THE INFLUENCE OF HEALTH ASSESSMENTS ON MOTIVATING COLLEGE STUDENTS TO BECOME MORE PHYSICALLY ACTIVE

by

Keith McKelphin

Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

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ABSTRACT

Motivating individuals has become a major initiative in higher education, and many different strategies are being implemented on campuses. The purpose of this study was to examine the influence of health assessments on motivating college students to become more physically active. The research aimed to interpret the knowledge gained from an individual's health assessments as an effective strategy. The knowledge gained can be used to assist the college-aged population in adopting active lifestyles that will lower their health risks. The researcher used the self-determination theory to examine community college students' motivation to be physically active; the transtheoretical model of change and the social cognitive theory were used to assess physical activity behavior. The participants in this study were students enrolled in the Health and Personalized Fitness course at a Mid-Atlantic community college. The researcher used quasi-experimental, pretest-posttest, nonequivalent comparison group design. An analysis of covariance was used, with the pretest as the covariate, to determine whether a statistically significant difference occurred in posttest levels for stage of change, self-regulation, and self-efficacy. No statistically significant difference in the posttest levels of physical exercise self-efficacy and motivation was found between college students taking the health assessment (treatment or program group) and those not taking the assessment (comparison group). The students taking the health assessment exhibited a significant reduction in body fat percentage, and a significant enhancement in the levels of VO_2 MAX before and after the course. Additionally, analysis indicated that students who received the health assessment reported more significant changes to their stage of change than students who did not receive the health assessments.

Keywords: self-determination, stage of change, physical activity, self-efficacy

Acknowledgements

First and foremost, I thank my Lord and Savior for directing and helping me through this journey. This could never have been possible without his stewardship and unconditional love.

To my wife, Camille, your steadfast love, loyalty, patience, and motivation never wavered during this process. You are truly my best friend and life partner. It has been a wonderful ride through the many years.

To my three beautiful kids, Kelvin, Austin, and Alexis, thank you for being a shining light in my life. You all are my most precious creation. Your perseverance and forgiveness in dealing with me through the good and bad times cannot be overstated. I truly hope you can use our joint experiences as a motivation to believe that anything is possible if you try.

To my parents, words cannot sufficiently express my love. Mom, your son did it! Your constant presence in my life made me who I am today—a father, husband, and man of God. To my father, I wish you were here to enjoy this accomplishment. The degree is for you because you started on this journey to achieve a doctorate many years ago, and now it is completed. To my second father figure and an important man in my life, Jackie Bruce, you are a big part of my reaching this achievement. I can never forget the role you have played in my life.

To my brother, Marvell, we had many days together growing up in Greenville, MS. My love and admiration for you grew over the years as we reflected on and grew throughout our lives. To Kevin, Jarrett, and Stanley, three friends who became my brothers in life and throughout this journey, thank you for encouraging me and motivating me during the down moments.

I thank my colleagues, family, and friends who helped me and encouraged me during this process. To my committee chair, Dr. Judy Sandlin, thank you for motivating, encouraging, and leading me through this process. You were a Godsend. To my committee members, Dr. Susan Milstein and Dr. Dale Clemente, thank you for your guidance and leadership. I learned so much from each of you.

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List of Abbreviations

American College of Health Association (ACHA)

American College of Sports Medicine (ACSM)

Analysis of Covariance (ANCOVA)

Behavioral Regulation in Exercise Questionnaire (BREQ-2)

Body Fat Percent (BFP)

Body Mass Index (BMI)

Centers for Disease Control and Prevention (CDC)

Division of Nutrition, Physical Activity, and Obesity (DNPAO)

Health-Related Fitness (HRF)

International Business Machines (IBM)

Maximal Oxygen Consumption (VO_2 MAX)

Multivariate Analysis of Covariance (MANCOVA)

Physical Activity Stages of Change Questionnaire (PASCQ)

Physical Exercise Self-Efficacy Scale (PESES)

Self-Determination Theory (SDT)

Social Cognitive Theory (SCT)

Statistical Package for the Social Sciences (SPSS)

Transtheoretical Model (TTM)

U.S. Department of Health and Human Services (USDHHS)

World Health Organization (WHO)

CHAPTER ONE: INTRODUCTION

The problems of physical inactivity persist despite years of efforts to reverse this trend (Cooper, 2010). In 1960, president-elect John Kennedy wrote about Americans' physical inactivity in his groundbreaking article "The Soft American." President-elect Kennedy stated that physical inactivity is a leading contributor to the problems of being overweight and obesity. During the 1970s, organizations such as the American College of Sports Medicine, the American Heart Association, the National Institutes for Health, and the U.S. Centers for Disease Control and Prevention, among others, started paying more serious attention to exercise and health by taking position stands, holding roundtable discussions and conferences, and producing reports and books (Berryman, 2010).

The U.S. Department of Health and Human Services (USDHHS) Centers for Disease Control and Prevention's (CDC's; 2010d) *State Indicator Report on Physical Activity* has reported that this problem is not subsiding. A study by the USDHHS (2010d) indicated that 40% of adults in the United States do not participate in any leisure time physical activity. The USDHHS Office of the Surgeon General (2011) found that the obesity epidemic has tripled since the 1980s and established that the nation's health problems are magnified by a lack of physical activity. In the 2007–2008 results of the National Health and Nutrition Examination Survey, the CDC reported that about two-thirds of U.S. adults aged 20 years and over were classified as overweight or obese (Ogden & Carroll, 2010). As Grim, Hortz, and Petosa (2011) stated, the population is becoming overweight and obese because people between the ages of 18 and 24 are showing a sharp decline in physical activity levels. Health problems, associated with unhealthy behaviors by college-aged students, present colleges with a great opportunity to enhance physical activity levels by using interventions that have been validated through research.

Research has indicated that physical activity can lessen the risk of premature death from heart disease and some cancers, which are the leading causes of death (Hackman & Mintah, 2010; Milroy, 2010; USDHHS CDC, 2011). Moreover, the 2008 Physical Activity Guidelines for Americans identified the lack of physical activity as a major health risk factor (USDHHS Office of Disease Prevention and Health Promotion, 2008). This report prompted the USDHHS National Institutes of Health's (NIH) National Heart, Lung, and Blood Institute (NHLBI) to launch an Obesity Education Initiative (OEI) for reducing the incidence of overweight and physical inactivity to decrease chronic illnesses associated with obesity (Simons-Morton et al., 2010).

Efforts to boost exercise behavior have been widespread in recent years (Anshel, 2013). In fact, the surgeon general recommends that adults participate in at least 150 minutes of moderate-to-intense physical activity a week (USDHHS CDC, 2010a). However, less than one-third of adults meet this recommended amount of physical activity (USDHHS CDC, 2010b). Indeed, as reported by Buckworth and Nigg (2004), many adults develop their health behaviors during late adolescence and the beginning stages of adulthood; as a result, this decline indicates an alarming trend that leads to many health issues later in life.

The researcher attempted to identify factors that have the potential to motivate college students to become more physically active. The researcher grounded the quasi-experimental, pretest-posttest, nonequivalent, comparison group design study in self-determination theory, social cognitive theory, and the transtheoretical model. The researcher used these theories to evaluate changes that focus on a person's motivation and behavior toward physical activity, therefore determining if college students who understand their current health fitness assessment scores would be motivated to become more physically active. Chapter One provides a background of the study, specifies the problem of the study and the study's significance, and provides an overview of the methodology.

Background

The USDHHS Office of Disease Prevention and Health Promotion's (2010) Healthy People 2020 objectives designated physical inactivity as a serious and pervasive public health concern and a top priority. Along with Healthy People 2020, there have been several public health initiatives—such as the CDC's Division of Nutrition, Physical Activity, and Obesity (DNPAO)—to address the issues of being overweight and obesity through a partnership with individual states (USDHHS Office of Disease Prevention and Health Promotion, 2008). For instance, the American College Health Association (ACHA) sponsored a task force on national health objectives. The task force created a campaign in association with Healthy People 2020 (USDHHS Office of Disease Prevention and Health Promotion, 2010) called Healthy Campus 2020 (ACHA, 2012).

The USDHHS CDC (2011) reported that regular physical activity is one of the most significant lifestyle priorities for a person's health. Newton, Kim, and New (2006) stated that the issue of physical activity greatly affected the college-aged population. Research results have indicated that the age group of 18- to 29-year-olds had the greatest increase of weight gain, which coincides with a decrease in activity level (ACHA, 2009; Butler, Black, Blue, & Gretebeck, 2004; Huang et al., 2003). Within this group were individuals with some college education. Recent data on the physical activity of college-aged students show that 15% to 30% of students meet the recommended amount for health benefits (ACHA, 2009). As such, the Healthy Campus 2020 initiative identified students in higher education and the age group of 18–24 years as those in need of improving their physical activity (ACHA, 2012).

The authors of the Healthy Campus 2020 report acknowledged the importance of physical activity for college students (ACHA, 2012). Furthermore, Lockwood and Wohl (2012) stated that the college-aged years are a suitable time for health promotion. Lockwood and Wohl determined that health and physical education courses could positively influence students' attitudes toward physical activity.

Morrow, Krzewinski-Malone, Jackson, Bungum, and Fitzgerald (2004) concluded that additional education on stage of change intervention and motivation to improve physical activity levels is warranted. In particular, Welk (2002) discussed the findings of a 1997 conference held at the Cooper Institute that stated the need for "application of interventions in different settings and with different populations and provided recommendations for future research" (p. 15). Several public health initiatives have begun to address this issue, such as Healthy People 2020 (USDHHS Office of Disease Prevention and Health Promotion, 2010) and Healthy Campus 2020 (ACHA, 2012), which promote the implementation of programs that reach the United States' goals for healthy living in the college environment. Antikainen and Ellis (2011) found that behavior could be modified by effective physical activity interventions; however, additional research should be conducted to examine adopting these interventions for wide-range usage. Nelson, Gortmaker, Subramanian, and Wechsler's (2007) findings showed that the college setting is neglected in promoting physical activity and that colleges need to be targeted to improve physical activity. Further research is needed to identify effective interventions and promote physical activity among college students.

As argued by Hutto and Russell (2011), multiple studies have examined the effect of increased physical activity on children and adolescents and their perceived competence and motivation to be physically active. In addition, Bian, Liu, Wang, and Yan (2011) reported that children and adolescents are the focus of research regarding motivation and physical activity, with a small amount of research focusing on college students. Keating, Guan, Pinero, and Bridges (2005) identified a gap in the research literature in the assessment of health and fitness programs for colleges. Additionally, Ullrich-French, Smith, and Cox (2011) indicated that the college population—as compared to secondary school students—has been woefully under-represented in meaningful research regarding motivation theory in physical activity. Milroy (2010) posited that the present studies regarding physical activity promotion are promising, but nonetheless the research involving the college student community remains inadequate.

Problem Statement

Few studies have focused on motivating college students to become more physically active. Consequently, there is a need for more research on motivating college students to engage in and maintain physical activity behavior (Kemper & Welsh, 2010; Ullrich-French et al., 2011). The researcher's study analyzed interventions to determine if they influence and motivate physical activity behavior in college students. The results of the study facilitate an understanding of innovative practices suitable for college students that will promote better physical activity behavior. Furthermore, the results of the study can lead to an understanding of the innovative practices suitable for a college community promoting physical activity practices.

To contribute to the existing research, the researcher used a quasi-experimental, pretest-posttest, nonequivalent, comparison group design that identified health assessments as a strategy that can be used to assist the college-aged population in adopting active lifestyles. The results of the study were used to determine if there was a statistical significance between the treatment and comparison groups. The results of the study were also used to contribute to the existing literature gap in determining those factors that could influence physical activity behavior in college students.

Purpose Statement

The purpose of this study was to analyze the influence of health assessments on motivating college students to become more physically active. Using a quasi-experimental, pretest-posttest, nonequivalent, comparison group design, the researcher tested the hypotheses that college students' awareness of their current health fitness assessment scores would motivate them to become more physically active. The theories used by the researcher are self-determination theory (SDT), social cognitive theory (SCT), and the transtheoretical model (TTM). Ryan and Deci (2000) defined SDT as an individual's level, or intensity, of self-regulation that will vary on a Likert scale, and these variations have significant effects on an individual's physical and mental well-being. SDT was developed to explain how extrinsic motivation could become autonomous (Deci & Ryan, 1985). The research on individual differences in causality led to the formulation of SDT (Deci & Ryan, 1985; Vallerand & Losier, 1999). SCT has been used successfully in changing behaviors dealing with physical activity, and the main concept of this theory is self-efficacy. In the mid-1970s, Bandura (1986) developed this model with an emphasis on the influences on social behaviors. Self-efficacy is the belief or awareness regarding a person's ability to engage in a given behavior or task (Bandura, 1982). TTM was developed to focus on an individual's decision-making. This model of change has stages that have been used as an effective approach to lifestyle self-management (Hales, 2009). TTM was originally used in psychotherapy to treat addictive behaviors (Marshall & Biddle, 2001).

Using SDT, this study was guided by the hypothesis that there is a significant difference in community college students' posttest level of self-determination based on whether or not they are exposed to a health assessment in a Health and Personal Fitness course. Moreover, from Bandura's (1982) theory of self-efficacy, the study hypothesized that when controlling for the students' pretest level of physical exercise self-efficacy, there would be a significant difference in community college students' level of self-efficacy measured by a posttest based on whether they participated in a health assessment in a Health and Personalized Fitness course. Another of the study's hypotheses, based on TTM, was that, when controlling for the students' pretest stage of change (covariate), there would be a statistically significant difference in community college students' posttest stage of change based on whether they participated in a health assessment in a Health and Personal Fitness course.

As applied to this study, SDT maintains that the Health and Personalized Fitness course HE 109 with lecture and health assessments indicated whether there was a significant difference in the community college students' level of self-determination. SDT was used as an indicator of a person's fitness level and desire to exercise in the future. As a result, SDT provided evidence that individuals can regulate their actions. As applied to this study, SCT maintains that the Health and Personalized Fitness course HE 109 with lecture and health assessments indicated whether there was a significant difference in the community college students' level of physical exercise self-efficacy. SCT provided evidence that an individual's self-confidence in the undertaking of barriers will have an effect on his or her belief of being physically active. Along with that belief, he or she can achieve positive outcomes from being physically active. As applied to this study, TTM maintains that the Health and Personalized Fitness course HE 109 with lecture and health assessments indicated whether there was a significant difference in the community college students' stage of change. TTM has distinct stages when people are trying to change a specific health behavior by focusing on both motivation and the actual behavior change.

This research helps fill the current gap in the literature by determining factors that could influence physical activity behavior in college students. The researcher identified health assessments as a strategy that can be used to assist the college-aged population in adopting active lifestyles.

Significance of the Study

It is imperative that people are able to live life with optimum health and vitality; therefore, the role of health promotion is to inform and to motivate (World Health Organization [WHO], 2014). Thus, it is crucial to establish methods and strategies that will motivate people to live a more active lifestyle. The USDHHS Office of Disease Prevention and Health Promotion (2008) found that regular physical activity promotes health, prevents premature death and a variety of chronic illnesses, and improves brain function. It is clear that effective methods to motivate must be developed so that people can adopt lifelong healthy and active lifestyles. In particular, Donnelly et al. (2009) updated a 2001 article entitled "Appropriate Intervention Strategies for Weight Loss and Prevention of Weight Regain for Adults," in which they recognized that there are benefits to physical activity if weight is lost and, in fact, even if weight is gained.

Past studies have found that those individuals between the ages of 18 and 24 start to have a sharp decline in physical activity levels (Butler et al., 2004; Grim et al., 2011; Huang et al., 2003). In fact, several public health initiatives have begun to address this age group; among them, the government's Healthy People 2020, in conjunction with Healthy Campus 2020

(ACHA, 2012), has been promoting the implementation of programs to reach the United States' goals for healthy living. However, higher educational institutions also have a great opportunity to effect change through validated research (ACHA, 2009; Bian et al., 2011; Hackman & Mintah, 2010; Hutto & Russell, 2011; Milroy, 2010).

Because many adults develop their health behaviors during late adolescence and the beginning stages of adulthood, this study's results can add to the literature that is helping to reverse the trend of obesity and health-related issues of inactivity (Grim et al., 2011; Lerner, Burns, & Róiste, 2011; Wang, Koh, Biddle, & Chye, 2011). Although some past research has addressed motivating college students to be more physically active, a study by Morrow et al. (2004) concluded that additional education is warranted on stage of change intervention and motivation to improve physical activity levels. The present study addresses the educational gap in developing strategies that encourage increased physical activity among students. Additionally, this research adds to the current literature by addressing factors that could influence physical activity behavior in college-aged students. As such, this study is significant because it enhances the discussion on improving the health of college students and identifies the possibility of health assessments as a strategy to motivate students to become physically active.

Research Questions

The researcher used the following questions and hypotheses to guide this research:

RQ1: Controlling for the pretest scores on the Physical Activity Stages of Change Questionnaire (PASCQ), is there a significant difference in a community college student's stage of change, as measured by posttest scores on the PASCQ, based on the student's participation in a health assessment in a Health and Personalized Fitness course?

RQ2: Controlling for the pretest scores on the Revised Behavioral Regulation in Exercise Questionnaire (BREQ-2), is there a significant difference in a community college student's level of self-determination, as measured by the posttest scores on the BREQ-2, based on the student's participation in a health assessment in a Health and Personalized Fitness course?

RQ3: Controlling for the pretest scores on the Physical Exercise Self-Efficacy Scale (PESES), is there a significant difference in a community college student's level of physical exercise self-efficacy, as measured by the posttest PESES, based on the student's participation in a health assessment in a Health and Personalized Fitness course?

RQ4: For community college students who participated in a health assessment in a Health and Personalized Fitness course, is there a significant difference between the pretest levels of the body fat percent (BFP) before the course and the students' level of body fat measured by the posttest BFP after the course?

RQ5: For community college students who participated in a health assessment in a Health and Personalized Fitness course, is there a significant difference between the pretest levels of Maximal Oxygen Consumption ($V0_2$ MAX) before the course and the students' posttest level of $V0_2$ MAX after the course?

Null Hypotheses

The following null hypotheses were used for this study:

$H_0$1: Controlling for the pretest scores on the PASCQ, there is no statistically significant difference in a community college student's stage of change, as measured by posttest scores on the PASCQ, based on the student's participation in a health assessment in a Health and Personalized Fitness course.

