	.44
Grit-S	3.42	.56	3.74	.70
Grit-P	3.96	.63	4.15	.76
Grit-I	2.89	.74	3.33	.74
ITF	34.62	5.41	34.70	.96
Age in Years	20.07	1.81	20.60	1.96

Note: Quantitative (Phase 1) $N = 366$; Qualitative (Phase 2) $n = 10$

Results for Research Question 1 (Phase 1)

Research Question 1 asked, “Are perceived non-cognitive skills related to college student exercise behavior?” More specifically, “are grit, mindset, and/or self-efficacy related to college exercise behavior?” It was hypothesized that grit, as shown through full Grit-S scale scores (including Grit-P and Grit-I subscales), mindset, as shown through the ITF mindset scale results, and/or self-efficacy, as seen in the ESE scale measuring exercise self-efficacy, would be correlated with college exercise behavior, as measured by total minutes, calculated from final PAVS scores of minutes and as measured in three behavior levels (IA, A, and HA). All means and standard deviations for both Phase 1 and Phase 2 can be found in Table 4.1. A matrix of all correlation coefficients between the variables and exercise behavior as measured by total minutes of physical activity per week can be found in the Table 4.2.

Correlations Between All Variables and Total Minutes PA

To examine whether there were significant correlations between grit and college student exercise behavior, a Pearson product-moment correlation coefficient was computed to assess the relationship between student grit, as reported through Grit-S scores, and overall total minutes of PA. Considering grit, there was a significant weak positive correlation between total grit and total minutes of PA, $r(366) = .132, p < .05$, and there was a significant weak positive correlation between the grit subscale of Perseverance of Effort (Grit-P) and PAVS total minutes, $r(366) = .177, p < .01$. However, there was not a significant correlation between the other grit subscale, Consistency of Interest (Grit-I) and PAVS total minutes, $r(366) = .051$. Considering mindset, there was a weak significant positive correlation between Mindset (ITF) total reported PA minutes,

$r(366) = .161, p < .01$. Considering the relationship between the level of student ESE and overall total minutes of PA, there was a significant moderately strong positive correlation between the two variables $r(366) = .543, p < .01$.

Table 4.2. Correlations for All Participants Between Non-Cognitive Variables and Total Minutes of PA (PAVS)

Measure		Total Minutes of PA
Grit-S	Pearson Correlation	.132*
	Sig. (2-tailed)	.011
Grit-P	Pearson Correlation	.177**
	Sig. (2-tailed)	.001
Grit-I	Pearson Correlation	.051
	Sig. (2-tailed)	.333
Mindset ITF	Pearson Correlation	.161**
	Sig. (2-tailed)	.002
ESE	Pearson Correlation	.543**
	Sig. (2-tailed)	.000

Note. $N = 366$

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

With significant correlations between the variables and PA (with the exception of the Grit-I subscale), a multiple linear regression was conducted to predict college student exercise behavior from the collective Grit-S, Grit-P, ITF, and ESE scale scores. These variables significantly predicted exercise behavior, $F(5, 359) = 42.08, p < .05$, with an R^2 of .680, and an adjusted R^2 of .361 of the variance accounted for. However, only ESE was a moderately strong significant predictor of exercise behavior ($p = .000, p < .05$), while Grit-S, Grit-P, and Mindset (ITF) were weak significant predictors ($p = .394, p = .526$, and $p = .199$, respectively). Upon full analysis, although both Grit-S scores and Grit-P scores predicted reported PA, Grit-S only accounted for 1.7% of the variance and Grit-P only accounted for 3.1% of the variance, while Mindset (ITF) only accounted for 2.6% of the variance. Thus, ESE was the primary predictor of reported PA, with an adjusted R^2 of .361 of the variance accounted for. The summary of the multiple regression is in Table 4.3 with a corresponding scatterplot in Figure 4.1.

Table 4.3. Summary of Regression Analysis for Variables Predicting PA (minutes)

	<i>B</i>	<i>SE</i>	<i>B</i>	β	<i>p</i>
Grit-S	-17.79	20.82	-.06	-.86	.394
Grit-P	11.97	18.87	.04	.63	.526
Mindset-ITF	1.75	1.36	.06	1.29	.199
ESE	8.22	1.35	.33	6.11	.000

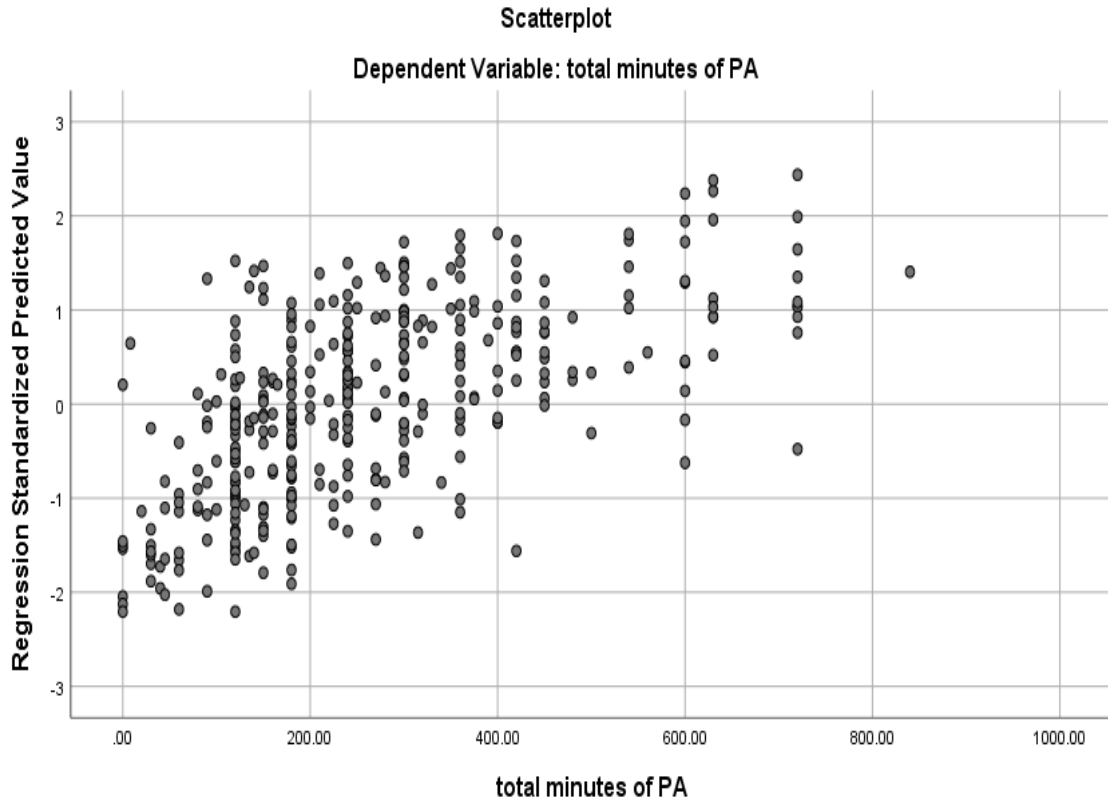


Figure 4.1. Scatterplot of Multiple Regression ALL Variables Predicting Total PA

Results for Research Question 2

Research Question 2 asked, “Are perceived non-cognitive skills related to one another in a college student population?” More specifically, are grit, mindset, and/or self-efficacy related to one another in a college student population? It was hypothesized that grit, mindset, and/or exercise self-efficacy, would be correlated with one another in relationship to college student total reported exercise behavior. The full correlation matrix can be seen in the following Table 4.4.

Table 4.4. Correlations Matrix Between All Non-Cognitive Variables

Scale	ITF	ESE	GRIT-S	GRIT-P	GRIT-I
ITF					
ESE	.192**				
GRIT-S	.230**	.243**			
GRIT-P	.176**	.321**	.787**		
GRIT-I	.200**	.096	.852**	.348**	

Note. ** = $p < .01$, * = $p < .05$

To examine whether there were significant correlations between all the variables of grit, mindset, and self-efficacy in a college student sample when examining exercise behavior, Pearson product-moment correlation coefficients were computed to assess the relationships between the variables, as reported through Grit-S, Grit-P, Grit-I, ITF, and ESE scores. Considering grit, there was a significant positive correlation between total grit Grit-S and every other variable. The correlations between Grit-S and the subscales was expected from review of the literature with Grit-S having a significant strong positive correlation with Grit-P, $r(366) = .787, p < .01$ and Grit-S also having a significant strong positive correlation with Grit-I, $r(366) = .852, p < .01$. In addition, there was a weak positive correlation between Grit-S and ITF, $r(366) = .230, p < .01$ and between Grit-S and ESE, $r(366) = .243, p < .01$. Finally, ESE and ITF also had a weak

positive correlation, $r(366) = .192, p < .01$. The only two variables that were not correlated were ESE and Grit-I, $r(366) = .096$.

Results for Research Question 3

Research Question 3 asked, “Are there differences in perceived non-cognitive skills between college students based on their exercise behavior level (inactive/insufficiently active [IA], active [A], and highly active [HA])”? It was hypothesized that grit, mindset, and/or exercise self-efficacy, would have differences based on PAVS score, delineated by exercise behavior level as adapted from the HHS 2018 PA Guidelines (IA, A, and HA). For the current research, the HHS 2018 Guidelines categories were IA (failing to meet recommended 150 minutes/week), A (achieving recommended 150-300 minutes/week), and HA (reaching more than 300 minutes/week).

Means and standard deviations were first examined for the three separate groups to see if there were differences. As can be seen in Table 4.5, all variable mean scores increased as the amount of total minutes of PA increase. After examining the descriptive data, a one-way between subjects MANOVA was conducted to determine these HHS 2018 PA Guidelines groups (IA, A, HA) were statistically different on Grit-S, Grit-P, Grit-I, ITF, and/or ESE scores. Results showed that there was a statistically significant difference between exercise behavior groups on the combined variables, $F(2, 363) = 17.12, p < .01$; Wilks' Lambda (λ) = .71; partial eta squared (η_p^2) = .16, achieved $\beta = 1.00$. When each variable is considered separately, all variables reached statistical significance at an alpha level of .05 with the exception of Grit-I ($p = .67$). However, the effect size across variables was small and thus had only a marginal effect on differences, with the exception of ESE. Results of the MANOVA can be viewed in Table 4.6.

Table 4.5. Means and Standard Deviations for All Variables in adapted HHS 2018 PA Guidelines Groups

Measure	3 Groups		IA		A		HA	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Total Minutes of PA	90.62	42.01	221.99	51.40	474.81	128.62		
Grit-S	3.30	.54	3.46	.59	3.48	.53		
Grit-I	2.83	.68	2.92	.76	2.89	.76		
Grit-P	3.77	.65	4.00	.63	4.07	.56		
ITF	33.62	5.18	34.53	5.55	35.69	5.29		
ESE	19.08	6.14	24.47	5.78	28.79	5.45		

Note: IA Group, $n = 101$; A Group, $n = 158$; HA Group, $n = 107$ (total $N = 366$)

Considering the MANOVA results (see Table 4.6), there was a statistically significant difference between the HHS 2018 PA Guidelines groups on Grit-S, $F(2, 363) = 3.41, p < .05, \eta^2 = .018$ and Grit-P, $F(2, 363) = 7.15, p < .05, \eta^2 = .038$. Overall, Grit-S and Grit-P accounted for a very small effect on total reported exercise behavior. Considering the Grit-I subscale, there were no statistically significant differences between the groups. Considering mindset, there was also a statistically significant difference between the exercise behavior groups for ITF, $F(2, 363) = 3.89, p < .05, \eta^2 = .021$. Finally, there was a statistically significant difference between the exercise behavior groups on ESE, $F(2, 363) = 73.47, p < .05, \eta^2 = .288$. See Figures 4.2 - 4.5 for graphs of the four variables' means represented across the three groups.

Table 4.6. MANOVA Tests of Between-Subjects Effects for Adapted HHS 2018 PA Guidelines

Source	Measure	<i>F</i>	<i>p</i>	η_p^2
3 GROUPS	GRIT-S	3.405	.034	.018
	GRIT-I	.398	.672	.002
	GRIT-P	7.150	.001	.038
	ITF	3.891	.021	.021
	ESE	73.473	.000	.288

