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AN EXAMINATION INTO THE IMPACT OF PHYSICAL FITNESS ON CONSTITUENT BEHAVIORS UNDERLYING ACADEMIC AND PSYCHOSOCIAL OUTCOMES: A PILOT STUDY

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ABSTRACT

Physical activity has been associated with numerous benefits related to health status, chronic disease, and mental illnesses. Exercise provides protective effects against the onset of high mortality diseases such as cardiovascular disease, diabetes, cancer, stroke, and depression. Additionally, exercise may provide additional benefits to academic achievement and psychosocial outcomes. College students are remaining largely inactive despite access to recreation centers and gyms through their campuses. The purpose of this study was to identify if physical activity held associations with the specific constituent behaviors underlying academic and psychosocial success in college students. Objective health and fitness markers were performed as part of their undergraduate physical activity classes, and they were asked to take part in a behavioral survey analyzing academic and psychosocial behaviors, perceptions towards exercise's benefits, and exercise scheduling efficacy. Data was analyzed by SPSS software, where t-tests and correlations were set at $p<0.05$. Significant differences in VPA were found in those reporting academics rarely interfered with ability to exercise, exercise affected their satisfaction with the day, and exercise affected motivation towards academics. Students engaging in positive academic behaviors such as attending help or office hour sessions reported greater scheduling efficacy for exercise. This experiment served as an exploratory study to determine if relationships existed between PA and these underlying behaviors of successful academic and psychosocial outcomes. Future studies with a greater sample size and more objective measurements of PA could potentially find more significant differences between these underlying behaviors and PA.

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Chapter 1 Literature Review

Physical Activity and Health Outcomes

Physical activity (PA) has significant benefits to health as noted in a wide range of evidence. From physical health and mortality to cognitive and psychological benefits, physical activity has been shown to establish a linear relation with health status, such that greater physical activity leads to greater improvements in health status (Physical Activity Guidelines Advisory Committee, 2018, Warburton, Nicol, & Bredin, 2016). PA has been consistently demonstrated to have an inverse relationship with all-cause mortality and cardiovascular death (Blair, Kohl, & Barlow et al. 1995, Blair, Kohl & Paffenbarger et al., 1989). This relationship was studied in 13,344 healthy subjects who reported no personal history of myocardial infarction, hypertension, diabetes, or stroke. After eight years of follow-up, subjects who were in the lowest quintile of physical fitness compared to those in the highest quintile held relative risk (RR) for all-cause mortality of 3.44 in men and 4.65 in women. Furthermore, the RR in the least physically active men and women was 8.0 compared against the most physically active subjects (Blair, Kohl & Paffenbarger et al., 1989). In a separate study, the greatest reductions in mortality occurred between the least fit and the next-to-least fit quartiles with a 41% reduction in death between these two quartiles (Myers, Kaykha, & George et al., 2004).

PA is one of the most effective and modifiable risk factors towards preventative treatment of cardiovascular disease and other chronic diseases, such as hypertension, diabetes, stroke, and cancer. In a narrative review by Warburton, Nicol and Bredin (2006), it was

determined that regular physical activity contributes to both the primary and secondary prevention of several chronic diseases. They determined a graded linear relation between volume of PA and health status exists where greater physically active people are at the lowest risk. The greatest improvements in health status occurred in individuals who were the least fit and became physically active. PA guidelines promoted in both Canada and the U.S. of at least 150 minutes per week of moderate intensity PA appear to provide sufficient reductions to health risks. Additionally, it was determined that individuals engaging in PA above these recommendations were likely to gain further health benefits towards reductions in all-cause mortality and chronic disease.

In other studies reviewing epidemiological trends, physical activity has shown to be associated with greater protective effects than inactivity. Men and women were physically active were shown to have up to a 30-40% decreases in RR of colon cancer while physically active women showed a 20-30% reduction in RR of breast cancer (Lee, 2003). In an active intervention study for Type 2 Diabetes, Knowler, Barrett-Connor, & Fowler et al. (2002) determined lifestyle interventions including moderate physical activity of at least 150 minutes per week was found to be more effective in reducing the incidence of diabetes than metformin. In a systematic review of stroke and PA, high levels of PA were associated with a 31% risk reduction. This reduction was seen in both men and women, and it appeared that the benefits occur for both types of stroke, ischemic and hemorrhagic (Lee, Hennekens, Berger et al., 1999).

Benefits of PA towards other diseases such as chronic stress and depression are also well documented. The anti-depressive association between PA and depression has been studied since the early 1900s. There is strong evidence to suggest that PA reduces depressive symptoms in individuals with and without major depression disorder across the lifespan (Physical Activity

Guidelines Advisory Committee, 2018). Josefsson, Lindwall, and Archer (2014) reported a moderate-sized effect of physical activity intervention on depressive symptoms (Hedges' g = -0.77). More recently, interventional studies using aerobic exercise as a behavioral modifier has shown promising results in combatting depression. A walking program that consisted of walking for 20 to 40 minutes three times a week for six weeks resulted in a greater overall reduction in depression symptoms and was much more effective in reducing somatic depressive symptoms (Doyne, Deforche, De Bourdeaudhuij, & Clarys, 2015). Furthermore, reductions in mental stress and depressive symptoms may also enhance the ability of the immune system to function, further reducing effects related to chronic disease (Sothern, Loftin, Suskind, & Udall et al., 1999).

The most recent U.S Department of Health and Human Service guidelines for U.S. citizens were published again in 2018. The guideline recommendations are based on age; for adults, these guidelines recommend 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity PA in order to attain the health benefits of exercise. Additionally, the guidelines recommend two days of resistance training and breaking up large periods of sedentary behavior. These guidelines expanded on the 2008 PA guidelines by promoting greater evidence between PA's positive associations with sleep quality, broadening the mental health benefits by focusing on specific conditions, and identifying how to track PA across the day and what constitutes PA. (Physical Activity Guidelines Advisory Committee, 2018).

Physical Activity in the College Population

Despite the bulk of literature highlighting the benefits and positive associations PA has with many chronic diseases associated with early mortality, studies consistently find a decrease

in physical activity participation and increases in sedentary behavior during the college-aged years (Small, Bailey-Davis, Morgan, & Maggs, 2013). In a study of 871 undergraduate students, Pauline (2013) discovered that 18% of students participated in no moderate-vigorous PA. In a meta-analysis of college student physical activity behaviors, Keating, Guan, Castro, & Dwan et al. (2005) reported that up to 40-50% of college students were not meeting sufficient PA recommendations. Moreover, the research identified that college students were more likely to be active during the weekday, as opposed to the weekend, different from the majority of adults in other populations. PA patterns in college-aged adults is extremely important because they help predict physical activity later in life. Researchers identified 84.7% of college seniors that were physically active were still physically active five and ten years later. Conversely, they determined the same trend among college seniors who were inactive. In college seniors who were inactive, 81.3% maintained a sedentary lifestyle out of college (Sparling & Snow, 2002). Likewise, Miller et al. (2019) found that MPA levels decreased significantly during specific life events, such as the transition to college.

Physical activity in the college population helps to provide protective effects against chronic diseases, primarily obesity, type 2 diabetes, and hypertension at this age. In the 2005 national survey by the American College Health Association, it was indicated that three out of ten college students were either obese or overweight (ACHA-NCHA, 2006). Furthermore, this survey discovered nearly six out of ten students engaged in three days or fewer of vigorous or moderate intensity PA. During the transition to university, students gain a higher control of autonomy over PA and dietary decisions, which has resulted with higher rates of obesity and other chronic conditions in this population.

There are plenty of studies that show the positive benefits in college-based fitness classes. Physical education classes as an intervention have been shown to significantly increase the amount of moderate PA college-aged students engage in. In a review of 29 physical activity interventions in a college-based fitness class, 18 interventions resulted in increases in moderate PA compared against the control group (Plotnikoff et al., 2015). In a review of universities that held different physical activity education requirement, Kim and Cardinal (2018) determined a required physical activity education, as opposed to elective, allowed for students with little motivation for PA to engage in PA at a higher rate than in an elective requirement.

