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The Influence of the Educational Environment on College Student Activity Behaviors

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The Influence of the Educational Environment on College Student Activity Behaviors

by

Helen Melissa Ziegler

A Dissertation
Submitted to the Graduate School, the College of Education and Psychology and the Department of Educational Research and Administration at The University of Southern Mississippi in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy

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ABSTRACT

Healthy Campus 2020, an initiative that provides a framework to support campuses in improving the health of their students, staff, and faculty, recognizes physical activity as one of the top eleven priorities for positively influencing health risk behaviors in college populations (American College Health Association, 2012). However, there is not much research to support the best way to influence physical activity behaviors and what types of programs and facilities can provide the greatest impact. The purpose of this study was to investigate which components or programs within the higher education environment have the greatest influence on college students’ intention to engage in physical activity.

To investigate which component offers the greatest influence, a joint effort between the Astin’s Input-Environment-Output Model and Ajzen’s Theory of Planned Behavior was used to better understand how the educational environment influences the perceived value of physical activity in college students. The use of structural equation modeling allowed for the opportunity to assess the relationships among multiple variables and see what, if any, relationship exists (Hoyle, 2012). The model revealed that campus safety was the only influencer of all four known predictors of intention, attitude, perceived control, subjective norm, and self-efficacy toward physical activity while the accessibility of a wellness or fitness facility did not have a relationship with the intention to participate in physical activity. By increasing efforts toward those that offer greater influence, HE may want to decrease funding and efforts towards those initiatives that offer little or no value toward increasing physical activity behaviors.
ACKNOWLEDGMENTS

I would like to extend my sincerest gratitude to the members of my dissertation committee, Drs. Steven Chesnut, David Dolbow and Eric Platt, for their insightful feedback and support throughout this process. I would also like to thank my dissertation chair, Dr. Lilian Hill, for her time, expertise, and encouragement and providing critical feedback that helped produce this research. I am forever indebted for the expertise and kindness shown by all committee members.
DEDICATION

This dissertation is dedicated to my husband, Trey, who has been a constant source of support and encouragement during the challenges of graduate school and life. I am truly thankful for having you in my life. This work is also dedicated to my parents, Wayne and Helen, who have always loved me unconditionally and whose good examples have taught me to work hard for the things that I aspire to achieve. And finally, to my daughter, Zoey, your energy and enthusiasm for life pushed me to complete this process. I am so grateful for you.
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CHAPTER I - INTRODUCTION

The 2008 Physical Activity Guidelines recommend that adults (ages 18 to 64) perform at least 150 minutes of moderate-intensity physical activity (PA) per week (U.S. Department of Health and Human Services, 2008), yet according to the 2016 National College Health Assessment Summary, only 50% of male and 45% of female college students reported that they meet these guidelines. Many college students cite a lack of time due to high course workload, lack of transportation to facilities, lack of energy or motivation, and lack of certain sports opportunities to join at their university as reasons for lack of PA (Curry, Jenkins, & Weatherford, 2015). There are many physical health benefits from regular PA including weight loss and improved cardiorespiratory function, but more important for college students may be the reduction in stress, anxiety, and depression that are associated with maintaining the daily recommended amounts of PA (Brown & Blanton, 2002). PA is defined as any body movement that requires more energy than resting (U.S. Department of Health and Human Services, 2008). This includes walking, running, weight training, swimming, yoga, and other exercises, but also includes leisure time activities such as gardening and walking the dog (Keating, Guan, Piñero, & Bridges, 2005).

Perez, Cromley, and Kaplan (2014) stated that an individual chooses to engage in a specific activity or assignment based upon the perceived value of the task. The purpose of this study was to investigate what components within the higher education environment have the greatest influence on college students’ intention to engage in PA. The educational environment of the institution is the culture that is created by the university or college including a wide range of factors, such as the curriculum, personnel,
facilities, peers, and any activities carried out during students’ enrollment (Ahmad, Anantharaman, & Ismail, 2012; Thurmond & Popkess-Vawter, 2003). Intention to participate in a behavior is determined by a combination of attitude towards the behavior, perceptions of social pressure to perform the behavior and perception of the ease or difficulty of performing the behavior (Jackson, Smith, & Conner, 2003) and is highly correlated with engagement in the behavior (Icek Ajzen & Sheikh, 2013).

In order to increase intention to participate in PA behaviors, colleges and universities have a responsibility to educate and provide opportunities for college students to live a healthy life (Curry et al., 2015). Studies show that sedentary habits established during college years influence an individual’s long-term PA behaviors and health (Calfas, Sallis, Lovato, & Campbell, 1994; Keating et al., 2005; Sparling & Snow, 2002). Learning more about how individuals perceive the role of the educational environment and its influence on their PA patterns could lead to changes in the campus that encourage and promote PA (Reed, 2007). By discovering how the educational environment can positively influence PA behaviors, higher education can focus their efforts and funding into which programs or facilities that offer the greatest return on investment to influence a student’s intention to engage in PA.

For many young adults, the college or university provides one of the last opportunities for educational and practical interventions for increasing PA behaviors. With the number of individuals with 4 or more years of higher education nearly doubling during the past 3 decades (Reed, 2007) it is more important than ever that HE take the responsibility to intervene in preparing college graduates for PA after college. The
opportunity is limited, and after entering the workforce alumni are even less likely to pick up a habit of PA (Keating et al., 2005).

To understand the relationship between PA behaviors during and after college, Calfas et al. (1994) surveyed 149 junior and senior college students and 204 alumni regarding their level of PA. They found that approximately one-third of both students and alumni were inactive and almost half of the alumni reported that they are less active now than they were in college (Calfas et al., 1994). Sparling and Snow (2002) found similar results noting a strong positive association between PA patterns in college seniors and current PA behavior as recent alumni. They indicated that 81.3% of those who were physically inactive as college seniors maintained a sedentary lifestyle as graduates. Physical inactivity doubles health risks and adds a disease burden to society comparable with smoking (Levine, 2014). As there is insurmountable evidence that proves that sedentary behaviors contribute to the increased risk of developing several chronic diseases including cardiovascular disease, diabetes, cancer, obesity, and osteoporosis (Rhodes, Kaushal, & Quinlan, 2016).

Healthy Campus 2020, an initiative that provides a framework to support campuses in improving the health of their students, staff, and faculty, recognizes PA as one of the top eleven priorities for positively influencing health risk behaviors in college populations (American College Health Association, 2012). This initiative acknowledges that higher education faces the great challenge of encouraging college students to engage in PA. If college students are participating in PA many are not doing enough to accrue the needed health benefits to encourage lifelong health or make a change in behavior that includes PA and other healthy habits (Keating et al., 2005). Even though public health
professionals have made remarkable efforts to educate the general population on the need to include PA to combat chronic diseases, not all higher education institutions have adopted the same initiatives. This may be because the resources needed to effectively promote and motivate PA behaviors is still unknown (Ickes, McMullen, Pflug, & Westgate, 2016; Keating et al., 2005; Lauderdale, Yli-Piipari, Irwin, & Layne, 2015).

There is research that documents college students’ PA patterns and stages of PA behavior change (Buckworth & Nigg, 2004; Calfas et al., 1994; Leslie et al., 1999; Nahas, Goldfine, & Collins, 2003; Pinto, 1995; Sparling & Snow, 2002; Sullum, Clark, & King, 2000; Zabinski, Calfas, Gehrman, Wilfley, & Sallis, 2001). Previous research focused on programs that either educate or motivate college students to increase PA (Bjerke, 2013; Curry et al., 2015; Ickes et al., 2016; Pope & Harvey, 2014). No matter if the motivation was monetary incentives or weight loss all of these studies found that PA levels increased but were limited to the specific focus group of the research. Even though the results were positive for changing that specific group, there is very little research on how programs, facilities, and campus safety influence PA levels in the entire student body.

Theoretical Framework

A joint effort between the Astin’s Input-Environment-Output Model (I-E-O) and Ajzen’s theory of planned behavior (TPB) was used to investigate how the educational environment influences the perceived value of PA in college students. Astin’s I-E-O Model suggests that student outcomes are directly influenced by who the students were before they entered college (e.g. individual characteristics) and what happened to them after they enrolled (e.g. educational environment) (Ahmad et al., 2012; Pascarella &
Terenzini, 2005). Input refers to characteristics that a student brings to the education setting; examples include demographic information, educational background, political orientation, or behavior pattern (Ishler, 2003; Thurmond & Popkess-Vawter, 2003). Environment refers to students’ experiences during enrollment, including educational experiences, practices, programs, or interventions (Thurmond & Popkess-Vawter, 2003). Outputs refer to the expected results or outcomes the educational system is trying to develop, such as academic achievement, values or behaviors (Ahmad et al., 2012).

Astin’s I-E-O Model has been used in a variety of studies in the social sciences (Astin, 1999). House (1998) used this model to study student satisfaction with college and bachelor's degree completion. The unique characteristics of the incoming student were used as the input and specific school experiences as the environmental factors. Ahmad et al. (2012) examined how students’ motivation, perceived environment, and student involvement influenced professional commitment to accounting college students. By controlling for input characteristics these studies were able to highlight the interactivity between student background characteristics and the college environment. Both studies found that college students that had both intrinsic and extrinsic motivations tend to score higher on stated outcomes using the I-E-O model.

The primary focus of Ajzen’s theory of planned behavior (TPB) is the prediction of the individuals’ intentions; essentially this theory suggests that practical intentions govern the choices and behaviors of individuals (Icek Ajzen, 1991, 2002, 2011; Icek Ajzen & Fishbein, 2008; Icek Ajzen & Sheikh, 2013; Schifter & Ajzen, 1985). The building blocks in the TPB are guided by three conceptually independent variables: behavioral beliefs or attitude towards the behavior (e.g. favorable or unfavorable
consequences of the behavior); normative beliefs (e.g. perceived social pressure); and control beliefs (e.g. factors that facilitate or impede performance of the behavior) (Icek Ajzen, 1991). Guided by the attitude toward the behavior, perceived social pressure and perceived control over the behavior (Ajzen, 2011; Ajzen & Sheikh, 2013), this theory aided in assessing college student’s intention to engage in PA behaviors.

An individual’s intention to perform a behavior is dependent on how few barriers they have to deal with and the degree of control over that behavior (Kraft, Rise, Sutton, & Røysamb, 2005). According to TPB, the intention to perform a specific behavior is guided by the attitude toward that specific behavior (Schifter & Ajzen, 1985). Social pressures play an important role in a person’s attitude toward a specific behavior (Doll & Ajzen, 1992). Finally, an individual’s perceived behavioral control plays an influential role. The control beliefs are dependent on the degree to which individuals see themselves as knowledgeable about the behavior, skilled in the behavior, and able to complete the behavior. Additionally, individuals feel that external factors, such as the cooperation of colleagues, resources, or time constraints could inhibit or facilitate the behavior (Kraft et al., 2005).

Astin’s I-E-O model provided the opportunity to assess the influence of the educational environment on the college students’ intention to and participation in PA behaviors (Astin, 1999; Hirschy, Wilson, Liddell, Boyle, & Pasquesi, 2015; Ishler, 2003). Input variables in this study include three student characteristics shown to be predictors of PA: gender, BMI, and previous exercise experience. Trost, Owen, Bauman, Sallis, and Brown (2002) note in their review of the literature related to factors associated with PA: men are more involved than women in PA; having a BMI over 25 is negatively
associated with exercise adherence; and past experiences with self-efficacy associated with PA are all correlated with participation and adherence to increased PA behaviors.

The environmental variables included in this study are five measures of college students' educational environment that previous research suggests increases PA levels: accessibility to the fitness center, physical layout of the campus, campus safety, required PA courses, and PA incentive programs. In a meta-analysis conducted by Keating et al. (2005), the availability of fitness/wellness facilities, the proximity of fitness facilities to campus, the physical layout of the campus, and campus safety all were influences of PA levels. Requiring college students to engage in PA courses or intramural sports may help some maintain or strengthen their activity behaviors beyond high school, thus potentially increasing their engagement in PA in the present, as well as in the future (Downs, Van Hoomissen, Lafrenz, & Julka, 2014; Lauderdale et al., 2015).

For the outcome measures, the college students’ intention to perform PA and self-reported health–related PA behavior was used. Ajzen’s theory of planned behavior (TPB) was used to investigate college students’ intention to perform PA (Ajzen, 2011). Since attitude is an important predictor for adherence and adoption of health behavior, including exercise behavior, it is important for higher education to assess this factor when analyzing the environmental impact on PA behavior (Yasunaga, Kawano, Kamahori, & Noguchi, 2014). The outcome measurements included attitude toward PA, the perception of social attitude of PA and, students' perceptions of ability to engage in PA behaviors. Combined, these predict intention to engage in PA and participation in the behavior itself. Combining these two models provided the opportunity to see how the learning environment affects a college student’s intention to engage in PA.
No previous research on student development that incorporated the I-E-O model and TPB has been identified. However, there are a few studies that have used the I-E-O model to organize and plan their research while using another theory as the output measure, similar to this study. Mayhew, Seifert, and Pascarella (2012) used Astin’s I-E-O model in organizing the literature. They used high school grade point average and race for inputs and general collegiate contexts and specific educational practices for environments. The outcome of this analysis was moral reasoning at the end of the first-year in college. They found that inputs and environments exerted influence on developmental gains in moral reasoning.

Another study using this design, Rosch and Coers (2013), used gender, race, and political orientation for inputs and high school and college involvement for environments. The outcome of this analysis was the Socially Responsible Leadership Scale developed within the theoretical frame of the Social Change Model. They found that while their sample showed similar levels of involvement and leadership in high school and higher levels in college, they do not make some of the same leadership outcome gains in college. This information could allow for structural changes to the classroom environments and how they advise student organizations.

Even though there is very little research using the exact frameworks as the ones used in this study, there are similar studies providing comparable design using Astin’s I-E-O model as the framework for the design and another model as the output or outcome measure. Hence, this research may provide a new perspective in looking at student behavior development.
Purpose of the Study

The purpose of this study was to apply the I-E-O assessment model to predict a college students’ intention to engage in PA behaviors because of their experience of the educational environment. The following research questions guided this study to develop a better understanding of student perspectives in relation to PA levels during and shortly after college.

1. Which programs or facilities within the educational environment are greater influencers of the value or attitude towards PA in college students?

2. Which programs or facilities within the educational environment are greater influencers of perceived control of PA behaviors in college students?

3. Which programs or facilities within the educational environment are greater influencers of intention to participate in PA behaviors in college students?

The Research Design

This was a quantitative study designed to evaluate the intentions of college students to engage in PA and how the programs within the educational environment influences these intentions. The output variables used in predicting the intention to engage in PA include attitude toward PA, perception of social norm of PA, and perceptions of students’ ability to engage in PA.

Instruments

Intention to exercise was measured using survey research following recommendations from Constructing a Theory of Planned Behavior Questionnaire (Ajzen, 2006) and adapting an instrument used by Motl et al. (2000). The questionnaire to measure intention allowed insight into understanding the reasons why college students
hold certain attitudes, subjective norms, and perceptions of behavioral control towards PA.

Self-reported PA behavior was measured using the International Physical Activity Questionnaire (IPAQ). This questionnaire has been validated in assessing a 7-day recall of activities and behaviors among diverse populations between ages 18 and 65 years (Bjerke, 2013; Craig et al., 2003; Hubbard-Turner & Turner, 2015). This international questionnaire measures frequency, duration, and intensity of weekly PA. The IPAQ has a long and short version; the short version was used in this study as it has been found to be easier to interpret when compared to the long version (Craig et al., 2003). The short version asks questions specifically pertaining to vigorous, moderate, walking, and sedentary activity while the long version includes activities that many college students do not engage in including: digging in a garden or yard, sweeping inside ones’ home, heavy construction and washing windows (Craig et al., 2003; Hallal et al., 2010).

Participants

Undergraduates enrolled in colleges and universities were recruited for this study. The questionnaire was disseminated via email. Participants were not limited by gender, race, or any additional special characteristics. The goal of this study was to distribute the online survey to students enrolled at 12 colleges and universities and receive a minimum of 200 completed surveys. The Southcentral United States (US) was targeted for this study since the Southern US had the highest prevalence of obesity and the lowest PA levels (Centers for Disease Control and Prevention). Permission from the Institutional Review Board was obtained from each of the institutions solicited for this study to ensure that this research meets the relevant federal and institutional standards and guidelines.
Definitions

The following definitions are provided to ensure consistency and understanding of these terms throughout the study.

*Educational Environment.* Experiences during enrollment of a university or college, these include a wide range of factors, including the curriculum, personnel, facilities, peers, and any activities carried out during students’ enrollment (Ahmad et al., 2012).

*Exercise training.* A goal-oriented physical activity that is planned and structured (U.S. Department of Health and Human Services, 1996).

*Physical activity.* Body movement that requires more energy than resting (U.S. Department of Health and Human Services, 1996).

*Sedentary behaviors.* Tasks during waking hours that require minimal energy expenditure. Examples include: sitting or reclining postures, watching TV, using a computer, playing a video game, or reading (Ho, Gabriel, & Kohl Iii, 2015).

Justification

The results of this study may be beneficial for educators, administrators, and individuals who are interested in the lifelong health and well-being of college students. The results provided greater insight as to the areas that should be addressed when developing programs that promote PA for this population. The frequency of vigorous PA declines by 6.2% for men and 7.3% for women during the first few years of college (Curry et al., 2015). Although promoting PA has emerged as a public health priority, identifying the external environment’s influence on PA remains difficult (Reed, 2007). By having a better understanding of the preferences and motivations for PA in college
students, this outcome of this study could be used to help to fill the gap in the literature regarding the complex relationships between the educational environment and the PA patterns of college students. Being able to identify and modify the environment to produce positive changes in PA are important (Duncan, Spence, & Mummery, 2005).