$H_0$2: Controlling for the pretest scores on the Revised Behavioral Regulation in Exercise Questionnaire (BREQ-2), there is no statistically significant difference in a community college student's level of self-determination, as measured by the posttest scores on the BREQ-2, based on the student's participation in a health assessment during a Health and Personalized Fitness course.

$H_0$3: Controlling for the pretest scores on the PESES, there is no statistically significant difference in a community college student's level of physical exercise self-efficacy, as measured by the posttest PESES, based on the student's participation in a health assessment during a Health and Personalized Fitness course.

$H_0$4: For community college students who participated in a health assessment in a Health and Personalized Fitness course, there is no statistically significant difference between the pretest levels of the BFP before the course and the students' level of body fat measured by the posttest BFP after the course.

$H_0$5: For community college students who participated in a health assessment in a Health and Personalized Fitness course, there is no statistically significant difference between the pretest levels of $V0_2$ MAX before the course and the students' posttest level of $V0_2$ MAX after the course.

Identification of Variables

Independent Variable

The independent variable was participation in the Health and Personalized Fitness course's health assessment treatment. The treatment consisted of instruction discussions, lectures, videos, and personal evaluations. The Health and Personalized Fitness course was designed to assist students in the development of a lifelong commitment to a wellness lifestyle, with an emphasis on regular participation in fitness activities and healthy dietary habits. Core concepts, methods, and behavior management techniques related to the development and maintenance of fitness, nutrition and weight management, and managing stress and reducing risks associated with various lifestyle-related diseases were examined, assessed, and evaluated during the course. Students developed and implemented a comprehensive fitness and wellness plan to achieve a healthier lifestyle. The course included participation in instructional exercise sessions, with additional opportunities for students to utilize the fitness facilities beyond scheduled class times. The comparison group included students who enrolled in the Health and Personalized Fitness course but who did not receive the health assessment.

Dependent Variables

This research study had five dependent variables that coincided with the five research questions. The first dependent variable was the stage of change, which represents the distinct stage when people are trying to change a specific health behavior (Hales, 2009). The stage of change is often used in studies to examine physical activity interventions (Hales, 2009). Research has shown that the stage of change is successful at developing approaches that influence physical activity levels (Dunn et al., 1998). The PESES was used to assess its potential influences in initiating behavior change (Brown, 2005; Schwarzer & Renner, 1993). There are five stages of change of motivational readiness through which an individual progresses (Marshall & Biddle, 2001). Different factors are hypothesized at each stage of readiness to become physically active. The first stage is *precontemplation*, which means that an individual does not intend to become regularly physically active. The second stage is *contemplation*, which means that an individual intends to become regularly physically active within the next six months. The third stage is *preparation*, which means that an individual intends to become regularly physically active within the next 30 days. The fourth stage is *action*, which means that an individual intends to be regularly physically active 30 minutes per day, most days of the week, but has only done so within the last six months. The last stage is *maintenance*, which means that an individual meets the requirements of physical activity (PA) for at least 6 months.

The second dependent variable was the level of *self-regulation*, which is an indicator of a person's fitness level and desire to exercise in the future (Deci & Ryan, 1985; Vallerand & Losier, 1999). This variable examined individuals' different degrees of self-determination by moving along a continuum of self-directed regulations and by controlling reasons for participating in physical activity. At the lowest end of the continuum is *amotivation*, which is a total lack of motivation to participate in physical activity. On the opposite end of the continuum is *intrinsic motivation*, which indicates that a person is motivated for the pleasure of the activity (Deci & Ryan, 1985, 2000; Vallerand & Losier, 1999). Along the continuum between amotivation and intrinsic motivation is *extrinsic motivation*, which has four levels of regulation (Deci & Ryan, 1985; Ryan & Deci, 2000). Daley and Duda (2006) stressed that external regulation is controlled by rewards and threats, and reflects low self-determination on the continuum. *Introjected regulation* occurs if people are motivated by pleasing others, whereas *identified regulation* means being motivated by a positive reception of the outcome or volition (Daley & Duda, 2006). The highest level of extrinsic motivation is *integrated regulation*, which signifies that individuals are motivated to achieve a goal (Ryan & Deci, 2000).

The third research question's dependent variable was the level of self-efficacy, which is the belief or perception regarding one's ability to complete a given task (Bandura, 1982). The PESES was used to measure an individual's belief that he or she can perform the task of exercise.

The fourth research question's dependent variable was the community college student's body fat, which is an estimate of total body fat. BFP is used to assess an individual's health risk factor (American College of Sports Medicine [ACSM], 2010).

The fifth research question's dependent variable was the community college student's VO_2 MAX, which is the overall measure of capacity of the cardiorespiratory system. VO_2 MAX reflects the aerobic capacity that the body uses during exercise (Welk & Meredith, 2008). Research has shown that submaximal prediction tests are not as precise as direct measures; however, they are still considered acceptable indicators of VO_2 MAX (Larsen et al., 2002). The 1.5-mile, walk-run VO_2 MAX assessment permits large numbers to participate and requires a stopwatch and an area to perform. Additionally, the 1.5-mile test can accommodate wide-ranging fitness levels (ACSM, 2010).

Definitions

1. *Activity assessments*—Test used to determine whether a particular behavioral intervention is successful in changing activity behavior (Welk, 2002).
2. *Body mass index (BMI)*—A measure of body fat based on height and weight that applies to adult men and women (WHO, 2006).
3. *Body fat percent (BFP)*—A relative percentage of body fat compared to lean body mass (Fahey, Insel, & Roth, 2010).
4. *Cardiovascular fitness*—The circulatory and the respiratory systems' abilities to supply oxygen during physical activity (Fahey et al., 2010).
5. *Exercise*—A planned, structured, repetitive movement intended specifically to improve or maintain physical fitness (Fahey et al., 2010).

6. *Extrinsic motivation*—People's behavior controlled by specific external contingencies (Deci & Ryan, 2000).
7. *Flexibility*—The joint range of motion (Fahey et al., 2010).
8. *Health-related components*—Elements that represent how well the body is able to do work (Fahey et al., 2010).
9. *Intrinsic motivation*—People's behavior controlled by internal interest (Deci & Ryan, 2000).
10. *Maximal oxygen consumption (VO_2 MAX)*—Measurement that determines how intensely an individual can perform an endurance activity and for how long (Fahey et al., 2010).
11. *Muscular endurance*—A repeated muscle contraction over a period of time (Fahey et al., 2010).
12. *Muscular strength*—A single amount of external force produced during a contraction (Fahey et al., 2010).
13. *Physical activity*—Movement carried out by the skeletal muscles that require energy (Fahey et al., 2010).
14. *Physical fitness*—The capability to perform with vigor and alertness daily basic tasks without excessive fatigue and with sufficient energy to have the benefit of leisure activities and to handle unanticipated emergencies (Caspersen, Powell, & Christenson, 1985).
15. *Obesity*—An excessive accumulation of body fat (Fahey et al., 2010).
16. *Overweight*—A body weight above the recommended range for good health (Fahey et al., 2010).

17. *Self-determination theory (SDT)*—Theory that posits that an understanding of human motivation requires a consideration of innate psychological needs for competence, autonomy, and relatedness (Deci & Ryan, 2000).
18. *Self-efficacy*—A person's belief in his or her ability to successfully take action and perform a specific task (Fahey et al., 2010).
19. *Transtheoretical model (TTM)*—An effective approach to lifestyle self-management. People move through distinct stages as they change a target behavior (Fahey et al., 2010).

CHAPTER TWO: LITERATURE REVIEW

Introduction

This literature review synthesizes a series of research publications, articles, and books that were selected with the intent to examine the scientific methods used to change unhealthy behaviors associated with health and wellness and a lack of physical activity. Physical activity occurs during any body movement that results in burning calories and includes a wide range of activities, such as conditioning, weight training, sports, household work, yard work, and other activities (ACSM, 2010; Caspersen et al., 1985; Pierce, 2009). Physical activity has been established as a fundamental component of health promotion and overall health. For over 40 years, Dr. Kenneth Cooper (2010) has advocated for regular physical activity because of its many health benefits—prolonging one's life being the most significant one. Furthermore, physical activity has been acknowledged as a principal health indicator (ACSM, 2010; USDHHS CDC, 2010d). The *2008 Physical Activity Guidelines for Americans* identified lack of physical activity as a major health risk factor (USDHHS Office of Disease Prevention and Health Promotion, 2008). Research has shown that physical activity can lower an individual's risk of chronic illness—such as stroke, diabetes, some cancers, and the incidence of high blood pressure, and it can also reduce many causes of death (Cooper, 2010; USDHHS CDC, 2011). Lack of physical activity has been cited as one of the leading preventable causes of death, and a definite relationship exists between all illness-related causes of death and a lack of physical activity (Marcus et al., 2006).

As explained by Marcus and Forsyth (2009), the terms *physical fitness*, *physical activity*, and *exercise* are used interchangeably by novices and health and fitness professionals. The USDHHS CDC (2010c) breaks down physical activity into the categories of *sedentary, aerobic,* *moderate intensity*, or *vigorous intensity*. Activities that promote exertion and raise breathing rates to somewhat harder than normal are considered moderate to vigorous intensity (USDHHS CDC, 2010c). Everyone performs some type of physical activity, and this varies among members of the population, from the high-end to low-end of exertion (Caspersen et al., 1985; Pierce, 2009). Marcus and Forsyth (2009) stated that physical activity or physical fitness reduces one's risk of cardiovascular disease. Individuals lower their risk of cardiovascular disease as their level of fitness and participation increases. In fact, although studies show the benefits of physical activity, only 32% of U.S. adults and 66% of children and adolescents (based on Healthy People 2020 guidelines) engage in regular leisure time physical activity. Research has recognized for years that all ethnic groups, ages, sexes, and sizes can benefit from being physically active (Marcus & Forsyth, 2009; USDHHS CDC, 2011; USDHHS Office of Disease Prevention and Health Promotion, 2008).

The USDHHS CDC (2011) and the ACSM issued a number of recommendations for physical activity, such as moderately intense activities five days a week, at 60–74% maximum heart rate, and vigorous, intense activities three days a week, at 75–85% of maximum heart rate (Marcus & Forsyth, 2009). Haskell et al. (2007) stated that recommendations are intended to provide a comprehensible and succinct message to encourage a largely sedentary U.S. population to increase its physical activity. It has been over 15 years since the USDHHS CDC (2011) and the ACSM issued their recommendations; yet, being overweight, obesity, and a general lack of physical activity persist today at an alarming level.

SDT, SCT, and TTM were used to determine the motivation of the participants in this study. Moreover, the TTM instrument was used to determine physical activity behavior. Daley and Duda (2006) posited that TTM provides more of a quantitative perspective on motivation. In essence, individuals who are at higher stages of change are more motivated than individuals at lower stages of change. Furthermore, Daley and Duda (2006) stated that SDT places more importance on the quality of motivation. As a result, this theory states that an individual's engagement in exercise is structured essentially through self-regulation and controlled reasons. These theoretical approaches are important to understand potential ways to influence a person's physical activity level in a positive way.

Historical Overview

A lack of physical activity and unhealthy eating are prevalent lifestyle issues in American society. The USDHHS CDC (2010c) has conducted extensive research on the problems that can result from an unhealthy and inactive lifestyle, and has called the lifestyle of Americans an epidemic that must be addressed. Some of the health issues attributed to a poor lifestyle are obesity, heart disease, stroke, diabetes, various types of cancer, sleep apnea, and others. These problems have put a major burden on the nation's health care system. As reported by the surgeon general, obesity is responsible for 300,000 deaths every year (USDHHS Office of Disease Prevention and Health Promotion, 2008). Garrett, Brasure, Schmitz, Schultz, and Huber (2004) conducted a study that examined the long-term cost of living a physically inactive lifestyle. Garrett et al. used the cost-of-illness method to determine the cost of physical inactivity. Some of the issues related to physical inactivity included heart disease, stroke, hypertension, type 2 diabetes, colon cancer, breast cancer, osteoporosis, depression, and anxiety. Furthermore, Garrett et al. noted that 12% of depression and anxiety and 31% of colon cancer cases are attributed to physical inactivity. This study also determined that heart disease was the number one outcome of physical inactivity, with $35.3 million in health plan expenditures during

2000. The Garrett et al. study brought to light the need for more research magnifying the public health problems associated with physical inactivity.

Garrett et al. (2004) argued that issues attributed to obesity cost hundreds of millions of dollars a year in health plan expenditures. In particular, heart disease caused by inactivity had the greatest estimated cost of $35.3 million. Additionally, the USDHHS CDC's (2010c) recent data indicated that medical costs, to all stakeholders, associated with obesity are estimated to be as high as $147 billion. Moreover, when broken down for obese individuals, these medical costs are estimated at $1,400 per person more than for individuals of normal size. The obesity problem must be addressed to limit the health issues with which it is associated. Additionally, in 2007, total healthcare costs surpassed $2.2 trillion, and the chronic disease portion was estimated to account for over 75% of these expenditures. These astronomical costs are indicative of the monetary toll of the obesity epidemic (USDHHS CDC, 2010c).

With all of these issues arising out of poor health habits, Haywood (1991) stated that health and physical educators have to expand their role by becoming more versed in different strategies to promote activity and a healthy lifestyle. According to Buckworth and Nigg (2004), the health benefits of physical activity described in the *Surgeon General's Report on Physical Activity and Health* offer persuasive evidence that society needs to adopt and maintain an active lifestyle. However, people's level of physical activity begins to decline during adolescence, and once they reach adult age, about 70% of Americans are sedentary or inactive (Grim et al., 2011; USDHHS CDC, 2011). Efforts must be focused on successfully minimizing the problem. The USDHHS CDC (2010c) estimated that a reduction of 30,000–35,000 American deaths per year from obesity-related diseases could be achieved by increasing the number of adults who participate in 30 minutes per day of moderate intensity physical activity.

Hackman and Mintah (2010) posited that most adult health behaviors are developed during late adolescence and early adulthood. Research has shown a rapid decline in physical activity from adolescence to young adulthood, which is the age most representative of college students (Hackman & Mintah, 2010). Such research underscores the importance of addressing the decline in physical activity in adolescence and young adulthood. Sullum and Clark (2000) reported that more than 60% of American adults do not engage in regular physical activity, and 25% do not engage in any physical activity, and that approximately one-half of Americans aged 12 to 21 years do not exercise vigorously on a regular basis. The 2000 National College Health Assessment showed that 57% of male college students and 61% of female college students performed no exercise on at least three of seven days (ACHA, 2009). In spite of the large number of recognized benefits of physical activity, the decline in the health of young adults—and especially the findings that college-aged students are being physically inactive on a regular basis—cannot be ignored (Delong, 2006). Ironically, the curriculum at most colleges and universities requires a physical activity and health-related fitness course (Adams, Graves, & Adams, 2006). In fact, research on the impact of a health or fitness course is not new. Adams et al. (2006) indicated that there is inadequate research on the effects of student health-related fitness knowledge, attitudes, and exercise behaviors. However, these higher educational institutions have an excellent opportunity to increase the health-related fitness knowledge of college students and to develop positive healthy lifestyle behaviors—yet very few evaluate effectiveness in terms of knowledge or behavioral change (Adams et al., 2006). Moreover, these courses are very important as a way to counterbalance numerous negative lifestyle behaviors linked with a college lifestyle, such as poor diet, academic stress, and lack of physical activity (Adams et al., 2006).

Pearman et al. (1997) conducted a study on the impact of a required college health and physical education course by randomly selecting 2,000 college alumni. The researchers chose to examine an extensive health and fitness course that offered both activity and classroom sessions. Pearman et al. evaluated the impact of a required college health and physical education course on selected health knowledge, attitudes, and behaviors of alumni. Alumni who completed a health and fitness course were more knowledgeable about their blood pressure, blood cholesterol, and diet than alumni who did not take a course. Furthermore, the course appeared to have a positive influence on their outlooks toward exercise, eating, and smoking, which suggested that a required health and fitness college course enhanced the alumni's health-related knowledge, attitudes, and behaviors. In a more recent study, Adams et al. (2006) determined the immediate and long-term effectiveness of a health-related fitness course. Their study indicated that students developed above-average health-related fitness knowledge immediately following completion of a university-level, conceptually based, health-related fitness course. Additionally, they concluded that even four years later, those students that had completed a health-related fitness course had retained significantly higher health-related fitness knowledge than students that had never taken or completed a health and fitness course.

Healthy People 2020 implemented a major initiative to reduce the percentage of inactive adults by designing and evaluating intervention programs (USDHHS Office of Disease Prevention and Health Promotion, 2010). Research has shown that all age groups need physical activity interventions (USDHHS Office of Disease Prevention and Health Promotion, 2008). However, studies have determined that it is critical for young adults to develop positive physical activity interventions to develop lifelong physical activity behaviors (Keating et al., 2010; USDHHS CDC, 2010b). University students ages 18 to 25 have been a targeted group for interventions because members of this age group are often making choices about their lives and behaviors on their own for the first time (Keating et al., 2005; Keating et al., 2010).

Strategies are continually being sought in an effort to reverse unhealthy behaviors. Today's most critically important behavior is inactivity. Adults' physical activities decline at a rapid level during their college years, which also represents societal trends of a decline in physical activity (Hackman & Mintah, 2010). In general, the transitional mental and physical changes that college-aged students go through may influence their lives positively and negatively. These transitions may have a harmful impact on students' physical activity (Lerner et al., 2011).

Lerner et al. (2011) contended that more research must be conducted on the physical activity of college students aged 18–22 years. Lerner et al. determined that colleges need to be creative in designing and implementing physical activities and sports that promote fun, fitness, and competition to tap into the varying needs of students' intrinsic motivation. Initiatives that promote levels of physical activity should place greater emphasis on females. Additionally, colleges need to develop initiatives that focus on freshman (first-year) students, thus minimizing the barriers to being physically active during their initial transition to college life. Therefore, Lerner et al. suggested that each college should assess the physical activities and sport opportunities it offers.