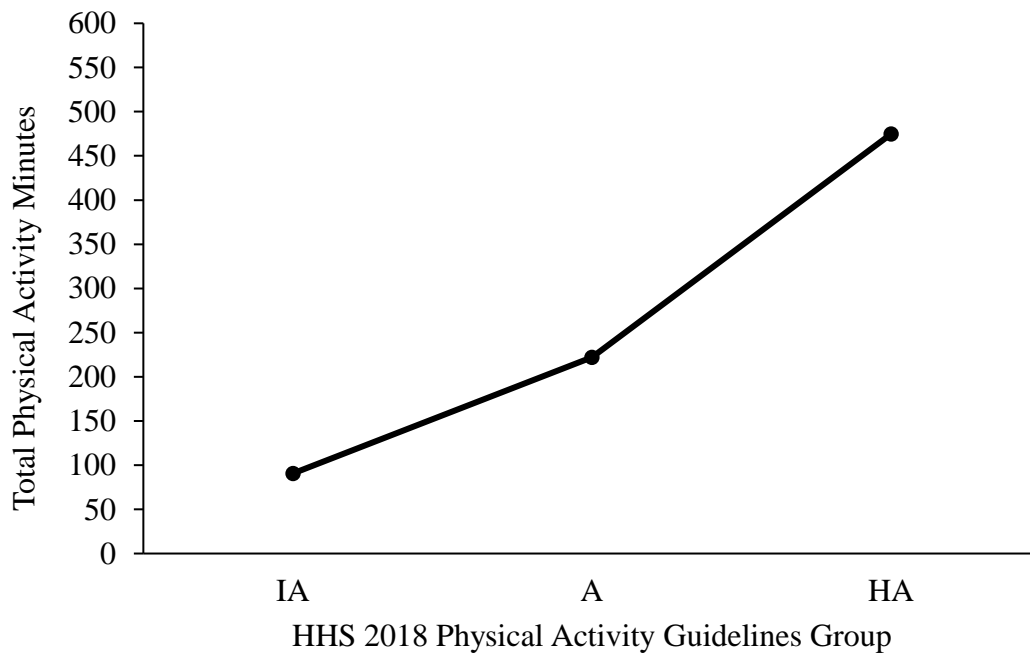


Figure 4.2. PAVS Means Across HHS 2018 PA Groups

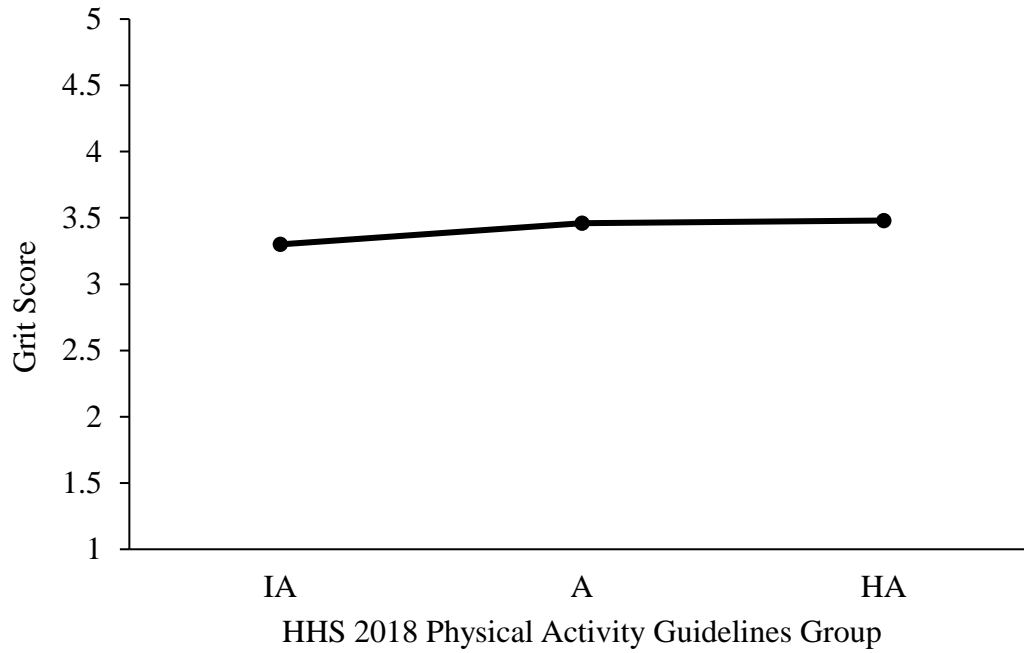


Figure 4.3. Grit-S Means Across HHS 2018 PA Groups

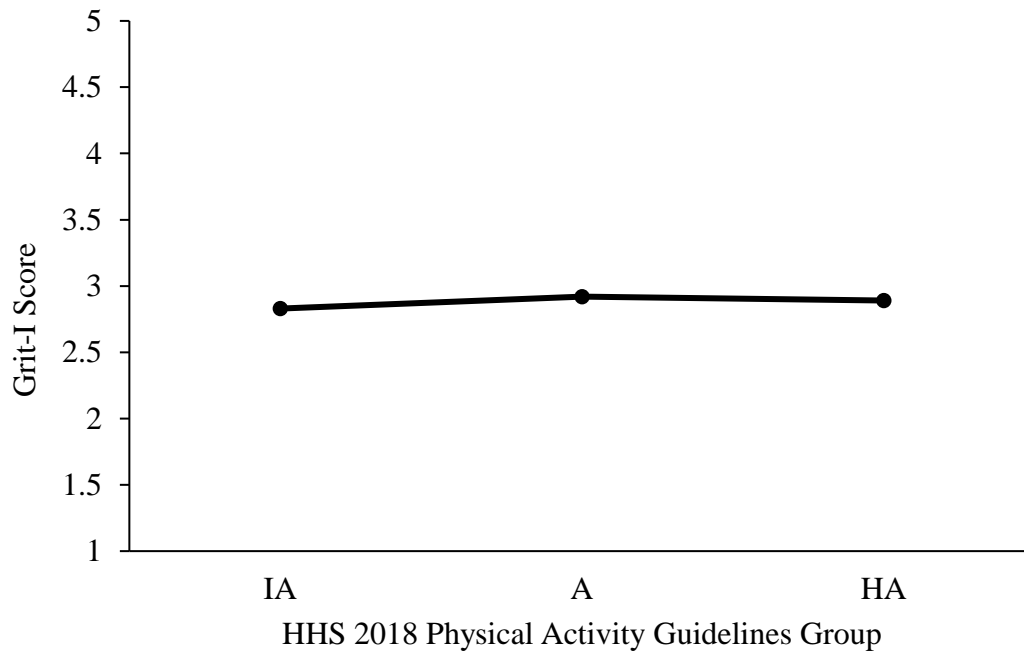


Figure 4.4. Grit-I Means Across HHS 2018 PA Groups

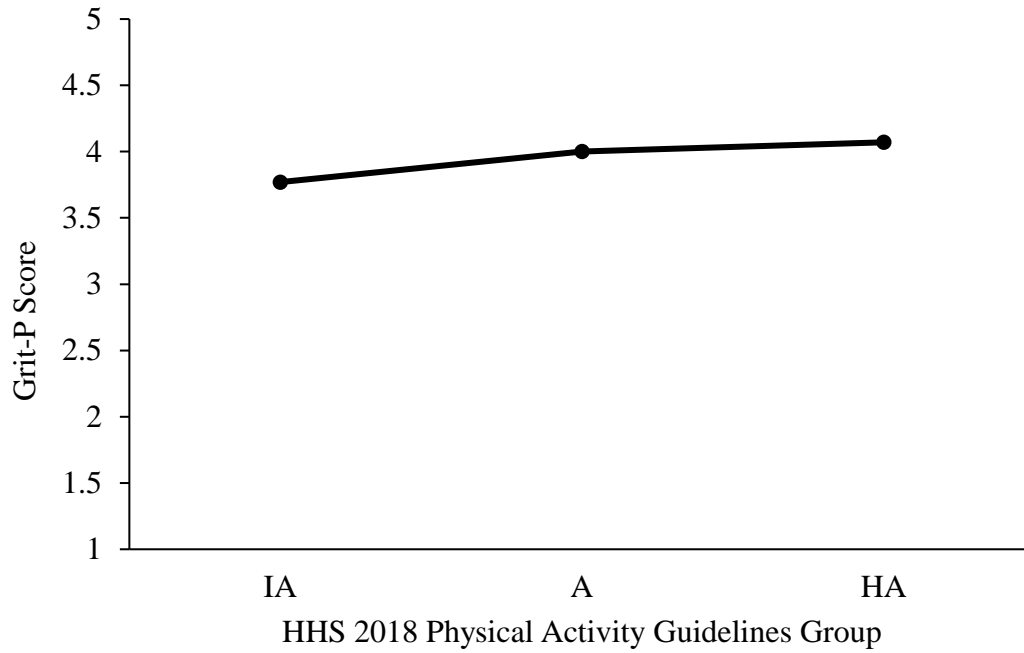


Figure 4.5. Grit-P Means Across HHS 2018 PA Groups

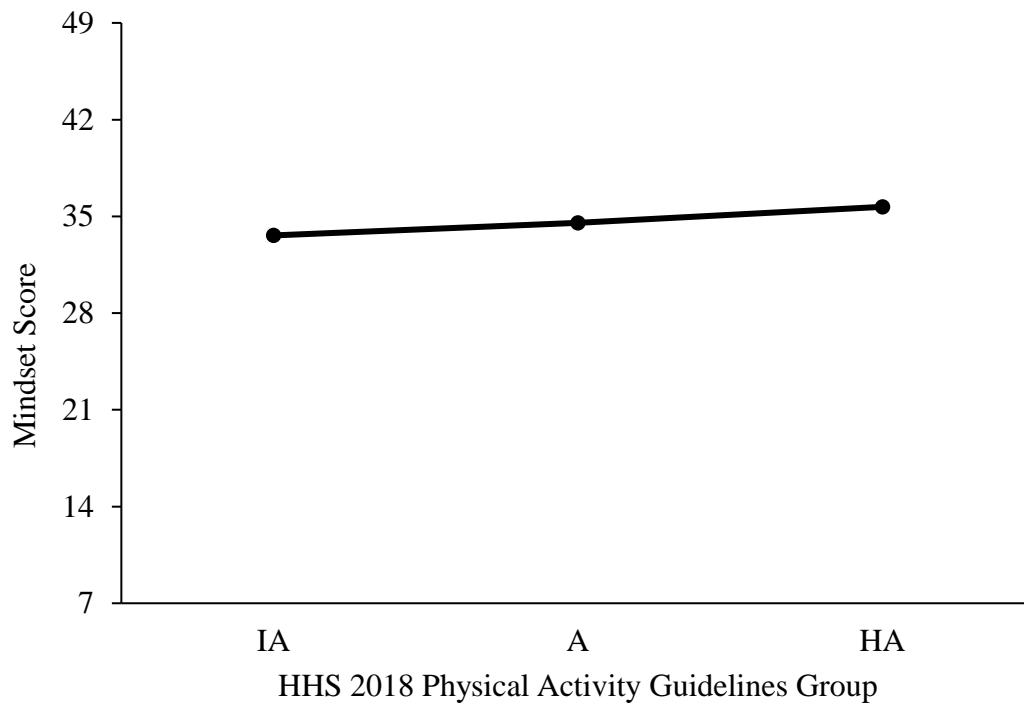


Figure 4.6. Mindset (ITF) Means Across HHS 2018 PA Groups

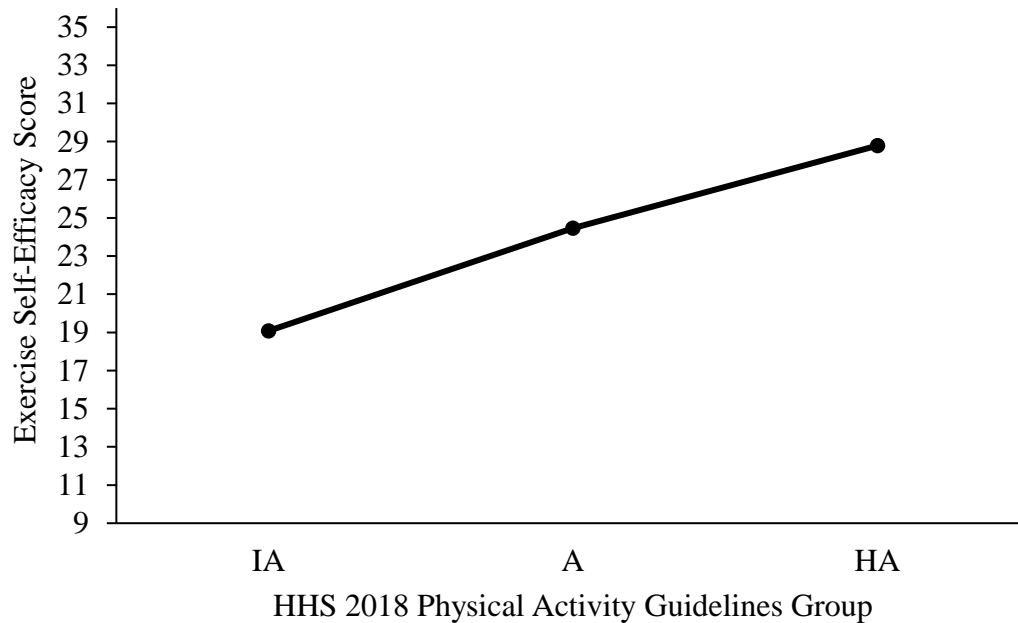


Figure 4.7. ESE Means Across HHS 2018 PA Groups

Additional Quantitative Results

Variable Differences According to Gender

Beyond the direct research questions, additional analyses were conducted to view all variables and relationships according to gender. Table 4.7 presents the means and standard deviations for the relevant variables by the two identified genders of male and female. Those who identified as non-binary or who chose not to answer were less than 1% of the total sample; thus, they were omitted from the following analyses.

A two-group MANOVA was then conducted on the data in Table 4.7 which was not significant (Wilks' lambda $\lambda = .938$, $p = .086$, partial eta squared = .021). The only significance was found for total PA (PAVS) and ESE where males had higher scores than females.

Table 4.7. Means and Standard Deviations for Variables According to Gender

Gender		Total PA	Grit-S	Grit-P	Grit-I	ITF	ESE
Female	<i>M</i>	231.26	3.40	3.93	2.87	34.22	23.71
	<i>SD</i>	163.42	.56	.60	.75	4.93	7.03
Male	<i>M</i>	289.48	3.46	4.00	2.92	35.03	24.93
	<i>SD</i>	170.74	.55	.65	.72	5.87	6.54

Note: Female $n = 181$; Male $n = 181$

Table 4.8. Two-way MANOVA Conducted According to Gender

Source	Measure	<i>F</i>	<i>p</i>	η_p^2
Gender	GRIT-S	2.230	.084	.018
	GRIT-I	1.115	.343	.009
	GRIT-P	2.040	.108	.017
	ITF	.704	.550	.006
	ESE	3.001	.031	.024
	PAVS	3.876	.009	.031

To examine significant correlations between all the variables of grit, mindset, and self-efficacy when examining exercise behavior, according to gender, a Pearson product-moment correlation coefficient was computed to assess the relationships between the variables, as reported through Grit-S, Grit-P, Grit-I, ITF, and ESE scores and illustrated in Table 4.9 below.

Table 4.9. Correlations Matrix for All Variables According to Gender

Scale	PAVS	ITF	ESE	GRIT-S	GRIT-P	GRIT-I
Female						
PAVS						
ITF	.133					
ESE	.525**	.221**				
GRIT-S	-.003	.219**	.165**			
GRIT-P	.061	.234**	.200**	.790**		
GRIT-I	-.053	.143	.088	.872**	.390**	
Male						
PAVS						
ITF	.159*					
ESE	.525**	.154*				
GRIT-S	.247**	.242**	.293**			
GRIT-P	.267**	.234**	.420**	.780**		
GRIT-I	.137	.249**	.071	.827**	.293**	

Note. ** = $p < .01$, * = $p < .05$

As a final analysis, PAVS scores were correlated with students' age, number of completed credits, and GPA. None of these correlations were significant.

Qualitative Analyzing Process

To examine further how undergraduate students experience physical activity, grit, mindset, and exercise self-efficacy both within the context of exercise behavior as measured by total minutes and in other domains, structured interviews were conducted with a small sample ($n = 10$) of college students. They were chosen randomly from Phase 1 participants who fully completed the Phase 1 questionnaire and who volunteered for Phase 2 (See Table 4.10). The interviews were transcribed and analyzed using an explanatory sequential approach. In this specific type of mixed method, quantitative data were collected and analyzed followed by the collection and analysis of qualitative data leading then to interpretation (Creswell, 2014). This strategy was useful because it allowed for the qualitative data analysis to assist in understanding, explaining, and even contradicting the quantitative data analysis. In novel fields of research, or more accurately old fields with a new twist, such as non-cognitive skills like grit, mindset, and exercise self-efficacy being connected to a specific behavior, this more in-depth understanding of the variables was particularly important.

The data were then interpreted through a Thematic Analysis approach (TA). This approach gave me flexibility while also requiring active choices about how to interact with the data, identify patterns, and interpret these data (Braun & Clarke, 2006; Braun et al., 2016). In short, this TA approach, like many qualitative approaches, acted as a tool used to uncover the potential for “nuanced, complex, interpretive analysis” (Braun et al., 2016, p. 191) through creation of higher-order themes, lower-order themes, and

representative meaning units. Higher-order were overarching themes, followed by lower-order subthemes, and representative meaning units which expressed how these themes were seen through the participant responses and data.