The challenge of motivating inactive people to adopt a more active lifestyle and irregularly active people to become more consistent in their PA choices is a concern and area of concentration for many physical education professionals (Nahas et al., 2003). Understanding the determinants of motivation is the first step in changing behavior. The literature review conducted by Nahas et al. (2003) proposes that by providing students with multiple opportunities for PA inside and outside of the classroom encouraged PA behaviors for those in high school. However, many higher education structures do not allow the opportunity to offer such activities. Thus, wellness professionals must find other ways to encourage the behavior change and increase PA behaviors for their students as they have a responsibility of educating students in not only how to earn a living, but also how to live a healthy life (Curry et al., 2015).

Even though college students are achievement oriented and interested in good grades for careers or graduate studies, they may need extrinsic motivation to drive interest in healthy habits (Crone & MacKay, 2007). Administrators and program developers may need to reevaluate the programs and amenities college students are offered if they want to encourage college students to engage in activities that increase PA (Keating et al., 2005). The outcomes of this study could provide information to administrators and health program supervisors on how the higher education institution can change the educational environment to positively influence students to increase PA.
levels. Understanding more about what motivates students to choose healthy habits could possibly be the answer to one of the worst health crisis in recent history. At present, the prevalence of obesity for those students ages 18-24 is 20% (Bjerke, 2013). Lack of PA has been linked to obesity as well as several chronic diseases including, but not limited to cardiovascular disease, diabetes, cancer, and osteoporosis (Rhodes et al., 2016).

Limitations

As in any research, this study has some limitations. The methodology of the study may not permit the determination of causation. Since the age of the participates is not limited, causation may not be limited to only the programming within the educational environment but also the age of the participant. Another limitation of the study is the actual measures of attitude toward PA, perception of social norm of PA, and perceptions of their ability to engage in PA, can be subjective and difficult to measure. A final limitation is a lack of control over who choose to participate in a web-based survey.

Assumptions

The assumption was made that the participants answered all questions honestly and without bias. However, when using survey instrumentation, recall bias, response bias, selection bias, and truthfulness of responses, are always potential limitations. An individual’s memory is a limiting factor in their ability to recall events and may affect the accuracy of responses to specific questions (Thomas & Nelson, 2001). To help combat response bias, the subject was reassured throughout the survey that the information from the survey was completely anonymous. Participants were allowed to withdraw from the study at any time and with no ramifications. This study assumed that instruments used for this study were reliable and valid as prior research studies have indicated. It is also
assumed that those who chose to participate in the survey were representative of the
population. Even though the survey was sent to a large audience, the nature of a survey
on PA behaviors of college students may lead to underrepresentation of those who choose
not to participate in PA and may compromise the external validity as the subject pool
may not truly represent the general university population.

Delimitations

This study is delimited to only those students enrolled or recently enrolled in a
university or college setting. Additionally, the theoretical framework accepted by this
study may not allow the opportunity to explore items outside of the framework. Finally,
the instrument used in this study included only closed-ended Likert scale responses in the
survey, rather than including additional open-ended responses, to assure manageability of
the collected data. This allowed respondents the opportunity to quickly complete the
survey but may limit additional explanatory information.

Summary

The introduction identifies the purpose and significance of this study, the focus
of research, an overview of the research method, and limitations associated with this
study. As articulated in this chapter, this research is important because it provided
information to higher education administrators and health program supervisors on
programs and facilities that can positively influence students to increase their intention to
participate in PA. By influencing students’ intention in turn there could also be a positive
influence on the activity itself. This chapter also identified and introduced the theoretical
framework that was used in this study and summarizes the method, identifying survey
research as the primary approach to collecting data. The last section of Chapter I provides definitions and discusses the limitations and assumptions associated with this study.

Remaining Chapters

In addition to Chapter I: Introduction, there are four remaining chapters: Chapter II: Review of Related Literature; Chapter III: Methods; Chapter IV: Results; and Chapter V: Summary.

The first section of Chapter II reviews the current trends in PA behavior of college students as well as the institutional responsibilities as they relate to the education of PA. Section 2 of Chapter II examines Astin’s Input-Environment-Output Model (I-E-O) and explains why the theoretical framework is an ideal model for this study. The I-E-O section is divided into three sections: input, environment, and output. Each section allowed for the opportunity to review and justify the selected variables in each category. The output section discusses Icek Ajzen’s Theory of Planned Behavior (TPB) and its origins and other competing models. The last section of Chapter II summarizes conclusions from the Literature Review and reiterates the problem statement.

Chapter III examines the study’s research method. This chapter applies the theoretical frameworks and related constructs (discussed in Chapter II) to the development of the study’s instrument, the participants, and approach to data analysis. In addition, this chapter discusses detailed information about how the model was created, the data prepared, examined, and applied.

Chapter IV: Results focuses on the research findings. Chapter IV discusses demographic data of the sample, as well as the descriptive findings for each variable. This chapter also discusses the verification of each latent variable through confirmatory
factor analysis and any adjustments made as a result of each analysis. The last section discusses the analysis of the complete model and the adjustments made to the model during that process.

Chapter V: Summary summarizes the study, provides an overview of significant findings, restates the objectives of the study, discusses limitations and makes recommendations for future studies.
CHAPTER II – REVIEW OF RELATED LITERATURE

Physical activity (PA) is an essential portion of daily life. Research shows that by increasing PA behaviors you can also improve overall quality of life (Rhodes et al., 2016). Participating in PA improves the functioning of the cardiovascular, respiratory, endocrine and nervous systems, as well as reducing the risk of cardiovascular disease, total mortality (Callaghan, Eves, Norman, Chang, & Yuk Lung, 2002), and may reduce depression and anxiety, while enhancing cognitive functioning (Rhodes et al., 2016). PA is defined as any body movement that requires more energy than resting (U.S. Department of Health and Human Services, 2008), this includes all traditional exercise activities such as walking, running, and swimming but also consists of leisure time activities such as gardening or meditation (Keating et al., 2005).

This literature review examined the role of the educational environment as it relates to Astin’s Input-Environment-Output Model (I-E-O). Additionally, this review will discuss current trends in PA behavior of college students as well as the institutional responsibilities as they relate to the education of PA. The I-E-O section is divided into three sections: input, environment, and output. Each section will review and justify the different variables in each category. The output section discusses Icek Ajzen’s Theory of Planned Behavior (TPB) and its origins in the Theory of Reasoned Action. This section also examines competing models such as the Transtheoretical model and justifies the use of the TPB as an output variable in this study. The last section of Chapter II summarizes the two previous sections and reiterates the problem statement.

The first-year of college is when many students make their own food choices and develop physical inactivity patterns that can influence health status throughout the rest of
their lives (Grinnell, Greene, Melanson, Blissmer, & Lofgren, 2011). The average weight gain for first-year college students is 2.7 to 4.2 pounds in their first semester or year due to increased caloric intake and decreased energy expenditure (Grinnell et al., 2011), resulting in one in three college students being overweight or obese. Wengreen and Moncur (2009) found those who gained ≥ 5% of body weight reported participating in less PA during college than high school, were more likely to eat breakfast, and slept more than were those who did not gain ≥ 5% of body weight.

Getting the recommended amount of PA is difficult for many college students (Callaghan et al., 2002). According to the Spring 2016 National College Health Assessment, only 47% of college students engaged in 5 days of moderate activity for 30 minutes or 3 days of vigorous activity for 20 minutes (American College Health Association). Wallace, Buckworth, Kirby, & Sherman (2000) found concuring results with the national assessment, stating that more than half of the undergraduates enrolled at a large Midwestern university were sedentary or did not get the recommended amount of PA. Callaghan et al. (2002) found that only 29% of Hong Kong college students were regularly exercising at the recommended level but more importantly found that 55% of the students assessed reported that they were not even thinking about participating in exercise. Callaghan et al. noted that they believed that the culture and environment of Hong Kong is not conducive to exercise and that is why so many students reported being disinterested in exercise. Exercise in the Hong Kong culture is often seen as play and considered less important than studying hard. Therefore, low priority is given to PA and few schools have a comprehensive physical education program.
The university environment may be sending a similar message if they are not perpetuating activities or programs that encourage PA. The university setting may be one of the last opportunities to educate and encourage young adults to engage in PA (Lounsbury, Huffstetler, Leong, & Gibson, 2005). The American College Health Association reports that, on average, 37% of college students are overweight or obese and 81% of inactive college students continue to be inactive upon leaving the educational institution (2016). This evidence creates a need for colleges and universities to improve the overall wellness and health of their students (Fullerton, 2011). The purpose of this study is to analyze the role that the programming and facilities within the educational environment plays in a college students’ intention to engage in PA behaviors.

Several studies have looked at the environmental impact of PA (Babey, Hastert, Yu, & Brown, 2008; Brown & Blanton, 2002; Brownell, Stunkard, & Albaum, 1980; Buckworth, 2001; Buckworth & Nigg, 2004; Dinger, 1999; Keating et al., 2005; Poobalan, Aucott, Clarke, & Smith, 2012; Sidman, D'Abundo, & Bullard, 2014; Sparling & Snow, 2002; Spence & Lee, 2003; Tappe & Glanz, 2013; Taras, 2005; Von Ah, Ebert, Ngamvitroj, Parj, & Kang, 2004) but none have examined how the programming and facilities within the educational environment in a university setting influences future PA behavior.

Institutional Responsibility

Promoting healthy behavioral habits including proper nutrition, diet, and increased PA have been national objectives of the United States for many decades (Abu-Moghli et al., 2010). A recent initiative designed to bring awareness to the need to improve health objectives for U.S. college students, Healthy Campus 2020, focuses on
the need to encourage behaviors that are intended to prevent and treat obesity in college-aged students (Ickes et al., 2016). Healthy Campus 2020 objectives include increasing the proportion of students who receive information on nutrition and PA from their institution, increasing the number of college students who are at a healthy weight, increasing the number of students who report eating 5 or more fruits and vegetables per day, reducing the number of college students that reported stress and anxiety adversely influenced their academic performance, and increasing the number of college students who meet present federal guidelines for aerobic PA (American College Health Association, 2012; Ickes et al., 2016).

The college years are critical for health promotion. This is a time in which individuals strive to form a clear sense of identity and are transitioning from their family unit toward independence (Downs, Van Hoomissen, Lafrenz, & Julka, 2014; Lechner, Garcia, Frerich, Lust, & Eisenberg, 2013; Lounsbury et al., 2005). When young adults attend college, they gain increased control over their lives. It is a transition period in which an individual no longer feels like an adolescent, but may not be ready for the responsibilities of adulthood (Dinger, 1999; Lechner et al., 2013). Chickering & Reisser’s Theory of Seven Vectors (1993) suggests that college students experience seven vectors of development throughout their college experience and that a graduating senior will have resolved many of the vectors by the time they are ready to complete their degree. These vectors or factors essentially are the stepping stones to establishing their own identity and developing their purpose in life (Chickering & Reisser, 1993). This cannot be done by the student alone as Erikson’s Theory of Psychosocial Development (1959) emphasizes that identity and purpose are shaped by how one organizes
experiences within the environment. Therefore the educational environment plays an enormous role in a student’s ability to progress and resolve each of Chickering & Reisser’s vectors into a fully developed person (Evans & Guido, 2012).

The educational environmental influences a student’s development through the institutional objectives, institutional size, student-faculty relationship, curriculum, teaching, friendships and student communities, and student development programs (Evans & Guido, 2012). Since the educational environment is instrumental in the development of various characteristics of the college student, parents should be holding the institution accountable for guiding the students towards positive outcomes. Colleges and Universities have historically promised parents and students that their wellbeing would be a top priority. Until the 1960s, American universities have been deemed by courts to be acting in loco parentis with respect to their students. In loco parentis (Latin for “in the place of a parent”) refers to a legal relationship in which a temporary guardian or caretaker of a child takes on all or some of the responsibilities of a parent (Bowden, 2007). Because of the shift from parental supervision to a more independent lifestyle, students find themselves struggling with time management, work issues, as well as learning to cope with a variety of social role changes (Cullen et al., 1999). The university is responsible for guiding them not only academically but helping them to build healthy lives outside of the university.

Even though PA patterns of students are not as much not an immediate concern for the university system as suicide prevention, learning more about how individuals perceive the role of the educational environment and its influence on their PA patterns could lead to changes in the university campus that encourage and promote PA (Reed,
Lechner, Garcia, Frerich, Lust, and Eisenberg (2013) examined students’ perceptions of individual and institutional responsibility for sexual health education. The students thought that it was the responsibility of the college to provide access to sexual health resources, but it was the responsibility of the students to take the initiative to access the information. More importantly, the students emphasized that it was important that the campus community be supportive of the sexual health needs of the students at their institution. This is equally important to PA as oftentimes students may be unaware of university, community, and environmental resources that could contribute to their PA (Ebben & Brudzynski, 2008).

PA levels typically decline as students transition from high school to college, decline further throughout college, and continue to decline from age 24 throughout adulthood, making the college years a key time to reduce or reverse this trend in order to improve health (Calfas et al., 1994; Downs et al., 2014; Keating et al., 2005; Sparling & Snow, 2002). Research shows that 84.7% of those who exercised regularly as college seniors were still physically active 5 or 10 years later. The same trend is found among those who were inactive, 81.3% of those who were physically inactive as college seniors maintained a sedentary lifestyle well into adulthood (Keating et al., 2005).

Astin’s Input-Environment-Output Model (I-E-O)

To better understand the best place to focus the university efforts, Astin’s Input-Environment-Output Model (I-E-O) can be used to identify those areas that are most influential in PA patterns of college students. This model suggests that students’ outcomes are directly influenced by environmental variables (Ahmad et al., 2012; Astin, 1999; Fike & Fike, 2008). This model provides the opportunity to focus on how the
characteristics and experiences of students prior to college interrelate with their experiences in college (Ishler, 2003; Thurmond & Popkess-Vawter, 2003). Figure 1 provides a graphic representation of the model. Use of this model provides an opportunity for researchers to address not only outcomes, but also the students’ influences prior to entering college and environmental variables (Astin, 1993).

![Figure 1. Model of Astin’s Input-Environment-Outcome (I-E-O) Theory](image)

Astin’s I-E-O model has been used in numerous studies involving college students (Ahmad et al., 2012; Fike & Fike, 2008; Garrin, 2014; Hirschy, Wilson, Liddell, Boyle, & Pasquesi, 2015; Ishler, 2003; Thurmond & Popkess-Vawter, 2003) and is applicable in almost any social science field (Astin, 1999). By using Astin’s model, researchers are able to control for individual differences and more accurately estimate how environmental variables affect student outcomes (Thurmond & Popkess-Vawter, 2003). By using the I-E-O model, both Fike and Fike (2008) and House (1998) were able to assess that input variables were better predictors of student satisfaction and retention than the environmental variables in each study. For example, the use of Astin’s model allows for the opportunity to understand how specific student attributes influence retention. House (1998) examined 594 students who had started college about five years
prior and found that high school GPA was a significant predictor of students' satisfaction with college. While using retrospective data of approximately 9000 community college students, Fike and Fike (2008) found that passing (or not needing to take) a developmental reading course was the strongest predictor for retention.

Input variables are not the only predictors for college students. Thurmond and Popkess-Vawter (2003) found that student characteristics only explained 6.5% of the variance in student satisfaction with their college experience while environmental variables explained 52%. With the use of the I-E-O model, they found that the strongest predictor of student success was instructors that used a variety of assessments of student learning, followed by working in groups and timely feedback from the instructor (Thurmond & Popkess-Vawter, 2003). These findings suggest that what is happening in the classroom is a stronger predictor of success than what the student brings to college.

Other studies offer alternative approaches. Both Ahmad et al. (2012) and Hirschy et al. (2015) found that combinations of input and environment variables are better predictors of professional identity using the I-E-O model. Both studies found that professional colleagues and involvement in professional organizations were significant influences of professional identity development (Ahmad et al., 2012; Hirschy et al., 2015). However, Ahmad et al. (2012) found that the students’ intrinsic motivation to be successful in their career must also be high for the two environmental influencers to be predictors in the students’ professional identity development. Both studies concluded that the socializing agents that influence a student during their college career play a vital role in their professional identity development (Ahmad et al., 2012; Hirschy et al., 2015).
In the following sections, each of the input, environment, and output variables for this study will be discussed and justified as viable variables. Input variables include four student characteristics shown to be predictors of PA: gender, BMI, and previous exercise experience. The environmental variables included are six measures of college students' educational environment that previous research suggests increases PA levels: fitness/wellness facilities, proximity of fitness facilities to campus, physical layout of campus, campus safety, required PA courses, and physical education incentive programs. For the outcome measures, the college students’ intention to perform PA.

**Input.**

Input variables constitute the primary independent variables in the study (Ahmad et al., 2012; Astin, 1999). These are the pre-established set of characteristics that students come to college with that influence their views about college and other aspects of their lives (Ishler, 2003). Examples of input variables include gender, ethnicity, academic preparation, and first-generation status.

**Gender.** By the age of 21, only 30% of females and 42% of males report regular participation in vigorous PA. This may be because men and women have different motivations to engage in PA behaviors (Buckworth & Nigg, 2004; Egli, Bland, Melton, & Czech, 2011; Keating et al., 2005; Çağlar & Åşçi, 2006). Egli et al. (2011) examined 2,214 students from 156 sections of PA classes at a midsize southeastern university using a quasi-experimental, cross-sectional descriptive study. They found that males tended to be more motivated in PA participation by intrinsic factors, whereas females were more motivated by extrinsic factors. Males mentioned enjoyment, challenge, social recognition, affiliation, competition, and strength and endurance, whereas females were
more likely to state ill-health avoidance, maintain positive health, weight management, and appearance as motivations (Egli et al., 2011). Buckworth and Nigg (2004) and Wallace et al. (2000) each found that social support is one of the most important motivating and predictive factors in PA behavior for men, stating that college men tend to participate in more group activities, such as intramural sports and enrollment in elective PA courses. Wallace et al. (2000) found that females exercise self-efficacy and family supports were significant predictors PA behaviors while Leslie et al. (1999) found that family and friend support was of equal importance for both males and females. All this research together demonstrates that social support in many facets is important in college students’ PA levels. This research confirms the need for the exercise intervention programs to be tailored towards the specific motivations of college students (Wallace et al., 2000).