Despite the outcomes associated with PA in the college-aged population, a steady decline in university required physical activity courses continues to contribute to the downward trend of PA engagement in college students. During the 1920s, over 97% of universities required physical education courses as a requirement. Since this peak in physical education, this trend has declined to the point where only 39.55% of 354 American universities required physical education classes in 2010 (Cardinal, Sorensen, & Cardinal, 2012). This trend is further evidenced on the international scale; in a review of 17,928 undergraduate students from 23 different countries, physical inactivity rates averaged 33.0% for males and 45.8% for females (Pengpid et al., 2015). Worldwide, universities requiring physical education and activity classes are declining, and the adverse effects of physical inactivity are becoming more prominent in the college-aged adult population.

Perceived Barriers to Physical Activity in College-Aged Students

Perceived barriers are constructs that relate to any obstacle associated with participating in PA behaviors. These barriers have been identified as one of the most influential negative correlates to PA among both college-aged students and adults across the general population (Grubbs and Carter, 2012, Kamarudin & Omar-Fauzee, 2007). Perceived barriers were shown to be the most influential factor on regular exercise habits and has been strongly associated with inconsistent or nonexistent PA behaviors (Grubbs and Carter, 2012).

The negative relationship between perceived barriers and less PA was confirmed in various studies identifying perceived barriers influence on PA habits. In Grubbs and Carter's (2002) review of perceived benefits and barriers of physical activity, mean scores for the barriers were identified using the EBBS to report the greatest barriers to PA (Sechrist & Walker et al., 1987). They determined the variance was most significant in the following barriers: exercise takes too much time, embarrassment, and exercise takes too much time from family responsibilities. Additional studies have also determined similar barriers in other college student populations. Kemper and Walsh (2010) identified that time demand and muscle soreness from exertion were the most common obstacles to exercise reported by a sample of African American college students. Availability of discretionary time use has also been linked as a barrier to PA engagement. Lack of discretionary time may serve as a barrier to PA in adults; however, availability of greater discretionary time does not necessarily impact PA uptake (Wolin, Bennett, McNeill, Sorensen, et al., 2009).

Further identification of barriers to PA engagement in the adult population reveals an additional variety of demographic, socioeconomic, and cultural barriers that may interact to

negatively affect PA. In an assessment of college students living on or off campus, (Small et al. 2013) concluded that daily physical activity and fruit and vegetable consumption declined significantly from the first semester to the seventh. For both findings, off campus living was associated with the most significant exacerbation of the problem. In a survey of non-exercising United Kingdom female university students, research determined the greatest perceived barrier was physical exertion, rated significantly higher than time expenditure. These findings suggest one of the strongest barriers to PA in female college students is the perception of unpleasantness during physical exertion (Lovell & Ansari et al., 2010). Even in nursing students, a profession expected to understand and promote proper health education, findings determined female nursing students spent less time exercising and had lower exercise self-efficacy (Chan, 2013). While perceived barriers are one of the strongest negative correlates to PA engagement, the literature appears to show certain barriers affect different populations at disproportionate levels, indicating further need to identify specific barriers across different adult populations. In college students, it appears that some of the most common barriers to PA engagement include the following: time demand, exertion and soreness resulting from exercise, and access to physical activity.

Physical Activity and Academic Outcomes

In addition to the proven general health and fitness benefits that adequate PA provides, a growing body of research related to the academic benefits have established additional benefits to meeting PA recommendations. Significant evidence has been published that indicates academic outcomes are positively related to greater outcomes in health and fitness among youth; however, these findings are not necessarily clear in the college-aged population (Burkhalter and Hillman,

2011). Evidence shows that cognitive performance declines as PA rates and aerobic fitness decrease and mass and energy consumption increases (Vaynman and Gomez-Pinilla, 2006). Alongside these findings, evidence that found weight gain and obesity are associated with increased academic workload suggest that physical activity, cognitive performance, and weight status are all associated with one another (Economos, Hildebrandt, & Hyatt, 2008)

In one of the most comprehensive analyses on the relationship of physical fitness and academic performance, the California Department of Education tested field tests of physical fitness against performance on the Standardized Achievement Test (Grissom). The Fitnessgram tested aerobic capacity through a PACER shuttle run, push-ups and sit-ups for muscular strength, sit and reach for flexibility, and BMI for body composition. The findings showed that students who performed with higher scores on the Fitnessgram achieved higher scores in the reading and writing portions of the SAT. They also found that females exhibited higher academic achievement than males, especially at better Fitnessgram scores, suggesting physical activity is potentially more beneficial for female students (Grissom, 2005). These findings were corroborated in an additional study in 3rd and 5th grade students who participated in the Fitnessgram protocol and took the Illinois Standardized Achievement Test (Castelli, Hillman, Buck, & Erwin, 2012). A study of 601 New Zealand youth further revealed an association between physical activity and cognition, which predicts a strong association with academic performance (McPherson and Mackay, 2018).

While there appears to be an established body of evidence concerning physical activity and academic performance in youth, the effect among college-aged students remains a lot more unclear. In an examination of college students using the Student Recreation Center, Belch, Gebel, and Maas (2001) tracked three freshmen cohorts' physical activity until the conclusion of

their first year. This study found students who used the SRC persisted until the end of their first, year at a greater rate, earned slightly higher GPAs, and earned more credit hours than the other two cohorts. These findings were particularly interesting because one cohort included SRC nonusers that entered college with higher standardized test scores and high school GPAs.

In a sampling of 260 university students and teachers, data revealed a link between participation in sports and physical activity education and academic performance. Respondents reported participation in sport resulted in improvements to GPA, class success, and cognitive development (Khan and Jamil et al. 2012). In a study focused on the mediating effect of physical activity to self-esteem and academic performance, Kayani et al. (2018) found physical activity predicted greater self-esteem in a survey of Pakistani college students. They concluded physical activity had a significant but smaller effect than the total indirect effect produced by mediating factors. Calestine, Bopp, Bopp, and Papalia (2017) found that hours spent studying was positively associated with greater adiposity. Conclusive evidence on the exact extent to which PA predicts academic performance in college students is not apparent, but enough evidence suggests that there is an association between the two and should be analyzed further.

Physical Activity and Psychosocial Outcomes

Researchers have identified numerous variables associated with PA adherence and outcomes in psychosocial behaviors. Within the context of psychosocial behaviors, researchers have identified important constructs that increase or decrease PA adherence in the general population, such as exercise motivations, self-efficacy, sociability, and certain trait characteristics. Exercise motivations have been shown to explain PA behaviors by attempting to

identify the autonomous and extrinsic factors involved in PA maintenance. Exercise motivation is grounded in the Self-Determination Theory; SDT is a meta-theory that serves to understand how autonomous and extrinsic forces interact to either promote or obstruct involvement in a given behavior (Deci & Ryan, 2008). This theory serves well in identifying the expectations an individual expects to gain from a given behavior. Autonomous motivations are linked to the sense of self-identity the behavior provides, (e.g., engaging in PA because it is enjoyable and an identifiable part of your sense of self). Extrinsic motivations are linked to the external expectations gained from engaging in a behavior (e.g., engaging in PA because you lose weight and will look good to the outside world).

Autonomous motivation is a useful measure in helping to explain the motivation factors in the college-aged population and how best to apply interventions. In a systematic review of SDT, Texeira et al. (2012) determined that promoting autonomous motivation in PA promotes greater adherence than extrinsic motivations. Their research indicated that a predominance of autonomous motivation is especially important in promoting long-term exercise adherence while extrinsic motivation is valuable in promoting initial adoption. The Exercise Planning Scale (Rovniak et al., 2002) is a scale developed to determine how an individual builds their schedule, particularly as it pertains to exercise. Individuals who regularly schedule their exercise and adhere to that schedule are more likely to see exercise as autonomously motivational and predict greater adherence to consistent PA.

Self-efficacy is also another useful psychosocial construct to predict PA engagement, especially in the college-aged population. A key component of the social cognitive theory, self-efficacy is the theory that people's behaviors can be predicted by their perception of their own capabilities to complete the behavior. Self-efficacy serves as a determinant to behavior: the

higher an individual's self-efficacy, the greater likelihood they will perform the behavior (Bandura, 1977). In an intervention study in college students, Franko et al. (2008) created an internet based program to promote PA and nutrition education. Following the intervention, students who adopted the intervention were more likely to increase self-efficacy, social support, and change their eating habits. However, self-efficacy might not be represented at comparable levels between the two sexes. In a review of Irish college students' self-efficacy, significant correlations between activity and positive self-efficacy were only found in the male students (Patterson et al., 2006). Psychosocial behavior examinations are important to understanding the motivation behind PA engagement and tailoring interventional strategies to best suit the needs of an individual in the psychosocial context.