Table 4.10. Descriptive Information for Qualitative Participants (Phase 2)

Pseudonym	Age	Gender	Grit-S	ITF	ESE	GPA	PAVS	Muscle
Jacqui	19	F	3.50	23	9	2.74	0	0
Rafaela	24	F	4.38	38	34	DNP	225	0
Eli	18	M	3.88	33	14	2.98	30	1
Melanie	21	F	4.25	42	29	3.56	240	2
Unity	22	F	2.13	28	10	2.67	15	0
Aleah	19	F	4.63	41	18	3.50	60	2
Sawyer	23	M	3.75	36	30	2.75	420	3
Devon	21	M	3.88	37	27	3.38	480	5
Teryn	20	F	3.25	33	29	2.98	180	3
Cruz	19	M	3.75	36	36	3.98	540	6

Note: DNP = Did Not Provide

Qualitative Results

Four higher-order themes emerged from the analyses that seemed to characterize the experience of exercise behavior, grit, mindset, and exercise self-efficacy for the college student Phase 2 participants in this study. They included Responses to Failure, Goals/Goal Setting, Behavioral Influence, and Non-cognitive Skills. As discussed previously, approaching the qualitative data in this way, through a Thematic Analysis

approach (Braun, Clarke, & Weate, 2016) allowed me flexibility in wrangling with the data, as well as allowing me to let the qualitative data seamlessly connect with the quantitative. Table 4.11 depicts the overarching thematic structure, including higher-order themes, lower-order subthemes, and representative meaning units. Of the higher-order themes, participants' Responses to Failure, which is also at the crux of many of the research studies of grit, mindset, and exercise self-efficacy, represented the overall context within which the participants experienced the other higher-order aspects: Goals/Goal Setting, Behavioral Influence, and Non-cognitive Skills. Each of these higher-order themes had lower-order themes and representative meaning units drawn from them. These higher-order themes, lower-order subthemes, representative meaning units, and corresponding quotes (with pseudonyms of participants indicated) are discussed in the following sections. The overall Thematic Analysis model, shown below, shed light on the experiences of the sample and was then connected to quantitative results in the later Discussion section.

Responses to Failure

In much of the research regarding grit, mindset, and self-efficacy, the catalyst has often been the question of how individuals respond to failure and why some respond with action while others tend to quit. Both Dweck (2006, 2019) and Duckworth (2016, 2019c) not only continue seeking answers to this question, but they also point to their own failures along the way, and the learning that has happened from those failures. All interviewed participants spoke to the salience of the failure context and how they respond to failures: in reaching goals, academics, personal issues, athletics, and in adhering to

physical fitness. Lower-order subthemes tied to Responses to Failure were Perseverance and Giving Up.

Table 4.11. Qualitative Themes and Representative Meaning Units

Higher Order Themes	Lower Order Themes	Representative Meaning Units
Responses to Failure	Perseverance	Fuel to work harder/use failure Finding a way Understanding of long-term focus Effortful control of motivation
	Giving Up	Disappointed that work \neq outcome Re-prioritizing lacks intention Lack of self-driven motivation
Goals/Goal Setting	Hierarchical Goal System	Modify smaller goals as needed Health is part of goal system SMART goals Know what trying to achieve
	No Formal Goal System	Don't know what trying to achieve Articulate lack of goals Not concrete/Not SMART Positive health is not a goal
	Intention to Move	Desire to enhance PA
Behavioral Influence	Supportive of PA	Active family members Inspirational figures (e.g., coaches, teachers) Sports involvement Self - belief in malleability/mindset
	Discouraging of PA	Following the crowd Self - "What I have been dealt" mindset
Non-Cognitive Skills	Grit	Self-reported grit level
	Mindset	Self-reported mindset

Perseverance. The differences between this lower-order theme and Giving Up were clear and powerful. Perseverance in this context and as defined by the current literature on non-cognitive skills refers to persisting with a task or challenge even in the face of obstacles or failures (Duckworth, 2009; Duckworth et al., 2007; Peterson & Seligman, 2004). In addition, perseverance is the key factor being measured in the Grit-P subscale. Participants spoke both of grit and of perseverance as “putting in the work” and using failures and challenges to drive action. For example, Teryn stated the importance of responding to failure with a fuel to work harder:

So I was like telling myself when I fail in lacrosse, ‘okay I have got to work harder everyday’, and I have things to do, there are people that I want to be better than, not necessarily better than, but I want to like be at their level and stuff like that. There is always something to work on, and I truly believe in that.

While Sawyer added the need to endure and spoke to the importance of perseverance and in finding a way to succeed, no matter what:

My major, it’s a lot of pretty-tough math courses. I would say I’ve just kind of like just been determined like to succeed, no matter what. Like, even if it gets really bad. Grades get really bad or it gets really late at night just about trying to be able to get through it. No matter what, it is realizing that you have an opportunity that maybe others don’t have is something to keep you pushing forward, through tough obstacles.

Devon spoke of his understanding of the need to persevere until he finally reached a long-term goal:

Like two or three years ago about when I seriously got into more lifting, one of my goals was always to hit like 220, 225 pounds on the bench for 10 reps and, like, I was nowhere near that and like that was just like I don’t know like I had my – usually, would lift with – like a, I’d say like one of my bigger friends and then like, ‘Hey, that looks so easy, and I couldn’t even like do a rep for that and I was like . . . I was like I will get that one day . . . at that time it seemed impossible, and I knew like it would be just a matter of time and I just – I don’t know like – about like three or four weeks ago. I like finally hit it, and I was like wow. I’ve had this goal for like four years now and like four years ago it did seem impossible because I was so far off with it. So that was one thing that was like very, it made me happy in my life; that was a long-achieved goal I had for myself.

Finally, Cruz highlights the critical nature of how he perceives failure and maintaining a focus on his continued effort:

So you can . . . you can choose to perceive a failure – a fitness failure as something that's just going to derail you completely and are you going to just not keep going to begin with, or you can perceive a – or you can perceive a fitness failure as a reason to keep going and just an obstacle that's a part of the path to get where you want to go, so I think it's just – I think it comes down to how you perceive different influences throughout your day.

Giving Up. Despite the participants collective desire to succeed, the thought of quitting or giving up was something that all experienced, even if only momentarily. However, the difference between those who persevered and those who gave up was subtle. First, Melanie explained how her motivation was lessened by what she felt were unmet expectations as the amount of work she was putting in to her goal was not congruent with the desired outcome:

I was taking a course that was very difficult for me to understand it. I feel I was very unmotivated because I did, I felt I didn't understand it, so I didn't want to; I've tried to put in so much effort and continuously didn't do well, so I feel it really hurt my motivation. I wasn't seeing the results that I was putting in.

Jacqui added how maintaining her routine may keep her from making necessary intentional changes in order to create a different outcome:

Yes, there is a lot of times where, like, after studying for an exam for so long and then I ended up getting a bad grade on it, I will be like really unmotivated to work on other things on anything really and like stuff like that. As for focusing on health, I have never really thought about it, but I am kind of a routine person that, like, if I find something that I do like, I just kind of want to stick with that and keep doing it.

Finally, Teryn speaks of how losing motivation from failure pushed her to give up not only on that task (academics) but also other aspects of her life:

At the beginning of high school when I was completely lost and things just got a lot harder, and I think just, like academics got harder because no school is nothing if you are going to have to take physics as a freshman. And then, I was not used to

not being good at school, and I was not used to not being good at something because I am the type of person when I start a project or when I am in a class, or something like that, I would like to be good at it. So . . . I took Physics, and I was not good at it, so I just did not care for it anymore. And I was just, my mindset, it was just like, I just want to get this over with, study whatever I get, and just do what I can, and just, I was not motivated to do anything, school, sports, nothing...

Goals/Goal Setting

The second higher-order theme from the qualitative data was goals and goal setting. Goals are an essential piece of the variables examined in this study. For example, grit is defined as perseverance and passion toward reaching long-term goals (Duckworth et al., 2007), and mindset is the continuum stretching from growth to fixed mindset that can impact an individual's ability to believe that skills are malleable and goals that perhaps an individual is unable to achieve today could be achieved at some other point through this skill malleability. Three lower-order themes were connected to this higher-order theme: Hierarchical Goal Setting, No Formal Goal System, and Intention to Move.

Hierarchical Goal Setting. Sawyer spoke to what he saw as a critical way of breaking goals into smaller, lower-level goals, and modifying these smaller goals as necessary to reach a higher-level goal, in what Duckworth (2019a) calls "hierarchical goal setting":

It would be just, I think, it's like fitness and health can't, it's not, there's no bar. I think you should always try to be improving yourself. But so it's at least, it's kind of taking it a step at a time, and then improving, and then setting smaller goals, and then improving. And it's just kind of about being happy with yourself and reaching small goals, and like, oh, if it's too hard and kind of stepping back, and or if you're getting too used to something then tightening the goal is a measure of going forward.

Aleah added that health and fitness are a direct part of taking these smaller steps within her hierarchical goal setting scheme:

. . . success in fitness would be any goal that you have, not necessarily accomplishing it but doing anything to get closer to the goal. I'd say would be a success because some people see success in accomplishing their goal, I personally think that any step towards your goals like physical fitness-wise is considered success itself.

Devon discussed the nature of his goals as he speaks of being very specific and that his goals are often time-bound (SMART goals):

I set goals and like specific ones like whether it's like, "I wanna bench 10 reps," or if I want to get, like, right now I'm trying to, shoot, like lose 15 pounds for summer. So like right now it's, like, my success is based on if I reach my goals, and kind of like if I'm only improving; to me that's something that's really good; so it's like all right and almost working towards something, and so that's always being good but like mainly if I hit the goals that I set for myself, I would consider myself to be a success not like comparing myself to others.

Cruz spoke of the importance of remembering what he was trying to achieve, even as he struggled to maintain his physical activity and nutrition regimen required to reach his ultimate goal:

A lot of my hard work was adhering to a very strict diet for 12 weeks and making sure everything was accounted for with everything I ate and everything I did, as I was trying to get in peak shape. Counting calories was very mentally fatiguing for 12 weeks and then in the weight room part of that, I never liked – I don't know how people do, but I never really liked cardio that much and having to adapt to three, four, five, six days of cardio to the goal that I set was a little challenging in finding ways to at least enjoy it a little bit and not hate it that much. Because if I'm going to go at it five, six, seven days a week, yes, you need to find a way to at least tolerate it a little more and then going down to the weight room with that – with that same mission -- at the end, I knew I was trying to get to this end goal.

Finally, Raphaela (as Cruz did above) also showed a hierarchical goal approach and that individuals who have this focus rarely modify the larger primary goal, even if the individual wants to stop en route to that goal. In this case, she spoke of the goal of her relay team breaking their own previous record:

. . . my senior year, it was our year at the relays. We had to go hard or go home. We worked every day. We did everything together just to get ready for the chance

to break our own record. It was hard work every day. Constantly working, but we kept encouraging each other too. Because we wanted to stop. Cuz of course you want to stop. And your mind tries to trick you, so you believe you are there at your goal. Until you reach that limit. Until you reach that goal. You must fight your mind. We worked *so* hard. We kept working. At the end, we broke our old record and set a new record. Was amazing.

No Formal Goal System. Although a number of participants did speak to having goals and finding ways to achieve them, even if they didn't have a formally structured system, a number of them also lacked specific goals or articulated very few goals regarding health and fitness. This is the second lower-order theme connected with Goals/Goal Setting. For example, Eli stated, "Yes, I can do a lot better with goals, and you know, my body. But I don't set real goals. Never do." Unity spoke candidly about the physical challenges she faced and that she hasn't set firm fitness goals because of these physical challenges. In the following example, Unity expressed that she could set more concrete goals that she could accomplish:

In actuality, no, my body probably couldn't handle it, I could probably take a little bit more strength training, physical therapy is ideal for me but I couldn't take on any of the absurd goals that I set for myself in my head like going to the gym a lot of times during the week, exercising intensely, or doing yoga or anything. Like, I need to do water aerobics, and call it a day.

Aleah added her own lack of concrete goals, specifically around exercise, and a lack of knowing what she was trying to achieve with her personal exercise behavior:

I have to be honest, my exercise goals are barely there. I am on intramural sports in college, and I did want to do club sports but – I wanted to do club basketball, but our school didn't have it, so that kind of, I don't know, short stemmed my sports goals in a way; but I do play intramural, but I'm not super active; my friends are, but I don't find the time to join them, so yeah, I wouldn't say I'm very active, maybe once or twice a week, three times if I'm lucky and not busy, but that's it. Really, I don't even know what my real goal would be.

Finally, Jacqui also spoke of her lack of health goals, as well as how her primary goals were not solidified, especially within the realm of health and fitness:

No, I do not think I have any real health goals. I think just with like school right now it is hard to start, but I have already like decided that whenever I go home for the summer, I am going to start going to the gym more then hopefully kind of while I am home not worrying about school, I can get into that routine so that whenever I come back, I can find more time and work on time management, so that I have time to go more while I am at school . . . I feel like I would not say depressed but I feel like if I were to go to the gym, I could be happier on not only with the way I look, but I like I know it would make me feel better, just like overall.

Intention to Move. This is the final lower-order theme connected with Goals/Goal Setting. As Jacqui stated in the previous example, most individuals, regardless of current PA levels, have intentions to enhance their physical activity, and these 10 participants are no exception. Unity said that “although I know I won’t, I want to go to the gym three times a week”, so at the very least, the thought of intention for this goal is present. Aleah also stated her desire to move more but the challenges of doing so. She explained that she intended to refocus during summer:

So definitely I'm not happy with not moving my body, I'm not where I want to be but I'm thinking about starting again this summer. I've been doing some green tea diets and things and hopefully this summer, I have a job on campus, so I am thinking to hit the gym more often, so yeah, I definitely have goals to get better, but now I'm definitely not happy with where I am.

Eli also spoke to how he wanted to change his approach with his health and lifestyle to include more movement:

I want to get up earlier. Go to the gym. I just wanna try it like that would definitely be the main one, but I mean instead of like driving around like the city, like a walk, walk in the city, walk to and from where I'm going instead of Ubering. That can be like the little minor thing. I think it's just like a probably – there's probably more of an effort if you go into the gym.

Teryn and Melanie, both of whom reported reaching recommended PAVS minutes, also had clear intentions to create new routines and to make health a larger priority. Teryn said:

. . . so I would go to the gym again, and I would try to wake up early, try to, I would try to like put together a routine, so I have some sort of idea of what is coming next in the future rather than just taking it day by day. I would try to plan out a schedule, so I would leave at the same time, I would go to the gym at the same time, and I would go to class at this sort of time, and I would like flip it another time . . . And I could definitely choose different types of activities at the gym. And I could definitely push myself harder. I could go multiple times a day and go even when I do not feel like going.

Melanie similarly stated that she, too, wanted a better routine that she could adhere to:

. . . I really want to get a better fitness exercise together for myself, a routine that I could definitely get into. Well, I definitely try to get to the gym every day of the week, Monday through Friday at some point. And the way, I like to run on the treadmill, and I've been working on just being able to run at least a mile or so on the treadmill. I usually go to [the college's fitness center] because they have fitness classes, and I feel that's a lot easier for me to go to because they kind of have set in place what you could do, so you don't have to go to the gym and figure it out on your own.

Finally, Devon spoke to the fact that he wants to continue to improve; however, he was one of the few that said he is tapping into his peak performance:

My behaviors can definitely improve, but they are probably at the peak of, like, the way I watch my diet and work out . . . and stuff like that . . . and I have kind of like learned to cope more over the years . . . so there are so many things I can do better . . . but I am very close to my peak.