**Body mass index (BMI).** The Centers of Disease Control (CDC) report that the BMI provides an inexpensive yet reliable indicator of body fatness (U.S. Department of Health and Human Services, 2008). BMI is the ratio of human body weight to squared height (kg/m\(^2\)) (Amuta, Crosslin, Goodman, & Barry, 2016). “Overweight was defined as BMI 25.0–29.9 kg/m\(^2\), and obesity as BMI ≥30.0 kg/m\(^2\)” (Amuta et al., 2016, p. 398). BMI is often used in research as a criterion measure of overweight and obesity (Amuta et al., 2016; Bhattacharyya & Dasgupta, 2015; Ebben & Brudzynski, 2008; Ickes et al., 2016; Mackey et al., 2015; Young, Lee, & Sturts, 2015). In this study, it was used as a predictor for participation in PA. In many studies, BMI has been observed to have a negative association with PA behavior (Godin, Nolin, & Belanger-Gravel, 2008; Trost, Owen, Bauman, Sallis, & Brown, 2002; Young et al., 2015). Yasunaga et al. (2014)
found contradictory results, stating that their results did not support the negative
association between BMI and PA levels; however, the average BMI in their study was
only 20.6 kg/m² and only 5.5% of those in their study had a BMI over 25 kg/m². This is
not an accurate comparison with the average college student in the United States. Ahmed
et al. (2005) also found inconsistent results. Instead, they found that underweight and
obese men were less likely to participate in leisure time PA, with 40% of obese men and
44% of underweight men considered sedentary.

Previous exercise experience. PA during childhood and adolescence has been
found to be one of the strongest predictors of current leisure-time PA for college students
and adults (Brownson et al., 2000; Trost et al., 2002; Yasunaga et al., 2014; Zizzi, Ayers,
& Watson, 2004). Zizzi et al. (2004) found that 80% of those that were high school
athletes or those that currently categorized themselves as regular exercisers use the fitness
facilities regularly at their university. Yasunaga et al. (2014) found a higher rate of
positive attitudes toward physical education lessons (12% vs. 5%) when considering
those that have participated in PA for more than 6 months and women who had not
participated in exercise had a more negative than positive attitude toward physical
education lessons (32% vs. 14%). PA behavior dramatically increases for those with a
history of PA of more than 10 years (Elizondo & Arazuri, 2014). These results suggest
that past attitudes toward sports and exercise are linked to current exercise behavior.

To assess the students’ self-report PA, the International Physical Activity
Questionnaire—short form (IPAQ), a validated measure of adult PA (Craig et al., 2003)
was used. The IPAQ measures past week PA by examining duration and intensity of PA-
associated behavior within the past 7 days (Bjerke, 2013). This questionnaire has been
validated in several studies with repeatable and comparable data with both the short- and long-form versions for 7-day recall of activities among diverse populations between ages 18 and 65 (Craig et al., 2003; Hallal et al., 2010; Lee, Stewart, Lam, & Macfarlane, 2011).

The IPAQ has become the most widely used PA questionnaire, with two versions available: the 31 item long form (IPAQ-LF) and the 9 item short form (IPAQ-SF) (Lee et al., 2011). The IPAQ-LF provides detailed and comprehensive information on daily PA habits in 4 different domains, including housework, leisure time, occupational and transportation activities. The IPAQ-SF comprises activity of four intensity levels: walking, moderate- and vigorous-intensity PA, as well as sedentary behavior and is often recommended for PA surveillance studies (Craig et al., 2003; Hallal et al., 2010; Lee et al., 2011).

The IPAQ has been used in a variety of studies as an instrument to assess PA (Bjerke, 2013; Downs et al., 2014; Grinnell et al., 2011; Peachey & Baller, 2015; Pedišić, Greblo, Phongsavan, Milton, & Bauman, 2015; Tappe & Glanz, 2013; Topp et al., 2011). Bjerke (2013) and Topp et al. (2011) both used the IPAQ to examine the PA-related behaviors of college students. Bjerke (2013) used the IPAQ to determine if diverse types of PA education course at a university in Connecticut directly affected the PA behaviors of students after the courses. They found that courses that exposed students to conceptual information during lecture combined with supervised and directed physical activities may further augment the link between concepts and activities (Bjerke, 2013). Topp et al. (2011) found similar results with a 10-week program designed to improve PA, physical fitness, body weight, dietary intake, and perceptions of exercise and diet among 30
healthy college freshmen. They found that this peer-administered program can improve perceptions of exercise and diet in this population.

The IPAQ was used to calculate the achievement of the moderate or vigorous-intensity PA recommendations required for health benefits by the World Health Organization (WHO) in a study from Pedišić, Greblo, Phongsavan, Milton, and Bauman (2015). This study used the IPAQ data to calculate students’ PA minutes weighted by their metabolic equivalents (METs) to express PA in MET-minutes per week to determine if PA was associated with life satisfaction. They found that among all PA variables, only leisure-time vigorous-intensity PA was significantly associated with life satisfaction after adjustments for socio-demographic characteristics, lifestyle, and self-rated general health (Pedišić et al., 2015). Peachey and Baller (2015) also used the IPAQ as a method to express PA in MET-minutes per week, but they analyzed how living off campus affected PA levels of college students. They found that in total, leisure and transportation PA were significantly lower among off-campus students (Peachey & Baller, 2015).

Some research has found negative results of the IPAQ (Downs et al., 2014; Hallal et al., 2010). Downs et al. (2014) compared self-report PA behaviors to actual data obtained by an accelerometer in 77 first-year college students at a private university in the Pacific Northwest. They found that on average participants self-reported engaging in an average of 66.14 minutes of moderate intensity PA while accelerometer data indicated that participants only engaged in an average of 19.90 minutes of moderate intensity PA per day during the study (Downs et al., 2014). These results suggest that researchers, health professionals, and other individuals who use self-report to assess PA may
significantly overestimate many college students’ PA levels. Hallal et al. (2010) also found several limitations with the use of the IPAQ in Latin America; not only did they found overestimation of self-report PA behaviors similar to Downs et al (2014) but they also found that particularly for the IPAQ-LF, respondents become fatigued and lose focus while answering all the questions. Hallal et al. (2010) discourages the use of the IPAQ-SF all together in this population, stating that each question on the IPAQ-SF inquiries about physical activities performed combining all domains, which may generate difficulties for respondents both in understanding the domains and summing across them.

Environment

Environment "refers to the student's actual experiences during the educational program" (Astin, 1993, p. 18). The environment includes everything and anything that happens during the college years that might influence the student and includes those things such as programs, personnel, curriculum, instructor/teaching styles, facilities, institutional climate, peers, extra-curricular activities, and organizational affiliation (Thurmond & Popkess-Vawter, 2003).

Perceived barriers may have a significant and negative impact on the health behaviors of college students (Von Ah et al., 2004). By understanding how these variables influence the college student, universities can find ways to intervene and encourage the establishment of healthy behavioral patterns (Grinnell et al., 2011). To learn about the influence of the educational environment, the instrument used in this study evaluated the use and availability of fitness/wellness facilities, fitness facilities proximity to campus, physical layout of campus, campus safety, required PA courses, and physical education incentive programs as environmental variables.
Accessibility of fitness/wellness/recreation facilities. Comprehensive student recreation and wellness centers have become a major component on today’s college and university campuses. A web-based survey of 241 colleges and universities, in nine states, determined that 84% of four-year institutions had a wellness center (Strand, Egeberg, & Mozumdar, 2010). However, Reed (2007) found that significant percentages of male and female undergraduate college students claimed to be unaware of a variety of recreational facilities on their campuses, suggesting that having the facility is not enough and that universities need to make sure they promote the convenience of these facilities continually to students during their academic careers.

Recent environmental interventions promoting walking, biking, and other recreational PA behaviors, for example, have revealed that awareness and proximity are major factors influencing respondents' decision to use an exercise facility (Reed, 2007). Universities cannot just have these facilities that promote PA, but faculty and administration must also advertise and support the need for the facility. In a recent study of 467 university students, 20% of participants were not aware of campus facilities and 32% were unaware of the group exercise classes that were offered at the facility (Strout, 2007).

This is not just a problem within the university communities. A phone survey conducted in a rural southeastern community in the United States revealed that only 56% of survey respondents reported knowing of the availability of walking trails in their community and only 49% of regular walkers reported using the facility (Reed, Ainsworth, Wilson, Mixon, & Cook, 2004). As colleges and universities around the country face extreme financial pressures, they also face mounting public expectations to
improve and increase the quality and number of services they provide to their students (Fullerton, 2011).

**Proximity of fitness/wellness facilities to campus housing.** Convenient access to fitness facilities not only encourages PA, but also supports models of healthy lifestyle behaviors and choices (Reed, 2007). Reed and Phillips (2005) found that 66.7% of college students engaged in PA less than two-thirds of a mile from their residence and the closer the facility was the greater the duration and intensity of that PA. A small pilot study conducted by Allen and Ross (2013) revealed similar results, finding that on average college students participated in PA that was located less than 1.84 miles from their place of residence.

**Pedestrian friendly campus.** The initial focus of the university system should be on redesigning the campus environment to force a change in lifestyle (Keating et al., 2005). Recommended changes include changing the surrounding physical environments to integrate PA into the daily routine. The presence of sidewalks, street lights, other people engaging in physical activity were all positively associated with PA (Allen & Ross, 2013; Diez Roux et al., 2007; Duncan, Spence, & Mummery, 2005; French, Story, & Jeffery, 2001; Keating et al., 2005; Trost et al., 2002). Convenience was found to be an environmental factor that positively increased walking time; both men and women were more than twice as likely to have increased their walking when they perceived it to be convenient (Humpel, Marshall, Leslie, Bauman, & Owen, 2004). In a literature review written by Trost et al. (2002), both enjoyable scenery and frequently observing others exercise were positively associated with PA participation in women over the age of 40 years.
A tremendous potential exists for increasing the population’s PA by making environmental changes that would encourage and support the use of walking and bicycling as a mode of transportation (French et al., 2001). A case study by Cervero and Gorham (1995) found that on average, people make 20 trips per week (including commuting to work and personal trips), only 1.6 trips are currently made by walking or bicycling, and that a neighborhood redesign that included more walking and bicycling paths would increase this to 19 trips/1000 households. The environmental barriers that need to be addressed include lack of bike access across roads, bridges and over highways; safety concerns, including crime, lighting, and traffic; lack of changing facilities at work or a place to store bicycles; lack of employer support; and inconvenience transporting heavy items (French et al., 2001).

Research specific to the college environment by Sisson, McClain, and Tudor-Locke (2008) examined distance walked on campus, as a construct of campus walkability at two Arizona State University Branch Campuses. Using pedometers to measure steps per day and questionnaires to ascertain self-reported walk-ability, Sisson et al., (2008) found that the campus with the higher rating for walk-ability also reported more PA and more steps taken in a 5-day period.

*Campus safety.* Perceived environment has a modest, yet significant association with PA since people living in a particular environment can be influenced by that setting (Duncan et al., 2005). Access to a safe place to participate in PA has a positive association with regular PA (Babey et al., 2008). A meta-analysis conducted by Duncan et al. (2005) suggested that areas with reduced or little vehicle traffic has a positive influence on PA. Neighborhood safety (traffic, no sidewalks, dogs, and gangs) influences
participation of PA in youth. Indicating the favorable changes to neighborhood safety may produce significant modifications to PA behavior especially since many parents consider safety an important barrier to youth PA (Duncan et al., 2005; Rutten, Boen, & Seghers, 2013). There were contrasting findings for men and women who reported traffic as less of a problem: Men were 61% less likely to have increased walking; however, women were 76% more likely to have done so (Humpel et al., 2004).

Required physical activity courses. Even though most campuses have the infrastructure in place to encourage PA (fitness centers, pools, exercise classes, etc.,) many students report motivation to exercise as a barrier to participation in PA (Pope & Harvey, 2014). Required PA classes to earn an undergraduate degree have declined significantly. In the 1930s 97% of the universities in the United States required PA classes in 2010 only 39.55% still continue this requirement (Cardinal, Sorensen, & Cardinal, 2012). Downs et al. (2014), recommend that requiring undergraduates to participate in PA courses or intramural sports would be a strong motivator to increase PA. Alumni from colleges with PA requirements were more active than their peers who attended colleges without such requirements (Sparling & Snow, 2002). Curry et al. (2015) found that courses designed to teach the value of PA and improve health-related fitness knowledge increased the time spent in intense exercise. They hypothesized that because the students could better identify opportunities on campus and throughout the community to engage in greater PA behaviors because of the course. They recommend that freshmen be directed to enroll in these types of courses so that they can begin the process of improving lifelong health early in their college career. Pearman et al. (1997) found that alumni who completed a one-semester undergraduate course on health
knowledge and practices were more likely to participate in higher intensity PA than those that did not complete the course, resulting in significant positive effects on the health knowledge and health-related behaviors of these alumni.

**Physical activity incentive programs.** Research shows that courses that only educate about the importance of PA are not enough to motivate college students to make a lifestyle change, but those that expose college students to a conceptual framework combined with supervised and directed physical activities enhance the link between concepts and application (Bjerke, 2013). These types of courses often result in positive outcomes for change in PA behaviors for college students. Implementing programming at the college level that targets campus-based lifestyle modification programs in at-risk populations are warranted as the collegiate population is unique in that their living and learning environments serve as a convenient setting for health education programming (Ickes et al., 2016). A 15-week, campus-based lifestyle modification program on obese college students found improvements on PA levels and suggested that the sedentary lifestyle of college students may be the main contributor to marked weight gain in college students (Ickes et al., 2016). Other specifically designed activity classes that are designed to teach the value of PA and improve basic health-related fitness knowledge have found marked improvements on the time spent on intense PA behaviors (Curry et al., 2015).

Magoc, Tomaka, and Bridges-Arzaga (2011) evaluated the efficacy of a web-based intervention to promote PA among a sample of predominantly Hispanic college students attending a large southwestern university. They found that the intervention increased both moderate and vigorous days of PA, showing that a web-based intervention can
significantly increase levels of moderate and vigorous PA among a group of sedentary and insufficiently active college students (Magoc et al., 2011).

Pope and Harvey (2014) evaluated the effectiveness of weekly and variable-interval incentive payments to encourage first-year college students to meet fitness-center attendance goals both during and after incentive provision. They found that providing monetary incentives on a variable-interval schedule is a more effective way of maintaining fitness-center attendance-goal achievement in college first-year students than discontinuing incentives. Rouse (2016) investigated employee participation in college-based wellness program. This study found that those that participated in regular PA have reductions in absenteeism encouraging higher education wellness professionals to take a more active role in reducing barriers for participation in PA behaviors. These structured programs found significant improvements in the PA behaviors of their participants.

The programs may not need to be formal or expensive. Inexpensive environmental prompts, such as small signs near stairways and escalators, can have an influence on PA behaviors. Several studies have shown that these signs are effective in increasing use of stairs instead of escalators or elevators (Boutelle, Jeffery, Murray, & Schmitz, 2001; Brownell et al., 1980). In two studies, signs promoting stair use were placed at choice points by the stairs and escalators in various locations (train terminal, a bus terminal, shopping mall, and university public health building. Brownell et al. (1980) made 45,694 observations of persons using stairs or an adjacent escalator when the colorful sign was present. Stair usage increased twofold, from 6% to 14%, during times when the sign was posted. Boutelle et al. (2001) made 35,475 observations resulting in
increased stair use by 14%. These observations showed that with little or no cost, universities could increase PA levels.

**Output**

Outputs "refer to the 'talents' we are trying to develop in our educational program" (Astin, 1993, p. 18). Outputs are outcome variables that may include posttests, grade point average, exam scores, course performance, degree completion, course or degree satisfaction, consequences, or end results (Thurmond & Popkess-Vawter, 2003). The outcome measures in this study include the college students’ intention to perform PA and health–related PA behavior was assessed. These two together allowed the opportunity to better understand if the college student not only understands the importance in PA through their intention to participate but also their action in participation in PA behavior.

**Intention to exercise.** In this study, Ajzen’s Theory of Planned Behavior (TPB) is used to help understand a college student’s intention to engage in PA and therefore predict PA behavior. This intention is derived from three conceptually independent determinants of intention: behavioral beliefs or attitude towards the behavior (e.g. favorable or unfavorable consequences of the behavior); normative beliefs (e.g. perceived social pressure); and control beliefs (e.g. factors that facilitate or impede performance of the behavior) (Ajzen & Fishbein, 1980).

The TPB is an extension of the theory of reasoned action (TRA) (Icek Ajzen, 1991; Doll & Ajzen, 1992) which was developed using the principle of compatibility to better predict behaviors from attitudes and was later improved upon by forming the TPB (Ajzen, 1991). Figure 2 provides a graphic description of the model.
Figure 2. Model of Ajzen’s Theory of Planned Behavior (TPB)

The TPB has been used in many avenues to study PA (Brenes, Strube, & Storandt, 1998; Budden & Sagarin, 2007; Faulkner & Biddle, 2001; Jackson et al., 2003; R. Rhodes, de Bruijn, & Matheson, 2010). Budden and Sagarin (2007) used TPB to study working adults ages 18-65 and found that exercise intention did indeed predict exercise behavior; however, perceived behavioral control over exercise did not contribute to the behavior. Ajzen (2013) suggests, perceived behavioral control will only predict behavior when perceptions accurately reflect control and vary across situations and behaviors. When an individual has complete control over behavioral performance, intentions alone should be sufficient to predict behavior (Icek Ajzen, 1991). Faulkner and Biddle (2001) found comparable results when studying mental health professionals. They found that attitude, rather than perceived behavioral control, was the strongest predictor of intention.

The TPB has been used in research as a useful tool for guiding the promotion of PA and in supporting interventions to increase such behavior (Faulkner & Biddle, 2001).
An interview guide based on the TPB was used to conduct individual semi-structured interviews to understand behavioral, normative and control beliefs of overweight adolescents. Findings showed that overweight adolescents exhibited positive attitudes in dealing with their weight status and valued their family’s support and guidance in helping control their weight. Although friends were important to facilitate regular exercise, families, particularly mothers, were crucial in addressing healthy eating habits (Rhodes et al., 2016). Wang et al. (2014) used the TPB to develop a Regular Exercise Belief Questionnaire for those with chronic obstructive pulmonary disease. They chose to use this theory because it provides a systematic and comprehensive method to understand the types of beliefs and their impact on an individual’s intention to perform a specific behavior. Rhodes et al. (2010) used TPB to analyze whether PA was just a habit or if PA was more intentional. The results showed that some properties of PA may have an automatic component and that habits may be important to PA action control.