Chapter 2

Journal Manuscript

Introduction

Background and Study Rationale

Researchers have established a wide range of significant evidence supporting the benefits of physical activity on overall health status and reductions in mortality rates (Warburton, Nicol, & Bredin, 2006). This research has been primarily interested in identifying and examining specific constituent behaviors promoting academic and psychosocial success and determining the relationship physical activity (PA) has in predicting engagement in these constituent behaviors. Previous studies have been conducted in the general population to identify the relationships between PA and academic and psychosocial success. In young children, studies identified that greater outcomes in health and fitness among youth indicated greater academic success; however, this evidence was less clear in college-aged students (Burkhalter and Hillman, 2011). Freshmen students who utilized their student recreation center their first year responded with greater GPAs, class success, and cognitive development (Khan et al., 2012). Even so, it appears that the exact relationship between PA and academic success diminishes in college-aged students and improvements in academic outcomes at this age may be related to mediating effects on self-esteem and self-efficacy (Kayani et al., 2018). Research examining psychosocial outcomes has found significant relationships between autonomous motivation for exercise behaviors and PA adherence as well as self-efficacy as a predictor for PA engagement (Deci and Ryan, 2008, Frank et al., 2018). In predicting successful psychosocial outcomes, it appears that integrating exercise

positively, seeing exercise as beneficial, overcoming barriers to exercise, and planning it regularly all play a role in increasing PA engagement and adherence.

Overall, current research shows that college-aged students who exercise regularly achieve better outcomes in health status and potential additional benefits to academic and psychosocial success. However, there exists little to no research on the relationship between PA and the individual behaviors that predict greater success in these two domains. The rationale behind this study was to identify the most common constituent behaviors predicting success in academic and psychosocial outcomes. It was intended for this project to serve as a pilot study in determining whether further research into the impact of PA on college-aged student behaviors was worthwhile to pursue.

Purpose and Significance

The purpose of this study was to conduct an exploratory experiment aimed at evaluating the constituent behaviors predicting academic and psychosocial success and determining if meeting PA recommendations predicts greater occurrence and adherence in those constituent behaviors. It attempted to identify the impact of PA on the identified academic and psychosocial variables as well as determining the extent to which perceptions of PA's benefits and scheduling efficacy predicted PA engagement.

This study contributes to the current literature about PA in predicting both academic and psychosocial measures by providing exploratory data into the specific behaviors underlying these two larger constructs. This research provides insight for college-aged students, campus health and fitness departments, and healthcare professionals to better understand the exact benefits,

especially in academic and psychosocial outcomes, meeting PA recommendations may provide. While this study only served as an introductory analysis into PA's impact on these specific constituent behaviors, it provides the opportunity to expand further with a greater sample population and stronger objective measurements for PA.

Aims

1. To evaluate differences in physical activity and fitness markers in a sample of college-aged students.
2. Identify the most common constituent behaviors underlying academic and psychosocial success in college-aged students
3. Examine associations between academic outcomes and their constituent behaviors, physical fitness, and behavior planning.
4. Examine associations between psychosocial outcomes and their constituent behaviors, physical fitness, and behavior planning.
5. Examine associations between perceptions of exercise's benefits as well as exercise scheduling efficacy as they relate to academic and psychosocial outcomes.

Hypotheses

1. Students who engage in positive academic behaviors underpinning academic success will be positively associated with higher physical activity related variables.

2. Students who engage in positive psychosocial behaviors and integrate exercise into their sense of self will be positively associated with higher physical activity related variables.
3. Students who engage in positive academic and psychosocial behaviors will positively associate with seeing exercise as beneficial and worthwhile.
4. Students who engage in positive academic and psychosocial behaviors will positively associate with incorporating exercise into their life readily.

Methods

Participants and Recruitment

This was a one-time, cross sectional analysis following undergraduate students (n = 63) enrolled in for-credit physical activity (PA) classes between August 2018 and December 2018. Courses required fitness assessments as a part of course requirements, reflected students from all colleges across the university, and were used as a general education requirement.

Students were invited to take part in survey and allow access to the fitness data required for their PA courses. Results from their fitness data were compiled at the Center for Fitness and Wellness and were used to compare against survey responses. They were provided with an online consent form to use both their responses and fitness data for the purpose of this research. This study was approved by the Pennsylvania State University Institutional Review Board.

Recruitment was conducted in-person among the undergraduate students enrolled in the PA courses. Participation in this research was voluntary. Course instructors did encourage students to participate, but it did not have a negative impact on their evaluation in the course. All students enrolled in PA courses were eligible for participation. Those who completed both the survey and consented to use their fitness data were awarded a $5 gift card.

Physiological Variables

Body Composition – Height, weight, Body Mass Index (BMI), body fat %, fat mass, fat free mass, muscle mass via Bioelectrical impedance analysis were used to assess subject's overall body composition.

VO2max – An estimate of maximal oxygen consumption was calculated via YMCA submaximal cycle ergometer test.

Resting Energy Expenditure (REE) and Total Energy Expenditure (TEE) – REE and TEE were assessed by the SECA analysis machine.

Survey Design

Following the objective fitness measurements, participants were asked to complete the survey delivered online via Qualtrics (Qualtrics, Provo, UT). Students were invited to take part in a 69-question survey focusing on the following areas: Physical Activity (16), Mental Health (4), General Health (4), Academic and Psychosocial Attitudes (30), and Demographics (13). The survey used measures previously validated for survey use in these PA courses. The Academic and Psychosocial Attitudes block were comprised of mostly original questions for the purpose of this research related to academic, psychological, and social outcomes. This block did include shortened forms of two previously validated scales: the Exercise Benefits and Barriers Scale (EBBS) (Sechrist & Walker et al., 1987) and the Exercise Planning and Scheduling Scale (EPS) (Rovniak & Anderson et al., 2002).

Self-report Variables

Demographics – Subjects self-reported their current academic year, age, gender identity, and race/ethnicity.

Behavioral Measures – The Global Physical Activity Questionnaire (GPAQ) assessed self-report moderate and vigorous aerobic and strength-training physical activity per week, transportation related physical activity, and sedentary behavior during the week and weekend (GPAQ citation). Minutes per week of moderate and vigorous physical activity as well as minutes per week and weekend of sedentary behavior were used in analyses. Subjects reported how many nights of restful sleep in the past week using a scale from 0 to 7 nights.

Academic Measures – Subjects reported their current grade point average (GPA) using a continuous scale. The distribution was examined, and the median GPA was 3.3 (check). GPA was dichotomized into less than equal or greater 3.3 (all values rounded to nearest tenth. Subjects reported current credit enrollment using a continuous scale (dichotomized as (≤ 15) and (>16). Subjects responded to six items related to academic time interference with exercise, academic help, class preparation, group study contributions, academic motivation, and study environment importance. Time interference with exercise, academic help, and class preparation were evaluated on a 5-item Likert Scale from never (1) to always (5). Group study contribution was evaluated on a 6-item Likert scale from I do not participate in group study sessions (1) to extremely likely (6). Academic motivation was evaluated on a 5-item Likert scale from not very motivated (1) to highly motivated (5). Study environment was evaluated on a 6-item Likert scale from it isn't important (1) to very important (6). All item distributions were evaluated and dichotomized.

Psychosocial Measures – Subjects responded to 6 items related to social personality, trying new activities, the quality of a day with exercise, mental health without exercise, and academic motivation with or without exercise. These questions were asked in a 5 to 6-item Likert scales. Social personality asked from introvert (1) to extrovert (5). Trying new activities asked

from never (1) to always (5). The quality of a day with exercise asked from very unsatisfied (1) to very satisfied (5). The mental health without exercise asked from no negative impact (1) to very high negative impact (5). The academic motivation with or without exercise asked from doesn't affect it (1) to affects a lot (5). All item distributions were evaluated and dichotomized.

The Exercise Benefits and Barriers Scale (EBBS) was used to provide descriptive information on a participant's perception of physical activity's benefits. The scale used 22 items from the benefits portion of the scale on a 4-item Likert scale from strongly agree (1) to strongly disagree (4). The 22 items were summed between a possible range from 22-88. The internal consistencies for this scale were tested and a Cronbach's alpha of 0.943 indicated a high level of internal consistency.