Understanding this connection is imperative to developing strategies to promote increased physical activity. There is a growing body of research addressing why society is not as active today as in the past. College students go through many physical and mental changes and face many positive and negative influences on their lives as they transition from adolescence to adulthood, generally during late adolescence (Lerner et al., 2011). Previous research recognized that sports participation is associated with intrinsic motivators such as fun; whereas participation in a physical activity was more associated with extrinsic motivators such as appearance and stress management (Kilpatrick, Hebert, & Bartholomew, 2005). Furthermore, interest in activities, social support, and self-efficacy have been identified as having a significant influence on regular activity (Lerner et al., 2011; Sylvia-Bobiak & Caldwell, 2006).

Studies have shown that younger adults who are motivated both extrinsically and intrinsically separate from those individuals who lead an inactive lifestyle (Dacey, Baltzell, & Zaichkowsky, 2008). Whitehead (1993) and Dacey et al. (2008) attempted to identify the relationship between physical activity and intrinsic motivation. Whitehead's research was designed to discover behaviors that enhance intrinsic motivation in sport, exercise, and other physical activities. The research revealed that intrinsic motivation is a key factor in promoting active, healthy lifestyles. The study also determined that personal proficiency and control are the necessary foundations of intrinsic motivation (Whitehead, 1993). For younger adults, self-determined extrinsic and intrinsic motivation distinguishes those who are regularly active from individuals who are sedentary or inactive (Dacey et al., 2008; Mullan & Markland, 1997).

Theoretical Framework

SDT, SCT, and TTM provided a framework for the research concerning the physical activity and motivation of community college students. The research proffers effective methods to empower young adults toward make prudent choices related to engaging in physical activity that can help them over their lifetime. In particular, SDT and the stages of change theory are used to determine when individuals become more intrinsically motivated, which leads to enhanced overall activity levels (Mullan & Markland, 1997). However, a paucity of research focuses on the effect that health assessments can have on a person's motivation to be more active

(Bjerke, 2012; Lerner et al., 2011; Nelson et al., 2007). At this time, research only uses the assessment to determine a person's current level of physical fitness.

Self-Determination Theory

SDT is a well-accepted theory of human motivation, development, and wellness (Deci & Ryan, 2008). What distinguishes SDT from other theories of motivation is that it focuses on types of motivation instead of just quantities of motivation and pays particular attention to self-directed motivation, controlled motivation, and amotivation as predictors of performance, interactive, and wellness outcomes (Deci & Ryan, 2008).

Initial research on the physical activity of students suggested differences in the types of motivation with varied success. Daley and Duda (2006) recognized the importance of researchers examining motivational factors that might discriminate between young adults who are active and those who are inactive. Health and physical educators cannot agree on the theoretical application of intrinsic and extrinsic motivation (Daley & Duda, 2006). The behavioral regulation in exercise research instruments based on SDT can be used to assess theoretical constructs that are indicators of a person's fitness level and desire to exercise in the future (Deci & Ryan, 1985; Vallerand & Losier, 1999). Ryan and Deci (2000) defined SDT as an individual's level or intensity of self-regulation, which varied on a continuum scale, noting that these variations have significant effects on an individual's physical and mental well-being. The lowest range on the continuum of motivations is amotivation, referring to someone who lacks the drive to be active; the middle range on the continuum is extrinsic motivation (there are different levels—external, introjected, identified, and integrated), which refers to doing something because it leads to a separable outcome. The highest range on the continuum is intrinsic motivation, which refers to doing something because it is inherently interesting or enjoyable (Deci & Ryan, 1985; Ryan & Deci, 2000; Vallerand & Losier, 1999). SDT is one of the most widely used theoretical frameworks to examine a person's motivation to be physically active (Deci & Ryan, 2002).

Delong (2006) cited extrinsic motivation as the reason that most individuals are physically active. The multidimensional levels of extrinsic motivation start with integrated regulation, which is the highest level of extrinsic motivation and the closest form of intrinsic motivation. In fact, they have very similar traits (Deci & Ryan, 1985, 2008; Vallerand & Losier, 1999). Individuals who are motivated by integrated regulation will exercise to control their behavior and to accomplish some result; for example, the result may be to improve or retain their current fitness level. Additionally, integrated motivation individuals are driven to achieve personal goals. The other levels of extrinsic motivation are external, introjected, and identified regulators. They are regarded as being far from reaching intrinsic motivation levels (see Figure 1). However, individuals are classified by their needs. Consequently, individuals who have little or no motivation must progress from amotivation through extrinsic motivation to intrinsic motivation to reach a high level of self-determination (Biddle, 1999; Ryan & Deci, 2000). When an individual reaches the maximum level of self-determination, that person is intrinsically motivated. To reach this level, one must believe the activity to be pleasurable or appealing (Deci & Ryan, 1985; Ryan & Deci, 2000; Vallerand & Losier, 1999).

Ryan and Deci (2000) indicated that SDT includes multiple aspects, such as motivation and psychological well-being, along with three inherent psychological needs: autonomy, competence, and relatedness. Autonomy represents the need to experience oneself as initiator and regulator of one's actions. Competence represents the need to create behavioral outcomes and to recognize the instrumentalities most important to these behavioral outcomes. Relatedness represents the need to understand acceptable relationships (Deci & Ryan, 1985). As theorized by SDT, behavior in any life situation can be intrinsically motivated, extrinsically motivated, or amotivated. Self-determined motivation is observed more often when individuals' basic psychological needs are fulfilled. On the contrary, if societal factors challenge an individual's needs, then a self-determined motivation or amotivation will be observed (Deci & Ryan, 1985). For instance, the instructional style and behaviors of a teacher can have considerable effects on students' psychological needs, which will indirectly affect a student's motivation (Ntoumanis, Barkoukis, & Thøgersen-Ntoumani, 2009).

		Regulation of Behavior in Exercise			
Amotivation		Extrinsic Motivation			Intrinsic Motivation
	External Regulation	Introjected Regulation	Identified Regulation	Integrated Regulation	
Little or no motivation to attempt behavior	Controlled by reward and threats	Avoidance of guilt or to please others	Motivated by appreciation of outcomes—acted out by choice	Values activity in relation to one's goals	Participates for fun and activity itself

Figure 1. Self-determination continuum. Adapted from "Self-Determination Theory and The Facilitation of Intrinsic Motivation, Social Development, and Well-Being," by R. M. Ryan & E. L. Deci, 2000, American Psychologist, *55*, p. 72. Copyright 2000 by the American Psychological Association. Adapted with permission.

A study by Kilpatrick et al. (2005) on the motivation of college students' physical activity indicated significant physical activity effects for motivation. Participants indicated greater motivation to exercise for appearance, strength and endurance, stress management, weight management, and explicitly in health promotion. Men indicated higher levels of motivation in the areas of challenge, competition, social recognition, and strength and endurance.

Women indicated higher areas in motivation and weight management than did men. Additionally, participants were more motivated to engage in physical activity for enjoyment and to achieve positive health benefits. However, participants indicated insignificant perceived pressure to be healthy despite taking part in physical activity for health benefits. Kilpatrick et al. indicated that intrinsic motivation is closely related to sports participation, whereas exercise is closely related to extrinsic motivation.

The Transtheoretical Model of Change

TTM is an integrative model of behavior change developed from different psychological theories (Bandura, 1977). Prochaska, DiClemente, and Norcross (1992) described this model after observing smokers move through specific stages of motivational readiness along the path to behavior change. TTM was developed to focus on an individual's decision-making (Hales, 2009).

TTM has five distinct stages that have been used as an effective approach to lifestyle self-management (Hales, 2009). Also, the distinct stages are employed to identify when people are trying to change a specific health behavior and focus on both motivation and the actual behavior change. TTM posits that individuals move through the five stages of change as they realize the process for motivational readiness (see Table 1). These five stages of motivational readiness are precontemplation, contemplation, preparation, action, and maintenance (Prochaska et al., 1992). The essential component of TTM recognizes that people vary in their motivation when trying to make long-lasting behavior adjustments (Prochaska & Velicer, 1997). At each individual stage of readiness to become physically active, different factors are in play (Marshall & Biddle, 2001). As this model proposes, an individual's exercise goals should vary depending on his or her stage of motivational readiness for change (Pekmezi, Barbera, & Marcus, 2010).

Stage	Stage Number	Stage Description
Pre-Contemplation	One	No intention of becoming regularly physically active in the next six months
Contemplation	Two	Intending to become regularly physically active within the next six months
Preparation	Three	Intending to become regularly physically active within the next 30 days
Action	Four	Being regularly physically active 30 minutes per day, most days of the week, but only within the last 6 months
Maintenance	Five	Meeting the requirements of PA [physical activity] for at least 6 months

Table 1. Stages of change. Adapted from “College Students’ Motivation for Physical Activity,” by L. L. Delong, 2006, Unpublished doctoral dissertation, Louisiana State University and Agricultural and Mechanical College, Baton Rouge, LA. Adapted with permission.

Pekmezi et al. (2010) postulated that an individual who is not thinking about increasing his or her physical activity is considered to be in precontemplation. However, if an individual is thinking about becoming more physically active but has not taken any actual steps to reach the goal, he or she is in the contemplation stage. If an individual has started engaging in some physical activity but is not meeting the national guidelines for physical activity, he or she is in the preparation stage. If an individual is meeting the national guidelines for physical activity, he or she is in the action stage; once he or she has continued for six months or more, that individual is in the maintenance stage. Of note is that most people will not travel through the model in a linear fashion but rather in a more cyclical fashion because most individuals will need multiple chances to succeed in making lifestyle changes (Pekmezi et al., 2010). For example, an individual may start to become physically active on a regular basis; however, a major life-changing event—such as a job promotion—can make it more difficult to make time for physical activity. Once that individual can adjust to the life-changing event, he or she can again make physical activity a priority and recommit. Therefore, multiple attempts may be needed to make physical activity a habit.

Social Cognitive Theory

SCT has been used successfully for changing behaviors related to physical activity. The main concept of SCT is self-efficacy. Self-efficacy is belief or awareness regarding a person's ability to engage a given behavior or task (Bandura, 1982). Furthermore, "self-efficacy can be described as a person's self-confidence to perform a specific task in challenging and tempting situations" (Marshall & Biddle, 2001, p. 229). When facing barriers, self-efficacy will have an effect on an individual's self-confidence and beliefs. Although the benefit is short-term, SCT maintains that an individual must also believe that he or she will achieve positive outcomes from being physically active—and that these outcomes offset the negative issues associated with not being active (Marcus & Forsyth, 2009). SCT includes three reciprocally related factors: personal, behavioral, and environmental (Bandura, 1986). Personal factors encompass internal thoughts and feelings about a behavior such as self-efficacy and outcome expectations. Behavioral factors include knowledge and skills related to a health behavior. Environmental factors are perceptions of and the actual physical and social environment. The mutual relationship among the three social cognitive factors indicates that they can influence or be influenced by each other (Bandura, 1986).

As Antikainen and Ellis (2011) suggested, self-efficacy should include multiple measures, such as the participants' behavior, quality of life, and satisfaction with outcomes, when determining the effectiveness of the intervention. Antikainen and Ellis (2011) stated that when a person newly adopts a physical activity lifestyle that is a behavioral factor, the result is an increase in one's self-efficacy personal factors. Due to such an enhancement in self-efficacy, the person will be more likely to maintain his or her physical activity lifestyle.

Figure 2 shows the theoretical framework of this study that has been outlined in this section.

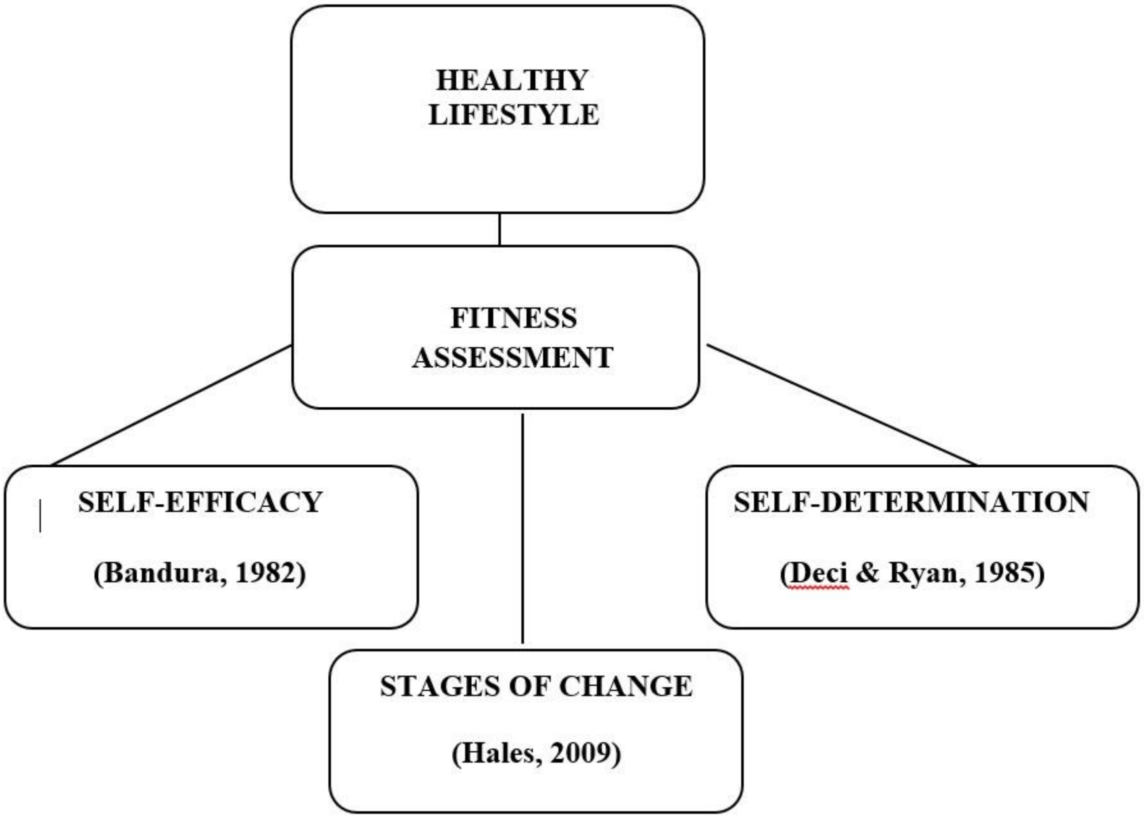

Figure 2. Study framework.

Application of Theory to the Research

Self-efficacy is one of the determinants that the stage of change captures, along with the three dimensions called sequential, motivational, and dependable (Cardinal & Spaziani, 2007). Bandura (1982) stated that an individual's motivation to exhibit a type of behavior was predicated on expectations of results and his or her understanding of self-efficacy. Specifically, self-efficacy beliefs can improve an individual's success and influence the choices a person makes and the courses of action he or she pursues. The research for this study focuses on a healthy physical lifestyle.

Numerous studies identify self-efficacy, decisional balance, and the stages of change about physical activity (Daley & Duda, 2006; Puente & Anshel, 2010; Sabiston et al., 2010). Daley and Duda (2006) examined the correlation between exercise regulations in self-determination and the stage of change for exercise and physical activity among university students. Daley and Duda focused on the connection between independent behavioral regulations for exercise and controlled regulations for exercise and included amotivated to motivated exercisers for both men and women. As presented by Daley and Duda, males reported a higher identified and intrinsic regulation than females. Furthermore, females who were in the preparation stage or who were inactive had less self-determined regulations for exercise than men did. The researchers also determined that most men and women who were in the maintenance and action stages supported more self-determined regulations than those who were in the prepreparation and preparation states.

A more recent study examined the role of women's self-determination to exercise. Sabiston et al. (2010) examined the relationship between the perceptions of body image, emotions, responsibility, embarrassment, and satisfaction related to female physical activity regulations. This study used SDT and its association to physical activity regulations. In particular, the experiences of embarrassment were negatively linked to identified regulation and intrinsic motivation and positively related to the least self-determined regulations, or external and introjected. Sabiston et al. hypothesized that personal pride in oneself was expected to show positive relationships to a large number of self-determined regulations or to develop a negative relationship or no relationship to the least self-determined regulations. The study findings supported the hypothesis by demonstrating unique relationships with the various physical activity regulations. Sabiston et al.'s research was consistent with prior research in which intrinsic regulations were significantly associated with women's physical activity behavior.

SDT has been used to determine what motivates people to become more physically active. Puente and Anshel (2010) used SDT to test the hypothesis that a person's perceived competence and autonomy can be affected by the person's interaction with his or her instructor, and that the instructor's pedagogical method would have a significant influence on the person's self-determined regulation. A secondary part of the study identified the affective and behavioral outcomes resulting from self-determined regulation. Puente and Anshel hypothesized that SDT could both considerably explain and predict a person's exercise behavior. As hypothesized, exercise participation improves if the person's main objective is exercise. However, the exercise participation occurs in reaction to the satisfaction and happiness received from physical activity. Puente and Anshel cautioned that the instructor's perceived interaction could have a considerable effect on self-determined regulation to fitness as a part of perceived competence and independence. As a result, the research of Puente and Anshel indicated that it might be useful to emphasize self-determination rather than controlling reasons to exercise in attempting to educate individuals about the benefits of leading a more physically active lifestyle.

Past studies hypothesized that self-determined motivation in physical education class is linked to high levels of organized and voluntary physical activity. Lonsdale, Sabiston, Raedeke, Ha, and Sum (2009) examined this hypothesis with 528 Chinese students enrolled in mandatory physical education (PE) classes. The results determined that voluntary physical activity choices led to greater PA for students than did structured lessons. Therefore, Lonsdale et al. (2009) suggested that incorporating voluntary physical activity choice into PE classes promoted self-determined motivation and might be an effective means of promoting activity, improving health, and enhancing physical fitness. The results indicated that self-determined motivation might be particularly vital when students have free choices.

An additional study by Standage, Duda, and Ntoumanis (2006) used SDT to examine the relationship between 394 British secondary school PE students. The results supported greater levels of performance and persistence with self-determined methods of motivation. Standage et al. found that self-reported levels of self-determined motivation positively corresponded with the way teachers' rate how hard students try to persevere. As such, the research indicated that when students perceived greater levels of autonomy, competence, and relatedness, they had higher scores on an index of self-determination. A study using 3,858 participants examined TTM across multiple problem behaviors between the stages of change and decisional balance (Prochaska et al., 1994). The study found that the consideration to change was higher in participants in the contemplation stage than in participants in the precontemplation stage. Moreover, the study found that the consideration to change had no consistent pattern of differences between subjects in the contemplation stage and those in action. The positives from the study were higher in the action stage for five of the behaviors, lower for five, and equal for two.