In all of these studies, intention to exercise was positively related to behavior, however only one or two rather than three of the cognitive determinants--attitudes, social norms, and perceived behavioral control--significantly relate to intention. This study will examine only intention and not discriminate whether it is driven by attitudes, social norms, or perceived behavioral control.

Models that compete with TPB. Two of the most widely used behavioral models are the Transtheoretical Model of Behavior Change (TTM) and the Theory of Planned Behavior (TPB). The TTM suggests that individuals who adopt new behaviors move through a sequential process of behavior change that occurs on a continuum (Prochaska & DiClemente, 1983). Each of the five stages of change are influenced by one’s
readiness to progress toward a target behavior: “precontemplation (e.g., not yet intending to change), contemplation (e.g., intending to change, but not within the near future), preparation (e.g., intending to change within the near future), action (e.g., engaging in the activities that support behavior change), and maintenance (e.g., sustaining the altered behavior patterns)” (Garrin, 2014, p. 45). Considerable research has been conducted around exercise behavior change using the TTM model (Bogg, 2008; Buckworth, 2001; Calfas et al., 1994; Callaghan, Eves, Norman, Chang, & Yuk Lung, 2002; Ho, Gabriel, & Kohl Iii, 2015; Pinto, 1995; Spencer, Adams, Malone, Roy, & Yost, 2006; L.S. Wallace & Buckworth, 2001). The foundation and appeal of this model lies in its ability to differentiate between the motivational and behavioral needs of sedentary adults, new exercisers, and habitual exercisers (Bogg, 2008).

TTM was not selected for use in this study because of its various limitations. The TTM model suggests that an individual progress through these stages at various rates, and he or she may leave and reenter the continuum of change at various points. Movement through the stages is not always linear but, instead, is cyclical, because many individuals must make several attempts at behavior change before they attain their goals (Pinto, 1995; Prochaska & DiClemente, 1983). A second limitation of this model is that the theory ignores the social context in which change occurs, such as SES and income (Bogg, 2008). Because social support from family and friends has been associated with exercise participation in college students in several studies (Leslie et al., 1999), the theory of planned behavior allows the social context of the behavior change to be considered (Jackson et al., 2003).
Summary

Over the last several decades, adults ages 18-65 years have become increasingly inactive. This change in behavior is not only associated with an increased risk of obesity, cancer, type II diabetes, osteoporosis, and coronary heart disease but research shows that a sedentary lifestyle is damaging not only to physical health, but also to cognitive health (Chaddock et al., 2012), life satisfaction (Maher, Doerksen, Elavsky, & Conroy, 2014), energy level, and self-confidence (Sherwood & Jeffery, 2000). Changes to current college physical education are required to increase PA behaviors of college students but the means to effectively promote students’ PA is still unknown (Keating et al., 2005).

The purpose of this study is to analyze the role that programming and facilities, within the educational environment, acts on a college students’ intention to engage in PA behaviors. With the application of Astin’s I-E-O assessment model, the researcher was able to determine which component of the educational environment (availability of fitness/wellness facilities, fitness facilities proximity to campus, physical layout of campus, campus safety, required PA courses, and physical education incentive programs) has a greater influence on intention to exercise during college. This study examined intention to participate in a behavior because intention is determined by a combination of the attitude towards the behavior, perceptions of social pressure to perform the behavior and perception of the ease or difficulty of performing the behavior. All these together have been shown to predict behavior in many different types of studies (Jackson et al., 2003)
CHAPTER III - METHODS

This chapter focuses on the methodological procedures that were used to collect and analyze data; included is a discussion of the study’s research design, participant description, data collection, and data analysis. This quantitative study used the I-E-O assessment model to analyze the role of components of the educational environment in influencing a college students’ intention to engage in physical activity (PA) behaviors.

Purpose

The purpose of this study was multifaceted. The primary objective was to better understand how the programming and facilities within the educational environment influences a college students’ intention to engage in PA behaviors. Second, this study determined which factors of the TPB best explain college students’ intention to engage in PA behaviors. Finally, this study is unique in using Astin’s Input-Environment-Output Model (I-E-O) as the framework and Ajzen’s theory of planned behavior (TPB) as an outcome to help describe PA behaviors.

Participants

Undergraduates enrolled in colleges and universities in the southcentral United States (US) were recruited for this study. The questionnaire was disseminated via email. Participants were not limited by gender, race or any additional special characteristics, but were limited to those over the age of 18 and those attending school in selected southcentral states: Alabama (AL), Mississippi (MS), Louisiana (LA) and Texas (TX). The southcentral US was targeted for this study since this area has the highest prevalence of obesity and the lowest PA levels out of any other region in the US (Centers for Disease Control and Prevention). AL, LA, and MS have had obesity prevalence rates over 30%.
consistently since 2005 (Centers for Disease Control and Prevention, 2017). These states also have some of the lowest reported levels of physical activity; in 2004 LA reported 18.3% and MS reported 21.3% achieving the recommended amount of the PA (Brownsons, Boehmer, & Luke, 2005). The Centers of Disease control report similar numbers in 2015, citing that AL, MS, LA, and TX all reported percentages below national average on engagement in the recommended levels of physical activity (2017).

Initially 12 universities nationwide were recruited for this study with the hope of receiving at least 200 completed surveys. Two hundred surveys were suggested as 200 entries were needed to complete the statistical analysis for this study (Kelloway, 2015). Additionally, permission from the Institutional Review Board from each institution was solicited for this study to ensure that this research met the relevant federal and institutional standards and guidelines.

The following institutions were solicited so that the sample would be diverse across geographical locations, types of universities (community, public and private), tuition, and size. The universities that were recruited include: Auburn University, Delgado Community College, Faulkner State Community College, Louisiana College, Louisiana State University, Pearl River Community College, Rice University, San Jacinto Community College, Spring Hill College, University of Houston-Clearlake, and University of Southern Mississippi. See Table 1 for more information regarding the diversity among the selected establishments. The participants that chose to participate in this study did so voluntarily, were not awarded or encouraged to participate, and could exit at any time.
Table 1

**Demographics of Universities Solicited**

<table>
<thead>
<tr>
<th>Name</th>
<th>Enrollment</th>
<th>Type</th>
<th>Diversity</th>
<th>Tuition</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring Hill College</td>
<td>1639</td>
<td>Private</td>
<td>67% white, 16% black, 7% Hispanic, 1% Asian, &lt;1% other</td>
<td>IS: $30,506</td>
<td>AL</td>
</tr>
<tr>
<td>Auburn University</td>
<td>26555</td>
<td>Public</td>
<td>76% white, 12% black, 3% Hispanic, 1% Asian, &lt;1% other</td>
<td>IS: $8,592</td>
<td>AL</td>
</tr>
<tr>
<td>Faulkner State Community College</td>
<td>6635</td>
<td>CC</td>
<td>73% white, 19% black, 3% Hispanic, &lt;1% Asian, 2% other</td>
<td>IS: $3390</td>
<td>AL</td>
</tr>
<tr>
<td>Louisiana State University</td>
<td>32843</td>
<td>Public</td>
<td>72% white, 11% black, 5% Hispanic, 3% Asian, &lt;1% other</td>
<td>IS: $6,678</td>
<td>LA</td>
</tr>
<tr>
<td>Delgado Community College</td>
<td>25488</td>
<td>CC</td>
<td>45% white, 32% black, 8% Hispanic, 3% Asian, &lt;1% other</td>
<td>IS: $2,992</td>
<td>LA</td>
</tr>
<tr>
<td>Louisiana College</td>
<td>1445</td>
<td>Private</td>
<td>67% white, 21% black, 2% Hispanic, 1% Asian, &lt;1% other</td>
<td>IS: $12,750</td>
<td>LA</td>
</tr>
<tr>
<td>University of Houston-Clearlake</td>
<td>9998</td>
<td>Public</td>
<td>41% white, 10% black, 26% Hispanic, 7% Asian, 16% other</td>
<td>IS: $4536</td>
<td>TX</td>
</tr>
</tbody>
</table>


Table 1 (continued)

<table>
<thead>
<tr>
<th>Institution</th>
<th>Code</th>
<th>Type</th>
<th>% White</th>
<th>% Black</th>
<th>% Hispanic</th>
<th>% Asian</th>
<th>% Other</th>
<th>IS:</th>
<th>OS:</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice University</td>
<td>7115</td>
<td>Private</td>
<td>39%</td>
<td>5%</td>
<td>11%</td>
<td>15%</td>
<td>&lt;24%</td>
<td>$39,880</td>
<td>$39,880</td>
<td>TX</td>
</tr>
<tr>
<td>San Jacinto College</td>
<td>40943</td>
<td>CC</td>
<td>30%</td>
<td>11%</td>
<td>45%</td>
<td>5%</td>
<td>&lt;24%</td>
<td>$2,136</td>
<td>$3,408</td>
<td>TX</td>
</tr>
<tr>
<td>University of Southern Mississippi</td>
<td>17933</td>
<td>Public</td>
<td>63%</td>
<td>28%</td>
<td>3%</td>
<td>1%</td>
<td>&lt;1%</td>
<td>$6,980</td>
<td>$15,550</td>
<td>MS</td>
</tr>
<tr>
<td>Pearl River Community College</td>
<td>6147</td>
<td>CC</td>
<td>67%</td>
<td>28%</td>
<td>2%</td>
<td>3%</td>
<td>&lt;1%</td>
<td>$2650</td>
<td>$5048</td>
<td>MS</td>
</tr>
<tr>
<td>Mississippi College</td>
<td>5830</td>
<td>Private</td>
<td>66%</td>
<td>26%</td>
<td>2%</td>
<td>2%</td>
<td>&lt;1%</td>
<td>$14,670</td>
<td>$14,670</td>
<td>MS</td>
</tr>
</tbody>
</table>

Note. CC= Community College; Tuition is undergraduate per year and does not include fees; IS= In-state OS= Out of State. Adapted from: Best Colleges.com. (July 27, 2017) Retrieved from http://www.bestcolleges.com/database/

All solicited institutions did not participate in the survey. IRB approval could not be obtained from the following institutions for the following reasons, administrative, clerical, and time constraints and no data were gathered from these institutions: Auburn University, Faulkner State Community College, Louisiana College, Mississippi College, or San Jacinto Community College. IRB approval was obtained from the following however, no responses were received despite numerous solicitations: Delgado Community College, Louisiana State University, and Rice University. IRB approval was
obtained from the following and completed surveys were obtained: Pearl River Community College, Spring Hill College, University of Houston-Clearlake, and University of Southern Mississippi. Table 2 shows the distribution of completed surveys by institution.

### Table 2

*Distribution of completed questionnaires by institution*

<table>
<thead>
<tr>
<th>Name of Institution</th>
<th>Number completed</th>
<th>% of total participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearl River Community College</td>
<td>50</td>
<td>20%</td>
</tr>
<tr>
<td>Spring Hill College</td>
<td>47</td>
<td>18%</td>
</tr>
<tr>
<td>University of Houston-Clearlake</td>
<td>20</td>
<td>8%</td>
</tr>
<tr>
<td>University of Southern Mississippi</td>
<td>139</td>
<td>54%</td>
</tr>
</tbody>
</table>

**Materials/Instrumentation**

The survey instrument measured nine variables, with a total of 48 questions. In the following sections, the method for measuring each of the input, environment, and output variables for this study will be discussed. The input and environment variables are known predictors for PA behavior as found in previous studies. Input variables include three student characteristics shown to be predictors of PA: gender, BMI, and previous exercise experience. The environmental variables included are six measures of college students’ educational environment that previous research suggests increases PA levels: fitness/wellness facilities, proximity of fitness facilities to campus, physical layout of campus, campus safety, required PA courses, and physical education incentive programs. The outcome measure was the college students’ intention to perform PA. Along with these, additional demographic information was collected including: sex, age, university attended, and university major.
**Self-reported Physical Activity**

Self-reported PA behavior was measured using the International Physical Activity Questionnaire (IPAQ). This physical activity questionnaire is publicly available, with open access, and no permissions are required to use the instrument (The IPAQ Group, 2005). This instrument has been validated in accurately measuring a 7-day recall of activities and behaviors among diverse populations between ages 18 and 65 (Bjerke, 2013; Craig et al., 2003; Hubbard-Turner & Turner, 2015). This international instrument measures frequency, duration, and intensity of weekly PA. A short and long version of this instrument is available; however, the short version asks questions specifically pertaining to vigorous, moderate, walking, and sedentary activity (Craig et al., 2003) and was appropriate for this study.

The IPAQ has been validated in several studies (Bjerke, 2013; Craig et al., 2003; Downs et al., 2014; Grinnell et al., 2011; Hagströmer, Oja, & Sjöström, 2007; Hallal et al., 2010; Lee et al., 2011; Tappe & Glanz, 2013; Vasheghani-Farahani et al., 2011), with repeatable and comparable data for 7-day recall of activities and behaviors among diverse populations between ages 18 and 65 (Bjerke, 2013; Craig et al., 2003). The International Physical Activity Questionnaire – Short form (IPAQ-SF) is comprised of 7 items that measure varying level of PA intensity, ranging from: walking, moderate- and vigorous-intensity PA, as well as sedentary behavior and is often recommended for PA surveillance studies (Craig et al., 2003; Hallal et al., 2010; Lee et al., 2011).

This instrument was used to describe PA behaviors prior to entering college. Subjects were asked to reflect upon their PA behaviors prior to college. An example includes, “Prior to entering college, on how many days did you do moderate physical
activities like carrying light loads, bicycling at a regular pace, or doubles tennis?”. And “Prior to entering college, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?”.

*Educational Environment Questions*

Several questions about the available programs and facilities at their institution were investigated. The Educational Environment refers to everything and anything that happens while attending college that might impact the student's experiences, this includes: “programs, personnel, curricula, instructors, facilities, institutional climate, courses, teaching style, friends, roommates, extra-curricular activities, and organizational affiliation” (Thurmond & Popkess-Vawter, 2003, p. 2). This study focused on programming and facilities component of the environment of the university system. Questions included those related to the accessibility and proximity of the fitness centers, walkability of the campus, campus safety, requirement of PA courses and availability of programs that encourage PA.

*Accessibility of fitness centers.* Four questions evaluated the availability of a fitness or wellness facility on the campus. Questions included items to determine the existence of a facility, the fee associated with use, how far the facility was from campus and hours of operation. Three of the questions regarding fees (The fee associated with the use of the facility was reasonable), accessibility (The fitness facility was easy to access /within reasonable walking distance in or near campus) and hours of operation (The hours of operation of the fitness facility were acceptable and comparably with other similar facilities in the area) were a rated on a 5-point Likert-type scale with response options ranging from (1) “strongly disagree” to (5) “strongly agree”.

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*Pedestrian friendly.* To determine if the campus was pedestrian friendly or walkable four questions were adapted from the walkability survey from health by design. This instrument was designed as a component of a toolkit used to evaluate if residents in neighborhood can safely and easily move about on foot (*"Walkability Survey - How Walkable is Your Neighborhood?,"* 2009). These items include availability and usability of sidewalks and crosswalks on their campus. All items were rated on a 5-point Likert-type scale with response options ranging from (1) “never” to (5) “always”.

*Campus safety.* The six questions designed to measure campus safety were adapted from a campus safety study conducted by the Norfolk State University Police Department (*Norfolk State University Police Department, n.d.)*. The primary purpose of this instrument was to better understand the safety needs of their university to help maintain a safe and secure environment. Five of the questions are intended to evaluate where, if any, places on campus students may feel unsafe. An example includes, “How safe do/did you feel in the Residence Hall(s) on your college campus?” All these items were rated on a 5-point Likert-type scale with response options ranging from (1) “not very safe” to (5) “very safe”. The final item, is designed to assess the student satisfaction with the emergency systems of the campus and is assessed by a 5-point Likert-type scale with response options ranging from (1) “not satisfied” and (5) “very satisfied”.

*PA programming.* This section of the instrument was designed to evaluate the PA incentive programs offered by the university. The questions in this section were intended to assess the PA incentive program offered by the university to encourage healthy behaviors and if the student felt the program influenced their PA behaviors. An example includes, “Did/does your college or university offer physical activity/wellness/health
programs?” If the student answers yes, they were prompted to answer the following: “How much do you feel that this program influenced you to participate in physical activity?” This item is rated on a 5-point Likert-type scale with response options ranging from (1) “did not influence” and (5) “strongly influenced”.

**Requirement of PA courses.** The final item in this section of the instrument was designed to determine if there were any required PA courses assigned by the university. An example includes, “Did/does your undergraduate college or university require physical activity or wellness courses to complete your degree program?” If the student answered yes, they were prompted to answer the following: “How many hours of these types of courses are required to graduate?”, with responses of 1-3 hours, 3-6 hours, 6-9 hours, 9-12 hours, more than 12 hours, and Not sure/ Do not know. They were also asked, “Which types of courses were accepted for this requirement?”, with responses of: physical Activity course where activity was required or wellness courses where no activity was required. Finally, there were asked “How much do you feel that these courses influenced you to participate in physical activity?” This item is rated on a 5-point Likert-type scale with response options ranging from (1) “did not influence” and (5) “strongly influenced”.

**Intention to Participate in Physical Activity**

The output variables used in predicting the intention to engage in PA include: attitude toward PA, perception of social norm of PA, and perceptions of students’ ability to engage in PA. These influences were measured using an instrument adapted from Motl et al. (2000). By using this type of multidimensional conceptualization, higher education could better understand why college students hold certain attitudes, subjective
norms, perceptions of behavioral control, and self-efficacy towards participation in physical activity. This portion of the instrument includes direct measures of attitudes, subjective norm, and perceptions of behavioral control. The formation of the items was based on a multiplicative approach in accordance with theory and previous research (Dishman et al., 2002; Robert W. Motl et al., 2002) to examine physical activity behaviors of adolescent boys and girls. By using these previously established items the validity of the present study increases as these items have been previously conformed to unidimensional models that were invariant across groups and time (Motl et al. 2002).