The Exercise Planning and Scheduling Scale (EPS) was used to provide descriptive information on a participant's priority in scheduling exercise. The scale used 6 items from the scale on a 5-item Likert scale from does not describe me (1) to describes me extremely well (5). The 6 items were summed between a possible range from 6-30. The internal consistencies for this scale were tested and a Cronbach's alpha of 0.244 revealed a very unreliable level of consistency for this study. While this scale was not particularly reliable for this sample group, previous studies using the EPS show Cronbach's alpha scores above the recommended value of .8.

Statistical Analysis

Basic descriptive statistics were used to describe the sample. Pearson correlations examined the relationships between the fitness, behavioral, academic, and psychosocial

outcomes. Independent t-tests were used to compare the differences between dichotomized variables to determine if significance existed between the two groups. Significance levels were at $p<.05$ and all analyses were run using SPSS 22.0 (IBM, Armonk, NY).

Results

Table 1 depicts the demographic characteristics of the sample (n=63) of college students. The sample was majority male (60.3%), non-Hispanic white (60.3%), and upperclassmen (85.7%). Non-Hispanic African Americans comprised 3.1% (n=2) of the population, and Hispanic/Latinos comprised 7.9% (n=5) of the population. Asian American/Pacific Islanders were 23.8% (n=15) of the total, and students identifying as other comprised the remaining 4.8% (n=3) of the total. The mean BMI for this study was 24.2 kg/m^2. The mean MPA reported was 224.22 minutes per week, and the mean VPA reported was 168.10 minutes per week. The mean MET-minutes for this study was 2700.84 minutes per week.

The correlational analyses of fitness and behavioral variables with academic outcomes are depicted in Table 2. Number of credits was positively correlated with AT (r=.293, p =.03). Academic time interference with exercise was positively correlated with body fat (r=.253, p=.05) and negatively correlated with MET-minutes (r=-.408, p=.01) and VPA (r=-.349, p=.008). Contribution in group study was correlated negatively with the EBBS (r=-.333, p=0.01). Academic motivation was correlated positively with MPA (r=.394, p=.01). The EPS scale was correlated positively with MET-minutes (r=.419, p=.007) and VPA (r=.542, p=.001) and negatively correlated with the EBBS (r=-.416, p=.001).

The correlational analyses of fitness and behavioral variables with psychosocial outcomes are depicted in Table 3. Day quality with no exercise was positively correlated with VPA (r=.287, p=.03) and negatively correlated with the EBBS (r=-.369, p=.005). Academic motivation with exercise was positively correlated with VPA (r=.324, p=.011) and negatively correlated with the EBBS (r=-.490, p=.001). Academic motivation without exercise was positively correlated with VPA (r=.314, p=.015) and negatively correlated with the EBBS (r=-

.432, p=.001). Mental health without exercise is negatively correlated with SB (r=-.321, p=.01) and the EBBS (r=.325, p=.01). Degree of making friends was positively correlated with SB (r=.261, p=.04). Degree to which new activities are tried was negatively correlated with the EBBS (r=-.345, p=.009).

The results of t-test analyses comparing academic outcomes (academic time interference, academic help, class preparation, group study contribution, academic motivation, and study environment) with fitness outcomes in Table 4. The academic variables above were dichotomized to determine if significant differences in fitness were observable between the two groups. Those reporting academic time never-sometimes interfered with the ability to exercise was associated with greater MET-minutes, VPA, and a higher EPS score. Students who often-always attended additional help or office hour sessions were associated with a greater score on the EPS. Students who often-always prepared for class by reading early were associated with greater AT and MPA. Students who were not motivated to do well academically were associated with a higher EBBS score, but students who were motivated to do well were associated with a higher EPS score. Additionally, students who rated a quiet study environment as moderately-very important were associated with a greater TEE.

The results of t-test analyses comparing psychosocial outcomes (day quality with exercise, academic motivation without exercise, academic motivation with exercise, mental health without exercise, trying new activities, and social personality type) with fitness outcomes are found in Table 5. Students who believed exercising did not affect-very unsatisfactorily affected their day were associated with greater EBBS and CESD scores; however, students who believed exercise satisfactorily-very satisfactorily affected their day were associated with a greater EPS score and significantly higher VPA. Students who believed not exercising did not

affect-moderately affected their motivation for school were associated with a greater EBBS score. Students who believed exercise affected motivation-affected it a lot were associated with greater VPA and EPS scores. Additionally, students who believed exercising did not affect-moderately affected their motivation for school were associated with a greater EBBS score. Students who believed exercising affected their motivation-affected it a lot were associated with greater VPA and EPS scores. For students who believed not exercising had a negative-very high negative impact on their mental health, they were associated with greater METS. In students who were often-always likely to try a new type of activity, they were associated with greater MPA, but students who were never to sometimes likely to try a new activity were associated with a greater EBBS score. The final finding found students who identified as ambiverted were associated with greater VPA and higher EPS scores.

Discussion

This study assessed the relationships between academic and psychosocial, fitness, and behavioral outcomes in college students. Few studies to date have focused on the relationship between both academic and psychosocial outcomes and their effect on fitness. The aim of this study was to continue research into determining the role of these outcomes in college-aged student's fitness. This study attempted to examine how these specific constituent behaviors related to their overall construct's association to college student fitness. The implications of this study are relevant for campus health and fitness personnel, college student healthcare providers, and college administrators and advisers for providing preventative intervention focused on impacting academic and psychosocial behaviors.

The current study noted a significant relationship between exercise time interference by academic requirements. Reporting academic work interfering with the ability exercise had greater adiposity and less vigorous physical activity (VPA) and volume of PA (MET-minutes). In a sample of African American college students, Kemper and Walsh (2010) found that time demand was reported as one of the two most common barriers to exercise. Furthermore, other studies have found that a lack of time as a result of work and study commitments was identified as the number one external barrier towards physical activity (Sharifi et al. 2013, Arzu, Tuzun, & Eker, 2006, Deliens, Deforche, De Bourdeaudhuij, & Clarys, 2015). This literature supports the idea that exercise is prioritized behind the academic schedule of the students and contributes to differences in fitness outcomes. In the current study, analyses of credit load revealed students reporting higher credit loads were positively associated with greater Active Transport (AT). This association could be due to students being more likely to walk across campus as a result of an increased number of classes per semester. Understanding scheduling efficacy in the college

student population could provide valuable insight into creating interventions that maximize short periods of time to help overcome little perceived time to exercise.

Further analyses compared the outcomes of the Exercise Planning and Scheduling Scale (Rovniak & Anderson et al., 2002) as it related to correlations of fitness outcomes. Exercise scheduling efficacy, tested using the EPS scale in this study, was positively correlated with VPA and MET-minutes and negatively correlated with the Exercise Benefits/Barriers Scale. Grave et al. found specific scheduling of exercise into day-to-day life worked as a successful psychological intervention to increasing adherence in the adult population. In the current study, higher EPS scores were positively associated with greater fitness outcomes. This suggests, along with the association to academic workload interference, that exercise that is regularly scheduled and intrinsically important is associated with greater fitness outcomes (Ryan, Lepes, Sheldon, & Rubio et al., 1997).

The correlational analyses between the psychosocial, fitness, and behavioral outcomes indicated positive relationships between VPA and three psychosocial variables: day quality without exercise, academic motivation with exercise, and academic motivation without exercise. These variables identified motivation levels, both towards student schoolwork and quality of their day in general, with or without exercise. Self-determination theory is a predominant theory used to explain motivation as the driver to exercise adherence (Deci and Ryan, 2008). Deci and Ryan described autonomous motivation as intrinsic, identified, or integrated motivation where an activity's value is important to an individual's sense of self. Autonomous motivation was associated with motives related to enjoyment, competence, and social interaction. The three variables above provide measures to determine how well integrated exercise is to the student's sense of self. Students reporting lower quality and motivation on days without exercise suggest it

is integrated greater into their sense of self. This information supports the idea that students who believe exercise is autonomously integrated will likely engage in greater amounts of vigorous physical activity.