Liang, Motl, McAuley, and Konopack (2007) examined the impact of self-efficacy on physical activity satisfaction. Liang et al. found that a person's efficacy had a considerable influence on satisfaction levels after completing a maximal fitness test and a cycling exercise session of moderate intensity. In comparison, participants with high efficacy reported a higher level of satisfaction with physical activity than those with low efficacy. Furthermore, post-exercise self-efficacy was linked to satisfaction with physical activity after controlling for pre-exercise self-efficacy and performance on the fitness test (Liang et al., 2007).

On the other hand, some disconcerting information also resulted from Liang et al.'s (2007) study. The evidence indicated that the self-efficacy satisfaction relationship was weak. In other words, satisfaction did not differ between the two circumstances, but was somewhat connected with post-exercise self-efficacy after controlling for pre-exercise efficacy.

In recent years, other research has concentrated on college students becoming more physically active. Berry and Howe's (2005) research focused on the effects of exercise marketing on self-efficacy and decisional balance for changing the exercise behavior of university students. The treatment addressed health, appearance, or control advertising and participants completed stage of change, exercise self-efficacy, and decisional balance questionnaires. As found by Berry and Howe, males experienced a significant negative effect in their overall self-efficacy and, in particular, their self-efficacy when exercising alone or exercising when there is resistance from others. Berry and Howe provided evidence that appearance-based marketing that focused on images of very attractive exercisers can have negative effects on self-efficacy for men in a similar way that images of attractive, thin women can have harmful effects on a woman's body image. Their research was important because of the need to find methods for increasing exercise participation. Ultimately, the failure of health and body image approaches to improving healthy lifestyle may indicate the need for a different method because health-related exercise marketing had no effect (Berry & Howe, 2005).

Cardinal and Kosma (2004) developed a study to measure the stages of change, the behavioral and cognitive processes of change, and the self-efficacy of change of college students. They used TTM as the basis of muscular-fitness-promoting behaviors. One of the hypotheses of this research was to identify significant predictors for determining the stages of change of college students concerning muscular-fitness-promoting behaviors. The researchers also examined the processes of change and self-efficacy compared to the stages of change (Cardinal & Kosma, 2004).

The Cardinal and Kosma (2004) study revealed that the behavioral and cognitive processes of change and self-efficacy were all essential contributors that indicated a possible modification in stage of change for muscular-fitness-promoting behaviors. Additional findings showed that the process of developing healthy behavior and self-efficacy might have a strong influence on increasing and maintaining muscular fitness among active college students. Research by Sullum and Clark (2000) indicated that self-efficacy is a predictor of adherence in college students staying physically active because findings showed that students with low self-efficacy quit or relapse from physical activity.

Healthy Behaviors and Physical Fitness

Regular physical activity leads to a healthy life (Cooper, 2010; USDHHS CDC, 2011). Indeed, research has shown that regular physical activity is positively linked to living life with optimal health and vitality (Berryman, 2010; Cooper, 2010; Fayeh et al., 2010; USDHHS CDC, 2011). Physical activity is also related to preventing or helping manage diabetes, metabolic syndrome, obesity, hypertension, cardiovascular disease, and colon cancer (Nelson et al., 2007). Among all different ages, a sedentary lifestyle is associated with increased body composition or high BFP rates (Berryman, 2010; Nelson et al., 2007). However, more than one-half of adults do not meet the minimum activity guidelines necessary for good health and lowered disease risk (Haskell et al., 2007).

The incidence of obesity is escalating among younger adults and adolescences (Morrow et al., 2013; USDHHS CDC, 2010c). A U.S. study by Ford and Capewell (2007) investigated coronary heart disease mortality from 1980 through 2002 among young adults and found an increase in mortality. Additionally, empirical research determined that one-third to two-thirds of college students are physically inactive and display poor health behaviors (Boyle & LaRose, 2008; Keating et al., 2005; Keating et al., 2010). This is the case even though college students usually have access to fitness facilities and equipment (Miller, Noland, Rayens, & Staten, 2008). Research also indicated that college students will not increase their physical activity merely because of proximity to and availability of equipment and facilities (Keating et al., 2005; Keating et al., 2010). Sparling (2003) recommended more effective physical activity interventions for students in higher education settings.

A study by Olshansky et al. (2005) predicted that a decline in life expectancy would occur in the 21st century. Life expectancy has traditionally been one way of distinguishing the public's health status. Olshansky et al. forecasted that by 2020 life expectancy could decline between 0.3 to 1.08 years. Olshansky et al. suggested that being diagnosed with chronic diseases earlier in life is related to the prevalence of being overweight and obesity among young adults.

A health promotion study by Anderson, Wojcik, Winett, and Williams (2006) used SCT to test the physical activity of 999 adults (21% African American; 66% female; 38% inactive) from 14 southwestern Virginia churches. The researchers examined the SCT influence on physical activity through self-efficacy and its effect on self-regulation, age, race, social support, and self-regulatory influences on physical activity level. Anderson et al. found that older age individuals had the greatest total effect on physical activity (β=-0.50); "greater age was associated with lower levels of physical activity" (p. 518). Self-regulatory behaviors increased as self-efficacy and outcome expectations improved. Although self-efficacy consistently emerged as a strong predictor of adopting and maintaining exercise, self-regulation was the variable that exerted the strongest total effect on physical activity. Participants in the study who scheduled time for exercise were more physically active. In addition, self-efficacy had no influence on physical activity levels. Anderson et al. found that the total effect of self-regulation on physical activity among participants far exceeded the total effect of self-efficacy. The study recommended that physical activity interventions emphasize increasing self-regulatory behaviors.

Positive and Negative Relationships Among Physical Activity Behavior Lifestyle

The relationships between physical activity behavior and age, race or ethnicity, and being overweight or obesity have also been subject to study (Milroy, 2010). Brown (2005) revealed that an individual’s barriers to an active lifestyle included inadequate time, lack of motivation, childcare issues, and lack of interest. A person’s perception of exercise and mood can also have a negative association with an adult’s physical activity level (Markus, Goldfine, & Mitchell, 2003). Research found that regular physical activity promotes a health and wellness lifestyle over a long period (Fahey, Layte, & Gannon, 2004; Lerner et al., 2011; Wijndaele et al., 2007) and reduces the risk of obesity, metabolic syndrome, and eventually type 2 diabetes among young adults (Fahey, Delaney, & Gannon, 2005; Lerner et al., 2011; Morrissey, McElligott, & Tangney, 2001). Demographic factors that have been documented as having a positive relationship to U.S. adults’ level of physical activity are being male, college-educated, and in an upper socioeconomic status. Genetics—or heredity—also demonstrates a positive relationship to physical activity (Milroy, 2010). Other determinants documented with a positive association to physical activity are enjoyment of exercise, benefits of physical activity, aiming to become more physically active, and having a positive opinion of exercise (Markus et al., 2003; Milroy, 2010). To enhance these determinants, self-efficacy for exercise and greater motivation to be physically active must be improved.

College Students' Physical Activity Behavior Lifestyle

The issue of inactivity among college students is identical to that which is affecting society as a whole (Hackman & Mintah, 2010). Today's problems with inactivity are vitally important, and inactivity is particularly persistent in young adults, the typical age range of most college-aged students (ACHA, 2009; Bjerke, 2012; Hackman & Mintah, 2010; Huang et al., 2003). Research has indicated that only 30% of college students are getting the recommended amount of physical activity health benefits (Blanchard et al., 2008).

Researchers have pointed to the decline in physical activity rates among high school students transitioning to college (Lerner et al., 2011). This decline has led to the detrimental impact of being overweight and obesity among college students (Bjerke, 2012). As reported in a study by Pritchard, Wilson, and Yamnitz (2007), undergraduate students' physical and psychological health deteriorated over their freshman year in school. The study found that handling stress, school pressure, poor self-efficacy, and low self-esteem accounted for the declines. Current published research focuses on the determinants of physical activity in adults; however, research is limited for determinants of college-aged students' physical activity (Nelson et al., 2007). Although Bjerke (2012) cautioned that research has continually established that being overweight and obesity concerns are prevalent among college students, only a small number of studies have specified precise risk factors that may be distinctive to this population.

According to the U.S. Department of Education, of all young adults aged 18-24 within the U.S., about 42% are enrolled as college and university students (USDED NCES, 2013). Past research has indicated that this college student age group has demonstrated a distinct decline in proper health and wellness behaviors (Pritchard et al., 2007). In fact, roughly two-thirds (65%) of U.S. adults over the age of 20 are overweight or obese, and the obesity rates have increased gradually in the United States over the last 30 years (Kim, Ahn, & No, 2012). Researchers have also found that low levels of physical activity are prevalent in young adults (Fahey et al., 2005), and physical activity has been found to decline rapidly in adolescence (De Róiste & Dineen, 2005; Fahey et al., 2004; Markus et al., 2003). Past research has shown that within a year following enrollment, college students' physical and psychological conditions worsened. Negative behavior increased and physical ailments and negative affect were more prevalent at the end of the first year of enrollment. In addition, researchers found that students with low self-esteem reported more physical health problems (Pritchard et al., 2007). All this negative information is ironic when considering the extant research, which shows that higher education institutions are ideal places to promote and motivate healthy behavioral changes.

According to Sallis, Prochaska, and Taylor (2000), the correlation of health benefits from physical activity is instrumental to successfully developing effective physical activity behavior strategies and to bringing about change. Research has been inadequate in investigating the correlation of health benefits from physical activity among college students 18–22 years old (Bian et al., 2011; Sallis et al., 2000). Lerner et al. (2011) performed a study focusing on rates of physical activity among college students. The study had a represented sample of 532 college students (men = 185, female = 335) across the Republic of Ireland. Participants ranged in age from 17 to 50 years, with 90% of the students who participated in the study aged between 17 to 25 years. Lerner et al.'s findings were consistent with past research that indicated that males participate in higher levels of physical activity than females (De Róiste & Dineen, 2005). However, females were found to participate in more unorganized physical activity than males. The conclusions confirmed other findings that males favored more competitive activities and team sports, whereas females preferred less competitive, individual physical activities (De Róiste

& Dineen, 2005; Lerner et al., 2011). As such, females are at a greater health risk due to their lower levels of physical activity (Lerner et al., 2011; Wijndaele et al., 2007).

A commitment to combat effectively the lack of physical activity in college students has mobilized many groups. The ACHA (2009) is committed to the health and wellness of students in higher education. The ACHA used the Healthy Campus 2010 objectives to assess the health needs of college students, conducting a comprehensive study of 106 campuses in 2008. The majority of these colleges were four-year institutions. The ACHA initiated research that determined that of the 36,000 students who self-reported their physical activity, a slight minority (45.5%) reported being vigorously active at least 20 minutes or moderately active for at least 30 minutes during at least three of the previous seven days. "Concerning skeletal muscle, 49.2% of students reported strength training on at least two of the past seven days" (ACHA, 2009, p. 480). The study also revealed that the mean estimated BMI for women and men fell within the healthy BMI range. The ACHA concluded that this evidence should be considered when advancing the health and fitness of college students.

Huang et al. (2003) studied approximately 740 students, assessing healthy lifestyles of students whose ages ranged from 18 to 27 years. Huang et al. found that college students perceived themselves as being healthy; however, a high percentage of the students surveyed were classified as overweight and engaged in a low level of physical activity. Results indicated that a large percentage of college students' physical activity level was below national recommended standards, particularly among students who were at least 20 years old. Huang et al. stressed that their study was delimited by a lower prevalence of overweight students, with almost 90% of the participants being white. The rate of obesity in whites may be only 60% of the rate found among African Americans. Conversely, Sira and Pawlak (2010) researched a southeastern university with over 25,000 college students, ages 18–25. Those students self-reported their BFPs. Sira and Pawlak found that fewer than six of 10 students (57%) surveyed reported BFP scores below or within normal limits; among the participants, male students and African American students were more likely to be overweight or obese.

Attending college is a major life event that many people in the United States experience. Chen, Cheng, Huang, Ting, and Yang (2011) explained that the college experience is considered a vital stage in an individual's life. The benefits of being physically active are evident, yet so many college students continue to disregard it (Racette, Deusinger, Strube, Highstein, & Deusinger, 2005). Racette et al. (2005) performed a longitudinal study of college students from freshman year to senior year. The researchers identified that over one-half of college students sampled did not meet the recommendation for physical activity. Additionally, the study indicated that approximately one-third of the students sampled did not engage in adequate physical activity during their freshman year. Equally important, the study revealed that these same students experienced statistically significant increases in negative body composition during their four years of college. As a result, the lifestyle behaviors that college students develop will have a significant impact on the rest of their life, possibly in a negative way (Chen et al., 2011).

Health Assessments

There are multiple roles for assessing an individual's health-related physical fitness; however, the most important aspect for this study is motivating individuals to become more physically active. In the words of Chen et al. (2011), "Health-related physical fitness is defined as the physical capability that individuals have to enable heart, blood vessels, lung, and muscles to function effectively" (p. 324). Health-related physical fitness consists of functional ability and is affected by an individual's level of physical activity and lifestyle behaviors (ACSM, 2010).

More specifically, an individual with a high level of health-related physical fitness concentrates on optimal health and prevents the onset of chronic illness and problems related to inactivity (Ortega et al., 2008).

Health Assessment Components

ACSM has led the development of guidelines for health-related fitness. ACSM has suggested that five measureable components comprise health-related fitness. The five health components of physical fitness include (a) body composition (body mass index, waist circumference, body fat percent, body fat distribution); (b) muscular strength; (c) muscular endurance; (d) flexibility; and, (e) cardiorespiratory fitness (aerobic fitness, resting blood pressure, resting heart rate (Shields et al., 2010).

Body composition refers to an individual's fat to fat-free mass (ACSM, 2010). Assessing an individual's body composition can provide information regarding an individual's health risk to certain lifestyle diseases. Thus, body composition provides information to help establish a point of reference regarding reasonable goals and decisions about weight gain or loss (Fahey et al., 2010). There are multiple methods available to assess body composition. Therefore, acquiring this information provides the first steps to developing a path toward positive long-term lifestyle behaviors.

The most common measure of body composition is body fat percent (BFP) (ACSM, 2010). However, all methods used to measure body fat have a margin of error, so precise value should not be the ultimate focus (Fahey et al., 2010). Another method is body mass index (BMI), which is used to classify an individual's health risk. BMI is calculated from height and weight; however, BMI provides no information on distribution of body fat, which makes the assessment limited (Shields et al., 2010). Waist circumferences and waist-to-hip ratio classification are used to assess fat distribution. Cardiorespiratory fitness or endurance is an indication of an individual's ability to maintain a level of activity for an extended period of time (ACSM, 2010). The direct measure of oxygen consumption is considered the best method of cardiorespiratory fitness (Laukkanen & Kurl, 2009). This method is expensive and must be administered in a physiology laboratory where one analyzes the air a person inhales and exhales while exercising. Nevertheless, there are a number of simple methods that provide a reasonable estimate of maximal oxygen consumption, such as the 1-mile walk test, the 3-minute step test, and the 1.5-mile run-walk test (Fahey et al., 2010). An individual's cardiorespiratory fitness level is a determinant of cardiovascular disease, diabetes, practical limitations, physical activity levels, and mortality (Shields et al., 2010). Cardiorespiratory fitness assessments give a better understanding of the relationship between fitness and current and future disease risk. According to Laukkanen and Kurl (2009), research has indicated that cardiorespiratory fitness can have effects on reducing death related to cardiovascular disease associated with obesity and all illness-related causes of death.

People use the last muscle fitness in all aspects of their life. The benefits of muscle strength and endurance on lifelong health are injury prevention, body composition, and muscle and bone health (Fahey et al., 2010). Shields et al. (2010) stated that significant evidence indicated that muscle fitness has considerable health benefits that include longer life, increased mobility, more independence, less pain, and an increase in quality of life. Muscle fitness is assessed in two ways. Muscle strength measures maximal forces, and muscle endurance measures continual static or dynamic contraction to resist fatigue (ACSM, 2010). Both strength and endurance assessment have multiple methods of measures that can be performed. ACSM recommended that different muscles or groups of muscles be tested to obtain an overall assessment of an individual. According to Jackson et al. (2010), research has determined a link between muscle strength and weight management. A study completed in Canada suggested that strength training helped ease weight gain as people age, which could lead to preventing obesity (Jackson et al., 2010). In addition, Welk and Meredith (2008) stated that muscle fitness in adolescents and young adults has shown moderately high relationships to musculoskeletal fitness and health status. That finding confirmed the significance of assessing an individual's muscle strength, muscle endurance, and flexibility (Welk & Meredith, 2008).

The body has numerous joints, and flexibility is specific to each joint (Fahey et al., 2010). Individuals are often not focused on flexibility. Discussions of the musculoskeletal system and health also address flexibility. A positive health status assessment factors in a person's flexibility (Welk & Meredith, 2008). ACSM (2010) specified that flexibility is an important component, because inadequate flexibility lessens one's ability to perform daily physical activities. According to Fahey et al. (2010), poor joint health can lead to joint lubrication issues such as deterioration of the joint. Flexibility refers to the free movement through a joint or group of joints. In addition, poor lower back and hip flexibility may contribute to the development of lower back issues, which is one of the leading causes of loss of productivity in the workplace and a leading medical cost issue (ACSM, 2010; Shields et al., 2010).

Flexibility assessment is essential to identifying joints with low ratings in range of motion or muscle strength imbalances (ACSM, 2010). Strength imbalances can result in potential injury or postural disturbance. Therefore, once these issues are recognized, remedies can be prescribed. This information is important for all health and wellness practitioners, scientists, and other health professionals with regard to designing rehabilitation, exercise, and preventative wellness programs (Fabre et al., 2007).

Flexibility assessments include a single measurement to represent general flexibility. The sit and reach flexibility test is the most commonly used assessment measure. In fact, this test assesses multiple muscles, which include the gastrocnemius, hamstring, and gluteals, and it assesses lumbar, thoracic, and scapular flexibility. In addition, there are some simple, specific assessment tests for general flexibility. It is recommended that the major joints be assessed (Fahey et al., 2010).