**Attitude.** The measure of attitude included seven items rated on a 5-point Likert-type scale with response options ranging from (1) “strongly disagree” and (5) “strongly agree”. The attitude questions consist of the impression one would have of themselves before or after physical activity. An example includes, “If I were to be physically active during my free time on most days it would make me more attractive.”

**Subjective norm.** Perceptions of social pressure (subjective norm) were formed as a product of the normative belief and motive to comply item scores. The subjective norm instrument included five items that consisted of normative beliefs about the expectations of others toward being physically active and the corresponding motivation to comply with the expectations. The items were rated on a 5-point Likert-type scale with response options ranging from (1) “strongly disagree” and (5) “strongly agree”. The subjective norm items were formed as the product of the normative belief and motivation-to-comply item scores (Ajzen, 1991).

**Perceived control.** The respondents’ control over their ability to participate in PA were measured with four items that pertain to perceptions of the ease/difficulty of being
physically active. An example includes: “I have control over my being physically active during my free time on most days”. This item along with two others were rated on a 5-point Likert-type scale with response options ranging from (1) “strongly disagree” and (5) “strongly agree”. One item “For me to be physically active during my free time on most days would be…” was rated on a 5-point Likert-type scale with response options ranging from (1) “extremely difficult” and (5) “extremely easy”.

**Self-efficacy.** The self-efficacy portion contained seven items that pertained to confidence in one’s ability to be physically active. Examples include: “I can be physically active during my free time on most days even if I could watch TV or play video games instead” and “I can ask my spouse/significant other to be physically active with me during my free time on most days.” All items were assessed on a 5-point Likert-type scale with response options ranging from (1) “strongly disagree” and (5) “strongly agree”.

**Intention.** The final component of this section included three items to assess intention to participate in physical activity. The items were developed as suggested by Ajzen (2006). The items were rated on a 5-point Likert-type scale with response options ranging from (1) “strongly disagree” and (5) “strongly agree”. An example includes, “I intend to participate in regular PA (at least 20 minutes, three times per week) for the next three months”.

Previous research has suggested that intention to participate in a behavior is determined by a combination of the attitude towards the behavior, perceptions of social pressure to perform the behavior and perception of the ease or difficulty of performing
the behavior. Combined, these predict intention to engage in PA and participation on the behavior itself (Faulkner & Biddle, 2001).

Data Analysis

Structural equation modeling (SEM) was used to examine the relationships between components of the educational environment and the student’s intention to participate in PA. SEM is a confirmatory approach to data analysis and is appropriate to estimate how well the model proposed fits the data collected (Hoyle, 2012; Kelloway, 2015; Meyers, Gamst, & Guarino, 2013). In this case SEM allowed the opportunity to determine which known predictors of PA are greater influencers on intention to participate in PA.

SEM is often used in social and behavioral sciences to examine the relationships between indicators and the constructs they represent (Hoyle, 2012; Kelloway, 2015). It is the most broadly applicable statistical procedure currently available because of its unique and flexible capabilities (Tomarken & Waller, 2005). To complete the analysis the following steps were used: model specification, estimation, evaluation of fit, interpretation and reporting, and respecification (Hoyle, 2012; Kelloway, 2015).

Model Specification

In the first step, model specification, a picture was drawn based on theory and prior research to depict the relationship among different variables. This model is a formal explanation of how the variables are associated and is a clearer, more efficient visual representation of the relationships among multivariate data than an algebraic equation (Hoyle, 2012; Kelloway, 2015). Figure 3 below illustrates the proposed model for this study. In the figure, rectangles are used to depict observed or measured variables.
or values. Ovals are unobserved or latent variables, items that are not measured directly, but are underlying constructs that tie multiple items together. An arrow at both ends indicates a correlation with each other, and directional paths are used to predict where the arrow is leading. Finally, letters or phrases inside boxes or circles serve as variable labels (Hoyle, 2012; Hoyle & Smith, 1994; Meyers et al., 2013).

In the model the inputs, environment, and outputs have been separated to show the different relationships that may be observed; however, both the input and environment was assessed in the same method to determine which variable has the substantial influence over PA intention. The observed variables: gender, BMI, PA behaviors prior to college, physical activity incentive programs, and required PA courses, are all measured with one question. While accessibility to fitness center, pedestrian friendly campus, and campus safety all are latent variables. The paths from the input and environment variables are all pointing towards the output variables indicating a relationship in their ability to predict intention to participate in PA.

Figure 3. Proposed Model for this study
Sample Size

SEM is a large-sample technique (Kelloway, 2015; Meyers et al., 2013). Many resources suggest a minimum sample size of 200 observations for simple models (Hoyle, 2012; Kelloway, 2015; Meyers et al., 2013; Tomarken & Waller, 2005). The estimation methods and tests of model fit used by SEM are based on the assumption of large samples (Kelloway, 2015). For the present study current estimates suggest that across 12 campuses nearly 170,000 potential participants exist. According to LaRose & Tsai (2014) the average response to online survey with no incentive could be as low as 2%. This study had the potential to capture over 3,000 responses.

Preparing the Data

Hoyle (2012) refers to this process as “doing your homework” and stressing that failing to clean and prepare the dataset can result in flawed conclusions from the data analysis. Hoyle (2012) suggests the following steps for careful inspection of data: evaluate descriptive statistics, check plots/graphs, and examine correlations. As a component of data preparation BMI must be calculated as well as MET calculation as a component of identifying PA behaviors. The MET calculation and clean up was done using the suggestions from the IPAQ group in “Guidelines for Data Processing and Analysis of the International Physical Activity Questionnaire” (2005). This section outlines each of these required steps in avoid any incorrect findings.

Calculating body mass index. Next, Body Mass Index (BMI) was calculated for each participant. BMI is the ratio of human body weight to squared height (kg/m²) (Amuta et al., 2016). To calculate BMI, the following formula with reported height and weight was used: \[ \text{BMI} = 703 \times \frac{\text{weight (lbs)}}{\text{height}^2 (\text{in}^2)} \]. BMI should be limited to 16-60 kg/m².
This was calculated as both reflective of BMI before college and current. First height was converted to inches using height in feet, multiplied by 12 and then adding the inches. Next BMI was calculated using the provided formula. BMI was then categorized to underweight (BMI>17.9 kg/m$^2$), normal (BMI 18-24.9 kg/m$^2$), overweight (BMI 25-29.9 kg/m$^2$), and obese (BMI>30 kg/m$^2$) (Godin et al., 2008).

Examining the IPAQ data. The IPAQ Group suggests the following when examining the data for the IPAQ-SF (2005). First, researchers should ensure that the responses to duration (time) are all recorded in minutes and not hours and minutes, if not make the necessary conversion. The ‘days’ variables should be limited to 0-7 days. Also suggested is to recode any duration of activity that is less than 10 minutes to zero. The rationale being that the scientific evidence indicates that episodes or bouts of at least 10 minutes are required to achieve health benefits. To be compliant with this request all participants that reported “Never” to questions, “Prior to entering college, on average how many days per week did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?”, “Prior to entering college, how many days per week did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis?, and “Prior to entering college, on how many days did you walk for at least 10 minutes at a time?” Their times were recorded associated with these questions as “zero” as they reported not participating in the activity.

Similarly, it is recommended that all walking, moderate and vigorous time variables exceeding 180 minutes are re-coded to be equal to 180 minutes, this permits a maximum of 21 hours of activity in a week to be reported for each category. Five entries in, “Prior to college, how many minutes or hours did you usually spend doing moderate
physical activities on one of those days?” were re-coded to 180 minutes as recommended. Thirteen entries in, “Prior to college, how many minutes or hours did you usually spend walking on one of those days?” were re-coded to 180 minutes as recommended. Those that did not enter in either data in either the days of the week or minutes categories for any category were calculated as a “zero” and recorded as such (The IPAQ Group, 2005).

Calculating MET values. Standard scoring procedures for the IPAQ were used to convert duration of reported activities into metabolic equivalents (The IPAQ Group, 2005). This information was used to categorize the participant’s overall activity levels. Activity times were weighted by standard MET estimates (vigorous physical activity = 8, moderate physical activity = 4, walking = 3.3) and summed to create a daily physical activity MET·min·day score. The following calculation was used: Total MET-minutes/week = Walk (METs*min*days) + Mod (METs*min*days) + Vig (METs*min*days). Figure 4 provides a sample calculation.

**MET – minutes/week for 30 min/day, 5 days**

3.3 * 30 * 5 = 495 MET – minutes/week
4.0 * 30 * 5 = 600 MET – minutes/week
8.0 * 30 * 5 = 1,200 MET – minutes/week
TOTAL = 2,295 MET – minutes/week

Figure 4. Sample MET Calculation

Calculating MET values allows for categorizing of the individuals as low, moderate or high levels of physical activity. Table 3 outlines the distinct categories and criteria.
Table 3

Criteria of categorizing participants PA levels using the IPAQ Guidelines

<table>
<thead>
<tr>
<th>Category</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>No activity is reported OR Some activity is reported but not enough to meet moderate or high levels</td>
</tr>
<tr>
<td>Moderate</td>
<td>3 or more days of vigorous activity of at least 20 minutes per day OR 5 or more days of moderate-intensity activity and/or walking of at least 30 minutes per day OR 5 or more days of any combination of walking, moderate-intensity or vigorous intensity activities achieving a minimum of at least 600 MET-minutes/week</td>
</tr>
<tr>
<td>High</td>
<td>Vigorous-intensity activity on at least 3 days and accumulating at least 1500 MET-minutes/week OR 7 or more days of any combination of walking, moderate- or vigorous-intensity activities accumulating at least 3000 MET-minutes/week</td>
</tr>
</tbody>
</table>


*Recoding Data.* Nominal variables: gender, BMI Category, and MET category used to describe PA before college, were coded to allow for further analysis. Gender was recoded 1 for male and 2 for female. METS were coded as 1 for low, 2 for moderate and 3 for high. BMI coded as 1 for underweight, 2 normal, 3 overweight and 4 obese.

*Educational environment scoring.* Each of the variables under educational environment: accessibility and proximity of the fitness centers, walkability of the campus, campus safety, requirement of PA courses and availability of programs that encourage PA were each were re-coded using excel software so that each variable was a
numerical and not a category. The items that were rated on a 5-point Likert-type scale were arranged so the ends of the items were ranked from negative to positive endpoints, 1 to 5. To find the value of the overall variable the mean of the item scores gave an overall score for each variable. The following sections outline the details for each variable.

**Accessibility of fitness centers.** The evaluation score of the campus fitness center was found using the following steps. First, all those that responded “No” to the question regarding the existence of a facility were recorded as zero (0) and all those responding yes were recorded as (1). If the participant responded, “Yes” to the question regarding the existence of a facility their responses for each of the remaining three questions were recoded to reflect: strongly disagree (1), somewhat disagree (2), neither agree nor disagree (3), somewhat agree (4), strongly agree (5).

**Pedestrian friendly.** An overall walkability or pedestrian friendly score was found by first recoding the responses: never (1), sometimes (2), about half the time (3), most of the time (4), and always (5).

**Campus safety.** Five of the questions with response ranging from “not very safe” to “very safe” were recoded to reflect the following: extremely unsafe (1), somewhat unsafe (2), neither safe or unsafe (3), somewhat safe (4), and extremely safe (5). The final item, designed to assess the student satisfaction with the emergency systems on campus was recoded extremely dissatisfied (1), somewhat dissatisfied (2), neither satisfied nor dissatisfied (3), somewhat satisfied (4), and extremely satisfied (5).

**PA programming.** The evaluation score used to evaluate the PA incentive programs was found using the following steps. First, all those that responded “No” to the question regarding the existence of a facility were recorded as zero (0) and all those
responding yes were recorded as (1). If they participant responded, “Yes” to this question they were prompted to respond to a question regarding the influence of that program. The responses to that questions were recoded to reflect the following: not effective at all (1), slightly effective (2), moderately effective (3), very effective (4), and extremely effective (5).

Requirement of PA courses. The evaluation score of required PA courses was found using the following steps. First, all those that responded “No” to the question regarding the existence of a facility were recorded as zero (0) and all those responding yes were recorded as (1). If they participant responded, “Yes” to this question they were prompted a question regarding the influence of that program. The responses to that question were recoded to reflect the following: none at all (1), a little (2), a moderate amount (3), a lot (4), and a great deal (5).

TPB scoring. Using the recommendations provided by Ajken (2002) the items to assess intention; intention, attitude, subjective norms. Perception of behavioral control, and self-efficacy were re-coded using Excel software. The items were arranged so the ends of the items rated on a 5-point Likert-type scale were ranked from negative to positive endpoints, 1 to 5. The measures of attitude, subjective norm, perceived control, self-efficacy, and intention that included items with responses ranging from “strongly disagree” to “strongly agree” were recoded to reflect: strongly disagree (1), somewhat disagree (2), neither agree nor disagree (3), somewhat agree (4), and strongly agree (5). The one item in perceived control that was rated with response ranging from “extremely difficult” to “extremely easy” was coded: extremely difficult (1), somewhat difficult (2), neither easy nor difficult (3), somewhat easy (4), and extremely easy (5).
Summary

The focus of this chapter was to outline how data were collected and prepared for this study. The SEM approach allowed for a comprehensive analysis that simultaneously considers questions of measurement and prediction (Hoyle, 2012; Kelloway, 2015). The final analysis hoped to provide information to university administrators and health program supervisors on how the higher education institution can change some components of the educational environment to positively influence students to increase PA levels. Understanding more about what motivates students to choose healthy habits could possibly be the answer to one of the worst health crises in recent history.
CHAPTER IV – RESULTS

This chapter provides a discussion of the results for the data gathered for use during this study. As mentioned earlier, this study sought to determine which known predictors of physical activity (PA) are greater influencers on intention of college students to participate in PA.

Demographic Data

The total distribution of the sample was rather homogenous, predominantly female between the ages of 18-20 and majoring in either science or a health-related field. The majority was also moderately active before college with a BMI within normal limits.

Table 4 provides a more detailed description of the sample.

Table 4

Demographic Distribution of the sample

<table>
<thead>
<tr>
<th>Category</th>
<th>N</th>
<th>% of total participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>University Major</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sciences</td>
<td>29</td>
<td>11.3</td>
</tr>
<tr>
<td>Business &amp; Communication</td>
<td>23</td>
<td>9.0</td>
</tr>
<tr>
<td>Computer, Engineering &amp; Math</td>
<td>8</td>
<td>3.1</td>
</tr>
<tr>
<td>Education</td>
<td>13</td>
<td>5.1</td>
</tr>
<tr>
<td>Health-related fields</td>
<td>102</td>
<td>39.8</td>
</tr>
<tr>
<td>Humanities</td>
<td>6</td>
<td>2.3</td>
</tr>
<tr>
<td>General studies</td>
<td>9</td>
<td>3.5</td>
</tr>
<tr>
<td>Pre-professional</td>
<td>18</td>
<td>7.0</td>
</tr>
<tr>
<td>Recreation &amp; Sports management</td>
<td>6</td>
<td>2.3</td>
</tr>
<tr>
<td>Social sciences</td>
<td>23</td>
<td>9.0</td>
</tr>
<tr>
<td>Undecided/None Listed</td>
<td>14</td>
<td>5.5</td>
</tr>
<tr>
<td>Visual and performing arts</td>
<td>5</td>
<td>2.0</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 - 20</td>
<td>155</td>
<td>60.5</td>
</tr>
<tr>
<td>21 - 24</td>
<td>68</td>
<td>26.6</td>
</tr>
<tr>
<td>25 - 27</td>
<td>9</td>
<td>3.5</td>
</tr>
<tr>
<td>28 - 34</td>
<td>11</td>
<td>4.3</td>
</tr>
<tr>
<td>Over 34</td>
<td>13</td>
<td>5.1</td>
</tr>
</tbody>
</table>
Table 4 (continued)

<table>
<thead>
<tr>
<th>Gender</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>220</td>
<td>85.9</td>
</tr>
<tr>
<td>Male</td>
<td>36</td>
<td>14.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BMI Before College</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>151</td>
<td>59.0</td>
</tr>
<tr>
<td>Obese</td>
<td>46</td>
<td>18.0</td>
</tr>
<tr>
<td>Overweight</td>
<td>42</td>
<td>16.4</td>
</tr>
<tr>
<td>Underweight</td>
<td>12</td>
<td>4.7</td>
</tr>
<tr>
<td>Unknown</td>
<td>5</td>
<td>2.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Physical Activity Level Before College</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>94</td>
<td>36.7</td>
</tr>
<tr>
<td>Moderate</td>
<td>123</td>
<td>48.0</td>
</tr>
<tr>
<td>High</td>
<td>39</td>
<td>15.2</td>
</tr>
</tbody>
</table>

Note: Physical Activity level before college was found by examining the IPAQ data.

Descriptive statistics

Descriptive summaries were used to look for normality in the data. Ranges, means, medians, and variances were all examined to ensure that the responses are within normal limits. All the 5-point Likert-type scale questions were limited to 1-5, with the exception to those that did not respond, those entries were left blank. All entries in university major that were left blank were recorded as “Unknown/None Listed.” No missing values were found in age or gender. BMI could not be calculated for five participants as either height or weight was not provided. These were recorded as “Unknown.”

Data Cleaning.

First, data were checked to ensure that all cases logged on Qualtrics were properly recorded and transferred to the data file. All 300 entireties that started the survey were transferred to an Excel document for further cleaning. Nineteen entries were removed as they were used for tests conducted by the researcher to ensure the survey was operational.
Three were removed because they did not agree to the consent, one was removed as he or she did not meet the minimum age of 18.