Behavioral Influence

The third higher-order figural theme that emerged from the interviews associated with the participants' exercise behavior experience was Behavioral Influence. Although exercise behavior is ultimately a personal endeavor, these participants discussed the influences both within and outside of themselves. The major theme of Behavioral Influence had two lower-order themes: Supportive of PA and Discouraging of PA.

Supportive of PA. As stated above, our desire to or intention for moving our bodies is an individual experience; however, we are all influenced by other entities.

Teryn spoke of the importance she placed on her continued positive mental health as

reason to move her body, and this is why she adheres to movement. Her belief in her own malleability and growth was an important factor for her:

I have noticed that, because I have been going through a lot of things in my life, and my mental health has not been where I want it to be, and it can seem to be difficult to get through . . . one of the main reasons why I do work out or like I keep up with my fitness . . . is because of that mental health reasons; that is why I go to the gym. Like when I am stressed or like something is going on, then I need to destress to have some sort of natural endorphins going on and things like that. So that is like a huge factor in why I keep up with my fitness.

A number of the participants (Sawyer, Devon, and Unity) spoke of positive influences from their family members. Sawyer stated:

I would say my dad's work ethic showed me how to keep going and persevere. As a young kid my grandparents gave me a lot of math problems to do, and my dad's an accountant. So it just kind of like transferred from like math to working every day, getting up early every day to go to the gym in the morning before work, having a good routine. . . I've also done like ballet two times with my mom. . . I am a lifelong learner. I would say I'm kind of . . . addicted to learning, especially with only having one class and try to like learn as fast as I can: diet, movement, yeah.

Devon also spoke of his father as both an influential parent but also someone who inspires him to be all he can:

I would say my father was definitely like growing up a big influencer because he was born in Italy and came to America like knowing little to no English and kind of like still wanted – made it to college, graduated and like he was just . . . like no matter the hard times he went through at the high school getting like bullied and everything like that, speaking in no English and kind of the exchange student. So like just to see the way he could like persevere through all of that, and like now he has like a real paying job just like it shows me, like, through my life, he always just taught me like no matter how hard it gets, like you can always just persevere through things and like it's just like a small – again, anything hard you're going through right now like a small chapter in your life, and it's like inspirational.

And Unity added to this parental impact with the significance of her mom in helping her reach her goals throughout her life:

. . . Mom was always really pushy when it came to my goal, not in a bad way or a good way. If I wanted to get something done or if I wanted something, she was

always very supportive in trying to make it happen for me. She'd do literally anything possible depending on the situation, talk to me, talk to other people, pay for me to take certain classes, pay for me to do certain things, anything she could possibly do.

Cruz articulated the importance of finding and maintaining a broader “supporting cast” as ways to keep focused on goals, including with health and fitness:

I think of just the importance of having a supporting cast and just having people around you that – maybe they don't clap you on or rally you actively, but it's more about them – it's almost more about them not talking down on your goals, school, fitness, more than it is – than actively supporting you. Don't get me wrong, the active support is definitely great, too, but it's definitely a lot more demoralizing when you have people around you that do not support you rather than the latter.

One substantial influence that all 10 participants discussed was that of past PA influences, especially sports and coaches, etc. who managed these PA activities. As Melanie explained:

In high school I was very active in sports. I played basketball and volleyball, and we had a program for people who wanted to be captains. And when we had to apply, we learned a lot about goals and how to set them and do SMART goals. I feel it made me realize setting a goal doesn't necessarily have to be, all right, we want to win the championship right away because we had to learn. You can't just go from wanting something to automatically doing it. There's a lot of steps in between. So that was definitely an influence from the people that did that was our principal and our athletic director who put that together for us.

Finally, Aleah discussed the importance of her friends and finding ways to be motivated through exercise in groups:

I would definitely say my friends motivate and are a good influence because all my friends are really active; they have busier schedules than me, but they find the time to be active, so definitely friends are a bigger motivator and time is one thing, but friends on the other hand, they can make me go because who wants to work out alone?

Discouraging of PA. Just as outside (and inside) influences can be positive in helping us reach our goals, especially within exercise behavior, these can also be negative, discouraging movement or goal setting in this area. For example, Eli talked

about the difficulty of getting distracted at times from his goals by “hanging out” with friends:

A couple of like summers I just got distracted, I started hanging out with my friends more, started eating what we like, like go out to dinner all the time, spending money, eating all the time, and it was just the diet went out the window. The gym went out the window. The weather’s starting getting warmer. I don’t really want to go to the gym; I wanted to be outside. I would have to try to, like, not match my friends because my friends weren’t going to the gym or watching what they’re eating. It’s like I would just follow in line with whatever they were doing and that would ruin my progress.

He also discussed his own personal outlook that he perceived that he doesn’t necessarily have control over his PA levels because of classes and other priorities. This discouraged him, as he didn’t see a way to readily change these circumstances:

I’m definitely not as happy, like, as I used to be like last semester I was definitely, like, more active. This semester is pretty – I’ve been constantly doing homework and stuff, so I haven’t really had time to go to the gym, like, as much as I . . . I would like to go to the gym. I feel like not really disappointed, but just like I could do better.

Unity added to this idea that things are outside of her control, and the implicit belief that this is the “hand I have been dealt” and it won’t change:

Yeah, I’ve never once accomplished the fitness goals I’ve set for myself. But if I wasn’t sick every day of my life, I feel like it’s really circumstantial for me because I’m very chronically ill, so most of the time when it’s – I’m like I should work out but I’m also like – my hips won’t stop dislocating and if I run, I’ll vomit, so it’s less of a choice and more of a forced thing.

Non-Cognitive Skills

This is the final higher-order theme that emerged from the qualitative data collection. The lower-order themes connected to this are Self-reported Grit level and Self-reported Mindset. Non-cognitive skills, specifically grit and mindset in the current study, have been researched as an important part of success, particularly in examining academic success above and beyond intellect. These skills have also shown levels of

malleability in recent research, giving promise to the possibility of individuals being able to grow in the areas of both grit and mindset. However, these skills have not been examined as readily within the area of exercise behavior (although the constructs have been more readily discussed within sports arenas).

Grit. In first considering grit, Duckworth et al. (2007) discussed the gritty individual as someone who utilizes the advantage of stamina, stating “whereas disappointment or boredom signals to others that it is time to change trajectory or cut losses, the gritty individual stays the course” (p. 1087). Grit can manifest as action toward a goal, bouncing back from setbacks, working hard, finishing what is started, and always seeking to improve toward a goal. In short, Grit uses stamina as a key to success. Responses to levels of perceived grit articulated by respondents can be found in Table 4.12 below.

Table 4.12. Sample Responses to “What is Grit, and How Gritty Do You Think You Are?”

Participant	Response
Melanie	I don't think I'm insanely gritty because I feel for me it's just I've been doing the same routine a lot recently. I feel once I start to up my routine and get more set higher goals, then I definitely know that I'll be more, I'll have more grit in my exercises for sure.
Aleah	Usually when I have my goals, I try to go above and beyond, I force myself, I give myself some kind of reason to go above and beyond and not just hit my goal but going above – being in a better mood makes me feel better about accomplishing a goal, so I'd say definitely gritty.
Unity	I know that grit is extended hard work. How gritty am I though? Not at all.

Table 4.12. (continued)

Participant	Response
Devon	<p>It's like the hard work you put in and like and now you're really just like kind of . . . putting the work in when you don't want to and like you just know you have to like now is what is convenient to you. And I would say I am very gritty just because like I know I need to put in the work or else like if I don't the results I'm going to get put in and something that I just like always see myself is I always like see myself improve and like if I don't do anything like say school doesn't go well or anything or something like that. If I go to the gym I know I'm always like better than I guess I was yesterday, like, this is getting motivation for me so I always like just going even on days I'm like super tired or like just like don't sit out of time even though I can always set aside like 70 minutes out of my day to go to the gym or something like that. So like I would say so just because I kind of like persevere a lot.</p>
Eli	<p>I would say more than ever like I'm more gritty than an average person because I usually do complete most of the things that I do want to do in life and then in the physical aspect, I complete probably half of what I want to do. I would guess that is more than most.</p>
Cruz	<p>I'd say I'm very gritty, the only days I can imagine that I don't drag my butt to the gym to do what I need to do is on days where I'm just – I'm ill really, ill or – ill or injured are usually my only – the only valid excuses I allow myself to use and even then, illness is a grey area, that still has some discretion to it.</p>
Sawyer	<p>I'm pretty gritty, just because I played competitive sports most of my life. So kind of ingrained in me like I'll realize like . . . it's just grit is like believing in something, believing in the team, believing in yourself. So yes, like I'm gritty I guess. And I'm a little bit more self-reflective these days than before so kind of, I know when I'm being too gritty I think.</p>
Teryn	<p>I would say, If I was saying from 1-10, I would put myself at seven because I guess I should do more. But sometimes I go the easy way out, so I guess I could have more grit. So I have a little grit. I could be grittier at an expense. Gotta be willing to pay that.</p>

Mindset. Similar to grit, mindset seeks to answer the question about how people respond to failure and challenges. Growth mindset can manifest as thriving in challenges, seeing failure as an opportunity rather than a deterrent, avoiding a mentality of seeking perfection, and a desire to learn. If a mindset is fixed, the person may not believe that being more or doing more is really an option. They believe this is who they are and that is not going to change. Responses to questions regarding mindset can be seen in Table 4.13.

Table 4.13. Sample Responses to “What is Mindset, and What is Your Mindset about Physical Activity?”

Participant	Response
Raphaela	Mindset is how your mind is determined. If you set your mind to a goal, then once you reach that goal, you have to set your mind to a new goal. My mindset is always moving forward to a positive place. No negative in me.
Jacqui	To me, mindset is like what you kind of tell yourself that you are able to do, and like, if you tell yourself that you are not going to be able to do something you are probably not going to be able to end up doing it . . . I have never really thought about my mindset with health, but I am like kind of a routine person that like if I find something that I do like I just kind of want to stick with that and keep doing it, even if it isn't working. I don't really wanna change.
Teryn	Like sometimes my mindset might change, sometimes it might not, but typically in my opinion, it is hard to change someone's mindset if they are already set on it. I am probably pretty set in mine.
Unity	I'm kind of open to it, learning a lot of things, but always having something new just kind of just pisses me off, but I'm sure there is a couple snippets of things that would be of value to add to my health. And I am kind of a perfectionist, so that doesn't help when I have to learn new things.

Table 4.13. (continued)

Participant	Response
Aleah	<p>Learning new things about your health I feel is really imperative, just maintain a healthy lifestyle because – I don't know, just knowing things, not necessarily doing them maybe is just – I think is just as helpful because knowledge is kind of powerful, so maybe if you know that you need to . . . take care of your body, you're inclined to do it. So I feel like learning about your body, learning about your lifestyle, what you should be doing versus what you're already doing, just – even if it doesn't change anything in your lifestyle, it puts you in a more – a better mindset kind of to at least try to improve in the future . . .</p>
Devon	<p>Mindset I think is just the way . . . you kind of look at things, and if you really have like, I don't know, like a great perspective on life, that's the way you look on things, so I guess I see a positive and a negative to everything. For if you're looking at the negative side, like, that's kind of your mindset all right, but if you're like looking at the positive side, I just feel like you're on a good track. So, definitely, like, your mindset is like, all right, yes you're tired today, but like if I go to the gym . . . I could stay home this week, or I can go to the gym and like looking at the positive side on how I'm going to get bigger, stronger, so I think definitely just kind of like perspective.</p>
Cruz	<p>I would say mindset is . . . how you – in what light you choose to perceive things that happen to you. So you can – you can choose to perceive a failure – a fitness failure as something that's just going to derail you completely and are you going to just not keep going to begin with or you can perceive a . . . a fitness failure as a reason to keep going and just an obstacle that's a part of the path to get where you want to go, so . . . mindset just comes down to how you perceive different influences throughout your day.</p>
Melanie	<p>I would say that's just your perception on what, what you want to get out of it. So if your mindset is, to just improve your time or something that, that'll be what you're focused on. If your mindset is I want to actually lose weight or cut calories or get muscle then it just kind of depends on your goals.</p>

Discussion for Research Question 1

RQ1 asked, “Are perceived non-cognitive skills related to college student exercise behavior?” More specifically, “Are grit, mindset, and/or self-efficacy related to college exercise behavior?” It was hypothesized that grit, (including Grit-P and Grit-I subscales), mindset, and/or self-efficacy, would be correlated with college exercise behavior for the full sample ($N = 366$), as measured by total minutes, calculated from final PAVS scores of minutes. Even though the grit and mindset models had low predictive power for exercise behavior, the findings do offer data and insights to build on. Overall, the results showed that, indeed, the non-cognitive skills of grit, mindset, and self-efficacy correlated with college student exercise behavior. Thus, the hypothesis for RQ1 was generally supported. However, the correlations, although significant, were not strong or even moderate with the exception of ESE scores.

Grit-S-P-I - RQ1. The first variable of interest was the non-cognitive skill of grit. This was measured according to the global Grit-S scale (Duckworth & Quinn, 2009) and was also examined through analysis of the two subscales (Grit-P and Grit-I). When examining Grit scale means, it was found that the Phase 1 Grit-I score was the lowest score, ($M = 2.89$), Grit-S score was higher, ($M = 3.42$), and Grit-P was highest, ($M = 3.96$) for the full population (with higher scores corresponding with higher grit levels). As for the connection between grit and exercise behavior, Grit-S and Grit-P were significantly correlated with the exercise behavior PAVS score, with Grit-P having a stronger correlation than Grit-S, but neither correlation was significantly strong. This indicated, at least initially, that grit levels were related to exercise behavior within this population. The initial correlations also positively translated to significance in Grit-S and Grit-P predicting overall exercise behavior. However, the predictive power was weak,

accounting for very little variance. Thus, in this population, Grit did not strongly, or even moderately predict exercise behavior.

In explaining these results, there were a number of things to consider. First, grit is a new field of study, at least in the context of Duckworth's operational definition being used in research in the past decade (Duckworth et al., 2007; Duckworth & Quinn, 2009); because of the recentness of the research, there has been little research conducted connecting grit to physical realms of performance and success, and even less with exercise behavior. Thus, these results add to the understanding of grit as a whole and even more about how it may or may not be related to health behavior such as exercise. More research examining exercise and grit will be important to add to the cumulative grit knowledge.

Second, according to Duckworth (2019b), grit truly predicts success (she specifies professional and academic) "particularly in domains that are both challenging and personally meaningful" (p. 15) and has come to be recognized as an indicator of these types of success domains. However, health, fitness, and exercise behavior are much more challenging to quantify than grades, test scores, spelling bee winners or getting through West Point (Duckworth et al., 2007; Kelly, Matthews, & Bartone, 2014). What does success in exercise mean? How does that manifest for a population of college students? For the current study, the HHS 2018 PA Guidelines were used as the "standard" by which exercise was examined, but there has been recent research that shows that this information, too, may be incomplete, dependent upon the individual, age, current PA levels, type of exercise, etc, and that the exercise experience is an individual one and even some physical activity is better than none (CDC, 2018).