Application of Health Assessments

The leading cause of death in the United States is cardiovascular disease (USDHHS Office of Disease Prevention and Health Promotion, 2010). Furthermore, musculoskeletal issues are a big problem for individuals and society (Ruiz et al., 2009). As a result, the need to assess an individual's health-related physical fitness components is important because of its significant relationship to an individual's health. However, these components must be measured as a sum rather than a single entity because the individuals could work on one component and forsake others (ACSM, 2010).

Numerous studies have examined the impact of health assessment. Butler et al. (2004) examined the effects of relocation to college on freshmen's diet, physical activity, and body-composition changes. The researchers compared the new college students to returning students. The results indicated that the body weight of the returnee participants was significantly higher. The study indicated that interventions related to physical activity and diet were needed to prevent increased adipose body composition among female college freshmen.

Keating et al. (2010) examined health-related fitness (HRF) knowledge and the relationship to PA on undergraduate students. Consistent with previous research (Keating et al., 2005), this study found that most college students did not exhibit a satisfactory amount of health-related fitness knowledge. Keating et al. (2010) stated that the researcher found it discouraging that universities have not been able to improve this situation. In fact, to educate students on health fitness knowledge, many higher educational institutions are now requiring undergraduate students to take at least a one unit credit class of physical education under their general education curriculum (Corbin & Cardinal, 2008; Keating et al., 2010). Notably, however, Keating et al. (2010) found that student health-related fitness knowledge and physical activity did not change significantly throughout their college years, indicating that the institution had not been able to educate the students about health behaviors. A more recent study by Saville et al. (2014) used the American College of Sports Medicine-recommended guidelines to investigate the health-related fitness of undergraduate kinesiology students. The study represented a sample of 98 women and 129 men, and the participants completed five HRF tests covering four areas of fitness.

Past research has shown that increasing the physical activity levels of college students is important for improving health (Bray & Kwan, 2006; Lowry et al., 2000). Conversely, a study by Saville et al. (2014) was the first to use direct physical tests to describe the HRF of a specific academic discipline, kinesiology, and compared them to commonly recognized standards. The findings determined that both women and men in the study were above the recommended norms in flexibility and muscular endurance. However, they were significantly poorer in the body composition component. In addition, men were below average in terms of cardiorespiratory endurance, whereas women met the recommended norm. Saville et al. (2014) concluded that undergraduate kinesiology students could improve their HRF to optimize health benefits.

Summary

Because of the health issues associated with obesity, proactive measures and lifestyle interventions must be pursued vigilantly. According to Garrett et al. (2004), the cost of this crisis amounts to hundreds of millions of dollars. Based on data from the CDC, the decline is continuing to worsen. The USDHHS CDC's (2010c) most recent data demonstrate that 80% of children 10–15 years old will be overweight or obese young adults in their college-age years. Unfortunately, college students seem to be particularly susceptible to unhealthy behaviors due to the changes that occur when they leave home and leave the organization of a daily school routine. Numerous studies have addressed motivation, physical activity, and perceived competence for children and adolescents; however, very few studies use the college student as a participant (Hutto & Russell, 2011). Therefore, there is a need to increase the research involving college students developing a physically active lifestyle. Teenagers and young adults need to be the focus of studies on implementing and maintaining a lifestyle of exercise (Sullum & Clark, 2000).

In this review of the literature, the researcher considered studies that examined effective ways to empower young adults to make prudent choices related to engaging in a physically active lifestyle. SDT and the stages of change are used to demonstrate when individuals become more intrinsically motivated, which leads to enhanced overall activity levels (Mullan & Markland, 1997).

The literature on motivational strategies for college students to develop health behaviors is minimal relative to similar research published on children and adolescents (Nelson, Kocos, Lytle, & Perry, 2009). Morrow et al. (2013) determined the need for additional research on the relationship between inactivity and the five health-related components of physical fitness (aerobic capacity, body composition, flexibility, muscular strength, and muscular endurance) among young people. The research from this study helps to contribute to the current body of literature regarding motivating college students. This study also provides evidence about determining the effect health assessments can have on a person's motivation to be more active rather than using health assessments only to determine a person's current level of physical activity.

CHAPTER THREE: METHODS

Design

The researcher conducted a quantitative, quasi-experimental, pretest-posttest, nonequivalent comparative research study. The purpose of this study was to determine whether health assessments motivated college students to become more physically active compared to students not participating in such assessments. This research was performed by combining aspects of the SDT, SCT, and TTM, which evaluate a person's motivations and behavior toward physical activity. The researcher used TTM and SCT, which is a behavior change theory, to assess the dimensions of decisional balance, self-efficacy, and stages of change (Prochaska & Velicer, 1997).

The independent variable was the Health and Personalized Fitness course HE 109, with lecture and health assessments. Both the comparison and treatment groups were enrolled in the Health and Personalized Fitness course. Students in the treatment group received instruction with discussion, lecture, videos, and health assessments. The Health and Personalized Fitness course was designed to assist students in the development of a lifelong commitment to a wellness lifestyle with an emphasis on regular participation in fitness activities and healthy dietary habits. Core concepts, methods, and behavior management techniques related to the development and maintenance of fitness, nutrition, weight management, managing stress, and reducing risks associated with various lifestyle-related diseases were examined, assessed, and evaluated. Students developed and implemented a comprehensive fitness and wellness plan to achieve a healthier lifestyle. The course included participation in instructional exercise sessions with additional opportunities for students to utilize the fitness facilities beyond the scheduled class times. The comparison group included students who had enrolled in the Health and Personalized Fitness course but did not receive the heath assessments.

Research Questions

The researcher used the following questions to guide this research:

RQ1: Controlling for the pretest scores on the Physical Activity Stages of Change Questionnaire (PASCQ), is there a significant difference in the community college students' stage of change, as measured by posttest scores on the PASCQ, based on the students' participation in a health assessment in a Health and Personalized Fitness course?

RQ2: Controlling for the pretest scores on the Revised Behavioral Regulation in Exercise Questionnaire (BREQ-2), is there a significant difference in the community college students' level of self-determination, as measured by the posttest scores on the BREQ-2, based on the students' participation in a health assessment in a Health and Personalized Fitness course?

RQ3: Controlling for the pretest scores on the Physical Exercise Self-Efficacy Scale (PESES), is there a significant difference in the community college students' level of physical exercise self-efficacy, as measured by the posttest PESES, based on the students' participation in a health assessment in a Health and Personalized Fitness course?

RQ4: For community college students who participated in a health assessment in a Health and Personalized Fitness course, is there a significant difference between the pretest levels of the body fat percent (BFP) before the course and the students' level of body fat measured by the posttest BFT after the course?

RQ5: For community college students who participated in a health assessment in a Health and Personalized Fitness course, is there a significant difference between the pretest levels of $V0_2$ MAX, before the course and the students' posttest level of $V0_2$ MAX, after the course?

Null Hypotheses

The following null hypotheses were used for this study:

$H_0$1: Controlling for the pretest scores on the Physical Activity Stages of Change Questionnaire (PASCQ), there is no statistically significant difference in the community college students' stage of change, as measured by posttest scores on the PASCQ, based on the students' participation in a health assessment in a Health and Personalized Fitness course.

$H_0$2: Controlling for the pretest scores on the Revised Behavioral Regulation in Exercise Questionnaire (BREQ-2), there is no statistically significant difference in the community college students' level of self-determination, as measured by the posttest scores on the BREQ-2, based on the students' participation in a health assessment in a Health and Personalized Fitness course.

$H_0$3: Controlling for the pretest scores on the Physical Exercise Self-Efficacy Scale (PESES), there is no statistically significant difference in the community college students' level of physical exercise self-efficacy, as measured by the posttest PESES, based on the students' participation in a health assessment in a Health and Personalized Fitness course.

$H_0$4: For community college students who participated in a health assessment in a Health and Personalized Fitness course, there is no statistically significant difference between the pretest levels of the body fat percent (BFP) before the course and the students' level of body fat measured by the posttest BFT after the course.

$H_0$5: For community college students who participated in a health assessment in a Health and Personalized Fitness course, there is no statistically significant difference between the pretest levels of MAX $V0_2$ before the course and the students' posttest level of MAX $V0_2$ after the course.

Participants and Setting

The participants for this study were drawn from a community college in the Mid-Atlantic region of the United States. The researcher chose a commuter-type community college (there were no dorms at this institution) to administer this study because the setting had college students whose lifestyles were closer to the activities and living arrangements of most Americans their age. The community college is located near Washington, D.C., and the college has one of the most diverse communities in the country in terms of age, gender, race and ethnicity, class, and disabilities among its students. At the time of this study, the community college enrolled over 60,000 credit and workforce development students and more than 3,000 distance education credit students. The institution has three campuses, and health and fitness are promoted at all of the campuses. Each campus has a fitness and health facility with a diverse set of equipment and settings, such as two basketball courts, a fitness center, a resistance training room, two pools, an outdoor track, and four activity fields; however, only one campus was represented in the study.

All participants were enrolled in the college's Health and Personalized Fitness course (HE 109) and represented different ranges of physical fitness and activity levels. In Maryland, students completing an associate's degree must pass a health course to graduate. Students who enrolled in this class for one semester were either fulfilling the general education health requirement or majoring in health or physical education. The one prerequisite for the Health and Personalized Fitness course was English 101: Introduction to Composition.

The researcher chose HE 109 in lieu of other health classes because it examined, measured, and appraised behavior management techniques related to the development and maintenance of fitness. The Health and Personalized Fitness course assisted students in developing a lifelong commitment to a wellness lifestyle with emphasis on regular participation in fitness activities and healthy dietary habits. The class focused on core concepts, methods, and behavior management techniques related to the development and maintenance of fitness, nutrition, and weight management and dealt with managing stress and reducing risks associated with various lifestyle-related diseases. As part of the course, students prepared and implemented an individualized, comprehensive fitness and wellness plan to achieve a healthier lifestyle. The course included active participation within an instructional exercise session and additional opportunities for students to utilize the fitness facilities beyond the scheduled class times.

The methods utilized for instruction in HE 109 consisted of discussion, lecture, and video. Groups received their instruction at three different venues: a 400-meter track, a fitness center, and a free-weight room. Students in HE 109 could reinforce the learned health behavior because they had access to the fitness facilities during non-class time. The institution allowed participation by students in the research and provided all necessary data for the researcher to complete the research study.

The researcher used four classes that had a maximum of 24–28 students enrolled. The total convenient sample size was 67 students who were freshmen or sophomores at the college. The researcher used Cochran's formula to determine a sample size of 67 students (Barlett, Kotrlik, & Higgins, 2001). The Cochran formula set the alpha level at .05 and the *t*-value at 1.96. As described by Ary, Jacobs, Razavieh, and Sorensen (2006), the majority of educational research uses an alpha level of 0.05 to determine sample size. There was no random selection of students or random placement into the treatment-program group and comparison group. Students volunteered their participation in the research, and they could drop out at any time. The comparison group was matched, based on demographics, as nearly as possible to the treatment-program group. Homogeneity of variance was tested using Levene's test. Variance effects from the pretest on the posttest were controlled for using the pretest as a covariate. Table 2 shows a description of the groups.

Table 2

Description of the Groups

Description	Treatment-Program Group	Comparison Group	Total Sample
N	34	33	67
Males	18	15	33
Females	17	17	34
Mean Age	21.1	22.3	21.7
Freshman	18	16	34
Sophomore	17	16	33

Instrumentation

The researcher used three self-reporting instruments to assess students' stage of change, self-regulation, and self-efficacy to be physically active.

Behavioral Regulation in Exercise Questionnaire-2 (BREQ-2)

Deci and Ryan's (1985) SDT is the accepted theoretical framework for studying motivation in exercise psychology. Mullan, Markland, and Ingledew (1997) developed the Behavioral Regulation in Exercise Questionnaire (BREQ) to determine exercise motivation along a graded self-determination continuum. BREQ consists of assessing the subscales—external, identified, introjected—and intrinsic regulations in exercise. Markland and Tobin (2004) revised this instrument, validating it as BREQ-2 by adding amotivation as a subscale. The BREQ is a 5-point Likert questionnaire—where 1 = *not true for me*, 2 = *hardly ever true for* *me*, 3 = *somewhat true for me*, 4 = *true for me*, and 5 = *very true for me*—to address 19 items measuring an individual's level of self-determination (Moreno, Cervelló, & Martínez, 2007).

Research has shown that the BREQ's Cronbach subscale reliability ranges from .76 to .90 and is valid in terms of predicting stage of exercise behavior (Mullan et al., 1997; Wilson, Rodgers, & Fraser, 2002). When amortization was added to the BREQ instrument, a factorial validity was assessed using confirmatory factor analysis, root mean square error of approximation (RMSEA), and non-normed fit index. The conclusion supported its validity (RMSEA = 0.02, 90%; CFI = .95; NNFI = .94). The group used for validation was comprised of individuals referred by United Kingdom health care professionals (Markland & Tobin, 2004). Furthermore, Moreno et al. (2007) performed a validity study measuring self-determination motivation in a Physical Fitness Setting using BREQ-2, and the empirical data showed a RMSEA of values respectively of 0.06 and 0.05, slightly above 0.05. After studying the reliability and validity of the BREQ-2 scale, they concluded that the BREQ-2 was a reliable instrument to determine the regulation levels along the amotivation to intrinsic motivation continuum.

The BERQ-2 consists of five scales: amotivation (items 5, 9, 12, 19), external regulation (items 1, 6, 11, 16), introjected regulation (items 2, 7, 13), identified regulation (items 3, 8, 14, 17), and intrinsic regulation (items 4, 10, 15, 18). According to Ingledew, Markland, and Sheppard (2004), the participants' scale scores are computed as the mean of their non-missing item scores. At the culmination of the research, the Cronbach's original subscales were tested to determine the internal consistency reliability of the five subscales.

Physical Activity Stages of Change Questionnaire (PASCQ)

The stage of change instrument was developed to measure the intent of behavioral change (Marcus & Simkin, 1993). The instrument has four statements to determine the five stages of change from TTM. The statements are as follows: "I am currently not physically active, and I do not intend to engage in physical activity in the next six months" (precontemplation); "I am currently not physically active, but I am thinking about getting more physically active in the next six months" (contemplation); "I currently do some physical activity, but not regularly" (preparation); "I am currently regularly physically active, but I have only begun doing so within the last six months" (action); and "I am currently regularly physically active and have been so for more than six months" (maintenance; Lorentzen, Ommundsen, Jenum, & Holme, 2007; Wei-Chen & Gillett, 2005). The PASCQ is responded to using a "yes" or "no" format and is scored on an algorithm that determines an individual's current stage of change. The scoring algorithm for the PASCQ is as follows (Welk, 2002, p. 234):

- If question 1 = 0 and question 2 = 0, then you are at stage 1 (precontemplation).
- If question 1 = 0 and question 2 = 1, then you are at stage 2 (contemplation).
- If question 1 = 1 and question 3 = 0, then you are at stage 3 (preparation).
- If question 1 = 1, question 3 = 1, and question 4 = 0, then you are at stage 4 (decision/action).
- If question 1 = 1, question 3 = 1, and question 4 = 1, then you are at stage 5 (maintenance).

Past research has established concurrent validity; however, PASCQ validity is often based on comparisons to other self-reported measures of behavior. In a recent study of a weight-loss intervention program of overweight and obese women, Robinson et al. (2008) tested the validity of the stage of change. The study used p-values, and the predictive validity tests were measured as statistically significant at ($p > .05$). Furthermore, the validity tests were statistically significant with a Bonferroni correction of $p < 0.01$. Marcus, Selby, Niaura, and Rossi (1992) tested 1,063 Rhode Island government workers and established Kappa reliability of 0.78 over a two-week, test-retest study. Furthermore, Mander, Teufel, Keifenheim, Zipfel, and Giel (2013) used a sample of 253 patients that validated an excellent factor loading of $0.52 \leq \lambda \leq 0.87$. The PASCQ had internal consistencies of $0.61 \leq \alpha \leq 0.84$.

Physical Exercise Self-Efficacy Scale (PESES)

The researcher used the PESES to evaluate potential influences in initiating behavior change (Brown, 2005; Schwarzer & Renner, 1993). The PESES uses five items with a 4-point Likert scale (1 = *very uncertain*, 2 = *rather uncertain*, 3 = *rather certain*, 4 = *very certain*) to assess an individual's confidence level to adhere to physical activity. The item scale begins by asking the question, "How certain are you that you could overcome the following barriers?" This question is followed by the statement, "I can manage to carry out my exercise intentions…" This statement is followed by five concluding phrases:

1. even when I have worries and problems.
2. even if I feel depressed.
3. even when I feel tense.
4. even when I am tired.
5. even when I am busy (Schwarzer & Renner, 1993).

Item-total correlations were good, ranging from 0.64 to 0.76, and internal consistency was excellent (Cronbach's alpha = 0.88). Validity for this measure was supported, as evidenced by a moderate correlation with exercise intention ($r = 0.33$) and physical activity behavior ($r =$

0.39) at the 6-month follow-up (Brown, 2005). Moreover, Marcus, Eaton, Rossi, and Harlow (1994) established an internal reliability ($\alpha = 0.82$) and test-retest reliability of 0.90.

Health Assessments

For this study, the health-related components were scored using the criterion-referenced evaluation (Welk & Meredith, 2008). The criterion method uses scores that have classifications that use health status (ACSM, 2010). When determining the criterion-referenced reliability and validity, often both the Kappa coefficient and the phi coefficient are reported to provide a more reliable or valid picture. The interpretable values of P range from .50 to 1.00, and Kappa values range from .00 to 1.00 (Welk & Meredith, 2008). The following are the protocols used to assess the five health components of fitness (ACSM, 2010; Fahey et al., 2010).

Procedures

To begin this research study, the researcher secured a letter of support and approval from the administration of the college where the research was to be performed. Then, certification of research was issued from the Institutional Review Board (IRB) of Liberty University. The proposed research study was completed during the spring semester of 2014. Two classes were randomly assigned to the program or treatment group and two classes were randomly assigned to the comparison group. The researcher attempted to match the two groups based on demographics. Additionally, all of the instructors teaching this course were fitness certified and ensured that the test they administered was reliable.

During the beginning of the spring 2014 semester, there was a college-wide department meeting. All HE 109 instructors assisting with the research received the testing protocol at this department meeting. At that time, the researcher provided a written checklist to insure that all instructors followed the common course standards and delivered the same treatment. The researcher convened a second orientation meeting before the first day of class by going to each instructor's office. The researcher also reminded the instructors that if they had any questions, they should call or email the researcher. An email address and phone number for the researcher, his chair, and the IRB Chair had been provided to the participants for them to address any questions regarding the study.