**Missing Data.**

During data preparation, missing data were found. Missing data often occurs in many types of research, especially survey research. Missing data in general is not a problem but needs to be evaluated for patterns. For this study, 15% of the overall data were missing. Further examination included missing data by person and by question. By participant, missing data ranged from 2% to 97% (M = 17%, SD = 27%). Approximately 13% of the participants were missing more than 25% of the expected data. Regarding the question analysis, items ranged in missing data from 2% to 15% (M = 10%, SD = 5.5%). The trends illustrated a relatively low level of missing data through in age, gender, height and weight (M = 4%, SD = 2.3%) with an increase missing at the start of the questions about physical active levels (M=7%, SD=5%). In addition, an increase in missing data were found at the start of the questions about a pedestrian friendly campus (M=12%, SD=1%).

Six entries removed, as the participants did not complete anything after the consent question, decreasing the overall missingness to 13%. Since there was also an increase in missing data after the body weight question, those individuals who stopped answering after that point were removed from the sample. The removal of these 14 entries, resulted in an overall pattern of missingness at approximately 6.5%, with individual patterns ranging from 0% to 73% (M = 7%, SD = 10%). A total of 256 completed surveys were used in the remaining analysis.
A modern method for estimation with SEM is full information maximum likelihood (FIML) estimation (Kelloway, 2015). FIML is considered a Maximum Likelihood (ML) method. AMOS handles all missing data in models with a FIML approach and this was used in the analysis. FIML estimates the missing value based on the variables that are present in the model so that all the available data are used (Allison, 2003). One of the disadvantage of FIML is that it is more difficult to incorporate auxiliary variables in a reasonable way (Hoyle, 2012). An auxiliary variable is not part of the model, but is highly correlated with the variables in the proposed model (Graham, 2009). The inclusion of auxiliary variables when looking for missing data helps to reduce estimation bias and restores some of the power lost due to missing data (Graham, 2009; Hoyle, 2012).

Factor Descriptives and Confirmation

To ensure that each factor variable was appropriately used each of the latent variables (accessibility and proximity of the fitness centers, walkability of the campus, campus safety, attitude, perceived norm, self-efficacy, and intention) was verified. To verify each variable, the following steps were used to ensure appropriate distribution and that the hypothesized constructs were appropriately measured.

*Check plots/graphs and correlation.*

To evaluate distribution graphs, both a histogram and frequency polygon were analyzed for each variable. Skewness and kurtosis was evaluated while checking for gaps and bimodal distributions in the data. Gaps can indicate possible errors in the data that need to be investigated (Hoyle, 2012).
Accessibility of fitness centers. Four questions evaluated the availability of a fitness or wellness facility on the campus. All those that responded “No” to the question regarding the existence of a facility were removed from the sample. The information from these 20 individuals, although valuable, resulted in missing information for the corresponding questions. Those additional questions included items to determine the existence of a facility, the fee associated with use, how far the facility was from campus and hours of operation. The table 5 describes the data found for the latter three questions. Data indicated that the negative skewness of the fitness center questions specifies that if the institution had a fitness center it was effective. Twenty (7.8%) reported not having a fitness center on their campus and 150 (58.6%) indicated that the fitness facility was within reasonable walking distance from campus.

Table 5

Data Descriptives for Accessibility of fitness centers

<table>
<thead>
<tr>
<th>Questions</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fee for access to facility</td>
<td>4.17</td>
<td>1.01</td>
<td>-1.03</td>
<td>0.42</td>
</tr>
<tr>
<td>Reasonable walking distance</td>
<td>4.50</td>
<td>0.86</td>
<td>-2.16</td>
<td>4.91</td>
</tr>
<tr>
<td>Hours of facility</td>
<td>4.02</td>
<td>1.09</td>
<td>-1.05</td>
<td>0.32</td>
</tr>
</tbody>
</table>

Pedestrian friendly. To determine if the campus was pedestrian friendly four questions describing the availability and usability of sidewalks and crosswalks on their campus were used. The skewness of this data shows that the majority of the participants found their campus to be safe. The table 6 describes the data found for these questions.
Table 6

*Data Descriptives for Pedestrian friendly*

<table>
<thead>
<tr>
<th>Questions</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Sidewalks</td>
<td>4.22</td>
<td>1.05</td>
<td>-1.37</td>
<td>0.98</td>
</tr>
<tr>
<td>Condition of Sidewalks</td>
<td>3.90</td>
<td>1.05</td>
<td>-0.99</td>
<td>0.32</td>
</tr>
<tr>
<td># of Crosswalks</td>
<td>4.13</td>
<td>1.21</td>
<td>-1.33</td>
<td>0.65</td>
</tr>
<tr>
<td>Condition of Crosswalks</td>
<td>3.53</td>
<td>1.48</td>
<td>-0.63</td>
<td>-1.06</td>
</tr>
</tbody>
</table>

*Campus safety.* The six questions intended to measure campus safety included five questions regarding places on campus students may feel unsafe and one questions about the emergency systems on campus. The skewness of these questions indicates that the majority of the participants felt safe on their campus. The recreation facility was rated as being the safest overall and the residence halls the least safe. Table 7 describes the data found for these questions.

Table 7

*Data Descriptives for Campus Safety*

<table>
<thead>
<tr>
<th>Questions</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Campus Safety</td>
<td>4.38</td>
<td>0.74</td>
<td>-1.40</td>
<td>2.74</td>
</tr>
<tr>
<td>Safety of Rec Facility</td>
<td>4.51</td>
<td>0.79</td>
<td>-1.82</td>
<td>3.68</td>
</tr>
<tr>
<td>Safety of Parking</td>
<td>3.87</td>
<td>0.97</td>
<td>-1.27</td>
<td>1.70</td>
</tr>
<tr>
<td>Safety of Residence Halls</td>
<td>4.42</td>
<td>0.97</td>
<td>-2.44</td>
<td>6.98</td>
</tr>
<tr>
<td>Safety of Classrooms</td>
<td>4.52</td>
<td>0.75</td>
<td>-2.51</td>
<td>9.66</td>
</tr>
<tr>
<td>Emergency Systems</td>
<td>4.14</td>
<td>0.90</td>
<td>-1.08</td>
<td>1.18</td>
</tr>
</tbody>
</table>

*PA incentive programming.* To evaluate the PA incentive programs two questions were used. The majority of participants (92%) reported having incentive programs on their campus, but their effectiveness was mixed. If the participant responded, “Yes” to this question they were prompted to answer a question regarding the effectiveness of that program. Only 10 (3%) reported that these programs were effective at influencing their
PA behaviors, many (30%) reported that these programs only moderately influenced their behavior. Complete data can be found in table 8.

Table 8

*Data Descriptives for PA Programming*

<table>
<thead>
<tr>
<th>Question</th>
<th>Extremely effective</th>
<th>Very effective</th>
<th>Moderately effective</th>
<th>Slightly effective</th>
<th>Not effective at all</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influence of Incentive Programs</td>
<td>10</td>
<td>34</td>
<td>74</td>
<td>50</td>
<td>39</td>
</tr>
</tbody>
</table>

*Requirement of PA courses.* The evaluation score of required PA courses was found using similar steps to the PA incentive programming. If the participant responded, “Yes” to this question they were prompted with a question regarding the effectiveness of that program. Additionally, they were asked, how many hours were required in these courses and if these courses were activity or lecture based. Few respondents (39%) stated that their university required PA courses. Complete data can be found in table 9. Some (34%) of those with required courses stated that 1-3 hours were required, while 23% did not know how many hours were required. The majority stated that these courses were wellness, lecture based courses where no activity was required. The respondents also stated that these courses had very little impact on the PA behaviors, 4.9% (11) stated they were helpful, where 16% (36) found them play a moderate influence on their PA behaviors.

Table 9

*Data Descriptives for PA Required Programming*

<table>
<thead>
<tr>
<th>Questions</th>
<th>A great deal</th>
<th>A lot</th>
<th>A moderate amount</th>
<th>A little</th>
<th>None at all</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influence of Required Programs</td>
<td>11</td>
<td>16</td>
<td>36</td>
<td>20</td>
<td>5</td>
</tr>
</tbody>
</table>


**Intention to Participate in Physical Activity.** Since the variables of the TBP have been measured and validated by several previous studies the descriptive statistics for these variables are listed in one table. The output variables used in predicting the intention to engage in PA include: attitude toward PA, perception of social norm of PA, and perceptions of students’ ability to engage in PA. Descriptives for the questions on attitude, perceived norm, self-efficacy, and attitude are outlined in table 10.

Table 10

*Data Descriptives for TPB variables*

<table>
<thead>
<tr>
<th>Questions</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA to cope with Stress</td>
<td>4.21</td>
<td>0.84</td>
<td>-1.04</td>
<td>0.89</td>
</tr>
<tr>
<td>PA is Fun</td>
<td>3.89</td>
<td>1.03</td>
<td>-0.91</td>
<td>0.30</td>
</tr>
<tr>
<td>PA to make Friends</td>
<td>3.35</td>
<td>1.14</td>
<td>-0.69</td>
<td>0.21</td>
</tr>
<tr>
<td>PA keeps me in Shape</td>
<td>4.64</td>
<td>0.71</td>
<td>-2.71</td>
<td>10.22</td>
</tr>
<tr>
<td>PA makes me Attractive</td>
<td>4.00</td>
<td>0.99</td>
<td>-1.04</td>
<td>1.04</td>
</tr>
<tr>
<td>PA gives Energy</td>
<td>4.33</td>
<td>0.80</td>
<td>-1.25</td>
<td>1.66</td>
</tr>
<tr>
<td>PA makes me better at Sports</td>
<td>4.19</td>
<td>0.90</td>
<td>-1.43</td>
<td>2.93</td>
</tr>
<tr>
<td>Classmates think I should be PA</td>
<td>3.31</td>
<td>0.95</td>
<td>-0.02</td>
<td>-0.09</td>
</tr>
<tr>
<td>Friends think I should be PA</td>
<td>3.42</td>
<td>1.02</td>
<td>-0.32</td>
<td>-0.03</td>
</tr>
<tr>
<td>Parents think I should be PA</td>
<td>3.76</td>
<td>1.05</td>
<td>-0.43</td>
<td>-0.52</td>
</tr>
<tr>
<td>Siblings think I should be PA</td>
<td>3.55</td>
<td>1.07</td>
<td>-0.14</td>
<td>-0.66</td>
</tr>
<tr>
<td>Spouse thinks I should be PA</td>
<td>3.53</td>
<td>1.11</td>
<td>-0.27</td>
<td>-0.56</td>
</tr>
<tr>
<td>Perception of PA</td>
<td>3.01</td>
<td>1.17</td>
<td>0.03</td>
<td>-1.20</td>
</tr>
<tr>
<td>Control over PA</td>
<td>3.75</td>
<td>1.11</td>
<td>-0.76</td>
<td>-0.28</td>
</tr>
<tr>
<td>Spouse thinks I should be PA (2)</td>
<td>3.37</td>
<td>0.98</td>
<td>-0.23</td>
<td>0.73</td>
</tr>
<tr>
<td>I have all I need to be PA</td>
<td>3.83</td>
<td>1.15</td>
<td>-0.95</td>
<td>0.22</td>
</tr>
<tr>
<td>If I want I can be PA</td>
<td>3.98</td>
<td>1.08</td>
<td>-1.07</td>
<td>0.70</td>
</tr>
<tr>
<td>I can be PA</td>
<td>3.74</td>
<td>1.15</td>
<td>-0.90</td>
<td>0.10</td>
</tr>
<tr>
<td>I can ask friend to be PA</td>
<td>3.85</td>
<td>1.05</td>
<td>-0.82</td>
<td>0.11</td>
</tr>
<tr>
<td>PA or Videogames/TV</td>
<td>3.68</td>
<td>1.14</td>
<td>-0.90</td>
<td>0.19</td>
</tr>
<tr>
<td>PA even in bad weather</td>
<td>3.65</td>
<td>1.21</td>
<td>-0.76</td>
<td>-0.49</td>
</tr>
<tr>
<td>Spouse will be PA with me</td>
<td>3.84</td>
<td>1.25</td>
<td>-1.09</td>
<td>0.84</td>
</tr>
<tr>
<td>PA even when busy</td>
<td>2.82</td>
<td>1.28</td>
<td>0.00</td>
<td>-1.29</td>
</tr>
<tr>
<td>Intend to be PA</td>
<td>3.86</td>
<td>1.15</td>
<td>-0.92</td>
<td>0.13</td>
</tr>
<tr>
<td>Will try to be PA</td>
<td>4.09</td>
<td>1.02</td>
<td>-1.21</td>
<td>1.13</td>
</tr>
<tr>
<td>I might be PA</td>
<td>3.90</td>
<td>1.12</td>
<td>-0.98</td>
<td>0.49</td>
</tr>
</tbody>
</table>

69
These descriptives show that, in general, college students feel like they have control over their PA behaviors. The attitude question, “If I were to be physically active during my free time on most days it would help get or keep me in shape”, generated the most positive results. Well over half, 162 (72%), strongly agreed with this statement indicating that they believe that exercise will keep them/get them in physical shape. Another interesting finding is that only 7% (18) said they strongly agreed with this statement, “I can be physically active during my free time on most days no matter how busy my day is.”

**Confirmatory factor analysis.**

A confirmatory factor analysis (CFA) was conducted using SPSS AMOS software for each latent variable to test the relationships between the measurement model and the hypothesized constructs (indicator variables and latent factors). Global model fit was determined through chi-square statistics ($\chi^2$), root mean square error of approximation (RMSEA), comparative fit index (CFI), and the Tucker-Lewis Index (TLI). To ensure that each factor variable was appropriately considered, each of the latent variables (accessibility and proximity of the fitness centers, walkability of the campus, campus safety, attitude, perceived norm, self-efficacy, and intention) was verified. To verify each variable, the following steps were taken to ensure that the hypothesized constructs were appropriately measured

**Degrees of freedom and chi-square.** First, total degrees of freedom were identified. This is determined by the number of observed variables and represents the number of estimated paths. Underidentified model has model $df<0$ meaning there is not enough information to uniquely determine parameters. Just-identified model has model
df=0, the model will have perfect fit. Overidentified model has model df>0, this type of model will have too many unknowns. Chi-square ($\chi^2$) is a goodness-of-fit statistic; higher values indicate worse fit or more error. When the $\chi^2$ statistic is statistically significant ($p < .05$), because the $\chi^2$ test is sensitive to sample size, it is necessary to also use additional fit statistics to assess the overall fit a model to the data.

*Other descriptive fit statistics.* The second step in model fit analysis is to examine the fit indices. There is good model fit if RMSEA is less than or equal to .05. There is adequate fit if RMSEA is less than or equal to .08. RMSEA tends to improve as more variables are added. CFI is independent of sample size. Close to one indicates a very good fit, > 0.9 or close to 0.95 indicates good fit, by convention, CFI should be equal to or greater than .90 to accept the model. Finally, TLI provides a slight adjustment for parsimony. TLI greater than or equal to 0.9 indicates acceptable model fit and TLI >.95 is good fit. TLI tends to decline as more variables are added.

*Respecification.* Based upon the findings of the model fitness, modification may need to be made to the model. Model modification involves adding or taking away parameters to fit the data (Hoyle, 2012; Kelloway, 2015). During the CFA portion of the analysis, standardized residual covariances (SRCs) should be reviewed. SRCs are much like modification indices, as they point out where the discrepancies are between the proposed and estimated models, but they also point out where items my need to be removed. SRC’s are much like Z-scores and represent estimates of the number of standard deviations the observed residuals are from the zero residuals that would exist if model fit were perfect. A SRC value greater than +/-2.58 are considered to be large and may significantly decrease the fitness of a model (Byrne, 2000).
**CFA each of the latent variables.**

A CFA model for each latent variable was completed to test each variable for appropriate factor loadings.

*Accessibility.* This model for the Accessibility of fitness centers (as depicted in figure 5) identified 0 total degrees of freedom indicating a perfect fit, both \( \chi^2 = 0.00 \) and CFI= 1.00 confirm. However, for this model RMSEA and TLI were not calculated by AMOS. Factor loadings were examined to ensure appropriate levels and loadings. Significant factor loadings were found for each variable (FEE#, \( \lambda = 0.67, p < .001 \), Distance, \( \lambda = 0.69, p < .001 \), HOURSFITT#, \( \lambda = 0.55, p < .001 \), for accessibility of fitness centers has been confirmed for use in the later model.

![Diagram of accessibility model](image)

**Figure 5. CFA for Accessibility of fitness centers**

*Pedestrian friendly campus.* The path diagram describing a pedestrian friendly campus variable (as depicted in figure 6) identified a poorly fitting model (\( \chi^2 (2) = 22.72, p < .001 \), CFI = .91, TLI = .59, RMSEA=.202, (90% CI [.133,.281]). Significant factor loadings were found for each variable (Sidewalks, \( \lambda = 0.61, p < .001 \), Condition of SW, \( \lambda = 0.65, p < .001 \), Crosswalks, \( \lambda = 0.70, p < .001 \), Condition of CW, \( \lambda = 0.55, p < .001 \)). A covariance between eCW and eCS was added to increase model fit. By adding the covariance, the degrees of freedom decreased to 1 and the \( \chi^2 \) statistics to 1.26 (\( p > .05 \)).
0.5). All fit indices suggest a good fit (CFI = 1.00, TLI = .99, RMSEA=.39, (90% CI [.000, .177]). All indicators show that by adding the covariance this model becomes a much better fit and is warranted as this is discussing the same items. Factor loadings remained significant with little change, (Sidewalks, λ=.68, p < .001, Condition of SW, λ=.75, p < .001, Crosswalks, λ=.56, p < .001, Condition of CW, λ=.40, p < .001).

Figure 6 depicts the latent variable for pedestrian friendly and has been confirmed for use in the later model.

![Figure 6. CFA for Pedestrian Friendly Campus](image)

**Campus Safety.** The path diagram describing a campus safety (as depicted in figure 7) indicates a well-fitting model ($\chi^2 (9) =20.39, p > .05$, CFI = .97, TLI = .95, RMSEA=.071, 90% CI= [.029,.112]. Significant factor loadings were noted among all the variables (overall campus safety, λ=.80, p < .001, safety of the recreation facility, λ = .72, p < .00, usefulness of the emergency management system, λ = .57, p < .001, safety of parking, λ = .57, p < .001, safety of residence halls λ = .77, p < .001, safety of classrooms λ = .69, p < .001).