In speaking with interviewed individuals with the highest PAVS scores measured in total minutes, they more readily articulated the value they saw in moving their bodies and the origin of that value and meaning (including family and friends) than those with lower PAVS scores (who reported from 0 to 60 minutes/week). Those with lower PAVS scores also spoke of other aspects of life (especially academics and social events) having priority and taking time away from exercise, even if they thought moving their bodies more would benefit them.

In addition, academics in college are required and have consequences if students do not engage in them; whereas, exercise and health deficits do not normally have immediate consequences, especially for college-aged adults. An excerpt from one of the qualitative responses, Jacqui spoke first to the value she saw in exercise and clearly thought it would be worthwhile, as she stated “I wouldn’t say I am like depressed, but if I could go to the gym that I would be happier on not only the way I look, but I like I know it would just make me feel better, just like overall.” However, she chose other priorities and articulated this just as clearly, as she stated “with like my classes and stuff, I am pretty busy, and I always, like, put that first, and I like want to go [to the gym] more, but feeling like I do not have time and cannot make time.” This response shows a lack of grit by definition (interest and perseverance) in the domain of exercise, but Jacqui appeared to have more grit within her academic pursuits. Contrarily, higher PAVS score participants showed that physical activity was not only worthwhile and meaningful in how they set health and fitness hierarchical goals (Duckworth, 2019a), but they also prioritized their days to manage time effectively and intentionally include these goals. Cruz said this about managing his time toward maintaining his “bigger picture” health goals:

When you have time constraints, you might need to cut out some things that are supplemental to your life like going to the gym, but I also think that one time, you also start to look for excuses not to go to the gym, and that's why I definitely, when my time gets a little tight . . . I know in reality that you can make time for your health and make time to go to the gym. Just have to focus on the bigger picture.

Next, it is also possible that the participants as a whole did not understand the concept of grit in the way it is operationalized within research and the overall scale. The qualitative data showed that the majority (8 of the 10 interviewed) understood grit as putting in hard work (again, showing higher scores for perseverance), but they did not have an understanding that grit included having consistent interest in something over the long term.

To continue the grit discussion, Grit-I was the outlier for many of the analyses, with the subscale scores registered as the lowest grit scores for the population ($M = 2.89$); and a lack of correlation with the majority of the variables (with the exception of significant correlations with Grit-S and its subscale counterpart, Grit-P). Thus, in the current study's data and in other examples (e.g. Datu, Valdez, & King, 2016), the Grit-P dimension of the global Grit-S scale was more salient than Grit-I in predicting key psychological outcomes that led to success and elevated performance. These results are not surprising, as there has been conflicting research debating whether the full Grit-S scale unintentionally measures perseverance more readily than this consistency of interest (Credé, 2019; Credé et al., 2017; Jachimowicz et al., 2018). Recent studies have pointed to possible discrepancies in what specifically is being measured in each of these. Also, does the subscale of "consistency of interest" truly capture the concept of "passion" (as the two have been used interchangeably) as one of the dimensions of the original operational definition (Duckworth et al., 2007; Duckworth & Quinn, 2009)? The

question of construct validity and whether the grit scale measures the construct of grit or primarily perseverance also both warrant further research (Credé, 2018; Credé, 2019; Credé et al., 2017).

Also, the results suggested the domain of specificity of grit. Because of the initial development and use of the Grit-S scale by researchers (especially beyond Duckworth and her colleagues) as a global conceptualization more so than with focus on the distinct dimensions within it, researchers are now reflecting on the growing data in the field and emphasizing the “need to determine if grit should be conceptualized and measured as a domain-specific construct” (Cormier, Dunn, & Dunn, 2019, p. 349). The current results may also add to the domain-specific debate as the data suggested that a person can be gritty in some areas or situations, while not showing grit in others. To this end, the discussion of domain-specific scales is becoming more prevalent (e.g., sport-grit scales and school-grit scales), as well as suggesting that grit levels may vary across different contexts, both in daily activities and across the lifespan (Clark & Malecki, 2019; Cormier et al., 2019).

As for placing Grit scores within a research context, it is challenging to determine how the data compare to other populations, because with the newness of this research area and the scales (developed in 2009), there are still not well established norms for Grit-S-P-I scores for the general population or for this college student sample. However, considering that this is a population which had intentionally connected with campus recreation services on a large university campus, and with many of the participants self-reporting A or HA levels of exercise behavior, it would not be surprising if the calculated means are higher than the average adult.

In sum, the results from this study found that grit is significantly correlated with and predictive of exercise behavior. However, the correlations were weak and the predictive power of the grit model (both global Grit-S at 1.7% and Grit-P at 3.1% of the variance) for exercise behavior was low. Thus, the statistical significance between the variables was ultimately negligible. This suggests that although grit may play a small role in college students' exercise behavior, there are likely stronger variables or predictors out there to examine.

Mindset (ITF) - RQ1. The second variable of interest was the non-cognitive skill of mindset (also known as implicit theory). This was measured using an adapted version of the unidimensional ITF scale, which specifically measures implicit theory as it relates to fitness (Orvidas et al., 2018). When examining Mindset means, it was found that the ITF mean score was 34.62 (with a possible score range from 7-49) for the full population. The higher the score, the higher the individual's growth mindset; the lower the score, the higher the individual's fixed mindset. As for connection between mindset and exercise behavior, ITF scores had a weak positive correlation with PAVS exercise behavior scores. This indicated, at least initially, that mindset levels were related to exercise behavior within this population. The initial correlations also positively translated to significance in ITF predicting overall exercise behavior. However, as with grit, the predictive power was very low. Thus, in this population, ITF did not strongly or even moderately predict exercise behavior.

The results add evidence to the possibility that mindset does not completely translate to physical activity in the way it is currently defined and operationalized in the domains of education and malleability of intellect. In addition, the majority of the

interviewed participants (8 of 10) understood mindset as how people view the world, without the expanded definition that they can continue to enhance these abilities throughout their lives because of this view/interpretation. They did speak, however, to the difference between the positive and negative mindsets that an individual can have and how mindset can impact someone's success and performance, even in fitness. For example, Eli stated that he thought he had a good mindset "because it is my outlook, it's the positive and negative ways of viewing something, a situation, and I try to be positive." And Cruz gave nearly a Dweck-ian definition of mindset as he stated, "you can choose to perceive a failure, a fitness failure, as something that is just going to derail you completely" . . . "or you can see a fitness failure as a reason to keep going, and it's just an obstacle that's a part of the path to get you where you're going." But, how do these views of mindset impact success and performance?

Recently, there has been research to emerge in the area of mindset in the domains of health, including implicit theory with physical activity, physical education, body image, and behavior change (e.g., Lyons, Kaufman, & Rima, 2015; Quinton & Brunton, 2017; Vella, Braithwaite, Gardner, & Spray, 2016), but more exploratory and intervention research is needed to examine general mindset research and domain-specific mindset research. Other connections that could be made with mindset would be with measures of motivation and self-determination. In addition, the current study's results suggest that more research is needed in a domain of specificity of mindset, including tackling the question of how to create growth mindsets in the area of health and fitness. There have been mindset scales created for fitness, weight loss, etc. (Burnette, 2010; Orvidas et al., 2018), but can an individual have a growth mindset for academics, yet a

more fixed mindset for exercise? I suggest the answer is yes. Furthermore, the ITF scale is a new one; thus, although the ITF scale was created utilizing validated measures and seems to have acceptable reliability, including in the current study results, additional research is warranted. As for placing the ITF scores within a research context, it is difficult to compare the current study's ITF scores with other samples, because few exist. Thus, there are not well-established norms for ITF scores for the general population or for this college student population.

However, despite this lack of norms, mindset interventions challenge participants to see their intelligence and their lives as malleable and that they can change themselves and their lives, with effort, goals, and help from others (Blackwell et al., 2007; Walton, 2014). As Duckworth concluded "having a growth mindset' could develop grit . . . and teaching a growth mindset and grit facilitates long-term goals and how to achieve them" (Hochanadel & Finamore, 2015, p. 49). These "wise psychological interventions" (Walton, 2014) aim to actually alter psychological processes and how people think or feel in their daily lives to help them prosper, in this case with exercise behavior, and have been tested and shown to create positive change in other settings with other populations (e.g. Bryan, Walton, Rogers, & Dweck, 2011; Finkel, Slotter, Luchies, Walton, & Gross, 2013; Wilson, 2006; Yeager & Dweck, 2012).

Also, the complexities of mindset and implicit theory are real. Lyons et al. (2015) discussed the intricacy of mindset that a mindset of body image could truly be what is impacting someone's mindset toward physical activity. In addition, Molden and Dweck (2006) explored how people's mindsets actually help them to find meaning in their own lives and actions, as well as a better understanding of others' social actions across many

circumstances. Because of the complex nature of this construct and the impact that mindset can have on an individual's life, researchers continue to create mindset interventions that can influence incremental changes. As Orvidas et al. (2018) discussed, there are many factors that impact our mindset and mindset for fitness (including genetics, background, environment, etc.), but beyond those, they found that incremental changes to mindset, specifically in the domain of health, can impact not only overall health but also physical health.

In sum, and similar to the results of mindset is correlated with and predictive of exercise behavior. However, correlations were weak and the corresponding predictive power of the mindset model (accounting for a mere 2.6% of the variance) for exercise behavior was extremely low. Thus, the relationship was not statistically significant, and the hypothesis was not supported.

Exercise Self-efficacy (ESE) - RQ1. The final non-cognitive variable of interest was self-efficacy, more specifically exercise self-efficacy. According to Pajares (2002) “self-efficacy beliefs can enhance human accomplishment and well-being in countless ways. They influence the choices people make and the courses of action they pursue” (p. 4). In this study, the choices and the courses being pursued in exercise were measured according to the ESE scale developed from Bandura's (1997, 2004) work and adapted by Neupert et al. (2009). When analyzing self-efficacy scores, it was found that the ESE score was $M = 24.25$ with possible scores ranging from 9-36 where higher scores translate to higher self-efficacy in the domain of exercise, and lower scores represented lower self-efficacy. As for connection between ESE and exercise behavior, ESE had a moderately strong positive correlation, the strongest correlation between any of the

variables and exercise behavior. This indicated that ESE levels may influence or be influenced by exercise behavior within this population. The initial correlations also positively translated to significance in ESE predicting overall exercise behavior with a moderate predictive power, accounting for nearly 30% of the variance. Thus, in this population, ESE moderately predicted exercise behavior.

These results are not surprising, as research supports that this predicted positive relationship could occur, as the importance of self-efficacy in behavior change has been well documented (e.g. Bandura, 1997, 2004, 2008; Dishman et al., 2005; Poag-DuCharme & Brawley, 1993). McAuley et al. (2011) showed that those individuals with higher self-efficacy tend to have stronger consistency with exercise than individuals who have lower self-efficacy. Furthermore, individuals with higher self-efficacy are more likely show a higher level of persistence, overcoming barriers such as lack of time, cost, and lack of desire. This tends to lead to elevated exercise levels (McAuley et al., 2011). Thus, the current study data were in line with the past and current literature on exercise self-efficacy. However, the current study did not show ESE as a strong predictor of exercise (rather it was more of a moderate predictor) and further research is warranted to examine other possible predictive factors (that could account for the other nearly 60% of the variance). Beyond that nuance, those individuals with the highest PAVS score measured in total minutes per week more readily articulated the belief they had in themselves to adhere to an exercise routine. However, it was interesting that the data did not suggest that ESE mediated or partially mediated the relationship between the other non-cognitive skills (grit and mindset) and exercise behavior, as research has shown exercise self-efficacy as a mediator between other character skills (like motivation, self-

regulation, etc.) and physical activity behavior (e.g., Dishman et al., 2005; McAuley et al., 1991; McAuley et al., 2011; Plotnikoff, Pickering, Flaman, & Spence, 2010). This may have been the case because of the domain of specificity of self-efficacy and mindset, as well as the fact that the study was done with college students and a baseline for this population needs to be established to help with the growing issue of inactivity (e.g. Pauline, 2013). It also may have been because the ESE scale has been used primarily with older adults rather than a college-aged population, so this may have also impacted the results. Finally, this potential ESE mediation between mindset and exercise behavior has not been explored previously to my knowledge, so perhaps, as the current study suggests, the relationships simply may not exist in this way.

Grit, ITF, ESE - RQ1. To summarize, when examining the three variables of Grit, ITF, and ESE, the data showed that all were significantly correlated with exercise behavior. However, upon further analysis with multiple regression, results showed that the correlations and predictive power of Grit and ITF were weak, and only ESE correlations predicted exercise behavior in any statistically significant way, at a moderately strong level.

Discussion for Research Question 2

RQ2 asked, “Are perceived non-cognitive skills related to one another in a college student population?” More specifically, are grit, mindset, and/or self-efficacy related to one another in a college student population? It was hypothesized that grit, mindset, and/or exercise self-efficacy, would be correlated with one another in relationship to college student total reported exercise behavior.

The results were that all of the variables significantly correlated with one another with $p < .01$; the only exception was that Grit-I was not correlated with ESE scores, but this is not completely unexpected considering that Grit-I has been an “outlier” throughout the analyses, as can be seen in results and discussion for RQ1. In RQ2, the strongest correlations were seen between the three Grit-S-I-P scores; although this, too, is not unexpected, as Grit-I-P are the two dimensions of the Grit-S scale, and the three should be closely correlated because of the multidimensional nature of Grit as a whole, again defined as perseverance and consistency of interest in achieving long-term goals (Duckworth et al., 2007; Duckworth & Quinn, 2009).

However, there were notable, surprising connections to explicate here. First, the weak correlation between grit and mindset was not predicted. This relationship and statistical correlation has been examined in a number of domains, especially within classroom settings (e.g., Hochanadel & Finamore, 2015; Laursen, 2015; Meyers, Wang, Black, Bugescu, & Hoeft, 2016; Snipes, Fancsali, & Stoker, 2012). These studies suggested that a growth mindset is possibly one of the strongest contributors to the development of grit. For example, Polirstok (2017) believed that whether mindset is a function of grit, or grit is a function of mindset has yet to be determined by research, “but clearly these ideas are closely intertwined and can offer a valuable lens into how students operate when challenged academically” (p. 2). Interestingly, the results of the current study do not show this strong correlation. Why? If we postulate reasons, there are two primary reasons to mention.

First, the research mentioned above, and the many studies not mentioned here, that have strongly correlated grit and mindset (more specifically grit with growth

mindset) have done so within the context or domain of education where success and achievement are easier to measure through grades and testing, because in education an “A” is an “A”, and a “D” is a “D”, and we all know which is more “successful”. In education, there are also tangible and immediate consequences to reinforce engagement and an attempt at avoiding failure. However, as far as our research showed, these correlations between grit and mindset have not been examined in the domain of exercise behavior or fitness prior to the current study. Exercise behavior is a completely different entity; so understandably, grit and mindset may function differently within this domain than in education or other similar domains to education. For example, what equates to achievement or success in exercise behavior could look many ways to many different people, dependent upon the person’s goals, so it is more difficult to measure.