On the fifth day that the HE 109 classes met, all college students who had enrolled in the selected classes were asked to participate in the study and were informed that participation was voluntary. Students who agreed to participate in the study received consent forms from the researcher. The consent form contained a description of the research, their rights as participants, how any risks would be mitigated, how the data would be maintained and destroyed after the completion of the dissertation, and how confidentiality of all data and materials would be maintained by the researcher by keeping related information locked in a file in his home office. Those who agreed to participate received an orientation to the study's protocol, and the researcher obtained the written confirmation of their participation in the study. Students who opted out or declined participation in the study continued to receive the same instruction, without access to the questionnaires. Students volunteering were informed that they had the right to drop out of the study at any time without any consequences or loss of benefits.

Once the informed consent forms were completed, the students were able to complete the pretest survey. The survey instruments were self-administered, and each survey included a date validation to distinguish the pretest from the posttest. In addition, names were not placed on the surveys to keep the identity of the participant anonymous; however, the researcher used the participants' age and sex to identify groups.

The study consisted of two administrations of the stage of change, self-regulation, and self-efficacy to be physically active survey. The first survey, pretest, was administered during the second week of classes—once student schedules were finalized—because department policy was not to enroll any additional students after the first week. The second survey administration, posttest, was completed once all of the treatments had been covered in class with the comparison group, and once the health assessment was completed and covered in class with the treatment group.

The instruments were uploaded to Survey Monkey, a web-based survey platform, so that students could access the surveys during non-class time. Some instructors developed a Blackboard developmental site, in which case the survey was placed on Blackboard. In other classes, the students received the link to Survey Monkey from the college website, which all students were encouraged to use as the official means of contact with their professors. Once the informed consent forms were completed, the students were able to complete the pretest survey.

During the second week of class, students received an email reminding them to complete the pretest instruments (BREQ-2, PASCQ, and PESES). All students participating received instruction on the five components of fitness (muscle strength, muscle endurance, flexibility, body composition, and cardiorespiratory endurance); however, the treatment/program group was also provided with a physical assessment. The physical assessment included a 1.5-mile walk-run test, a leg press and bench press test, a sit-reach test, an ankle and shoulder flexibility test, a push-up and curl-up test, a squat endurance test, a body mass index BFP measurement, a hip and waist circumference measurement, and a body fat percent measurement. The physical assessment was based on the guidelines outlined in the ACSM (2010) health-related physical fitness assessment.

After the five health assessments were taught, and the curriculum had been discussed, the students received an email to complete the posttest questionnaires. The researcher sent follow-up emails two weeks after the first wave of surveys to ensure that all participants responded to the posttest. For all students to receive the same instruction, the comparison group was afforded the opportunity to complete the health assessments during those classes following the culmination of the research (after the posttest had been administered). Figure 3 shows the pretest and posttest comparison design of the study.

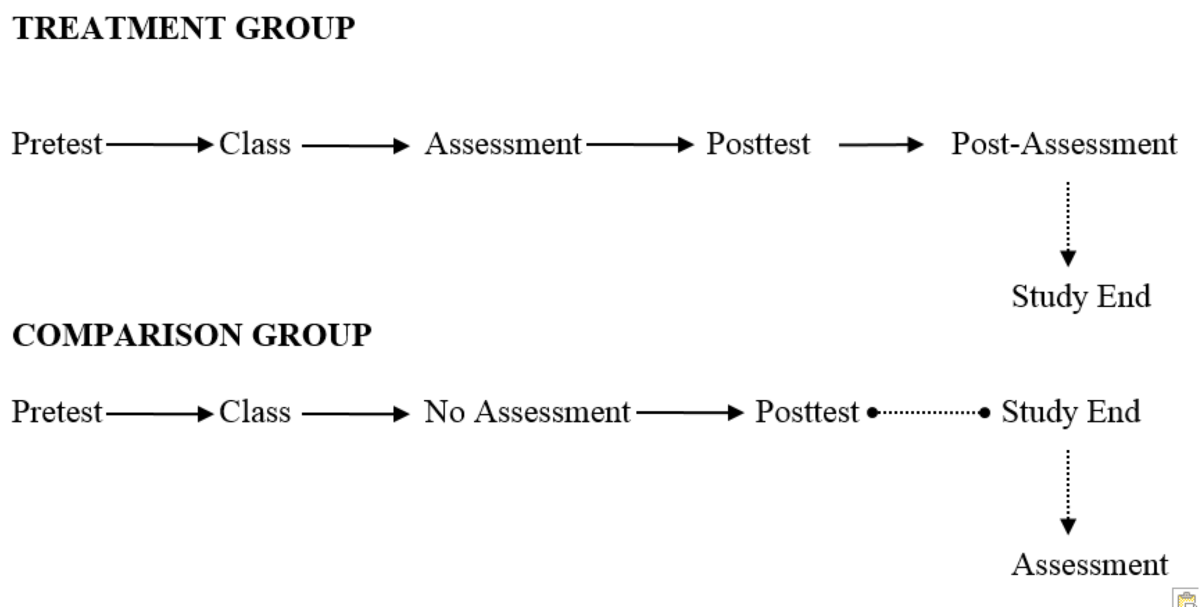

Figure 3. Pretest and posttest comparison design of the study.

Body fat percentages were measured. According to the BFP classification for adult women, an essential body fat range is 8–12%. For women, body fat is characterized as *low-athletic*, 13–20%; *recommended*, 21–23%; *over-fat*, 33–38; and, *obese*, 39 and greater. The essential body fat range for adult men is 3-5 percent. Classifications and ranges for men are *low-athletic*, 6–7%; *recommended* 8–19%; *over-fat* 20–24%; and, *obese*, 25 and greater. In general, an adult is considered overweight in the range of 25 to 29.9% body fat and included in a category of obesity when BFP is above 30% (Fahey et al., 2010).

In addition, during the health assessment, the 1.5-mile test was retested. The 1.5-mile test can accommodate wide-ranging fitness levels by determining a person's VO_2 MAX. The ACSM uses the rating developed by the Cooper (2010) Institute, which is *superior, excellent, good, poor,* and *very poor*.

Data Analysis

Initially, the researcher performed basic descriptive statistics to explore the measures of central tendency, variability, and frequency of the variables. An analysis of covariance (ANCOVA) was used to test all three hypotheses by comparing the pretest and posttest scores on each instrument. Although the instrument data output was from Survey Monkey in a format compatible with IBM Statistical Package for the Social Sciences (IBM SPSS®), the frequency analyses of all variables was facilitated by data checking and allowed the researcher to correct errors in the data entry process or in the respondents' completion of the instruments.

Once the database was completed, the hypothesis for each research question was tested using an analysis of covariance. Initially, an error bar plot was constructed for each dependent variable posttest to determine whether differences could be seen between variances and mean levels of the posttest between the comparison and treatment groups.

Although the pretest-posttest, nonequivalent comparison group design allowed the researcher to perform comparisons not ordinarily possible, the design had some drawbacks. First, the validity of the design would be compromised if the two groups differed on some important variable before the study began (Campbell & Stanley, 1963). To minimize this problem, the groups were matched as closely as possible prior to the study. Second, if either group was selected based on extreme scores on the pretest, then any shift of scores from pretest to posttest toward the less extreme values may have been due to regression toward the mean rather than to the effect of the treatment (Campbell & Stanley, 1963).

Campbell and Stanley (1963) discussed pretest–posttest designs extensively. Administering the pretest to participants may change the way they perform after introducing the intervention because the researcher is (a) drawing the participants' attention to the behaviors being considered on the posttests, (b) assessing, (c) providing practice on the test, or (d) introducing fatigue. Normally, such carryover effects are controlled through counterbalancing; however, the pretest and posttest administrations cannot be counterbalanced. Therefore, a simple pretest–posttest research design leads to problems with internal validity. To ensure internal validity, the researcher included a comparison group (Bordens & Abbott, 2008).

The ANCOVA was used to "test the statistical significance of the difference between all the groups simultaneously while holding the Type 1 error level constant" (Steinberg, 2007, p. 290). The purpose of a covariate is to partition out the influence of one or more variables before conducting the analysis of variance (ANOVA). A covariate (pretest) is a variable that has a substantial correlation with the dependent variable (posttest) and is included in the quasi-experiment to adjust the results for differences existing among subjects before the start of the experiment. The purpose is to exclude variance in the posttest levels that is determined by the pretest level (George & Mallery, 2010).

The ANCOVA has three assumptions. Each subject in the quasi-experiment is independent of every other subject; the scores on the posttest in the populations sampled are normally distributed; and the variances of scores in the populations are equal (homogeneity of variance). To test for normality of the dependent variable (posttest level), the Shapiro-Wilk nonparametric test was performed. If the significance level was less than $\alpha = 0.05$, then the assumption that the dependent variable posttest level was normally distributed was rejected. Levene's test examines the assumption that the variance of each dependent variable is the same as the variance of all other dependent variables. Levene's homogeneity of variance test did this by conducting an ANOVA on the differences between each case and the mean for that variable rather than for the value of that variable itself.

In ANCOVA, like ANOVA, an *F* statistic is calculated, with the treatment effect determined from the differences between the group variances because it is not possible for a single mean difference to represent treatment differences between more than two groups. If the group means were similar, they were clustered close together, which made variance between the means small. On the other hand, if the group means were very different from one another, they were more dispersed, which made the variance between the means large. Therefore, ANCOVA, like ANOVA, calculated the between-groups variance to determine whether there were any mean differences between the treatment and comparison groups. The one-way ANCOVA broke down the total variation in the scores of the quasi-experiment into the variance (mean of a sum of squares or mean square) that varied with both the systematic effect of the independent variable and sampling error among the group means and a variance that varies only with the within-groups error variation. The analysis of variance sorted the total variation of the scores in the quasi-experiment into between-group and within-group variances by assuming a simple model for a participant's score on the instrument. Including any treatment effect, the group means also differed from each other because of sampling error. Although the independent variable may have had no effect, the group mean differed somewhat from the grand mean simply because of sampling error. Therefore, any effect of the independent variable in the quasi-experiment occurred against a background of sampling error (Kiess & Green, 2010).

After evaluating the results of the ANCOVA, the researcher determined whether the calculated value exceeded the value at the specified Type 1 error level. The researcher assumed that it was acceptable to make a Type 1 error 5% of the time. At $\alpha = .05$, what is the critical value of the *F* statistic, and can the null hypothesis be rejected? When an *F* test was significant, there was a significant difference among the means of the posttest levels for the comparison group and the treatment/program group. Therefore, post hoc tests were not necessary.

A Multivariate Analysis of Covariance (MANCOVA) was not necessary in this research. Whenever multiple dependent variables are used, it is important to be certain that the dependent variables do not exhibit linear dependency on each other. In this study, the researcher expected that the dependent variable posttests for self-efficacy, self-determination, and stages of change would correlate. Thus, MANCOVA could not be used.

The researcher determined what constituted a meaningful difference, as opposed to a merely statistically significant difference. To address that question, the researcher measured the practical or clinical importance of the effect. The researcher used effect size (Steinberg, 2007). With ANCOVA, the effect size was measured by eta (η). A small effect size occurs when $\eta < 0.25$, a medium effect was for η between 0.25 and 0.40, and a large effect was found when $\eta > 0.40$.

Quasi-experimental research results should correctly detect not only when there is not a real difference between the treatment and comparison group, but also when there is a real difference in the treatment (participation in health assessments). This relates to a Type 2 error and its inverse, statistical power. Statistical power occurs when the null hypothesis is false and we correctly reject the null hypothesis. Alternatively, statistical power is achieved when there really is a difference between the treatment and comparison groups due to the treatment and we do find that difference (Steinberg, 2007).

The dependent variables were the stages of change, which represent the distinct stage when people are trying to change a specific health behavior (Hales, 2009). The "stages of change" is an important construct that represents a person’s readiness for change (Prochaska & Velicer, 1997). The second dependent variable was level of self-regulation, which is an indicator of a person’s fitness level and desire to exercise in the future (Deci & Ryan, 1985; Vallerand & Losier, 1999). A person’s level of self-determination was used to represent the different types of motivation (Deci & Ryan, 1985). The remaining dependent variable was self-efficacy, which is the belief in or perception of one’s ability to complete a given task (Bandura, 1982).

Experiential data collected for this study compared the treatment-program group and comparison group results in the instruments. The researcher performed basic descriptive statistics to explain the fundamental features of the study and then performed an analysis of covariance to test each hypothesis. The pretest scores served as the covariate in each case. The ANCOVA, which includes an ANOVA, controls for the effects of this extraneous variable, called a covariate, by partitioning out the variation attributed to this additional variable. In this way, the researcher is better able to investigate the effects of the primary independent variable.

Research questions four and five were addressed by conducting a paired sample t-test. In both analyses, the participants are those community college students who took part in the health assessment in a Health and Personalized Fitness course. The independent variable is the pretest scores prior to the intervention (participation in the course and assessment). Posttest scores are the dependent variables as measured after the intervention.

For the paired samples t-test for dependent groups, each case is assumed to have two measures of the same variable taken at different times. Each case represents the values for a single participant. This analysis is often designated as “repeated measures.” A dependent-samples t-test (i.e., matched or paired samples; matched pairs, samples, or subjects; simple repeated measures or within-groups; or correlated groups) assesses whether the mean difference between paired/matched observations is significantly different from zero. That is, the dependent-samples t-test evaluates a significant difference between the means of the two variables. This design is also referred to as a correlated groups design because the participants in the groups are not independently assigned. The participants are either the same individuals tested (assessed) on two occasions or under two conditions on one measure, or there are two groups of participants that are matched (paired) on one or more characteristics (e.g., IQ, age, gender, etc.) and tested on one measure. The assumptions for the paired t-test are that the dependent variable (difference in scores) is normally distributed in the two conditions, and the independent variable is dichotomous, and its levels (groups) are paired, or matched, in some way (e.g., pre-post).

CHAPTER FOUR: FINDINGS

Research Questions

The researcher used the following questions and hypotheses to guide this research:

RQ1: Controlling for the pretest scores on the Physical Activity Stages of Change Questionnaire (PASCQ), is there a significant difference in the community college students' stage of change, as measured by posttest scores on the PASCQ, based on the students' participation in a health assessment in a Health and Personalized Fitness course?

RQ2: Controlling for the pretest scores on the Revised Behavioral Regulation in Exercise Questionnaire (BREQ-2), is there a significant difference in the community college students' level of self-determination, as measured by the posttest scores on the BREQ-2, based on the students' participation in a health assessment in a Health and Personalized Fitness course?

RQ3: Controlling for the pretest scores on the Physical Exercise Self-Efficacy Scale (PESES), is there a significant difference in the community college students' level of physical exercise self-efficacy, as measured by the posttest PESES, based on the students' participation in a health assessment in a Health and Personalized Fitness course?

RQ4: For community college students who participated in a health assessment in a Health and Personalized Fitness course, is there a significant difference between the pretest levels of the body fat percent (BFP) before the course and the students' level of body fat measured by the posttest BFP after the course?

RQ5: For community college students who participated in a health assessment in a Health and Personalized Fitness course, is there a significant difference between the pretest levels of $V0_2$ MAX before the course and the students' posttest level of $V0_2$ MAX after the course?

Hypotheses

The following null hypotheses were used for this study:

$H_0$1: Controlling for the pretest scores on the Physical Activity Stages of Change Questionnaire (PASCQ), there is no statistically significant difference in the community college students' stage of change, as measured by posttest scores on the PASCQ, based on the students' participation in a health assessment in a Health and Personalized Fitness course.

$H_0$2: Controlling for the pretest scores on the Revised Behavioral Regulation in Exercise Questionnaire (BREQ-2), there is no statistically significant difference in the community college students' level of self-determination, as measured by the posttest scores on the BREQ-2, based on the students' participation in a health assessment in a Health and Personalized Fitness course.

$H_0$3: Controlling for the pretest scores on the Physical Exercise Self-Efficacy Scale (PESES), there is no statistically significant difference in the community college students' level of physical exercise self-efficacy, as measured by the posttest PESES, based on the students' participation in a health assessment in a Health and Personalized Fitness course.

$H_0$4: For community college students who participated in a health assessment in a Health and Personalized Fitness course, there is no statistically significant difference between the pretest levels of the body fat percent (BFP) before the course and the students' level of body fat measured by the posttest BFP after the course.

$H_0$5: For community college students who participated in a health assessment in a Health and Personalized Fitness course, there is no statistically significant difference between the pretest levels of $V0_2$ MAX before the course and the students' posttest level of $V0_2$ MAX after the course.

Results

The participants in this study were students enrolled in the Health and Personalized Fitness course (HE 109) at the community college during the spring 2014 semester. The participating classes represented different ranges of physical fitness and activity levels. The researcher identified 89 participants for the study. Sixty-seven (75.28%) students chose to participate in the study.

A quasi-experimental, pretest-posttest, nonequivalent, comparison group design study was used to address five research questions. An analysis of covariance (ANCOVA) was used to test all of the hypotheses by comparing the pretest and posttest scores on each instrument. The analysis for this hypothesis used the pretest as the covariate and the posttest as the dependent variable to discover whether a statistically significant difference might be found between college students in the Health and Personalized Fitness course who participated in the health assessments (treatment-program group) and those who did not take the assessment (comparison group). To test for normality of the dependent variable (posttest level), the Shapiro-Wilk's nonparametric test was performed. If the significance level was less than $\alpha = 0.05$, then the assumption that the dependent variable posttest level was normally distributed was rejected. Levene's test examines the assumption that the variance of each dependent variable is the same as the variance of all other dependent variables. Levene's homogeneity of variance test does this by conducting an ANOVA on the differences between each case and the mean for that variable rather than for the value of that variable itself. In addition to testing the assumption of independence and the assumption of normality, a test for the homogeneity of regression (slopes) assumption was completed. The homogeneity of regression test measures the interaction between the covariate and the independent variable treatment-comparison group in the prediction of the dependent variable posttest. The data were analyzed by IBM SPSS®.