Sedentary behavior was positively associated with making friends and associated with those reporting worse mental health on days without exercise. Stubbs et al. (2018) determined an elevated risk of increased levels of sedentary behavior in depressive populations. Furthermore, Sawka et al. (2013) determined that physical activity among social networks play a large influence on personal physical activity. College students are not meeting physical activity guidelines, and this data suggests an increased friend network, particularly if they are inactive, might play a role into increased sedentary behavior. Social support for exercise has been shown to be a consistent correlate across most populations. In an analysis of college student PA and nutrition, it was found that the students who reported high encouragement for exercise were more likely to meet PA guidelines, especially in female students (Gruber, 2008).

Further analyses compared the measures of the perceived benefits of exercise as it related to correlations of fitness outcomes. EBBS scores in the current study were negatively correlated to day quality without exercise, academic motivation with exercise, academic motivation without exercise, mental health without exercise, and trying new activities. Negative correlations on the motivations without exercise were expected as an individual is less likely to believe exercise has positive benefits if quality of day and motivation drop without exercise. The negative correlations with trying new activities and academic motivation with exercise were unexpected. Trying new activities consistently could be explained by decreased perceptions to the benefits of physical activity if they are constantly engaged in a new or different activity. Academic motivation with exercise is potentially explained by students who only perceive exercise as

beneficial to their academic work instead of general perception about exercise's benefits, but this particular finding is not supported by the current research. Future studies identifying whether college students perceive exercise as beneficial to their academic success would provide greater insight into this study's findings.

The comparisons between academic, fitness, and behavioral variables revealed significant differences in the academic workload interfering with exercise variable. Students responding academics interfered infrequently with exercise saw varying degrees of significance in MET-minutes (*), VPA (**). The difference in VPA minutes/week between the two groups was quite large, 110 minutes/week more for those responding academics infrequently interfered. These analyses strongly support the suggestion that lack of time due to academic workload is related to a decrease in physical activity in college students. Students responding often-always for class preparation had significant differences in AT and MPA. While specific literature does not exist on the underlying behaviors predicting academic success, McPherson et al. noted a relationship between physical activity and improved academic outcomes among youth is supported. Physical activity interventions suggest that decreased cognitive decline and function resulted from adoption of exercise (Burkhalter and Hillman, 2011, Calestine et al., 2017). While more data would need to be collected, this study's findings suggest specific academic behaviors such as class preparation are potentially positively related to greater engagement in PA.

Further analyses explored the relationship between the specific constituent variables as they related to the EPS scale. Significant relationships were found between students who frequently pursued academic help, were likely to contribute during group studies, and were very motivated for academic motivation and the EPS. It appears that students who are more engaged in academically successful behaviors more often produce greater scheduling efficacy towards

exercise planning. College students experience greater autonomy in the transition from high school. This can result in a decrease in PA engagement that may be explained by PA engagement during high school was the result of extrinsic motivations. Exercise that is regularly integrated into daily scheduling produces greater autonomous motivation and adherence to exercise (Deci & Ryan, 2008). Despite these individual components producing potential relationships with academic outcomes, there was no relationship between overall GPA and physical fitness found.

The comparisons between psychosocial, fitness, and behavioral variables revealed significant trends in both vigorous physical activity and the EBBS scale. VPA saw extremely significant differences of 130 minutes per week more in those satisfied with their day when they exercised. VPA also saw a very significant difference of 120 minutes per week more in the group who reported worse academic motivation with no exercise. It also held significant differences in the group who reported greater academic motivation with exercise and between individuals identifying ambivert over more introverted – introvert. Rhodes and Smith (2006) identified personality correlates related to exercise and determined extroversion (r=.23) was positively associated with physical activity. However, the current study favored ambiverts (n=21) over extroverts, which is why we believe we only saw significant differences between ambiverts and those responding more introverted-introvert.

The relationship between the EBBS and the psychosocial variables revealed significant differences in the does not affect to very unsatisfied group for quality of day with exercise. It is believed the group reporting no difference in motivation without exercise would perceive exercise as less beneficial. Additionally, the does not affect to moderately affect groups of both academic motivation with and without exercise reports a significant relationship to the EBBS. Again, it is thought that the does not affect groups would not see exercise as a significant benefit

to them if exercise does not affect their academic motivation. The never-sometimes group of students reporting they frequently try new activities reports a significant relationship with the EBBS. The data suggests those who stick to the same, few activities find that these activities are beneficial to them and provide them satisfaction. In a review of the Self-determination theory, Klain et al. (2015) determined autonomous motivation explained 40% of satisfaction from an activity. In future studies, determination of how the students above would rate their motivation towards the activities they are engaged in would be needed; however, autonomous motivation could explain part of the reason why they believed staying with the same activities saw benefits in exercise perceptions.

This research concludes with the preliminary findings that physical activity and successful academic and psychosocial behaviors may influence one another. There appears to be a positive relationship between those who engage in these successful constituent behaviors and their PA engagement. Significant differences in VPA in those who did not have exercise interfere with their schedules, were satisfied with their day when they exercised, and reported worse academic motivation without exercise suggest VPA's relationship to successful academic and psychosocial outcomes is important. Future research should be aimed at identifying whether the relationship can be more specifically associated with PA as the driver behind those engaging in these successful behaviors. Greater objectivity in both PA and characterizing the constituent behaviors would produce more compelling findings in determining the extent to which PA may produce benefits to academic and psychosocial outcomes in college students.

Limitations

The primary limitation to this study centered on the sample size collected. With (n=63), there was a not sufficient sample size to draw major conclusions around the constituent variables

involved with this study. Instead, this experiment was designed as a pilot study to explore potential relationships between the component variables of the much larger academic and psychosocial outcomes found to have a relationship with physical fitness (citations). Our primary objective was to potentially identify specific behaviors and perceptions within these two outcomes that may benefit from physical fitness, specifically in college-aged students. Secondary limitations to the study include reliance on self-report measures to determine these variables effect without another source of objective physical fitness as well as being a one-time cross sectional analysis. Future studies would benefit from incorporating an additional objective measure such as an accelerometer and tracking the group across the semester and identifying increases in physical fitness.

Appendix A

Results Tables

Table 1. Demographic characteristics of the sample (n=63)

Demographic Variable	n (%)	Mean (SD)
Gender		
Male	38 (60.3)	
Female	25 (39.7)	
Academic Class		
Lower classmen	9 (14.3)	
Upper classmen	54 (85.7)	
Race/Ethnicity		
Non-Hispanic White	38 (60.3)	
Non-Hispanic Black	2 (3.1)	
Hispanic	5 (7.9)	
Asian American/Pacific Islander	15 (23.8)	
Other	3 (4.8)	
Behavioral outcomes		
Moderate physical activity minutes/week		224.22 (206.52)
Vigorous physical activity minutes/week		168.10 (180.17)
METS /week		2700.84 (1521.03)
Active Transport minutes/week		375.25 (239.17)
Sedentary behavior (hours/weekday)		6.22 (2.05)
Sedentary behavior (hours/weekend)		6.00 (2.57)
Fitness Outcomes		
Body Fat %		23.26 (8.45)
BMI (kg/m2)		24.2 (4.19)
VO2 Max Estimate (ml/kg/min)		39.24 (9.83)
Fat Mass		38.68 (21.05)
Muscle Mass		58.05 (13.17)

	1697.67
REE	(314.33)
	2932.21
TEE	(555.90)

Table 2. Correlations between fitness, behavioral and academic outcomes

Academic Outcomes		Body Fat	BMI	VO_2Max	Fat Mass	Muscle Mass
GPA	R-value	0.074	-0.194	-0.067	-0.037	-0.234
	p-value	0.588	0.151	0.625	0.786	0.082
Number of Credits	R-value	-0.017	-0.057	-0.002	-0.068	-0.144
	p-value	0.899	0.671	0.99	0.614	0.286
Time Interferences	R-value	.253*	0.156	-0.134	0.202	-0.072
	p-value	0.049	0.231	0.305	0.119	0.582
Group Study Contribution	R-value	0.039	-0.155	-0.116	-0.091	-0.19
	p-value	0.77	0.238	0.379	0.491	0.145
Academic Motivation	R-value	-0.034	-0.174	-0.022	-0.095	-0.193
	p-value	0.797	0.185	0.865	0.472	0.141
EPS	R-value	-0.053	-0.106	0.176	-0.135	-0.103
	p-value	0.69	0.429	0.187	0.312	0.44
CESD	R-value	-0.087	0.028	-0.005	0.012	0.036
	p-value	0.505	0.828	0.968	0.925	0.783