The second possible reason why the correlation between grit and mindset could have been weak is that grit in the current study was measured with the Grit-S scale, a global scale that is not domain specific (as an exercise domain-specific scale does not yet exist). Thus, the global questions are more generic, and the participant can interpret the questions in whatever domain they prioritize or any domain they choose. However, mindset was measured through the ITF scale which measures implicit theory specifically in the domain of fitness. The questions are explicit to exercise, and the participant has less flexibility in interpretation when they respond. This may have impacted how participants responded to questions in each scale.

The other key correlations to discuss from RQ2 are the correlations between self-efficacy and mindset as well as between self-efficacy and grit. Similar to the correlation

between grit and mindset discussed above, these correlations were significant but also not considered strong. Why might the correlations only be weak?

First, we know that self-efficacy is the trust someone has in their own ability to complete a task successfully, and that task, goal, or project can be in many different domains. In fact, self-efficacy can exist in any domain (e.g., classrooms, courtrooms, operating rooms, and even defending dissertations) where individuals must believe in themselves and their abilities in order to achieve (e.g., Bandura 1977, 1997, 2004; Luszczynska, Gutierrez-Dona, & Schwarzer, 2005; McAvay, Seeman, & Rodin, 1996). In considering self-efficacy with mindset, mindset is a similar construct, although distinct. Mindset is the belief that an individual has that their own intellect (and other domains if they are the focus) has plasticity and can change through learning and deliberate work (Dweck, 2006). The more an individual believes in this neuroplasticity, the higher their growth mindset. In addition, both mindset and ESE were measured with a domain-specific instrument focused on exercise. However, one of the reasons for the weak correlation, despite these similarities, could be that to measure mindset, I used a newly developed and validated scale, the Mindset ITF, created in 2018 (Orvidas et al., 2018). Also, although there seems to be adequate reliability and validity with the ITF scale, including in the current study, there still has been limited testing of the scale, as well as limited mindset testing overall in the domain of exercise and fitness. The newness of the scale and of the study of mindset within this domain may have impacted the correlations.

In considering the correlation between self-efficacy and grit, the reasons for the lower correlations may be similar to what was discussed above with grit and mindset: the

global nature of the Grit-S scale scores vs. the domain-specific ESE scale generated scores, and the fact that grit is newly being measured within an exercise domain, whereas ESE has been recognized as one of the highest predictors of exercise behavior in measured psychological skills and has been prolifically tested in this area, as has been previously discussed.

In short, we do not have enough research to predict how mindset and grit interact with self-efficacy and/or each other within the domain of exercise behavior. And, finally, these constructs have not been tested in the college student population tied to exercise behavior; this, too, may have impacted responses to the scale questions. Thus, the weak correlations, though unexpected, can be reasonably explained.

Discussion for Research Question 3

RQ3 asked, “Are there differences in perceived non-cognitive skills between college students based on their exercise behavior level (inactive/insufficiently active, active, and highly active)”? It was hypothesized that grit, mindset, and/or exercise self-efficacy, would have differences based on PAVS score, delineated by exercise behavior level as adapted from the HHS 2018 PA Guidelines (IA, A, and HA).

First, when examining the means within the data for RQ3, we found incremental increases with every variable (with a slight nuance in Grit-I) across the increased amount of physical activity minutes including in PAVS scores. In examining the data further through the one-way MANOVA, these means represented statistically significant differences between the HHS 2018 PA Guidelines groups’ Grit-S, Grit-P, and ITF scores; however the amount that each accounted for the variance was extremely low. ESE, as has been the trend through every RQ and through nearly every analysis interpretation,

accounted for the majority of the variance, again nearly 30%. See Figures 4.2 – 4.5 for graphs of the four variables' means represented across the three groups.

An interesting piece of these results is the difference seen between the IA and HA groups, as this is where the most significant differences were seen between the variables; however, it is probably not unexpected that someone from the IA group (with PAVS from 0-60) would score and talk about their exercise behavior and non-cognitives differently than someone who prioritizes exercise behavior (PAVS above 300). Another interesting piece is the lack of difference in the A group from either of the other groups. It seems that even though this group meets the recommended amount of PA in the HHS 2018 PA Guidelines, their articulation of their experience of the variables is similar in some ways to the IA group and in other ways to the HA group. Also, again, ESE continues to increase across the groups. Finally, because the variances are so low across the groups, with the exception of ESE, and the reasoning is not due to small sample sizes, the qualitative results can add to this discussion.

One of the objectives of the study was to examine the grit, mindset, and exercise self-efficacy in the context of exercise behavior and to add qualitative data to explore how college student participants understand and manifest these constructs in their daily lives and through their engagement in exercise behavior. Interestingly, qualitative findings suggest that the majority of participants defined the non-cognitive variables differently than the way they are operationalized and measured. Especially for the constructs of grit and mindset, students discussed them more often in terms of the pop-culture definitions. Grit, thus, was articulated as “working hard”, “not letting anything stop you”, and “going above and beyond” rather than an intentional combination of

perseverance and extended interest toward long-term goals. Mindset was “emotional well-being”, “if something is positive or negative in your mind”, and even “a personal, spiritual experience” rather than the belief that individual intellect and self are malleable and can be developed and changed or that failure can be an opportunity for this growth rather than an obstacle to it. Qualitative understanding of self-efficacy was closer to the actual definition, as participants discussed it as “what I think I can do” and “how I feel about myself in different situations”.

In addition, participants with higher scores in the constructs of grit, mindset, and self-efficacy articulated these and illustrated these in their lives with more self-awareness and confidence, as well as a more global view of their grit, mindset, and self-efficacy which included exercise behavior. On the contrary, those with lower scores in the non-cognitive variables spoke about the non-cognitive skills more so in domains, as having grit, mindset, and self-efficacy within an area like academics or something they enjoy, but not within exercise behavior or things that were challenging to them.

There was also a discrepancy between scores on the grit scale and how the interviewees discussed their own grit. This may also be because the interview questions regarding grit were specifically in the exercise behavior domain, but those in the Grit-S scale in the questionnaire are not domain-specific; they are global and generic. Below are discussions of each variable from each of the HHS PA levels (IA, A, and HA). This may “muddy” the statistical waters between groups, as scores on scales and student responses are not always congruent. For example, in some instances, the individual with the highest PAVS scores reported the lowest Grit-S and ITF scores, while those with the lowest PAVS scores, at times, had higher reported Grit-S and ITF scores (see Table 4.14).

Table 4.14. Consistency of Grit and Mindset Answers for HHS PA Levels

IA Group	A Group	HA Group
Grit		
<p>I usually do complete most of what I want do in life, and then in the physical aspect of life I do probably half of what I want to do but don't see myself as super gritty.</p> <p>Grit-S: 3.88 PAVS: 30</p>	<p>I would say I am gritty in a way. Usually when I have my goals, I try to go above and beyond. I force myself; I give myself a reason to go above and beyond and not just hit my goal but go above. I try to do this in exercise, too, I get there a lot of the time.</p> <p>Grit-S: 4.63 PAVS: 180</p>	<p>I would say I'm very gritty. The only days I can imagine that I don't drag my butt to the gym to do what I need to do is on days where I'm just – I am ill really – ill and injured are really – my only valid excuses I allow myself to use, and even then, illness is a grey area.</p> <p>Grit-S: 3.75 PAVS: 540</p>
Mindset		
<p>Like sometimes my mindset might change, sometimes it might not but typically in my opinion, it is hard to change someone's mindset if they are already set on it. I am probably pretty set in mine.</p> <p>ITF: 41 PAVS: 60</p>	<p>I would say that's just your perception on what, what you want to get out of it. So if your mindset is, to just improve your time or something that, that'll be what you're focused on. If your mindset is I want to actually lose weight or cut or cut calories or get muscle then it just kind of depends on your goals I feel. I want to focus and keep moving forward.</p> <p>ITF: 42 PAVS: 240</p>	<p>Mindset I think is just the way you kind of look at things and if you really have like... a great perspective on life that's the way you look on things, so I guess I see a positive and a negative to everything. For if you're looking at the negative side like, that's kind of like your mindset, but if you're like looking at the positive side, I just feel like you're on a good track. . . I could stay home this week. Or I can go to the gym and like looking at the positive side on how I'm going to get bigger, stronger.</p> <p>ITF: 37 PAVS: 420</p>

The qualitative data certainly seems to add to the discussion of the issues of the scales, as well as the lack of connections between the variables in any systemic way (with the exception of ESE).

Discussion of Variables and Gender

Although not connected directly with a formal research question, examining results through the lens of gender differences and the relationship to exercise behavior (and between variables) proved relevant. A two-group MANOVA was conducted on the data in Table 4.9 which was not found to be significant (Wilks' lambda $\lambda = .938$, $p = .086$, partial eta squared = .021). Significance was only found for total PA (PAVS) and for ESE where males had higher scores than females.

Results in considering gender in the current study contradict research for grit scores (e.g. Batres, 2011; Bazalais, Lemay, & Doleck, 2016; Flanagan & Einarson, 2017), as much of the research shows females with higher scores for Grit-S and subscales. However, Chen et al. (2015) found no significant difference in Grit scores between female and male students, but they did not analyze Grit's subscales separately. Thus, the current study data can add to this discussion. It could also be noted that in the current study, grit scores showed that females saw themselves as at least moderately gritty, but in the qualitative responses, not one of the six females articulated being highly gritty.

For mindset, one of the questions posed within the research asks if females have a fixed mindset more often than males. The answer is that there is not definitive evidence either way. Some research has shown that girls have a more fixed mindset because of the type of praise for outcomes they receive and the compliance they exhibit when they are younger, as opposed to the praise for effort and being called out for misbehavior that

boys receive (Dweck & Simmons, 2014). And considering the population of college students and mindset, current research from ACHA's National College Health Assessment reported that 89% of college women felt overwhelmed by their college workload, a full 15% more than men. For these women, any setback can be perceived as a risk, and failure becomes an obstacle that they often do not overcome (ACHA, 2018). Thus, it could be suggested that a focus on perfection and avoiding scrutiny becomes a factor in the female mindset. However, other current research suggests (e.g. Macnamara & Rupani, 2017) that the differences between males and females in mindset are negligible. The current study's results showed differences in mean scores, but no significantly statistical difference between males and females, agreeing with the latter side of the debate. Also, although the research of mindset is quite established in the field of education, it is still up for more discussion in the field of psychology, and in its infancy in the study of exercise behavior.

Considering exercise self-efficacy, the current study data illustrated that males had higher scores in ESE, and this corresponded with higher PAVS scores; in addition, self-efficacy was found to be a significant correlate for both females and males, and there was a significant statistical difference between the two, although not strong. The data are congruent with self-efficacy and physical activity research that, indeed, self-efficacy remains an important correlate of physical activity for both genders and is statistically significant, but males are often seen as more physically active because of higher ESE and social norms (Spence et al., 2010).

Considering physical activity, according to the National Health and Nutrition Examination Survey, 2007-2016 (Armstrong et al., 2018), it is likely that females

reported less PA than males across all demographics, and young adults in general were not meeting the recommended guidelines for PA. The current study data for PA are congruent with these findings with female mean (231.26) and male mean (289.48).

Finally, as is mentioned as a later recommendation, it is important to further examine non-cognitive skills among samples who do not identify within a binary, cis-gender system. In the current study, unfortunately, participants who identified as anything outside of the binary, cis-gender system were less than 1% of the data and, therefore, were not included in the gender results. There are currently few studies of gender related to non-cognitive skills (e.g. Christensen & Knezek, 2014), and as far as we know, there has not been research examining non-binary genders within these non-cognitive areas to explore how those who identify beyond the binary experience them. Considering concepts of a gender mindset and how performance of gender impacts areas of grit, self-efficacy, motivation, self-control, etc. is warranted and necessary. This research and interventions could be similar to the use of psychological interventions and micro-interventions to help buffer against stereotype threat and using mindset to lessen the learning gap (Yeager & Walton, 2011).

General Discussion

The purpose of the current study was to explore the potential relationships among the non-cognitive skills, grit, mindset, and exercise self-efficacy, and self-reported exercise behavior in a sample of college students. When correlations between grit, mindset, exercise self-efficacy, and/or exercise behavior were found, the non-cognitive skills were examined as possible predictors of this exercise behavior as measured by total minutes per week. Additionally, the perceptions of the concepts of grit, mindset, exercise

self-efficacy, and exercise behavior were explored with this sample, as 10 randomly chosen participants from the larger Phase 1 sample were interviewed through a structured interview. Finally, the variables were examined through the three groups adapted from the HHS 2018 Physical Activity Guidelines: Inactive/Insufficiently Active (IA), Active (A), and Highly Active (HA). The outcomes of this study provide further insight into how non-cognitive skills such as grit, mindset, and exercise self-efficacy could positively influence current and future health and fitness behaviors. The outcomes also point to possible shortcomings of the self-report measures used.

Past research in the field of non-cognitive skills and character skills has been important for enhancing student outcomes in the classroom (Duckworth & Quinn, 2009; Duckworth et al., 2011; Duckworth, 2016; Dweck, 2006; Dweck, 2019; Dweck & Yeager, 2019). The current study explored the possibility that non-cognitive skills (specifically grit, mindset, and self-efficacy) could be as important in the gym. However, which non-cognitive skills should be targeted, how each operates with specific domains, and how best to measure the skills, all remain open questions for researchers and practitioners alike.

The current study reinforced the importance of self-efficacy in exercise behavior, and that this seems to hold true for college students. In addition, it shed light on the domain-specificity of non-cognitive skills, the need for continued analysis of measurement scales, and the uni- or multi-dimensionality of constructs, specifically grit, and the necessity of further research on the connection between non-cognitive skills and exercise behavior.

First, results from data across the research questions found the same outcome that ESE is an important predictor, one of the most recognized, domain-specific predictors of exercise behavior. Considering ESE in the current study, there were still positive, significant correlations with exercise behavior even when measured with a tool usually used primarily in clinical settings (PAVS) and that has not been used with the current study's population of college students. ESE has not been connected readily with other non-cognitive skills (grit, mindset, hope, self-control, etc.). Thus, the current study and future research can be beneficial to understand the relationships between ESE and non-cognitive traits.

However, despite the moderately strong correlations between ESE and PAVS, as well as between ESE and the other variables, ESE still only accounted for roughly 35% of the variance. Thus, the question of what other factors are in play is a formidable one. The current study did not control for factors such as race, age, socio-economic status, genetics, background, motivation levels and types, motivation for why they signed up with campus recreation services, past physical activity experiences, etc. In addition, it is difficult to know how the participants interpreted the PAVS questions. Did they include daily activities like walking to class as "moderate physical activity" in their daily minutes, or did see this as necessary daily movement, a method of conveyance, rather than as part of what they could report as exercise or physical activity. Considering these components, it is difficult to determine what is accounting for the remaining variance.