In order to decrease the degrees of freedom, reduce the number of individual items, and improve model fit, item parceling will be used. Item parcels are typically created by taking the sum or mean of a set of items within a factor. For this item the
following parcels were created by using the mean of each of these variables; safety parcel 1, overall campus safety, $\lambda = .80, p < .001$, safety of the recreation facility, $\lambda = .72, p < .001$; safety parcel 2, safety of residence halls $\lambda = .77, p < .001$ and safety of classrooms $\lambda = .69, p < .001$; safety parcel 3, usefulness of the emergency management system, $\lambda = .57, p < .001$ and safety of parking, $\lambda = .57, p < .001$.

Figure 7. Original Path Diagram for Campus Safety

This now perfectly fitting model ($\chi^2 (0) = .000$, CFI = 1.00) continues to depict significant factor loadings (safety parcel 1, $\lambda = .67, p < .001$, safety parcel 2, $\lambda = .66, p < .001$, safety parcel, $\lambda = .86, p < .001$). The model in figure 8 shows the adjustments that will be added to the final model.

Figure 8. Revised Path Diagram for Campus Safety
Attitude. The path diagram describing attitude (as depicted in figure 9) recognized an over-identified model with very poor fit ($\chi^2 (14) = 70.75 (p < .001, \text{CFI= 89, TLI= .78, RMSEA= .127}$, $(90\% \text{ CI= [.098, .157]}$. Factor loadings are high and significant for each variable: StressATT, $\lambda = .99, p < .001$, FunATT, $\lambda = .98, p < .001$, SportsATT, $\lambda = .97, p < .001$, EnergyATT, $\lambda = .99, p < .001$, AttractiveATT, $\lambda = .94, p < .001$, ShapeATT, $\lambda = .98, p < .001$, FriendsATT, $\lambda = .95, p < .001$. For this factor the following parcels were created by using the mean of each of these variables; attitude parcel 1, EnergyATT, $\lambda = .99$ FunATT, $\lambda = .98, p < .001$, AttractiveATT, $\lambda = .94, p < .001$; attitude parcel 2, StressATT, $\lambda = .99, p < .001$, SportsATT, $\lambda = .97, p < .001$; attitude parcel 3, ShapeATT, $\lambda = .98, p < .001$, FriendsATT, $\lambda = .95, p < .001$.

Figure 9. Original Path Diagram describing Attitude

This now perfectly fitting model ($\chi^2 (0) = .000, \text{CFI = 1.00}$) continues to depict significant factor loadings (attitude parcel 1, $\lambda = .82, p < .001$, attitude parcel 2, $\lambda = .82, p < .001$, attitude parcel, $\lambda = .60, p < .001$). The model in figure 10 shows the adjustments that will be added to the final model.
Figure 10. Revised Path Diagram for Attitude

Subjective norm. The path diagram describing subjective norm (as depicted in figure 11) recognized a slightly over identified model ($\chi^2 (5) = 82.88, p < .001$) with poor model fit (CFI=.82, TLI=.46, RMSEA=.264, (90% CI= [.215, .315])). Factor loadings were examined to ensure appropriate levels and loadings. Significant factor loadings were found on all the variables (SpouseSN, $\lambda = .65$, $p < .001$, SiblingsSN, $\lambda = .65$, $p < .001$, ParentsSN, $\lambda = .75$, $p < .001$, FriendsSN, $\lambda = .86$, $p < .001$, ClassmatesSN, $\lambda = .78$, $p < .001$).

Figure 11. Original Path Diagram describing Subjective Norm

After further review of the data, 61 (27%) of the participants responded “Does Not Apply” to the question, “My spouse/significant other thinks I should be physically active during my free time on most days” and 26 (12%) responded “Does Not Apply” to the question “My siblings think I should be physically active during my free time on most
days” these questions were removed from the factor. An attempt was made to parcel these items but with only 5 variables the model would not run.

By removing these variables, model fit improved significantly. This now perfectly fitting model ($\chi^2 (0) = .000$, CFI = 1.00) continues to depict significant factor loadings ParentsSN, $\lambda = .46$, $p < .001$, FriendsSN, $\lambda = .90$, $p < .001$, ClassmatesSN, $\lambda = .82$, $p < .001$). The model in figure 12 shows the adjustments that will be added to the final model.

![Revised Path Diagram for Subjective Norm](image)

Figure 12. Revised Path Diagram for Subjective Norm

*Perceived Control.* A significant chi-square ($\chi^2 (2) = 4.09$, $p > 0.05$) suggested that the proposed model was consistent with the observed data as depicted in figure 13 for perceived control. Fit indices indicate a good fit (CFI = .99, TLI = .97, RMSEA = .069, 90% CI [.000, .156]). Next factor loadings were examined (NeedsPC, $\lambda = .59$, $p < .001$, SpousePC, $\lambda = .20$, $p < .001$, ControlPC, $\lambda = .82$, $p < .001$, PerceptionsPC, $\lambda = .74$, $p < .001$), revealing low loadings on SpousePC.
Upon further review of the spouse questions it was discovered that the “Does Not Apply” option was not provided for the spouse question under perceived control (SpousePC) and it was identical to the previous spouse question in subjective norm. The low loadings and the accidental duplication may have caused confusion among the participants and may have skewed the results. The question SpousePC was removed from the model. This action greatly improved model fit ($\chi^2 (0) = .000$, CFI= 1.00). Factors loadings continue to remain high and significant (NeedsPC, $\lambda = .58$, $p < .001$, ControlPC, $\lambda = .84$, $p < .001$, PerceptionsPC, $\lambda = .73$, $p < .001$), figure 14 displays the model for perceived control.

**Figure 13. Initial Path Diagram for Perceived Control**

**Figure 14. Revised Path Diagram for Perceived Control**
**Self-efficacy.** The path diagram describing self-efficacy (as depicted in figure 15) reports a significant chi-square \( \chi^2 (14) = 112.88 \ p < .001 \), with less than desirable fit indices (CFI = .74, TLI = .48, RMSEA = .178, 90% CI [.149, .210]). Significant but low factor loadings were found in the variable SpouseSE \( \lambda = .39, p < .01 \), other factor loadings were significant \( p < .001 \) and ranged from 0.43 to 0.81.

![Diagram of self-efficacy](image)

**Figure 15. Original Path Diagram describing Self-Efficacy**

For this factor the following parcels were created by using the mean of each of these variables; self_e parcel 1, CanSE, \( \lambda = .81, p < .001 \), TempSE, \( \lambda = .45, p < .001 \), SpouseSE, \( \lambda = .40, p < .001 \); self_e parcel 2, WantSE \( \lambda = .76, p < .001 \), FriendsSE, \( \lambda = .44, p < .001 \); self_e parcel 3, BusySE, \( \lambda = .58, p < .001 \), TVSE \( \lambda = .44, p < .001 \). The addition of the parcelled data revealed a now perfectly fitted model \( \chi^2 (0) = .000, \) CFI = 1.00) continues to depict significant factor loadings (self_e parcel 1, \( \lambda = .89, p < .001 \), self_e parcel 2, \( \lambda = .82, p < .001 \), self_e parcel 3, \( \lambda = .76, p < .001 \)). The model in figure 16 shows the adjustments that will be added to the final model.
Figure 16. Revised Path Diagram for Self-Efficacy

*Intention*. The final path analysis was intention (as depicted in figure 17). The significance could not be calculated but the $X^2 (0) = 0.00$ indicating a perfect fit. To confirm, fit indices CFI also indicated a good fit (CFI = 1.00). Neither TFI or RMSEA could be calculated. Significant factor loadings include: Intent, $\lambda = .92, p < .001$, Try, $\lambda = .92, p < .001$, Might, $\lambda = .90, p < .001$). The latent variable for intention has been confirmed for use in the later model.

Figure 17. Final Path Diagram for Intention

*Complete Model for this study*

The proposed completed model for this study was used to describe how components of the educational environment influences intention of college students to participate in PA. In order to run the analysis AMOS suggested covariances between; campus safety and accessibility, pedestrian friendly campus and accessibility, and pedestrian friendly campus and campus safety. This model is depicted in figure 18.
The significant chi-square (\(X^2(374) = 911.67, p < .001\)) and baseline fit indices (CFI = 0.82, TLI =0.79, RMSEA = 0.80, 90% CI [.074, .087]) for this updated model suggested that the proposed model is not a perfect fit. All path correlations were examined to ensure appropriate levels and loadings. Several paths were non-significant, see table 11 for complete details on these relationships.

Figure 18. Original complete model
Table 11

*Unstandardized, Standardized, and Significance Levels for Original Model*

<table>
<thead>
<tr>
<th>Parameter Estimate</th>
<th>β</th>
<th>B</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitude ← Gender</td>
<td>-0.03</td>
<td>-0.05</td>
<td>0.63</td>
</tr>
<tr>
<td>Perceived Control ← Gender</td>
<td>-0.02</td>
<td>-0.04</td>
<td>0.83</td>
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<td>Subjective Norm ← Gender</td>
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<td>-0.15</td>
<td>0.40</td>
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<tr>
<td>Self-Efficacy ← Gender</td>
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<td>-0.04</td>
<td>0.53</td>
</tr>
<tr>
<td>Attitude ← BMI</td>
<td>-0.06</td>
<td>-0.04</td>
<td>0.40</td>
</tr>
<tr>
<td>Perceived Control ← BMI</td>
<td>-0.17</td>
<td>-0.17</td>
<td>0.02*</td>
</tr>
<tr>
<td>Subjective Norm ← BMI</td>
<td>0.02</td>
<td>0.02</td>
<td>0.78</td>
</tr>
<tr>
<td>Self-Efficacy ← BMI</td>
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<td>-0.03</td>
<td>0.26</td>
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<tr>
<td>Attitude ← PA level</td>
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<td>0.00</td>
<td>0.94</td>
</tr>
<tr>
<td>Perceived Control ← PA level</td>
<td>0.17</td>
<td>0.21</td>
<td>0.02*</td>
</tr>
<tr>
<td>Subjective Norm ← PA level</td>
<td>-0.03</td>
<td>-0.04</td>
<td>0.68</td>
</tr>
<tr>
<td>Self-Efficacy ← PA level</td>
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<td>0.05</td>
<td>0.15</td>
</tr>
<tr>
<td>Attitude ← PA Incentive</td>
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<td>-0.20</td>
<td>0.16</td>
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<tr>
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<td>-0.47</td>
<td>0.04*</td>
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<tr>
<td>Subjective Norm ← PA Incentive</td>
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<td>0.01</td>
<td>0.98</td>
</tr>
<tr>
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<td>-0.07</td>
<td>0.42</td>
</tr>
<tr>
<td>Attitude ← PA Required</td>
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<td>0.07</td>
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</tr>
<tr>
<td>Perceived Control ← PA Required</td>
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<td>0.19</td>
<td>0.11</td>
</tr>
<tr>
<td>Subjective Norm ← PA Required</td>
<td>-0.07</td>
<td>-0.13</td>
<td>0.31</td>
</tr>
<tr>
<td>Self-Efficacy ← PA Required</td>
<td>-0.01</td>
<td>-0.01</td>
<td>0.90</td>
</tr>
<tr>
<td>Attitude ← Pedestrian Friendly</td>
<td>0.81</td>
<td>0.43</td>
<td>.001***</td>
</tr>
<tr>
<td>Perceived Control ← Pedestrian Friendly</td>
<td>0.61</td>
<td>0.50</td>
<td>.001***</td>
</tr>
<tr>
<td>Subjective Norm ← Pedestrian Friendly</td>
<td>0.69</td>
<td>0.59</td>
<td>.001***</td>
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<td>Self-Efficacy ← Pedestrian Friendly</td>
<td>0.74</td>
<td>0.39</td>
<td>.001***</td>
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<tr>
<td>Attitude ← Accessibility</td>
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<td>-0.02</td>
<td>0.62</td>
</tr>
<tr>
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<td>0.11</td>
<td>0.09</td>
<td>0.18</td>
</tr>
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<td>Subjective Norm ← Accessibility</td>
<td>-0.08</td>
<td>-0.07</td>
<td>0.34</td>
</tr>
<tr>
<td>Self-Efficacy ← Accessibility</td>
<td>0.04</td>
<td>0.02</td>
<td>0.43</td>
</tr>
<tr>
<td>Attitude ← Campus Safety</td>
<td>0.17</td>
<td>0.09</td>
<td>0.04*</td>
</tr>
<tr>
<td>Perceived Control ← Campus Safety</td>
<td>0.17</td>
<td>0.14</td>
<td>0.03*</td>
</tr>
<tr>
<td>Subjective Norm ← Campus Safety</td>
<td>0.11</td>
<td>0.10</td>
<td>0.15</td>
</tr>
<tr>
<td>Self-Efficacy ← Campus Safety</td>
<td>0.49</td>
<td>0.26</td>
<td>.001***</td>
</tr>
<tr>
<td>Intention ← Perceived Control</td>
<td>0.08</td>
<td>0.09</td>
<td>0.20</td>
</tr>
<tr>
<td>Intention ← Attitude</td>
<td>-0.26</td>
<td>-0.30</td>
<td>.001***</td>
</tr>
<tr>
<td>Intention ← Subjective Norm</td>
<td>0.84</td>
<td>1.59</td>
<td>.001***</td>
</tr>
<tr>
<td>Intention ← Self-Efficacy</td>
<td>-0.01</td>
<td>-0.02</td>
<td>0.91</td>
</tr>
</tbody>
</table>

*** p < 0.001 ** p < 0.01 * p < 0.05
First the paths that were not statistically significant were removed. The entire variable for gender ($X^2 (349) = 870.60, p < .001, \text{CFI} = .83, \text{TLI} = .80, \text{RMSEA} = .082, 90\% \text{ CI} [.075, .089]$), required PA courses ($X^2 (325) = 855.88, p < .001, \text{CFI} = .82, \text{TLI} = .79, \text{RMSEA} = .086, 90\% \text{ CI} [.079, .093]$), and accessibility ($X^2 (254) = 713.80, p < .001, \text{CFI} = .84, \text{TLI} = .80, \text{RMSEA} = .090, 90\% \text{ CI} [.083, .098]$) were removed as none of the paths were significant. Other paths that were not statistically significant were also removed and the changes in model fit are outlined in table 12.

Table 12

<table>
<thead>
<tr>
<th>Path removed</th>
<th>Change in fit as paths were removed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitude $\leftarrow$ PA level</td>
<td>$df$  255  $X^2$  713.35  CFI  .83  TLI  .80  RMSEA  .090  90% CI  [.083-.098]</td>
</tr>
<tr>
<td>Subjective Norm $\leftarrow$ PA Incentive</td>
<td>$df$  256  $X^2$  700.66  CFI  .84  TLI  .82  RMSEA  .088  90% CI  [.081-.096]</td>
</tr>
<tr>
<td>Subjective Norm $\leftarrow$ BMI</td>
<td>$df$  257  $X^2$  701.12  CFI  .84  TLI  .82  RMSEA  .088  90% CI  [.080-.096]</td>
</tr>
<tr>
<td>Subjective Norm $\leftarrow$ PA level</td>
<td>$df$  258  $X^2$  701.34  CFI  .84  TLI  .82  RMSEA  .088  90% CI  [.080-.096]</td>
</tr>
<tr>
<td>Self-Efficacy $\leftarrow$ PA Incentive</td>
<td>$df$  259  $X^2$  714.62  CFI  .84  TLI  .81  RMSEA  .089  90% CI  [.080-.096]</td>
</tr>
<tr>
<td>Attitude $\leftarrow$ BMI</td>
<td>$df$  260  $X^2$  702.67  CFI  .84  TLI  .82  RMSEA  .088  90% CI  [.080-.096]</td>
</tr>
<tr>
<td>Self-Efficacy $\leftarrow$ BMI</td>
<td>$df$  261  $X^2$  703.81  CFI  .84  TLI  .82  RMSEA  .087  90% CI  [.080-.095]</td>
</tr>
<tr>
<td>Subjective Norm $\leftarrow$ Pedestrian Friendly</td>
<td>$df$  262  $X^2$  704.21  CFI  .84  TLI  .82  RMSEA  .087  90% CI  [.080-.095]</td>
</tr>
<tr>
<td>Attitude $\leftarrow$ PA Incentive</td>
<td>$df$  263  $X^2$  706.60  CFI  .84  TLI  .82  RMSEA  .087  90% CI  [.080-.095]</td>
</tr>
</tbody>
</table>

Modification indices suggested the addition of several covariances to increase model fit. The one offering the greatest change in fit was the addition of a covariance between the errors of two variables of campus safety (eCR and eOA) this will decrease $X^2$ by 36.122 ($X^2 (262) = 643.14, p < .001, \text{RMSEA} = .081, 90\% \text{ CI} [.072, .089], \text{CFI} = .87, \text{TLI} = .85$). The next covariance suggested by modification indices is the addition between two errors of variables of self-efficacy (eSE1 to eSE7) this should decrease $X^2$ by 26.122 ($X^2 (261) = 565.514, p < .001, \text{RMSEA} = .072, 90\% \text{ CI} [.064, .081], \text{CFI} = .87, \text{TLI} = .85$). The next covariance suggested by modification indices is the addition between two errors of variables of self-efficacy (eSE1 to eSE7) this should decrease $X^2$ by 26.122 ($X^2 (261) = 565.514, p < .001, \text{RMSEA} = .072, 90\% \text{ CI} [.064, .081], \text{CFI} = .87, \text{TLI} = .85$).
The next is the addition between two errors of campus safety (eOA to ePK) this should decrease $X^2$ by 16.122 ($X^2 (260) = 563.529, p < .001, \text{RMSEA} = .069, 90\% \text{CI} [.061, .077], \text{CFI} = .90, \text{TLI} = .88$). The final suggested addition is the addition of a covariance between eCS and eCW. This should decrease $X^2$ by 10.122. All additions were warranted as these variables are on the same factor.