Note: *p<.05, **p<.01, ***p<.001, GPA-Grade point average, BMI- body mass index,
METS - Metabolic Equivalents, AT - Active Transport, VPA- vigorous physical activity,
MPA- moderate physical activity, SB - sedentary behavior,
REE - Resting Energy Expenditure, TEE - Total Energy Expenditure, EBBS - Exercise Benefits and Barriers Scale, EPS - Exercise Planning Scale, CESD - Center for Epidemiological Studies Depression Scale

Table 2. Correlations between fitness, behavioral and academic outcomes continued

METS min/week	AT min/week	VPA min/week	MPA min/week	SB min/week day	SB min/week end	REE	TEE	EBBS
-0.18	0.222	-0.178	0.114	0.182	0.196	-0.231	-0.235	0.135
0.272	0.118	0.19	0.402	0.185	0.163	0.087	0.082	0.325
-0.109	0.293*	-0.111	0.151	-0.209	-0.05	-0.12	-0.096	0.06
0.504	0.033	0.412	0.263	0.123	0.72	0.374	0.48	0.659
-.408**	-0.091	-.349**	0.001	0.163	-0.031	0.065	-0.023	0.184
0.008	0.507	0.006	0.994	0.212	0.817	0.621	0.862	0.17
0.036	-0.004	0.096	0.165	-0.015	-0.072	-0.22	-0.067	-.333*
0.827	0.979	0.468	0.207	0.913	0.596	0.091	0.609	0.011
-0.095	0.187	-0.158	.394**	0.039	-0.077	-0.181	-0.072	-0.25
0.562	0.171	0.229	0.002	0.769	0.575	0.167	0.583	0.061
.419**	0	.542**	0.048	-0.118	0.118	-0.211	-0.073	-.416**
0.007	0.999	0	0.719	0.384	0.397	0.113	0.588	0.001
-0.082	0.077	-0.178	-0.148	-0.002	-0.093	0.056	-0.024	-0.027
0.611	0.575	0.171	0.256	0.989	0.493	0.668	0.854	0.844

Note: *p<.05, **p<.01, ***p<.001, GPA-Grade point average, BMI- body mass index, METS - Metabolic Equivalents, AT - Active Transport, VPA- vigorous physical activity, MPA- moderate physical activity, SB - sedentary behavior,
REE - Resting Energy Expenditure, TEE - Total Energy Expenditure, EBBS - Exercise Benefits and Barriers Scale, EPS - Exercise Planning Scale, CESD - Center for Epidemiological Studies Depression Scale

Table 3. Correlations between fitness, behavioral and psychosocial outcomes

Psychosocial Outcomes		Body Fat	BMI	VO_2Max	Fat Mass	Muscle Mass
Day Quality w/ Exercise	R-value	-0.01	-0.012	0.197	-0.056	-0.048
	p-value	0.938	0.925	0.131	0.67	0.713
Day Quality w/o Exercise	R-value	-0.157	-0.02	0.043	-0.089	0.183
	p-value	0.232	0.88	0.743	0.498	0.162
Academic Motivation	R-value	-0.107	-0.106	0.151	-0.126	-0.061
w/ Exercise	p-value	0.414	0.418	0.248	0.338	0.644
Academic Motivation	R-value	0.068	0.053	0.033	0.064	0.039
w/o Exercise	p-value	0.607	0.687	0.801	0.63	0.769
Mental Health w/o Exercise	R-value	0.029	0.024	0.113	-0.014	0.001
	p-value	0.829	0.858	0.388	0.915	0.994
Making Friends	R-value	-0.139	-0.217	0.121	-0.217	-0.113
	p-value	0.29	0.097	0.356	0.096	0.39
New Activity	R-value	-0.165	-0.111	0.071	-0.131	0.007
	p-value	0.209	0.397	0.587	0.317	0.955

Note: *p<.05, **p<.01, ***p<.001, GPA-Grade point average, BMI- body mass index,
METS - Metabolic Equivalents, AT - Active Transport, VPA- vigorous physical activity,
MPA- moderate physical activity, SB - sedentary behavior,
REE - Resting Energy Expenditure, TEE - Total Energy Expenditure, EBBS - Exercise Benefits and Barriers Scale, EPS - Exercise Planning Scale, CESD - Center for Epidemiological Studies Depression Scale

Table 3. Correlations between fitness, behavioral and psychosocial outcomes continued

METS min/week	AT min/week	VPA min/week	MPA min/week	SB min/week day	SB min/week end	REE	TEE	EBBS
0.195	-0.067	.287*	0.141	-0.144	-0.09	-0.083	0.041	-.369**
0.229	0.626	0.026	0.283	0.275	0.507	0.528	0.756	0.005
-0.017	-0.016	-0.142	-0.035	0.145	0.019	0.141	0.102	0.194
0.919	0.909	0.278	0.791	0.272	0.891	0.281	0.437	0.147
0.171	0.088	.324*	-0.051	0.061	0.066	-0.127	-0.079	-.490**
0.291	0.523	0.011	0.697	0.645	0.631	0.333	0.55	0
0.155	-0.177	.314*	-0.187	-0.019	0.091	0.023	0.054	-.432**
0.34	0.197	0.015	0.152	0.886	0.504	0.862	0.681	0.001
0.283	0.036	0.223	0.053	-.321*	0.042	-0.055	-0.012	-.325*
0.077	0.797	0.087	0.688	0.013	0.758	0.679	0.93	0.014
0.176	-0.076	0.245	0.137	.261*	0.053	-0.227	-0.098	-0.104
0.278	0.581	0.059	0.296	0.046	0.7	0.081	0.455	0.443
0.11	0.048	0.07	0.237	0.118	0.056	-0.08	0.007	-.345**
0.5	0.727	0.596	0.068	0.374	0.683	0.541	0.957	0.009

Note: *p<.05, **p<.01, ***p<.001, GPA-Grade point average, BMI- body mass index, METS - Metabolic Equivalents, AT - Active Transport, VPA- vigorous physical activity, MPA- moderate physical activity, SB - sedentary behavior, REE - Resting Energy Expenditure, TEE - Total Energy Expenditure, EBBS - Exercise Benefits and Barriers Scale, EPS - Exercise Planning Scale, CESD - Center for Epidemiological Studies Depression Scale

Table 4. Comparison of fitness and behavioral outcomes by academic variables

Fitness outcomes	Academic Time Interference			Acad Help			Class Prep		
	Never	Always		Never	Always		Never	Always	
	M (SD)	M (SD)	p	M (SD)	M (SD)	p	M (SD)	M (SD)	p
Body Fat	21.4 (8.98)	25.11 (7.60)	0.09	23.20 (8.65)	22.83 (7.52)	0.92	23.05 (8.70)	23.41 (8.25)	0.88
BMI	23.59 (4.26)	24.55 (3.99)	0.37	24.14 (4.31)	23.21 (1.86)	0.61	24.27 (4.51)	23.58 (3.28)	0.54
$V0_2max$	39.70 (9.86)	39.17 (10.2)	0.84	39.01 (10.16)	43.45 (6.85)	0.30	39.90 (10.02)	38.53 (9.93)	0.62
Fat Mass	34.75 (21.33)	41.79 (19.98)	0.19	38.61 (21.54)	33.36 (12.95)	0.56	38.57 (21.98)	37.13(18.75)	0.80
Muscle Mass	58.4 (12.73)	56.31 (13.18)	0.53	58.14 (13.15)	50.7 (8.00)	0.18	58.64(13.27)	54.88 (11.97)	0.29
METS min/week	3051.62 (1337.02)	2110.4 (1182.29)	0.022*	2509.56 (1372.14)	3189.6 (929.92)	0.29	2648.31 (1337.33)	2495.73 (1374.59)	0.73
AT min/week	384.93 (281.66)	364.8519 (188.04)	0.76	370.66 (248.73)	413.5 (144.80)	0.68	325.65 (206.20)	471.84 (273.59)	0.029*
VPA min/week	214.75 (191.85)	100.52 (128.29)	0.008**	152.31 (172.11)	235 (180.94)	0.27	178.15 (188.15)	124.15 (134.78)	0.26
MPA min/week	236.25 (243.44)	196.93 (143.39)	0.44	203.4 (184.58)	347.33 (311.31)	0.10	182.24 (169.94)	289.95 (243.36)	0.049*
SB hr/weekday	5.98 (1.90)	6.49 (2.19)	0.33	6.25 (2.04)	6.02 (2.26)	0.79	6.04 (2.15)	6.61 (1.82)	0.31
SB hr/weekend	6.10 (2.59)	5.89 (2.59)	0.77	6.08 (2.68)	5.33 (1.20)	0.51	5.93 (2.72)	6.14 (2.32)	0.77