Next, results pointed to the need for further examination of the construct of grit, both as a multi-dimensional construct (and corresponding scale) and as a construct that can change with the domain it is examined within. Duckworth herself stated that simply

because someone has grit in one aspect of life, this does not mean that they will be gritty in other areas (Duckworth, 2016). This is an important statement by Duckworth, as she is, perhaps, conceding that the current Grit scale should be examined and adapted to other domains, as self-efficacy research has done and mindset research is beginning to do. Again, considering specific domains, including health and exercise, and altering the scale accordingly could be important. Orvidas et al. (2018) did this when they adapted the mindset scale measure and created the ITF, specifically designed to measure fitness and what Burnette (2010) did when she adapted the mindset scale measure to examine the concept of weight.

In the current study, Grit-S was used, as there is no current grit scale that measures specifically in the domain of health or exercise. Self-efficacy has numerous scales in numerous domains, as Bandura has encouraged researchers and practitioners to create scales as needed to serve people, including accounting for validity, conceptual analysis of domain specificity, scale construction and minimizing bias (Bandura, 2006). Mindset and implicit theory research has also evolved to include domain-specific versions (e.g., Burnette, 2010; Orvidas et al., 2018) utilizing Dweck's original scale, which sought to measure strictly mindsets within intelligence, as the foundation. Domain-specific scales were used for both ITF and ESE. Development of domain-specific grit scales (including for exercise) could allow for more accurate measures of individual experiences of grit, as well as in developing interventions that could help people flourish in these non-cognitive areas and in life.

Considering the qualitative data explicating grit even further, across the study, grittier students' (measured by higher Grit-S) mean scores were more likely to

demonstrate higher levels of growth mindset ITF, physical activity total minutes PAVS, self-efficacy ESE, and an increased level of articulation of perseverance. These students were also able to strongly identify both their short-term and long-term goals and strived toward the achievement of these goals through smaller goals in a goal hierarchy. The willingness and ability to self-regulate, manage time, and prioritize tasks were also evident in the participants who had higher total minutes toward physical activity. In addition, these higher-achieving students held a positive attitude toward learning from others and through other resources. They also stressed the importance of feedback and constructive criticism in their personal development and growth.

Considering mindset, Duckworth (2016) stated that students with a higher ITF score, signifying higher growth mindset, showed higher grit scores, which was also found in the mean scores of the current study. In addition, as grit and mindset mean scores increased, the exercise behavior measured through the PAVS score, both total minutes of PA and days of muscle strengthening, also increased, even if through weak correlations. Perhaps examining a larger sample, with a longitudinal study to gather this additional information, may show other statistically significant results. Thus, the length of time a participant is analyzed may be the key to finding out if grit and growth mindset can be predictors of exercise behavior, as well as adjusting scales and studies to account for domain specificity of these constructs. Determining whether grit and mindset truly can or should be conceptualized and measured as a domain-specific construct will not only enhance our theoretical understanding of both constructs and the potential relationships between them, but additional research may also present opportunities for the development of domain-specific measures that could shed more light upon the role that they play in the

lives of individuals in different achievement contexts (Clark & Malecki, 2019; Cormier et al., 2019). In addition, creation of growth mindset interventions that have been shown to develop grit (e.g., Padin, Emery, Vasey, & Kiecolt-Glaser, 2017; Quinton & Brunton, 2017; Vella et al., 2016) could, perhaps, translate to physical activity and health behaviors.

Finally, considering the college population, they are often overlooked, especially when examining the population in the physical inactivity conversation. Even though the current study population was one that was registered with campus recreation services and had at least some intent to engage in movement through intramurals, there was still close to one-third ($n = 101$) of the full sample of participants who did not meet the HHS 2018 recommended physical activity minutes per week in self-reported PAVS scores. Further research for this population and interventions that could help with increasing exercise behavior, as well as possibly positively impacting other behavior changes that could enhance student health and experience is warranted.

Limitations

Although the current study generated several significant findings in relation to the meaningfulness of grit, mindset, and self-efficacy and their relationship with exercise behavior, the study is not without limitations. First, the current study only took part in one institution, a large, Division I, research institution in the Northeast, which limits generalizability. Thus, future research should recruit a larger sample size from different institutions, with a more diverse sample of cultures, ages, genders, and backgrounds. This would continue to add to the research around non-cognitive skills, especially in

examining them in connection to exercise behavior (and potentially in other populations beyond college campuses).

Second, the study used self-report measures that can allow participants to misrepresent themselves (either intentionally or unintentionally) in trying to present an ideal self because they are in a study context, especially questions that ask for information about exercise behaviors. In addition, self-report measures such as those used in the current study to measure grit, mindset, self-efficacy, and exercise behavior, limit what information we can ascertain from scores.

Next, there are, of course, problems in drawing conclusions from only cross-sectional studies. More longitudinal studies are needed in this field to see how these concepts impact a person's life and success over time rather than through a mere snapshot at this moment. Another potential limitation was bias that may be inherent in participant self-selection into the overall study. There may be inherent characteristics in those who chose to opt in and who chose not to opt in that could have affected the outcome of the study. Also, a modest sample size ($N = 366$) and characteristics of students who choose to volunteer for inclusion in the qualitative portion could also be considered a limitation when reviewing results.

A third limitation was using a non-representative sample. The student researcher utilized access to the student population already connected to campus recreation services at one large public university in the Northeast. This limited the generalizability and transferability to other college populations and to a population who chose not to register with campus recreation services on a college campus.

A final limitation was scale use. The student researcher used a non-domain specific Grit scale (as a version has yet to be developed) although domain-specific scales were used to measure both ITF and ESE scores. In addition, the PAVS scale has been used primarily in clinical settings, even though it has shown high reliability scores, but was chosen for the brevity and ease of use. Finally, an interesting thing to consider in possible scale discrepancy is how carefully participants read the directions in the ESE measurement. Because of the small typeface of the directions within Qualtrics, specifically for this measure, participants may have thought they were being asked *do they already engage* in the actions in the ESE measure vs. *do they believe they can engage* in the actions (even if they don't already engage in them). Thus, theoretically, ESE scores and PAVS scores could have been redundant, such that both measured current exercise engagement. Regardless, the literature is strong in the relationship between self-efficacy and exercise behavior, so it is more likely that the correlation seen between the PAVS and ESE is indicative of this connection than an error in reading, but it is worth noting. Ultimately, we do not believe that the smaller typeface altered the data.

Recommendations for Practitioners and Researchers

Recommendations for Practitioners

Exercise is Medicine (EIM) – PAVS measure. The PAVS measure used in the current study is one that is currently used primarily in clinical settings by doctors and other health providers. Because of its brevity, ease of use, and appropriate level of reliability in the current study, it proved to be an ideal tool to measure exercise behavior in the current study's sample. It allows practitioners to quickly ask the questions of their clients, students, patients, teachers, etc. to gauge the current PA behavior and to ascertain

in a matter of seconds a potential treatment plan for the individual being treated/served. Learning more about the measure and the EIM initiative could prove worthwhile for practitioners (American College of Sports Medicine [ACSM], 2018).

Hierarchical Goal Setting. As an initial part of building grit and/or growth mindset, Duckworth recommends helping someone visualize their goal setting as a hierarchy of multiple levels, including starting with low-level goals, building up to mid-level goals, which leads up to an overarching, long-term goal (Duckworth, 2019a). Lower-level goals can be altered, amended, or even deleted if another more effective and feasible goal takes its place. Teaching clients, patients, students, etc. how to layer goals, especially exercise and health goals, will help them to avoid having only outcome goals rather than process goals and will also help them to focus on their top-level goal. Not only does goal-setting assist with overall intentionality, but the research implies that it will also inadvertently move them closer to having grit (passion and perseverance toward overarching, long-term goals) and a growth mindset toward using failure to drive action (such as not reaching a low-level goal) (Duckworth, 2019a; Lee & Duckworth, 2018).

Use Scales as Conversation Starters. Over the course of this study, there have been some issues found in nearly every research scale (Grit-S, ITF, and even ESE), and as researchers, we should use these with the knowledge that they are self-report scales that can give a skewed snapshot of the individual or collective sample you are surveying. Indeed, some of the scales (specifically Grit-S or ITF) may have larger issues of construct validity or the newness of the scale's supporting research. However, these scales could be used with clients, athletes, students, patients, etc. and the responses can catalyze and

guide conversations between the practitioner and clients about goals, mindset, and what they believe they can accomplish to help set a baseline.

The Power of Self-Efficacy. Because of self-efficacy's dual role as a predictor and an outcome of exercise, self-efficacy theory has valuable and important implications for many aspects of health. For anyone working with people who want to improve their health, including within the realm of exercise behavior change, it is essential to find ways to help build this skill (Jackson, 2010). There are a number of ways to do this through a practitioner's lens. First, create an environment that allows for autonomy and task mastery by allowing space for clients, students, patients, etc. to find their own ways to be more reliant and choose their own tasks in trying to reach their exercise goals. This would help those we are serving to set short-term or low-level goals and to achieve them to build self-efficacy and confidence through each lower and mid-level step. Finally, we can assist in reframing obstacles by identifying them and replacing the thought blocks with positive interventions or action steps. Someone with higher ESE most likely would not see failures as personal shortcomings, but someone with low ESE might. Positivity and reframing creates an understanding that challenges and even failures will happen, but if we believe we can overcome them, then we are more likely to overcome them.

Recommendations for Researchers

Grit – Approach with Care. Grit has been seen (in connection with mindset) as a predictor of success and achievement above and beyond intelligence and ability in the past decade, and we should not abandon the work that has already been done or the belief that grit can be an important skill to develop. However, according to Credé (2018, 2019) and colleagues (2017), many of the core claims about grit have either been unexamined

or are directly contradicted by the accumulating research. Specifically, there appears to be no reason to accept the combination of perseverance and passion for long-term goals into a single grit construct (Credé, 2018, 2019). Also, according to Credé et al. (2017) and subsequent Credé research (2018, 2019) there is arguably limited support for the claim that grit is a true predictor of success and performance in an educational setting or that grit is malleable or even responsive to interventions. The current study also explored the discrepancies highlighted by Credé and colleagues. The current study showed that the Grit-S scale's construct validity is in question with conflicting information about subscales, and with lack of correlations or predictive ability of Grit-I (Credé et al., 2017), and the scale's lack of domain specificity, warranting further examination. And Duckworth doesn't disagree, as she concedes that there are survey questions that can be changed, as the scale fails to ask about interest over a long period of time, a key part of her definition of grit (Duckworth, 2019c). Credé et al. (2017) found that the actual Grit-S questions may end up actually measuring how conscientious (a Digman Big-Five Personality trait) a person is rather than grit level.

Grit and Mindset Relationship. As the current study discussion has mentioned, there have been a number of studies that have correlated grit and mindset (more specifically grit with growth mindset) (e.g., Meyers et al., 2016; West et al., 2016). The majority of these studies have made these correlations within the context or domain of education where success and achievement are easier to measure through grades and testing and where there are also tangible and immediate consequences to reinforce, at least for most students, engagement and an attempt at avoiding failure. However, as far as our research has shown, these correlations between grit and mindset have not been

examined in the domain of exercise behavior or fitness prior to the current study. Exercise behavior is a completely different entity; so as stated previously, grit and mindset may function differently within this domain than in education or other similar domains. Thus, research in these areas is important to truly see if pursuing these connections is worthwhile and/or if interventions involving the two could be fruitful.

Use of the PAVS Measure. Although this measure has not been used readily in research beyond the research that helped validate the scale (Coleman et al., 2012; Greenwood et al., 2010; Sallis, 2011) and has instead been used in clinical settings for doctors as part of the Exercise is Medicine initiative, it seemed to be an appropriate measure for use in the current study. The scale measured participant movement for minutes and muscle strengthening. For the current population and for the ease of use, further use of the scale could add to the validity of it beyond use by physicians.

Access to the College Student Population. Access to the college student population is a challenge because of survey saturation and fatigue that often occurs on college campuses (Porter, Whitcomb, & Weitzer, 2004). In the current study, I utilized a population to which I had easier access, through connections in campus recreation services on the targeted Division I campus in the Northeast. Because of this limitation, the sample included participants who may have been more inclined to physical activity because of their connection with campus recreation services. The sample included students who are, at the very least, intending to get involved in recreation, even if they never actually engage. Examination of other ways to tap into the college student population for research and intervention distribution, especially to further explore overall well-being and health, including exercise health, is important.

Lack of an Intervention. Because of access to the sample and time constraints, it was decided not to create and administer an intervention that would further explore not only the relationships between non-cognitive variables and exercise behavior, but also allow for further analysis of the possible growth of these non-cognitives over the course of the intervention. However, growth mindset interventions similar to Orvidas et al. (2018), or any other methods that have been shown to be effective in behavior change toward exercise initiation and maintenance seem important to explore further.

CHAPTER 5
SUMMARY, CONCLUSIONS, &
RECOMMENDATIONS FOR FUTURE RESEARCH

Returning to the original quote from the introduction of this dissertation: “If there were a drug that could do for human health everything that exercise can, it would likely be the most valuable pharmaceutical ever developed” (Oaklander, 2016, p. 54). This is so true. But there is truly nothing magical or miraculous about exercise. The only unbelievable part about physical activity and exercise is how long it continues to take for our society to embrace how important it is in our lives at every stage of the lifespan (MacAuley, Bauman, & Fremont, 2015). Unfortunately, many individuals are hoping for the magic drug rather than engaging in a brisk walk around the block.

Researchers and health care professionals agree that living an inactive lifestyle negatively impacts individuals and communities (e.g., CDC, 2018; Lee et al., 2012), and ongoing research highlights that the benefits for adults achieving a recommended 150 minutes of moderate to vigorous exercise of physical activity (MVPA) per week are numerous (CDC, 2018; HHS, 2018; Warburton et al., 2006). However, despite these benefits, less than half of individuals comply with these recommendations, including the college student population (American College Health Association - National College Health Assessment [ACHA-NCHA], 2017; Blackwell & Clarke, 2018; HHS, 2018). A recent area of research to address this issue within the college student population examined psychological non-cognitive skills in connection with predicting exercise behavior (Orvidas et al., 2018; Walton, 2014; Wilson, 2006; Yeager & Walton, 2011). The current study explored these relationships among college student exercise behavior,

exercise self-efficacy, grit, and mindset, through an explanatory sequential mixed-method design. In Phase 1 (quantitative) of the study, participants ($N = 366$) completed a survey online via Qualtrics assessing the above variables as well as collecting various demographic information. In Phase 2 (qualitative) of the study, participants ($n = 10$) were interviewed to further explore the variables and potentially help explain the quantitative results.

To analyze the Phase 1 data, Pearson correlations, linear and multiple regressions, and MANOVAs were conducted. Results showed that Grit-S, Grit-P, Mindset (ITF), and ESE were all significantly positively correlated with college student exercise behavior; however, all correlations were weak, with the exception of ESE being more highly correlated. In contrast, Grit-I was not significantly correlated with exercise behavior. Furthermore, the results of the regression analysis showed only ESE making a significant contribution to the variance, further suggesting it as being a moderate predictor of exercise behavior. In terms of the relationship between the variables, Grit, Mindset, and ESE results showed that Grit-S was significantly strongly positively related to Grit-P and Grit-I, and significantly, but weakly, related to Mindset and ESE. In addition, Mindset and ESE were also significantly, but weakly, positively related. Finally, the sample was split into three groups: Insufficiently Active (IA), Active (A), and Highly Active (HA) based on adapted HHS 2018 PA Guidelines. Overall, the groups were significantly different. Specifically, the HA group reported significantly higher Grit-S, Grit-P, Mindset (ITF), and ESE than the IA group. The A group was only significantly different from IA and HA groups for ESE. However, the effect size was small; thus, the effect, with the exception of ESE, was marginal. To analyze the Phase 2 data, Thematic Analysis (TA)

was used to delineate higher-order themes, lower-order subthemes, and representative meaningful units. Four higher-order themes were identified, including Responses to Failure, Goals/Goal Setting, Behavioral Influence, and Non-Cognitive Skills.