The updated model (figure 19) shows increased model fitness ($X^2 (260) = 516.56, p < .001, \text{RMSEA} = .067, 90\% \text{CI} [.058, .075], \text{CFI} = .91, \text{TLI} = .90$). Final standardized regression weights are represented in table 13. Noteworthy features of this updated model include the removal of paths that were not statically significant of many of the input factors (BMI, PA level and gender). All PA programming both required and incentive program were non-significant except for the path from PA incentive programs to perceived control. Remarkably, the relationship with the intention to participate in PA and the accessibility of a wellness or fitness facility was not significant. The significant factors reveal a strong relationship between campus safety and all the predictors of intention, additionally a pedestrian friendly campus had many significant but low relationships with the factors of intention.

Table 13

*Unstandardized, Standardized, and Significance Levels after path removal*

<table>
<thead>
<tr>
<th>Parameter Estimate</th>
<th>Estimate (B)</th>
<th>Standardized Estimate ($\beta$)</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Control $\leftarrow$ BMI</td>
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<td>-0.11</td>
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*** p < 0.001 ** p < .01 * p < .05

Figure 19. Final model

Summary

The final analysis provides information to university administrators and health program supervisors on how the higher education institution can change some components of the educational environment to positively influence students to increase PA levels. By analyzing both statically significant and non-significant paths this investigation revealed that campus safety was the only influencer of all four known predictors of intention, attitude, perceived control, subjective norm, and self-efficacy.
toward PA while the accessibility of a wellness or fitness facility had no statically significant relationship with the intention to participate in PA. Further investigation is warranted in the influence of these variables.
CHAPTER V – SUMMARY

Higher Education (HE) has the opportunity and responsibility to help students establish habitual participation in physical activity (PA) (Keating et al., 2005), but changing the PA behaviors of college students is a battle that cannot be easily won (Young et al., 2015). However, if HE could focus efforts towards strategies that have the greatest impact in improving intention to participate there is a greater likelihood for success (Keating et al., 2005; Young et al., 2015). Over the last decade HE has made improvements in increasing health education programming on college campuses, but there is little research in the area to assess which type of programming has the greatest impact on PA patterns (Ickes et al., 2016).

The purpose of this study was to investigate which components or programs within the higher education environment have the greatest influence on college students’ intention to engage in PA. This chapter will interoperate the findings of the survey used in this study, assess the limitations of the study, and make recommendations for future research.

Interpretation of Findings

The objectives of this study were to answer the following research questions:

1. Which programs or facilities within the educational environment are greater influencers of the value or attitude towards PA in college students?

2. Which programs or facilities within the educational environment are greater influencers of perceived control of PA behaviors in college students?
3. Which programs or facilities within the educational environment are greater influencers of intention to participate in PA behaviors in college students?

The use of structural equation modeling (SEM) allowed for the opportunity to assess the relationships among multiple variables and see what, if any, relationship exists (Hoyle, 2012). The model revealed that campus safety was the only influencer of all four known predictors of intention: attitude, perceived control, subjective norm, and self-efficacy toward PA. Some of the other known predictors of PA, such as required PA courses and the availability and location of a fitness center did not have any bearing on PA intention predictors in this sample.

The greatest influencer of attitude toward PA for this sample was a pedestrian friendly campus. This finding is consistent with previous studies (Brownsons et al., 2005; Keating et al., 2005; Peachey & Baller, 2015; Robinson et al., 2014). Brownsons et al. (2005) referenced a review that found that adults are more likely to walk and/or cycle more regularly when their neighborhoods are easier to navigate and have better connectivity to other places. Robinson et al. (2014) would agree, they suggested that by providing access to sidewalks and shoulders could potentially provide an avenue for increased physical activity in the community. Peachey and Baller (2015) found students living on-campus had greater physical activity than those who lived off-campus providing support for the finding that living on-campus provided a supportive physical environment for active transportation and leisure. Many campuses have become more pedestrian friendly to reduce vehicular traffic and improve the beauty, efficiency, and sustainability of their campus (Leslie, Fotheringham, Veitch, & Owen, 2000), but if there
could be an ever greater push to increase PA behaviors and improve the health of the students this could have great appeal to administrators.

Attitude is not the only influencer of intention. Perceived control’s and self-efficacy’s greatest influencer of PA in this sample was a safe campus. Additionally, a safe campus was the only statically significant predictor for subjective norm and the only variable that was statically significant for all the predictors of intention. This influencer of PA is directly related to a pedestrian friendly campus. Sherwood and Jeffery (2000) also noted comparable results in their review stating that there was an association between sedentary behavior and neighborhood safety. Robinson et al. (2014) suggest that safety features such as street lighting and aesthetics of the environment were the greatest influencers of campus safety. HE administrators have a responsibility to their students to maintain a safe campus by offering increased PA as a rational of this need there may now be more opportunity to focus efforts towards this issue.

By increasing efforts towards those that offer greater influence, HE may want to decrease funding and efforts towards those initiatives that offer little or no value towards increasing PA behaviors. Assessing both statically significant and non-significant predictors can be helpful in this study as those paths that were not statically significant suggest that they may not be offering a lot of value to the PA behavior of college students. These need further examination by HE to asses if valuable resources should be placed within those programs. Gender presented no statically significant relationship with this sample, however Çağlar & Aşığı (2006) found that males consistently scored higher than females on self-perception scales and that male students were more physically active and had more positive perceptions of physical conditioning than their
female peers. This study contrary findings suggest that further studies are warranted within the specific university before creating gender specific programming around PA behaviors.

Additionally, required PA courses were not statistically significant in this sample. This may have a relationship to the findings that Keating et al. (2005) suggested. They found that college students reported that they tend to get involved in PA that they already feel competent performing and find fun. If students are being forced to participate, they may not find any value in the activity and may not think that it will be fun. Therefore, they may choose not to actively participate in these activities.

The final finding, the lack of a statistically significant relationship to accessibility of the fitness center, was a surprise as many marketing professionals have suggested that the availability and accessibility of a recreational or fitness facilities is paramount in student recruitment. Reed (2007) suggested that many undergraduate students were unaware of the recreational facilities on their campus. If the students in this sample were unaware of the facilities this could have contributed to these results.

Limitations and Recommendations for Future Studies

There are a several limitations of the current study and future studies may address some of these limitations both in methodological construction and theoretical conceptualization. Even though the survey was distributed through list serves and through multiple courses, the sample was primarily female, majoring in a science, and participated in PA prior to college. Since the title of the study was sent alongside of the survey there could have been a stigma associated with the questions and those that did not participate in PA may have not found the motivation to begin. There was also a large
dropout rate after the questions of height and weight and after the PA questions. Reorganizing the questions and adjusting the title could have led to greater variety in respondents. There was substantial effort made to distribute the survey to many institutions throughout the south-central US but only survey responses were obtained from four campuses and most of responses (54%) were from the researchers’ home institution (University of Southern Mississippi). Future studies are encouraged to use a greater variety of institutions. More information is necessary to ascertain any plausible relationship between PA behaviors and how the education institution influences students’ behavior. Since only students from four institutions responded, generalizability of the study to other universities could be greatly improved. Also, only those institutions in the south-central US were solicited. Samples of participants from a more diverse geographical region should be sought after in future studies.

This study used self-report measures, though students were assured of their anonymity, PA level, weight, and usefulness of the programming may have been skewed. The IPAQ, for example, required participants to recall activities that they participated in before college. This type of self-report may include errors in data recall. Future studies may want to find a way to incorporate current PA levels and measuring PA using a measuring device such as a pedometer to eliminate self-report errors. Deficiencies in recall or attempting to answer in a more socially desirable way could be eliminated or least limited.

This study assumed that all respondents were physically able to complete PA and did not assess physical disability. For future studies, physical ability should also be assessed. By understanding both the able and disabled populations this body of research
could provide a better understanding of how college campuses are providing opportunities to all populations to participate in PA.

Finally, this survey consisted of 48 questions. Even though no reward was provided for completing the survey many students may have suffered from fatigue by the end of the survey and just wanted to finish what they started. Future studies are encouraged to focus on intention and behavior to reduce the need to include all the variables of TPB. This will reduce the number of questions and continue to assess the PA behaviors of college students.

Summary

This study could be beneficial to institutions striving to improve participation in PA behaviors. Overall the study has revealed some interesting findings. Consistent with previous research, many of the variables shown to be related to PA behaviors (campus safety, pedestrian friendly campus, BMI, PA level and PA inventive programs) were once again shown to be linked to PA intention in this study. However, by including all these variables at once the program or characteristic with the greatest connection in PA intention was identified.

Physical educators have devoted considerable attention to the question of how to influence college students PA behaviors, but with the shrinking budgets of HE, HE administrators now need to find ways to focus their funds and efforts. The impact of programs and facilities within the educational environment has been the focus of research by many scholars of higher education and student development, but none have looked at all these efforts collectively. This study has bridged a gap in those efforts and contributed to both bodies of literature, physical education and higher education, by
examining the influence of the college environment programing and facilities on the intention of college students to participate in these behaviors.
APPENDIX A - QUESTIONNAIRE

Instructions: Please complete the following questions as accurately as possible. The survey will only be used for research purposes but note that you may skip any question and withdraw at any time without consequence.

1. How old are you? _______ years
2. How tall? Height _____ ft _______ inches
3. How much did you weigh before college? Weight ________ lbs
4. How much do you weigh now? Weight ________ lbs
5. Which gender do you identify?
6. University major: ___________________
7. Are you a current student at a college or university? Yes/No
   a. Which institution do you attend: _____________________________

The following items measure the extent of the physical activities you participated in prior to college. The questions will ask you about the time you spent being physically active in high school or any time prior to entering college. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you did at work, as part of your house and yard work, to get from place to place, in your spare time for recreation, or as exercise or sport.

1. Prior to entering college, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling? Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time, for the time prior to entering college.
2. How much time did you usually spend doing vigorous physical activities on one of those days? _____ hours per day _____ minutes per day

3. Prior to entering college, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

4. How much time did you usually spend doing moderate physical activities on one of those days? _____ hours per day _____ minutes per day

5. Think about the time you spent walking prior to entering college. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure. Prior to entering college, on how many days did you walk for at least 10 minutes at a time? _____ days per week

6. How much time did you usually spend walking on one of those days? _____ hours per day _____ minutes per day

7. The last question is about the time you spent sitting on weekdays prior to entering college. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television. Prior to entering college, how much time did you spend sitting on a week day? _____ hours per day _____ minutes per day
Please answer the following questions based up on collegiate experiences.

1. Does your college or university have a fitness or wellness facility?

2. The fee associated with the use of the facility was reasonable.
   
   strongly disagree: 1 : 2 : 3 :_ 4 : 5 strongly agree

3. The fitness facility was easy to access /within reasonable walking distance in or near campus?
   
   strongly disagree: 1 : 2 : 3 :_ 4 : 5 strongly agree

4. The hours of operation of the fitness facility were acceptable and comparably with other similar facilities in the area.
   
   strongly disagree: 1 : 2 : 3 :_ 4 : 5 strongly agree

For the following questions answer based upon your experiences getting from place to place at your college or university campus

1. Are there sidewalks/paths along the minor/major streets surrounding or going through your campus? Never: 1 : 2 : 3 :_ 4 : 5 Always

2. Are the sidewalks/paths in good repair, without areas of uneven or broken pavement? Never: 1 : 2 : 3 :_ 4 : 5 Always

3. Are there marked crosswalks at major intersections in your campus?
   
   Never: 1 : 2 : 3 :_ 4 : 5 Always

4. Are there functional crossing signals at major intersections in your campus?
   
   Never: 1 : 2 : 3 :_ 4 : 5 Always

For the following questions answer based upon your experiences at your college or university campus
1. Overall, how safe do/did you feel on your college campus?
   Not very Safe: 1 : 2 : 3 : 4 : 5 Very Safe

2. How safe do/did you feel in the Recreational Sports Facilities/Gyms on your college campus?
   Not Very Safe: 1 : 2 : 3 : 4 : 5 Very Safe _____ Does not apply

3. How safe do/did you feel in the Parking Lot(s) on your college campus?
   Not Very Safe: 1 : 2 : 3 : 4 : 5 Very Safe _____ Does not apply

4. How safe do/did you feel in the Residence Hall(s) on your college campus?
   Not Very Safe: 1 : 2 : 3 : 4 : 5 Very Safe _____ Does not apply

5. How safe do/did you feel in the classroom(s) on your college campus?
   Not Very Safe: 1 : 2 : 3 : 4 : 5 Very Safe _____ Does not apply

6. How satisfied are/were you with the Emergency system located on your college campus?
   Not satisfied: 1 : 2 : 3 : 4 : 5 Very satisfied _____ Does not apply

For the following questions answer based the availability of programming at your college or university

1. Did/does your college or university offer physical activity/wellness/health programs? These are programs offered throughout the university to encourage
healthy behaviors. Yes________ NO________ If yes, explain this program ________

a. How much do you feel that these courses influenced you to participate in physical activity?

Did not influence: 1 : 2 : 3 : 4 : 5 Strongly influenced

2. Did/does your undergraduate college or university require physical activity or wellness courses to complete your degree program? Yes________ NO________

a. If yes, how many hours of these types of courses are required? ________

b. Explain which types of courses were accepted for this requirement. ________

c. How much do you feel that these courses influenced you to participate in physical activity?

Did not influence: 1 : 2 : 3 : 4 : 5 Strongly influenced

Please answer the following questions based upon your current feelings about physical activity. These questions should not be reflections but answered with your current knowledge of physical activity. Use the following definition of physical activity to answer the following questions. Physical Activity is defined as any body movement that requires more energy than resting (U.S. Department of Health and Human Services, 1996). Rank each item on a scale from 1-5, use the guidelines provided by the question to gage your response.
1. If I were to be physically active during my free time on most days it would help me cope with stress.
   strongly disagree:  1:  2:  3:  4:  5: strongly agree

2. If I were to be physically active during my free time on most days it would be fun.
   strongly disagree:  1:  2:  3:  4:  5: strongly agree

3. If I were to be physically active during my free time on most days, I would make new friends.
   strongly disagree:  1:  2:  3:  4:  5: strongly agree

4. If I were to be physically active during my free time on most days it would help get or keep me in shape.
   strongly disagree:  1:  2:  3:  4:  5: strongly agree

5. If I were to be physically active during my free time on most days it would make me more attractive.
   strongly disagree:  1:  2:  3:  4:  5: strongly agree

6. If I were to be physically active during my free time on most days it would give me more energy
   strongly disagree:  1:  2:  3:  4:  5: strongly agree

7. If I were to be physically active during my free time on most days it would make me better in sports and other activities
   strongly disagree:  1:  2:  3:  4:  5: strongly agree

8. My classmates/colleagues think I should be active during my free time on most days
   strongly disagree:  1:  2:  3:  4:  5: strongly agree
9. My friends think I should be physically active during my free time on most days
   strongly disagree: 1: 2: 3: 4: 5 strongly agree

10. My parents/guardians think I should be physically active during my free time on most days strongly disagree: 1: 2: 3: 4: 5 strongly agree

11. My siblings think I should be physically active during my free time on most days
   strongly disagree: 1: 2: 3: 4: 5 strongly agree

12. My spouse/significant other thinks I should be physically active during my free time on most days
   strongly disagree: 1: 2: 3: 4: 5 strongly agree

13. For me to be physically active during my free time on most days would be…
   Very difficult: 1: 2: 3: 4: 5 Very easy

14. I have control over my being physically active during my free time on most days
   strongly disagree: 1: 2: 3: 4: 5 strongly agree

15. I believe I have all the things I need to be being physically active during my free time on most days
   strongly disagree: 1: 2: 3: 4: 5 strongly agree

16. If I want to be I can be physically active during my free time on most days
   strongly disagree: 1: 2: 3: 4: 5 strongly agree

17. I can be physically active during my free time on most days
   strongly disagree: 1: 2: 3: 4: 5 strongly agree

18. I can ask my friends to do physically active things with me
   strongly disagree: 1: 2: 3: 4: 5 strongly agree
19. I can be physically active during my free time on most days even if I could watch TV or play video games instead.

   strongly disagree:  1:  2:  3__:  4:  5__strongly agree

20. I can be physically active during my free time on most days even if it is very hot or cold outside. strongly disagree:  1:  2:  3__:  4:  5__strongly agree

21. I can ask my spouse/significant other to be physically active with me during my free time on most days.

   strongly disagree:  1:  2:  3__:  4:  5__strongly agree

22. I can be physically active during my free time on most days no matter how busy my day is strongly disagree:  1:  2:  3__:  4:  5__strongly agree

23. I intend to participate in regular physical activity (at least 20 minutes, three times per week) for the next three months.

   strongly disagree:  1:  2:  3__:  4:  5__strongly agree

24. I will try to participate in regular physical activity (at least 20 minutes, three times per week) for the next three months.

   strongly disagree:  1:  2:  3__:  4:  5__strongly agree

25. I plan to participate in regular physical activity (at least 20 minutes, three times per week) for the next three months.

   strongly disagree:  1:  2:  3__:  4:  5__strongly agree
APPENDIX B – IRB Approval Letter

INSTITUTIONAL REVIEW BOARD
118 College Drive #5147 / Hattiesburg, MS 34006-0001
Phone: 601.266.3997 | Fax: 601.266.4377 | www.usm.edu/research/institutional.review.board

NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 21, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

• The risks to subjects are minimized.
• The risks to subjects are reasonable in relation to the anticipated benefits.
• The selection of subjects is equitable.
• Informed consent is adequate and appropriately documented.
• Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
• Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
• Appropriate additional safeguards have been included to protect vulnerable subjects.
• Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the “Adverse Effect Report Form”.
• If approved, the maximum period of approval is limited to twelve months. Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: 17092801
PROJECT TITLE: The Influence of the Educational Environment on College Student Activity Behaviors
PROJECT TYPE: Doctoral Dissertation
RESEARCHER(S): Helen Melissa Ziegler
COLLEGE/DIVISION: College of Education and Psychology
DEPARTMENT: Educational Research and Administration
FUNDING AGENCY/SPONSOR: N/A
IRB COMMITTEE ACTION: Expedited Review Approval
PERIOD OF APPROVAL: 10/2/2017 to 10/01/2018
Lawrence A. Hosman, Ph.D.
Institutional Review Board


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