REE	1666.16 (295.75)	1702.76 (323.30)	0.65	1705.31 (310.84)	1484.17 (206.54)	0.10	1717.29 (306.77)	1614.4 (306.83)	0.22
TEE	2878.03 (543.88)	2945.79 (566.57)	0.64	2931.04 (573.23)	2719.67 (220.69)	0.38	2952.27 (554.69)	2824.1 (547.72)	0.40
EBBS	28.69 (9.63)	31.36 (7.94)	0.27	30.02 (7.44)	28.5 (18.51)	0.70	29.05 (8.12)	31.61 (10.59)	0.32
EPS	110.34 (5.30)	104.35 (5.75)	0.00***	106.96 (6.17)	113.67 (2.66)	0.011*	107.95 (6.50)	107.05 (5.77)	0.61
CESD	5.66 (3.48)	7.41 (4.53)	0.09	6.45 (4.20)	6.83 (2.99)	0.83	6.34 (4.09)	6.8 (4.14)	0.68

Note: *p<.05, **p<.01, ***p<.001, BMI- body mass index, METS - Metabolic Equivalents, AT - Active Transport, VPA- vigorous physical activity, MPA- moderate physical activity, SB - sedentary behavior, REE - Resting Energy Expenditure, TEE - Total Energy Expenditure, EBBS - Exercise Benefits and Barriers Scale, EPS - Exercise Planning Scale, CESD - Center for Epidemiological Studies Depression Scale

Table 4. Comparison of fitness and behavioral outcomes by academic variables continued

Group Study Contrib			Acad Motiv			Study Environment		
Unlikely to Participate	Extremely Likely to Participate		Not Motivated	Highly Motivated		It isn't important	very important	
M (SD)	M (SD)	p	M (SD)	M (SD)	p	M (SD)	M (SD)	p
22.74 (9.72)	23.60 (7.73)	0.71	24.27 (9.37)	22.64 (8.10)	0.71	23.26 (8.29)	23.10 (8.73)	0.94
24.67 (5.27)	23.64 (3.16)	0.35	24.95 (5.21)	23.55 (3.39)	0.35	23.11 (3.18)	24.65 (4.58)	0.16
39.64 (9.25)	39.07 (10.55)	0.83	39.14 (10.60)	39.40 (9.70)	0.83	37.46 (10.57)	40.73 (9.41)	0.21
39.30 (25.79)	37.45 (17.12)	0.74	41.85 (26.38)	36.13 (17.17)	0.74	34.9679 (15.46)	40.13 (23.66)	0.35
59.84 (11.61)	55.45 (13.69)	0.20	58.78 (12.98)	56.41 (13.02)	0.20	53.6 (12.11)	59.88 (12.92)	0.06
2403.71 (1507.17)	2743.08 (1251.36)	0.45	2645.85 (1615.51)	2613.93 (1215.27)	0.45	2873.78 (1330.28)	2372.35 (1327.38)	0.24
345.33 (242.99)	392.41 (242.12)	0.49	352.47 (228.85)	386.03 (250.00)	0.49	373.14 (274.36)	376.62 (217.79)	0.96
135.04 (161.80)	179.74 (183.20)	0.33	156.36 (179.56)	163.87 (174.04)	0.33	161.83 (142.86)	159.54(192.27)	0.96
174.48 (159.94)	251.97 (224.81)	0.15	147.32 (154.32)	261.58 (216.72)	0.15	242.67 (210.34)	201.27 (196.77)	0.44
6.38 (2.25)	6.09 (1.93)	0.60	6.23(1.72)	6.20 (2.26)	0.60	6.16 (2.06)	6.27 (2.07)	0.85
5.86 (3.03)	6.00 (2.21)	0.84	6.15 (2.75)	5.82 (2.47)	0.84	5.77 (2.35)	6.14 (2.71)	0.61
1747.96 (311.87)	1634 (304.66)	0.16	1732.91 (338.75)	1651.71 (293.07)	0.16	1591.96 (253.08)	1742.97 (328.73)	0.06
2932.8 (470.32)	2884.31 (612.72)	0.74	2914.23 (522.07)	2898.89 (578.46)	0.74	2735.54 (427.13)	3023.57 (596.84)	0.045*
33.96 (8.65)	26.66 (7.93)	0.002**	32.71 (9.95)	28.19 (8.00)	0.002**	30.54 (10.16)	29.36 (8.09)	0.63
105.08 (6.10)	109.61 (5.68)	0.005**	106.52 (6.31)	108.30 (6.19)	0.005**	108.33 (5.56)	107.18 (6.71)	0.49
6.92 (5.01)	6.23 (3.37)	0.53	7.95 (3.84)	5.68 (4.07)	0.55	5.54 (3.95)	7.11 (4.09)	0.14

Note: *p<.05, **p<.01, ***p<.001, BMI- body mass index, METS - Metabolic Equivalents, AT - Active Transport, VPA- vigorous physical activity, MPA- moderate physical activity, SB - sedentary behavior, REE - Resting Energy Expenditure, TEE - Total Energy Expenditure,

EBBS - Exercise Benefits and Barriers Scale, EPS - Exercise Planning Scale,
CESD - Center for Epidemiological Studies Depression Scale

Table 5. Comparison of fitness and behavioral outcomes by psychosocial variables (n=63)

	Psychosocial variables								
	Quality_Ex			Acad_Motiv_NoEx			Acad_Motiv_Ex		
	Very Unsatisfied	Very Satisfied		It Doesn't Affect it	Affects it a lot		It Doesn't Affect it	Affects it a lot	
Fitness outcomes	M (SD)	M (SD)	p	M (SD)	M (SD)	p	M (SD)	M (SD)	p
Body Fat	26.13 (12.72)	22.8 (7.79)	0.49	24.33 (8.33)	22 (8.76)	0.30	23.42 (8.9)	22.94 (8.13)	0.83
BMI	25.23 (6.8)	23.89 (3.67)	0.40	24.22 (4.1)	23.89 (4.29)	0.76	23.8 (4.17)	24.49 (4.21)	0.53
$V0_2max$	33.09 (10.04)	40.26 (9.68)	0.06	37.53 (10.66)	41.34 (8.83)	0.14	38.79 (9.82)	40.14 (10.33)	0.62
Fat Mass	48.72 (34.36)	36.61 (18.09)	0.36	39.78 (20.46)	36.44 (21.81)	0.54	37.39 (20.57)	39.57 (22.03)	0.70
Muscle Mass	58.66 (12.51)	57.06 (13.12)	0.75	56.68 (13.37)	57.95 (12.66)	0.71	55.34 (13.38)	60.4 (11.84)	0.14
METS min/week	1725.33 (1044.38)	2697.19 (1342.92)	0.23	2309.4 (1067.39)	2939.2 (1523.71)	0.14	2513.39 (1417.53)	2774.35 (1246.34)	0.55
AT min/week	364.29 (181.55)	375.92 (250.35)	0.91	356.72 (231.85)	394.19 (254.54)	0.57	380.76 (250.83)	364.95 (231.72)	0.81
VPA min/week	45.88 (61.04)	178.85 (179.87)	0.00***	103.13 (101.09)	227.39 (215.27)	0.008**	118.19 (123.17)	230.17 (221.01)	0.034*
MPA min/week	135 (140.66)	232.71 (208.41)	0.21	220.66 (177.82)	218.57 (230.91)	0.97	248.43 (235.45)	173.43 (125.13)	0.11
SB hr/weekday	7.38 (2.33)	6.03 (1.98)	0.09	5.97 (1.92)	6.5 (2.22)	0.32	6.11 (1.8)	6.39 (2.48)	0.62
SB hr/weekend	7.36 (3.32)	5.74 (2.4)	0.12	5.69 (3.06)	6.24 (1.82)	0.41	5.66 (2.83)	6.38 (2.05)	0.31
REE	1779.75	1666.37	0.34	1687.56	1674.54	0.87	1643.38 (303.39)	1742.78	0.23