Conclusions

The current study reinforced the importance of self-efficacy in exercise behavior, and that this seems to hold true for college students. In addition, it shed light on the domain-specificity of non-cognitive skills, the need for continued analysis of measurement scales, the uni- or multi-dimensionality of constructs, specifically Grit, and the necessity of further research on the connection between non-cognitive skills and exercise behavior.

Unfortunately, physical inactivity is negatively impacting people across the country and the world, from all ages and backgrounds. Indeed, the modern environment and the modern lifestyle (with technology, time constraints, sedentary workplaces and jobs, etc.) are major challenges to moving our bodies, and basically were designed to reduce or eliminate physical work (MacAuley et al., 2015). With all of these challenges in mind and the wealth of knowledge about the numerous benefits of regular physical activity in our daily lives, researchers continue to seek ways to catalyze individuals and communities to engage in movement.

To summarize conclusions for the current study's three Research Questions:

1. RQ1. Grit-S, Grit-P, and Mindset (ITF) were significantly positively correlated with college student exercise behavior (PAVS), but only weakly, while ESE was strongly correlated with PAVS. Grit-I was not significantly correlated. ESE made a significant contribution to the variance, suggesting it is a moderately strong predictor of

exercise behavior (and the primary indicator in the current study), while Grit-S, Grit-P, and ITF were predictors, but only weak predictors, of PAVS. Also, because ESE only accounted for over 30% of the variance, there were other factors in play that were not measured or identified.

2. RQ2. Grit-S was significantly strongly positively related to Grit-P and Grit-I, which is expected between dimensions of the same scale. Grit-S was significantly but weakly related to ITF and ESE, and ITF and ESE were also significantly weakly correlated. Thus, most of the variables (beyond Grit-S-P-I) were not strongly correlated.

3. RQ3. The three groups (IA, A, and HA) were significantly different: the HA group reported significantly higher Grit-S, Grit-P, ITF, and ESE than the IA group. The A group was only significantly different from the IA and HA groups for ESE scores. However, beyond ESE, for Grit-S-P and ITF between groups, the effect size was small, thus indicating only a marginal effect.

Recommendations for Future Research

A number of recommendations for further research can be made:

1. An important next step in examining the connections between these non-cognitive skills and exercise behavior would be to create a psychological intervention that is ordinary and brief that would focus on building growth mindset and grit, as mindset interventions have been shown to not only bolster growth mindset but also grit.

2. A second recommendation would be further examination and testing of the Grit-S subscales (Grit-P and Grit-I).

3. Third, assuming grit remains a valid construct for predicting success and achievement through future research, domain-specific versions of the grit scale need to be developed and validated.

4. A fourth recommendation would be to further examine non-cognitive skills among samples who do not identify within a binary, cis-gender system.

5. A fifth recommendation is to continue to explore how to engage college students in physical activity.

6. A sixth recommendation is that longitudinal studies in the areas of non-cognitive skills, especially mindset and grit are necessary.

7. Finally, in addition, longitudinal studies with connections between non-cognitive traits and health, exercise, and overall well-being could also prove to be worthwhile considering the current state of healthcare costs and the physical inactivity pandemic.

Ultimately, with the end goal of fighting this inactivity pandemic, we must continue to explore ways to help people develop a new mindset about their ability to change and assist them in finding the stamina to ultimately follow through and sustain a routine of daily movement. As one of the interviewees, Devon, stated candidly when asked what barriers he faced to exercising regularly:

I kind of honestly, like, the past like five or six years I've always kind of, I've never really stopped just because I like – I don't know something about like sweating and exercising I just like – it's always been my whole life. I've never really like stopped for a period of time unless it was like maybe an injury, but like I don't have . . . a time that I really have been injured or anything, so I don't think I can really think of a time that I have stopped or something has stopped me. I wanna keep improving me and growing. So I just keep going.

This is an incredible mindset and approach, one that incorporates each of the non-cognitive skills discussed within this research project. But can we help others get to this place of motivation, grit, growth mindset, and self-efficacy? Perhaps. Yes, there are many factors that come into play in Devon's response (genetics, environment, family influence, demographics, etc.) and how he got to that place in his 21-year life. But, now, one of the challenges is for researchers and practitioners to help all people (e.g., college students, adolescents, older adults, children) continue to build mindset of growth and grit toward physical activity on a daily basis, or to find out that research suggests the connections between non-cognitives and exercise behavior are not significant enough for these changes to occur and intentionally move to other means of behavior change. We can do this as practitioners and researchers through our work with clients and through further research into exercise behavior and the psychological factors that can influence it.

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APPENDIX A

RECRUITMENT EMAILS

You are receiving this email for a project connected to a dissertation in the Department of Kinesiology, Psychology of Human Movement, hoping to learn more about what influences exercise behavior. You were selected to take part in this study because you are a Temple University student connected to Temple Intramural Leagues. If you agree to participate, the questionnaire takes about 10 minutes. Once you complete the questionnaire, you will have the opportunity to be entered into a random drawing for one of five \$20 gift cards or one of two \$50 gift cards at the end of the study. Upon completing the questionnaire, you will be asked if you want to volunteer for Phase 2 (face-to-face interview) of the study. If you volunteer for Phase 2 and are randomly selected as one of 10 interviewees, you will receive \$15 compensation at the completion of your participation.

Your participation is voluntary. If you decline to participate, it will not affect your relationship with Temple University or with Temple IMLeagues. Your answers are anonymous and there are no risks to your privacy. In any sort of report that is prepared, we will not include any information that would make it possible to identify you. All answers will be kept strictly confidential and only the researcher conducting this study will have access to them.

Entry into the drawing for the gift cards will be at the end of the survey. Your email address will be collected solely for the drawing and will NOT be associated with the questionnaire or linked to your individual responses. You may also decline to be entered into the drawing and therefore refrain from entering your email.

If you have questions, please contact the project coordinator, Jennifer B. Ciaccio, MA, in Pearson Hall, 242, via phone: 267-294-8381 or email: jciaccio@temple.edu. This research has been reviewed and approved by the Temple University Institutional Review Board. If you have any questions about research policies or concerns or would like to talk with someone besides the research team, you may contact them at irb@temple.edu.

It's not too late to complete the survey! Not only will you be entered into a drawing to win gift cards, but you will also be contributing to what we know about physical activity and exercise. Your input is important, and we appreciate your time. Please take a few minutes to complete the survey.

You are receiving this email for a project connected to a dissertation in the Department of Kinesiology, Psychology of Human Movement, hoping to learn more about what influences exercise behavior. You were selected to take part in this study because you are a Temple University student connected to Temple Intramural Leagues. If you agree to participate, the questionnaire takes about 10 minutes. Once you complete the questionnaire, you will have the opportunity to be entered into a random drawing for one of five \$20 gift cards and one of two \$50 gift cards at the end of the study. If you volunteer for Phase 2 of the study (face-to-face interview) and are randomly selected as one of 10 interviewees, you will receive \$15 at the completion of the questionnaire and interview.

Your participation is voluntary. If you decline to participate, it will not affect your relationship with Temple University or with Temple IMLeagues. Your answers are anonymous and there are no risks to your privacy. In any sort of report that is prepared, we will not include any information that would make it possible to identify you. All answers will be kept strictly confidential, and only the researcher conducting this study will have access to them.

Entry into the drawing for the gift cards will be at the end of the questionnaire. Your email address will be collected solely for the drawing and will NOT be associated with the questionnaire or linked to your individual responses. You may also decline to be entered into the drawing and therefore refrain from entering your email.

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APPENDIX B

INTERVIEW INQUIRY

Thank you for completing this Questionnaire! We have one more question for you.

Phase 2 of this research involves interviewing students who have completed this questionnaire and would be willing to discuss their experiences with exercise further. Only 10 participants will be randomly selected to be interviewed, so you may or may not be selected. If you choose to participate in an interview, and are randomly selected, you may be contacted within 3 weeks and your potential participation will include a 10-minute survey and 30-minute audio-recorded, individual face-to-face interview. The actual interview will take place face-to-face either at Temple University in a convenient location or virtually via Facetime, Skype, WebEx, or Google Hangout.

To compensate you for your time, upon completion of your participation, you will be paid \$15 (either in person or via digital cash transaction-PayPal, Venmo).

If you would like to be considered as a participant for the interview, please enter your name and email below. This email will not be tied to or be used in conjunction with your answers to the questionnaire.

APPENDIX C

8-ITEM GRIT-S SCALE

(Duckworth, Peterson, Matthews, & Kelly, 2007; Duckworth & Quinn, 2009)

Directions for taking the Grit Scale: Please respond to the following 8 items. Be honest—this is an opinion survey, so there are no right or wrong answers.

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 (delays and obstacles) don't discourage me. I bounce back from disappointments faster than most people.
 - 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 (follow) 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 keeping 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 (hard working and careful).

- 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).

APPENDIX D

IMPLICIT THEORY OF FITNESS SCALE

(adapted from Burnette, 2010; Orvidas et al., 2018)

Directions: Read each sentence and then choose the number that indicates how much you agree with each statement.

1	2	3	4	5	6	7
Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree Nor Disagree	Somewhat Agree	Agree	Strongly Agree

1. ____ You have a certain level of fitness, and you can't really do much to change it.
2. ____ Your ability to be fit is something about you that you can't change very much.
3. ____ No matter who you are, you can significantly change your ability to be a fit individual.
4. ____ You can change your basic level of fitness considerably.
5. ____ You can substantially change your fitness level.
6. ____ To be honest, you can't really change your ability to be fit.

Scoring:

1. Answers range from 1 = "Strongly Disagree" to 7 = "Strongly Agree" (questions 1, 2, 4 should be handled with reverse scoring 1 = "Strongly Agree" to 7 = "Strongly Disagree") (adapted from Orvidas et al., 2018). The scores are added together. After completing the assessment, individuals will have scores ranging from a fixed to a malleable/growth mindset regarding the individual's perceived fitness capabilities. The higher the score, the more malleable the participant's mindset (range from 7-49).

APPENDIX E

EXERCISE SELF-EFFICACY SCALE

(Neupert et al., 2009; Bandura 1997, 2004)

Directions:

Now I would like to ask you some questions about exercise. How sure are you that you will do each of the following:

1	2	3	4
Very Sure	Pretty Sure	A Little Sure	Not at All Sure

1. Exercise regularly (3 times a week for 50 minutes)
2. Exercise when you are feeling tired
3. Exercise when you are feeling under pressure to get things done
4. Exercise when you are feeling down or depressed
5. Exercise when you have too much work to do
6. Exercise when there are other more interesting things to do
7. Exercise when your family or friends do not provide any kind of support
8. Exercise when you don't really feel like it
9. Exercise when you are away from home (e.g., traveling, visiting, on vacation)

Scoring:

Add up the scores for the nine questions. The higher the score, the higher the level of exercise self-efficacy (range is 9-36).

APPENDIX F

PHYSICAL ACTIVITY VITAL SIGN (PAVS)

(Coleman et al., 2012; Greenwood et al., 2010; Sallis, 2011)

Directions: Please answer the following questions regarding your typical exercise habits.

1. On average, how many days each week during the semester do you engage in moderate to vigorous exercise (at least the level of a brisk walk)? (choose from drop-down options: 0-7)
2. On those days, on average, how many minutes per day do you engage in this level of physical activity? (write-in minutes)
3. How many days a week during the semester do you perform muscle strengthening exercises, such as bodyweight exercises or resistance training? (choose from drop-down options: 0-7)

Scoring:

Multiply answers to question 1 and 2 to calculate total minutes of physical activity per week. Question 3 is an optional component.

APPENDIX G

DEMOGRAPHIC QUESTIONS

1. Gender (Select from: male, female, non-binary, choose not to answer, write-in own response)
2. Age in years (Fill-in-blank, years)
3. What is your current role at Temple (Select from: undergraduate student, graduate student, employee, faculty, administrator, alumni)
4. Number of semesters completed in college (Fill-in-blank, semesters)
5. Credits number completed (Fill-in-blank, credits)
6. Race (Select from: asian american, black or african american, latina, native hawaiian or pacific islander, native indian or alaska native, white, I do not identify with any of the choices above, I choose not to answer)
7. Current GPA (Fill-in-blank, GPA)
8. Major (Fill-in-blank, major)
9. Did you participate this Fall semester (2018) in any of the following physical activities at Temple? (Select all that apply) (Select from: intercollegiate athlete, club-sport participant, Intramural-sport participant, none of the above)
10. Do you anticipate participating this Spring semester (2019) in any of the following physical activities at Temple? (Select all that apply) (Select from: intercollegiate athlete, club-sport participant, Intramural-sport participant, none of the above)

APPENDIX H

QUALITATIVE INTERVIEW

1. Can you talk about a time when you were younger, when someone else influenced you in the importance of reaching your goals? If so, how did they teach you this?
2. Can you talk about instances when you felt highly motivated? What about those instances made you feel motivated?
3. Talk about a time in which you felt a lack of motivation. How did you respond/recover in those situations?
4. Give an example of a time when you thought something was impossible. How did you proceed?
5. Tell me about your past physical activity/exercise routine/experiences.
6. Tell me about your current physical activity/exercise routine/experiences.
7. Tell me about how you feel about your current physical activity/exercise/health routines.
8. Have you ever set a physical activity/exercise goal? Please explain.
9. What is one specific physical activity/exercise goal you have and when will you complete it?
10. Do you ever set fitness goals and not reach them due to pursuing something new/different? Please explain.
11. Could you tell me about a time when you experienced challenges in starting/continuing an exercise/physical activity routine and how you overcame these (if you did/have overcome)?
12. What does help you or what would it take to help you maintain an exercise routine?

13. Give a time when you stopped your exercise routine and did not believe you could maintain it. How did you (or how would you) get through this?
14. When you think about your exercise/physical activity goals, what types of things have hindered success for you in the past? How did you overcome these?
15. Tell me about a time that you felt like you worked hard toward a physical activity/exercise goal.
16. Do you feel like your fitness/physical activity/health behavior are as good as they can be?
17. Do you feel that there are things you can do to enhance your physical activity/health behavior?
18. How do you feel about learning new things regarding your fitness/physical activity/health behavior?
19. How would you define “success” in your fitness?
20. How would you define the word “grit”?
21. How gritty do you think you are?
22. How would you define the word “mindset”? What is your mindset about PA?
23. Is there anything I haven’t asked you but you would like to tell me related to your exercise/physical activity?
24. Based on what we have talked about today, what else would you like to add?