Null Hypothesis One

To analyze the first null hypothesis that examined the statistical difference in the community college students' stage of change as measured by posttest scores on the PASCQ and based on whether the students participated in a health assessment in a Health and Personalized Fitness course, the researcher used ANCOVA, with the pretest PASCQ as the covariate and the posttest PASCQ as the dependent variable. This was used to determine whether a statistically significant difference could be detected in the level of posttest stages of concern between college students involved in the health assessments as part of their course (treatment-program group) and college students not taking the health assessments (comparison group). The researcher tested the assumptions for the ANCOVA. In addition to testing the assumption of independence and the assumption of normality, a test for the homogeneity of regression (slopes) assumption was completed. The homogeneity of regression test measured the interaction between the covariate PASCQ pretest stage of change and the independent variable treatment-comparison group in the prediction of the dependent variable PASCQ posttest stage of change. A significant interaction between the covariate and the independent variable indicated that the differences in the levels of PASCQ posttest stage of change among the pretest stages of change varied as a function of the levels of treatment-comparison group (see Table 3).

Table 3

Tests for Interaction Between the Covariate and the Independent Variable

	Type III sum of squares	*df*	Mean square	*F*	Sig.	Partial Eta squared	Noncent. parameter	Observed power[b]
Corrected model	21.456[a]	3	7.152	12.628	.000	.387	37.884	1.000
Intercept	56.133	1	56.133	99.113	.000	.623	99.113	1.000
Treatment/Comparison	8.645	1	8.645	15.264	.000	.203	15.264	.970
PASCQ pretest stage of change	12.588	1	12.588	22.226	.000	.270	22.226	.996
Interaction-Treatment/Comparison with PASCQ pretest stage of change	5.442	1	5.442	9.608	.003	.138	9.608	.862
Error	33.981	60	.566					
Total	1032.000	64						
Corrected total	55.438	63						

[a]R Squared = .387 (Adjusted R Squared = .356).
[b]Computed using alpha = .05.

The assumption of Levene’s test of homogeneity of variance for the one-way ANCOVA was not met [F (1, 62) = 6.274, $p = 0.015$]. In this case, Field (2013) recommended using the ratio of the largest variance (comparison PASCQ) to the smallest variance (treatment PASCQ). If the ratio is greater than 2, then “the variances are probably heterogeneous” (p. 6). For this procedure, 1.35913/0.35984 = 3.77 which is greater than 2.0.

The covariate pretest stage of change from PASCQ was included in the analysis to control for the differences on the independent variable treatment/comparison group. The primary purpose of the test of the covariate was that it evaluated the relationship between the covariate and the dependent variable, controlling for the factor (i.e., for any particular group). This relationship was statistically significant, and the researcher rejected the null hypothesis [F (1, 60) = 15.264, $p < 0.01$]. What this finding shows is that there was a significant effect between the covariate and the dependent variable, and that the covariate pretest stage of change from PASCQ was linearly related to the dependent variable posttest stage of change from PASCQ. From the effect size value, the covariate pretest stage of change from PASCQ accounted for 27.0% (partial $\eta^2 = 0.270$ effect) of the variance in the posttest stage of change from PASCQ, controlling for treatment/comparison group.

Descriptive statistics for the dependent variable posttest stage of change from PASCQ, broken down by treatment and comparison group and the total sample, are displayed in Table 4. The results from Table 5 can be interpreted as follows. The group source (labeled treatment-comparison on the SPSS output) evaluated the null hypothesis that the population-adjusted means of the independent variable were equal. The results of the analysis indicated that this hypothesis should be rejected [$F(1, 60) = 15.264$, $p < 0.01$]. The model was significant at the 0.05 level [$F(3, 60) = 12.628$, $p < 0.01$]. The test assessed the differences among the adjusted means (posttest stage of change from PASCQ) for the two groups, which were reported in the estimated marginal means table as 4.137 for the treatment group and 3.595 for the comparison group (see Table 6 and Figure 4).

Table 4

Descriptive Statistics for the Dependent Variable Posttest Stage of Change from PASCQ by Group

Groups	Mean	*SD*	*N*
Treatment	4.12	0.60	33
Comparison	3.68	1.17	31
Total	3.91	0.94	64

Table 5

Tests of Between-Subject Effects for the Dependent Variable: Posttest Stage of Change from PASCQ

Source	Type III sum of squares	*Df*	Mean square	*F*	Sig.	Partial Eta squared	Noncent. parameter	Observed power[b]
Corrected model	21.456[a]	3	7.152	12.628	.000	.387	37.884	1.000
Intercept	56.133	1	56.133	99.113	.000	.623	99.113	1.000
Treatment/Comparison	8.645	1	8.645	15.264	.000	.203	15.264	.970
PASCQ pretest stage of change	12.588	1	12.588	22.226	.000	.270	22.226	.996
Interaction-Treatment/Comparison with PASCQ pretest stage of change	5.442	1	5.442	9.608	.003	.138	9.608	.862
Error	33.981	60	.566					
Total	1032.000	64						
Corrected total	55.438	63						

[a]R Squared = .387 (Adjusted R Squared = .356).
[b]Computed using alpha = .05.

Table 6

Marginal Means for Type of Student with Dependent Variable: Posttest Stage of Change from PASCQ

			95% Confidence interval	
Groups	Mean	Std. error	Lower bound	Upper bound
Treatment	4.13[a]	.132	3.874	4.401
Comparison	3.56[a]	.136	3.323	3.867

[a]Covariates appearing in the model are evaluated at the following value: Pretest Stage of Change from PASCQ = 3.38.

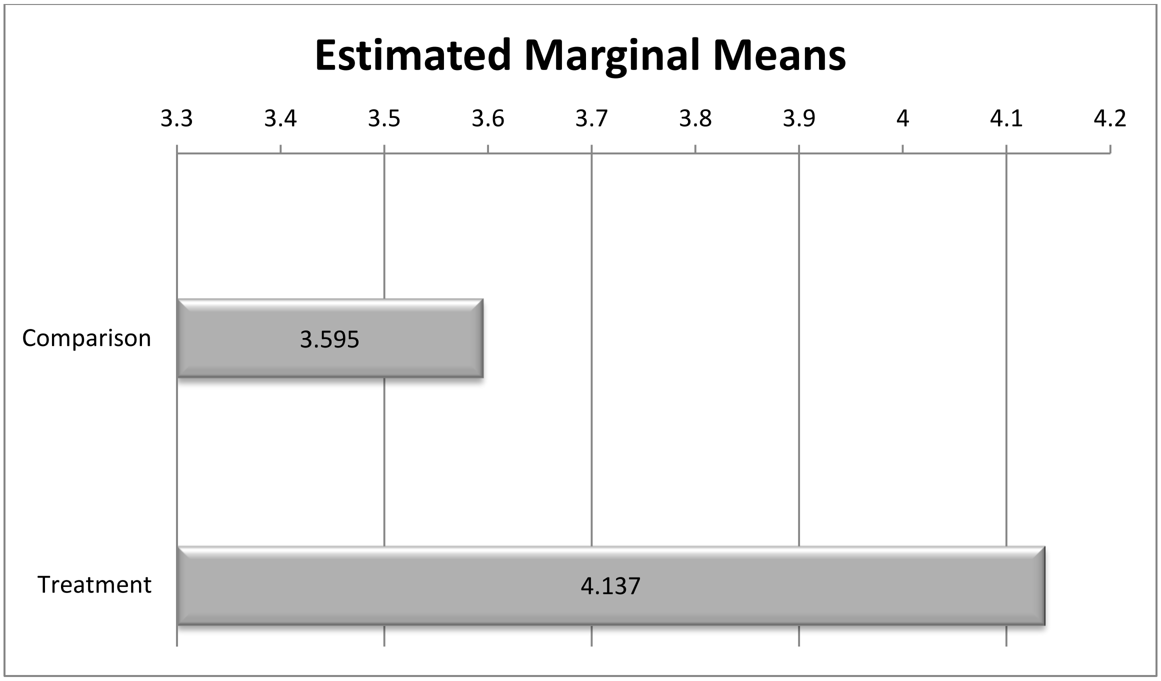

Figure 4. Estimated marginal means of posttest stage of change from PASCQ. Covariates in the model are evaluated at PASCQ Pretest Stage of Change = 3.38.

Table 7 shows the pairwise comparisons (Bonferroni test) based on the significant difference found in the treatment/comparison group variable (main effects). The difference in adjusted means was 0.542 between the two groups, which was statistically significant (p = 0.006).

The graph from the IBM SPSS output of the ANCOVA of the estimated marginal means of the PASCQ for the unequal sized treatment and comparison groups is displayed in Figure 4. As recommended by IBM SPSS®, it is the appropriate visual representation of Table 6.

Table 7

Pairwise Comparisons for Dependent Variable Posttest Stage of Change from PASCQ by Group

(I) Group1	(J) Group2	Mean difference (I-J)	Std. error	Sig.[a]	95% Confidence interval for difference[a] Lower bound	Upper bound
Treatment	Comparison	.542	.189	.006	.163	.921
Comparison	Treatment	-.542	.189	.006	-.921	-.163

Note. Based on estimated marginal means.

[a]Adjustment for multiple comparisons: Bonferroni.

The effect size (η^2) and statistical power for the ANCOVA model are given Table 8.

Table 8

Univariate Tests for Dependent Variable Posttest Stage of Change from PASCQ

	Sum of squares	*df*	Mean square	*F*	Sig.	Partial Eta squared	Noncent. parameter	Observed power[a]
Contrast	4.642	1	4.642	8.195	.006	.120	8.195	.804
Error	33.981	60	.566					

[a]Computed using alpha = .05.

Null Hypothesis Two

To analyze the second null hypothesis that investigated the statistical difference in the community college students' level of self-determination as measured by the posttest scores on the BREQ-2 and based on whether the students participated in a health assessment in a Health and Personalized Fitness course, the researcher used ANCOVA with the pretest BREQ-2 level of self-determination as the covariate and the posttest BREQ-2 level of self-determination as the dependent variable. This was used to discover whether a statistically significant difference might be found between college students in the Health and Personalized Fitness course who participated in the health assessments (treatment-program group) and those not taking the assessment (comparison group).

Table 9

Tests for Interaction Between the Covariate and the Independent Variable

Source	Type III sum of squares	*Df*	Mean square	*F*	Sig.	Partial Eta squared	Noncent. Parameter	Observed power[b]
Corrected model	562.581[a]	3	187.527	11.428	.000	.388	34.284	.999
Intercept	411.586	1	411.586	25.082	.000	.317	25.082	.998
Treatment/Comparison	34.469	1	34.469	2.101	.153	.037	2.101	.296
Pretest self-determination from BREQ-2	377.729	1	377.729	23.019	.000	.299	23.019	.997
Treatment/Comparison[c] pretest Self-determination from BREQ-2	12.771	1	12.771	.778	.382	.014	.778	.139
Error	886.117	54	16.410					
Total	8582.674	58						
Corrected total	1448.698	57						

Note. Dependent variable: Posttest self-determination from BREQ-2. The interaction source was treatment/comparison
[a]R Squared = .388 (Adjusted R Squared = .354).
[b]Computed using alpha = .05.
[c]Pretest self-determination from BREQ-2.

Table 9 indicates that this interaction was not statistically significant [F (1, 54) = 0.778, p = 0.382]. The assumption for homogeneity of regression slopes held, and research proceeded with the ANCOVA analysis.

From Levene's test, the assumption of homogeneity of variance for the one-way ANCOVA was met [F (1, 56) = 1.329, p = 0.254] for the dependent variable. The covariate pretest self-determination from BREQ-2 was included in the analysis to control for the differences on the independent variable treatment-comparison group. This relationship was statistically significant, indicating that the researcher should reject the null hypothesis [F (1, 54)

= 23.019, $p < 0.01$]. Additionally, there was a significant effect between the covariate and the dependent variable, and the covariate pretest self-determination from BREQ-2 was linearly related to the dependent variable posttest self-determination from BREQ-2. From the value of the effect size, the covariate pretest self-determination from BREQ-2 accounted for about 30% (partial $\eta^2 = 0.299$) of the variance in the posttest self-determination from BREQ-2, while controlling for the treatment/comparison group.

Table 10

Descriptive Statistics for the Dependent Variable Posttest Self-Determination from BREQ-2 by Group

Groups	Mean	*SD*	*N*
Treatment	12.16	3.77	31
Comparison	9.86	6.03	27
Total	11.09	5.04	58

Table 11

Tests of Between-Subject Effects for the Dependent Variable Posttest Self-Determination from BREQ-2

Source	Type III sum of squares	*df*	Mean square	*F*	Sig.	Partial Eta squared	Noncent. parameter	Observed power[b]
Corrected model	562.581[a]	3	187.527	11.428	.000	.388	34.284	.999
Intercept	411.586	1	411.586	25.082	.000	.317	25.082	.998
Treatment/Comparison	34.469	1	34.469	2.101	.153	.037	2.101	.296
Pretest self-determination from BREQ-2	377.729	1	377.729	23.019	.000	.299	23.019	.997
Interaction-Treatment/Comparison with Pretest self-determination from BREQ-2	12.771	1	12.771	.778	.382	.014	.778	.139
Error	886.117	54	16.410					
Total	8582.674	58						
Corrected total	1448.698	57						

[a]R Squared = .388 (Adjusted R Squared = .354).
[b]Computed using alpha = .05.

Table 11 indicates that the group source (treatment/comparison) evaluated the null hypothesis that the population-adjusted means of the independent variable were equal. The results of the analysis indicated that this hypothesis cannot be rejected [F (1, 54) = 2.101, p = 0.153]. The model was significant at the 0.05 level [F (3, 54) = 11.428, p < 0.01]. The test assessed the differences among the adjusted means (posttest self-determination from BREQ-2) for the two groups, which are reported in the estimated marginal means table as 11.91 for the treatment group and 10.29 for the comparison group, as shown in Table 12 and Figure 5.

Table 12

Marginal Means for Type of Student with Dependent Variable: Posttest Stage of Change from PASCQ

			95% Confidence interval	
Groups	Mean	Std. error	Lower bound	Upper bound
Treatment	11.91[a]	.735	10.432	13.380
Comparison	10.29[a]	.784	8.714	11.860

[a]Covariates appearing in the model are evaluated at the following value: Pretest self-determination from BREQ-2 = 9.75.

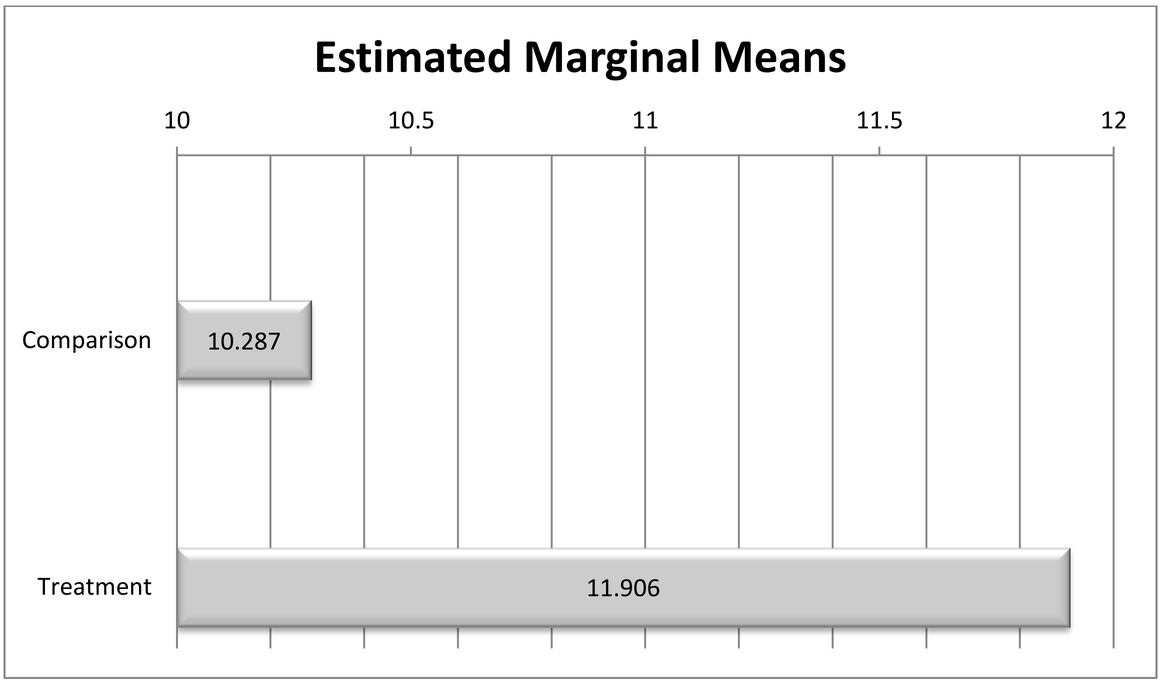

Figure 5. Estimated marginal means of posttest self-determination from BREQ-2. Covariates in the model are evaluated at pretest self-determination = 9.75.

Pairwise comparisons to determine the significant difference (see Table 13) using the Bonferroni test were not evaluated because the difference in adjusted means was not found to be statistically significant. Table 14 provides the statistical power and effect size (η^2) for the ANCOVA model.

Table 13

Pairwise Comparisons for Dependent Variable Posttest Self-Determination from BREQ-2 by Group

(I) Group 1	(J) Group 2	Mean difference (I-J)	Std. error	Sig.[a]	95% Confidence interval for difference[a] Lower bound	Upper bound
Treatment	Comparison	1.619	1.075	.138	-.537	3.774
Comparison	Treatment	-1.619	1.075	.138	-3.774	.537

Note. Based on estimated marginal means.
[a]Adjustment for multiple comparisons: Bonferroni.

Table 14

Univariate Tests for Dependent Variable Posttest Self-Determination from BREQ-2

	Sum of squares	*df*	Mean square	*F*	Sig.	Partial Eta squared	Noncent. parameter	Observed power[a]
Contrast	37.198	1	37.198	2.267	.138	.040	2.267	.316
Error	886.117	54	16.410					

Null Hypothesis Three

To analyze the third null hypothesis that examined the statistical difference in the community college students' level of physical exercise self-efficacy as measured by the posttest PESES and based on whether the students participated in a health assessment in a Health and Personalized Fitness course, the researcher used ANCOVA with the pretest PESES as the covariate and the posttest PESES as the dependent variable. This was used to determine whether a statistically significant difference occurred in the posttest levels of physical exercise self-efficacy between college students taking the health assessment (treatment-program group) and those not taking the assessment (comparison group).