	(380.85)	(299.51)		(302.81)	(324.01)		(318.07)	
TEE	2977.5 (673.97)	2893.29 (540.13)	0.69	2871.53 (567)	2942.21 (546.6)	0.63	2804.86 (545.25)	3064.83 (541.32)	0.08
EBBS	36.75 (5.52)	28.73 (8.94)	0.018*	33.59 (5.65)	25.08 (10.17)	0.000***	32.14 (7.08)	25.95 (10.56)	0.011*
EPS	101.75 (4.13)	108.6 (6.02)	0.003**	105.22 (5.27)	110.65 (6.11)	0.001**	106.35 (6.35)	109.95 (5.44)	0.033*
CESD	9.38 (4.5)	6.08 (3.9)	0.033*	6 (3.97)	7.11 (4.25)	0.30	5.84 (4.03)	7.61 (4.08)	0.11

Note: *p<.05, **p<.01, ***p<.001, BMI- body mass index, METS - Metabolic Equivalents, AT - Active Transport, VPA- vigorous physical activity, MPA- moderate physical activity, SB - sedentary behavior, REE - Resting Energy Expenditure, TEE - Total Energy Expenditure EBBS - Exercise Benefits and Barriers Scale, EPS - Exercise Planning Scale, CESD - Center for Epidemiological Studies Depression Scale

Table 5. Comparison of fitness and behavioral outcomes by psychosocial variables (n=63)

continued

	Psychosocial variables								
	Mental Health_NoEx			New Activity			Soc Personality		
	No Negative Impact	Very High Negative Impact		Never	Always		Ambiverted	Introverted	
Fitness outcomes	M (SD)	M (SD)	p	M (SD)	M (SD)	p	M (SD)	M (SD)	p
Body Fat	23.45 (9.18)	23.01 (7.96)	0.85	24.77 (8.35)	20.6 (8.41)	0.07	22.53 (8.74)	23.24 (9.87)	0.81
BMI	24 (4.64)	24.14 (3.66)	0.90	24.55 (4.68)	23.22 (2.97)	0.18	24.28 (4.72)	23.78 (4.41)	0.73
$V0_2max$	38.32 (11.22)	40.37 (8.45)	0.43	37.68 (9.38)	42.12 (10.49)	0.10	40.84 (9.2)	38.77 (10.36)	0.50
Fat Mass	38.83 (22.22)	37.58 (19.95)	0.82	41.51 (22.15)	32.54 (17.86)	0.11	37.96 (22.78)	37.97 (22.61)	1.00
Muscle Mass	56.77 (12.76)	57.82 (13.35)	0.75	57.15 (13.58)	57.5 (12.08)	0.92	57.85 (14.98)	56.76 (12.59)	0.80
METS min/week	2161.05 (1234.04)	3043.43 (1314.31)	0.035*	2403.33 (1365.77)	2955.75 (1262.12)	0.21	3103.67 (1691.38)	2331.71 (1160.8)	0.18
AT min/week	365.48 (285.39)	383.07 (194.59)	0.79	339.36 (208.67)	427.05 (280.25)	0.19	404.26 (281.98)	361.58 (232.05)	0.61
VPA min/week	139.45 (181.14)	184.28 (167.35)	0.33	160.82 (195.58)	161.64 (135.11)	0.99	226.24 (236.89)	98.24 (94.55)	0.03*
MPA min/week	189.9 (188.25)	251.52 (215.46)	0.24	172.29 (146.46)	301.55 (257.59)	0.039*	182.62 (205.21)	239.24 (185.92)	0.35
SB hr/weekday	6.7 (2.1)	5.67 (1.91)	0.06	6.07 (1.94)	6.45 (2.27)	0.49	6.59 (2.25)	5.83 (1.99)	0.26

SB hr/weekend	5.87 (2.74)	6.01 (2.41)	0.85	5.94 (2.8)	5.94 (2.16)	1.00	6.23 (2.38)	5.61 (2.91)	0.47
REE	1680.52 (318.99)	1682.52 (306.3)	0.98	1700.26 (328.18)	1649.05 (280.99)	0.54	1689.95 (339.35)	1680.38 (296.43)	0.92
TEE	2895.16 (603.63)	2914.52 (506.07)	0.89	2905.24 (573.65)	2903.27 (531.48)	0.99	2929.38 (577.99)	2910.24 (534.79)	0.91
EBBS	31.67 (7.8)	27.85 (9.85)	0.11	31.62 (9.35)	26.6 (7.32)	0.042*	28.65 (7.69)	32.3 (5.93)	0.10
EPS	107.19 (5.82)	108.19 (6.76)	0.55	107.61 (6.72)	107.75 (5.36)	0.93	109.25 (6.6)	105.15 (6.02)	0.047*
CESD	5.71 (3.87)	7.38 (4.24)	0.12	6.79 (4.36)	6.05 (3.68)	0.50	5.62 (3.92)	8.05 (4.51)	0.07

Note: *p<.05, **p<.01, ***p<.001, GPA-Grade point average, BMI- body mass index, METS - Metabolic Equivalents, AT - Active Transport, VPA- vigorous physical activity, MPA- moderate physical activity, SB - sedentary behavior,
REE - Resting Energy Expenditure, TEE - Total Energy Expenditure, EBBS - Exercise Benefits and Barriers Scale, EPS - Exercise Planning Scale, CESD - Center for Epidemiological Studies Depression Scale

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ACADEMIC VITA

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State College, PA 16801 724-708-2837 (Cell) / 724-836-3256 (Home)

EDUCATION

The Pennsylvania State University, University Park, PA May 2019

Bachelor of Science in Kinesiology: Movement Science

Schreyer Honors College Scholar

Awards: President Sparks Award (Fall 2015) – 4.0 GPA, Dean's List for Seven Consecutive Semesters

Special Opportunities: Study abroad in Italy (Spring Break 2018) to explore the origins of Anatomy in Florence, Bologna, and Rome

PROFESSIONAL EXPERIENCE

Biology 142 Lead Teaching Assistant August 2017–Present

Pennsylvania State University Biology Department

- Engaged in the active teaching of typically sixteen to eighteen Penn State students in the laboratory portion of our Anatomy and Physiology class in the Biology Department
- Responsible for delivering lessons on different aspects of Physiology, making the laboratory portion run smoothly, and grade students on performance in the class
- Requires lesson preparation, certifications through the university to teach an undergraduate course, and a commitment to fulfill the obligations necessary to ensuring students received all portions of the class curriculum

Kinesiology Undergraduate Research March 2018–Present

Pennsylvania State University Kinesiology Department

- Research assistanceship under Dr. Melissa Bopp to fulfill the requirements of the Kinesiology Honors Thesis
- Created pilot study to determine the associations between academic and psychosocial constituent behaviors, physical fitness, and behavioral outcomes

EPIC Rehab/Latrobe Hospital– Acute Care Physical Therapy May 2018–July 2018

121 W 2nd Avenue, Latrobe, PA 56 Hours

- Job shadowed with Dr. Kristy Eisele to work with patients in a setting focused on acute hospital care

- Patients received initial physical therapy for typically 7-14 days to progress to either home/outpatient therapy following stroke, heart attacks, or amputations

Lemont Physical Therapy – Lymphedema Physical Therapy February 2018–April 2018

2766 W College #300, State College, PA 45 Hours

- Job shadowed with Dr. Amy Flick to work with patients in a setting focused on the treatment of lymphedema resulting typically from surgical operations or cancer
- Engaged in Pediatric and Women's Health Physical Therapy, led basic rehabilitatory exercises

The PT Group – Orthopaedic Physical Therapy May 2017–August 2017

542 Rugh Street, Greensburg, PA 144 Hours

- Job shadowed with Dr. Aaron Tuscan to get an understanding of the lifestyle, experiences and expectations of Physical Therapists in a clinical setting
- Actively engaged in my future by asking relevant and meaningful questions as well as developed interpersonal skills with patients

ORION/VEGA Wilderness Experience August 6th, 2016-8 to August 15th, 2016-8

3400 Discovery Road, Petersburg, PA

- Responsible for leading six to ten participants involved in this outdoor college transition program through the outdoors for five days, relying solely on the gear and the experience of myself and another leader
- Taught incoming freshmen about adapting to life at the Pennsylvania State University as well as ways to succeed in their first years of college and how different college can be from high school