Table 15

Tests for Interaction Between the Covariate and the Independent Variable

Source	Type III sum of squares	*df*	Mean square	*F*	Sig.	Partial Eta squared	Noncent. parameter	Observed power[b]
Corrected model	192.375[a]	3	64.125	7.967	.000	.288	23.900	.986
Intercept	100.356	1	100.356	12.468	.001	.174	12.468	.935
Treatment/Comparison	.210	1	.210	.026	.872	.000	.026	.053
Pretest PE self-efficacy	189.801	1	189.801	23.581	.000	.286	23.581	.998
Interaction-Treatment/Comparison with Pretest PE self-efficacy	.363	1	.363	.045	.832	.001	.045	.055
Error	474.895	59	8.049					
Total	12298.000	63						
Corrected total	667.270	62						

Note. The interaction source is labeled Treatment/Comparison * Pretest PE Self-efficacy.
[a]R Squared = .288 (Adjusted R Squared = .252).
[b]Computed using alpha = .05.

The results in Table 15 show that the interaction was not statistically significant [F (1, 59) = 0.045, p = 0.832]. Because the assumption of homogeneity of regression slopes held, the next procedure was to conduct the ANCOVA analysis. First, descriptive statistics for the total sample and both groups were produced (see Table 16).

Table 16

Descriptive Statistics for the Dependent Variable Posttest PE Self-Efficacy by Group

Groups	Mean	*SD*	*n*
Treatment	13.63	3.71	32
Comparison	13.55	2.83	31
Total	13.59	3.28	63

Levene’s test was performed for the dependent variable posttest PE self-efficacy. The assumption of homogeneity of variance was met [F (1, 61) = 3.811, p = 0.055]. The covariate pretest PE self-efficacy was part of the analysis to control for the differences on the independent variable treatment and comparison group. The test of the covariate evaluated the relationship between the covariate and the dependent variable, controlling for the factor (group). Table 17 shows that this relationship was statistically significant, thus the researcher rejected the null hypothesis [F (1, 59) = 23.581, p < 0.01]. Additionally, there was a significant effect between the covariate and the dependent variable, and the covariate pretest PE self-efficacy was linearly related to the dependent variable posttest PE self-efficacy. From the effect size, the covariate pretest PE self-efficacy accounted for about 29% (partial $\eta^2 = 0.286$) of the variance in the posttest pretest PE self-efficacy, while controlling for the treatment/comparison group.

Table 17

Tests of Between-Subject Effects for the Dependent Variable Posttest PE Self-Efficacy

Source	Type III sum of squares	*df*	Mean square	*F*	Sig.	Partial Eta squared	Noncent. parameter	Observed power[b]
Corrected model	192.375[a]	3	64.125	7.967	.000	.288	23.900	.986
Intercept	100.356	1	100.356	12.468	.001	.174	12.468	.935
Treatment/Comparison	.210	1	.210	.026	.872	.000	.026	.053
Pretest PE self-efficacy	189.801	1	189.801	23.581	.000	.286	23.581	.998
Interaction-Treatment/Comparison with Pretest PE self-efficacy	.363	1	.363	.045	.832	.001	.045	.055
Error	474.895	59	8.049					
Total	12298.000	63						
Corrected total	667.270	62						

[a]R Squared = .288 (Adjusted R Squared = .252).
[b]Computed using alpha = .05.

The results from Table 17 indicate that the group source (treatment/comparison) evaluated the null hypothesis that the population-adjusted means of the independent variable were equal. The results of the analysis indicated that this hypothesis cannot be rejected [*F* (1, 59) = 0.026, p =0.872]. The model was significant at the 0.05 level [F (3, 59) = 7.967, p <0.01]. The test assessed the differences among the adjusted means (posttest PE self-efficacy) for the two groups, which are reported in the estimated marginal means table as 13.51 for the treatment group and 13.67 for the comparison group, as shown in Table 18 and Figure 6.

Table 18

Marginal Means for Type of Student with Dependent Variable: Posttest PE Self-Efficacy

Groups	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Treatment	13.51[a]	.502	12.512	14.523
Comparison	13.67[a]	.511	12.647	14.692

Note. Covariates appearing in the model are evaluated at the following value: Pretest Self-Efficacy = 13.52.

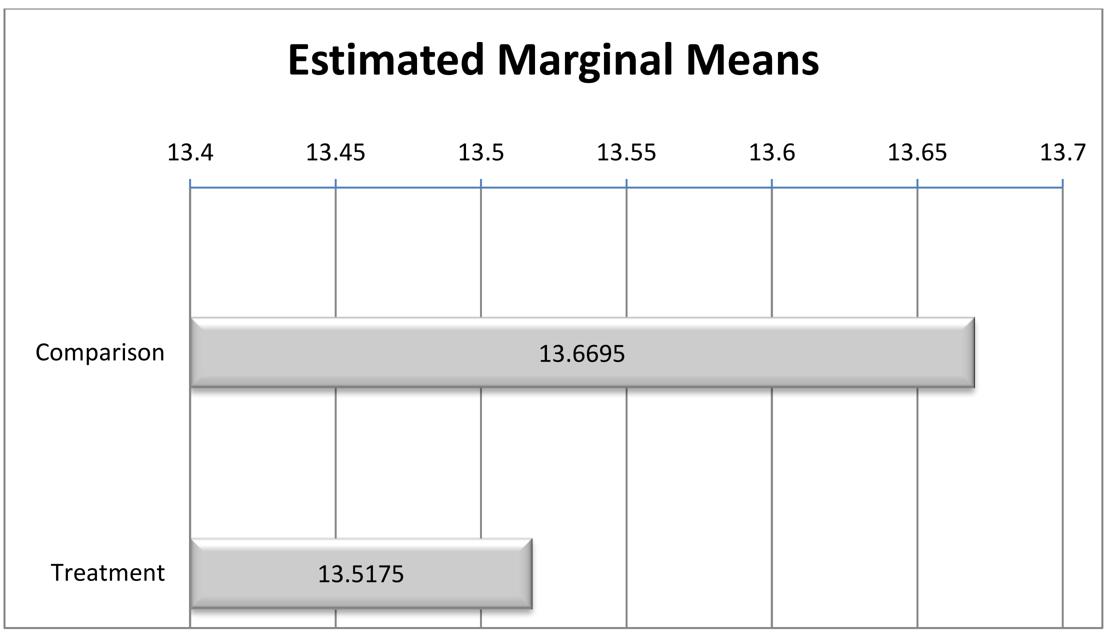

Figure 6. Estimated marginal means of posttest PE self-efficacy. Covariates in the model are evaluated at Pretest self-efficacy = 13.52.

Pairwise comparisons to determine the significant difference (see Table 19) using the Bonferroni test were not evaluated because the difference in adjusted means was not found to be statistically significant. The effect size (η^2) and power for the contrast model are shown in Table 20.

Table 19

Pairwise Comparisons for Dependent Variable Posttest PE Self-Efficacy by Group

(I) Group 1	(J) Group 2	Mean difference (I-J)	Std. error	Sig.[a]	95% Confidence interval for difference[a] Lower bound	Upper bound
Treatment	Comparison	-.152	.717	.833	-1.586	1.282
Comparison	Treatment	.152	.717	.833	-1.282	1.586

Note. Based on estimated marginal means.
[a]Adjustment for multiple comparisons: Bonferroni.

Table 20

Univariate Tests for Dependent Variable Posttest PE Self-Efficacy

	Sum of squares	*df*	Mean square	*F*	Sig.	Partial Eta squared	Noncent. parameter	Observed power[a]
Contrast	.362	1	.362	.045	.833	.001	.045	.055
Error	474.895	59	8.049					

[a]Computed using alpha = .05.

Null Hypothesis Four

To analyze the fourth null hypothesis to determine the statistical difference in the community college students' level of body fat mass before (pretest scores on the BFP) and after (the posttest BFP) participation in a health assessment in a Health and Personalized Fitness course, the researcher used a paired sample t-test with the pretest BFP and the posttest BFP as the paired measures. This was used to determine whether a statistically significant difference occurred between the pretest BFP and posttest BFP after completion of the health assessment intervention.

Pairwise tests were applied to compare the same group of individuals, or matched pairs, being measured twice—both before and after an "intervention." Using this methodology, the respondents functioned as their own control, lowering the level of unexplained variance or error. The BFP measurements were recorded for those 33 subjects in the Health and Personalized Fitness course. The BFP measurements were recorded before and after the course. A paired sample t-test was performed with the pretest BFP and posttest BFP as the matched pairs.

Table 21 shows the descriptive statistics of the BFP measurements for the 33 students before and after the intervention. An error bar plot in Figure 7 indicates a comparison of the mean and variance between the pretest and posttest BFP measurements. The amount of variance in BFP levels appears to be similar for both the pretest and posttest. The results of the paired samples t-test are shown in Table 22.

Table 21

Descriptive Statistics for Pretest and Posttest BFP Measurements

		N	Mean	*SD*	Std. error mean
Pair 1	Pretest body fat %	33	19.63	8.18	1.4235
	Posttest body fat %	33	18.79	7.54	1.3131

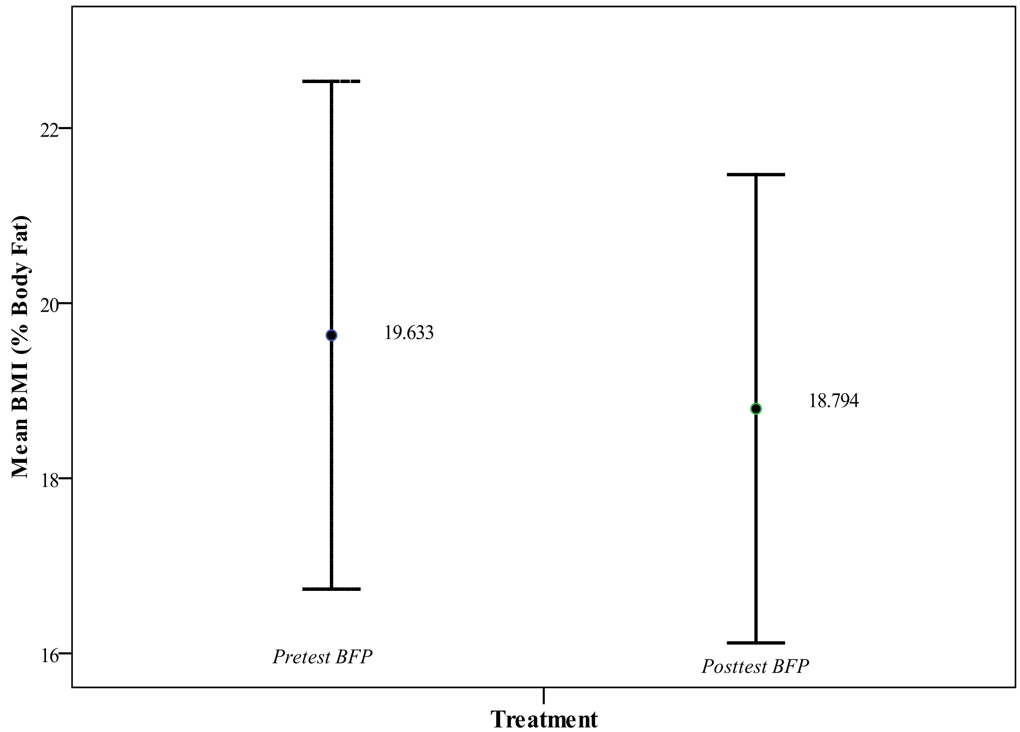

Figure 7. Error bar chart for BFP as percent of body fat before and after intervention.

Table 22

Results of the Paired Samples t-Test for Pretest BFP and Posttest BFP

		Paired differences							
					95% Confidence interval of the difference				
		Mean	*SD*	Std. error mean	Lower	Upper	*t*	*df*	Sig. (2-tailed)
Pair 1	Pretest body fat % - Posttest Body fat %	.84	1.49	.2595	.3109	1.3679	3.235	32	.003

The results shown in Table 22 indicate a statistically significant difference between the pretest and posttest percentage of body fat (BFP). The null hypothesis was rejected [t (32) =

3.235, p = 0.003]. There was a significant reduction in body fat percentage as measured by BFP before the course (*M* = 19.63, *SD* = 8.18) and after the course (*M* = 18.79, *SD* = 7.54).

Null Hypothesis Five

To analyze the fifth null hypothesis that examined the statistical difference in the community college students' $V0_2$ MAX before (the pretest $V0_2$ MAX) and after (the posttest $V0_2$MAX) participation in a health assessment in a Health and Personalized Fitness course, the researcher used a paired sample t-test with the pretest $V0_2$ MAX and the posttest $V0_2$ MAX as the pair measures. The hypotheses were tested to determine whether a statistically significant difference occurred between the pretest $V0_2$ MAX and posttest $V0_2$ MAX after completion of the health assessment intervention.

Table 23 shows the descriptive statistics of the $V0_2$ MAX measurements for the 33 students before and after the course intervention. An error bar plot in Figure 8 indicates a comparison of the mean and variance between the pretest and posttest $V0_2$ MAX measurements. The amount of variance in $V0_2$ MAX levels appeared to be similar for both the pretest and posttest; however, it appeared that there might be a difference in mean levels of $V0_2$ MAX.

Table 23

D*escriptive Statistics for Pretest and Posttest V02 MAX Measurements*

		n	Mean	*SD*	Std. error mean
Pair 1	Pretest $V0_2$ MAX	33	32.79	10.25	1.785
	Posttest $V0_2$ MAX	33	37.30	9.39	1.635

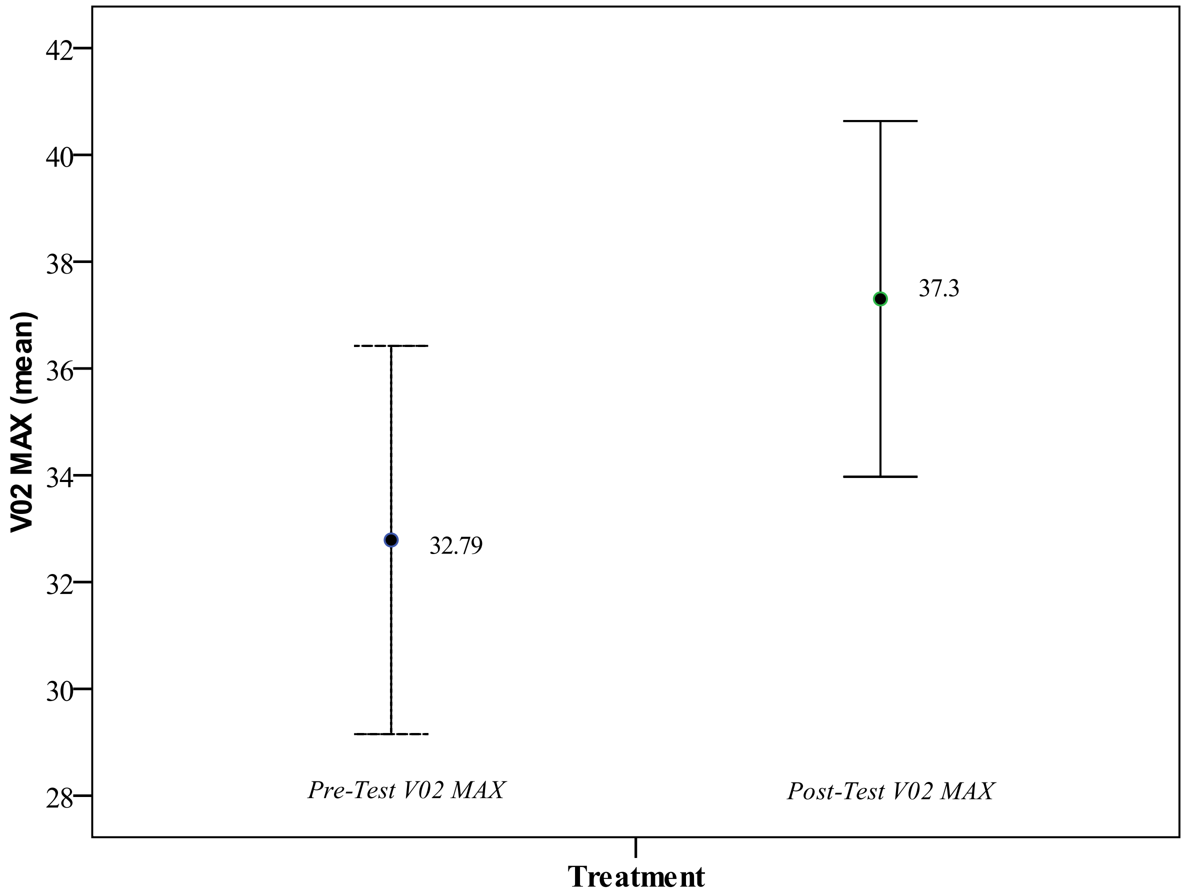

Figure 8. Error bar chart for V02 MAX before and after intervention.

Pairwise tests were applied to compare the same group of individuals, or matched pairs, being measured twice—both before and after an "intervention." Using this methodology, the respondents functioned as their own control, lowering the level of unexplained variance or error. The $V0_2$ MAX measurements were recorded for those 33 subjects in the Health and Personalized Fitness course. The $V0_2$ MAX measurements were recorded before and after the course. A paired sample t-test was performed with the pretest $V0_2$ MAX and posttest $V0_2$ MAX as the matched pairs. The results of the paired samples t-test are shown in Table 24.

Table 24

Results of the Paired Samples t-Test for Pretest $V0_2$ MAX and Posttest $V0_2$ MAX

		Paired differences							
					95% Confidence interval of the difference				
		Mean	*SD*	Std. error mean	Lower	Upper	*T*	*df*	Sig. (2-tailed)
Pair 1	Pretest $V0_2$ MAX – Posttest $V0_2$ MAX	-4.5	3.37	.586	-5.708	-3.322	-7.709	32	.000

The results shown in Table 24 clearly demonstrate a statistically significant difference between the pretest and posttest $V0_2$ MAX levels. Thus, the null hypothesis was rejected [t (32) = -7.709, $p < 0.01$]. There was a significant increase in $V0_2$ MAX levels from before the course (*M* = 32.79, *SD* = 10.25) to after the course (*M* = 37.30, *SD* = 9.39).

CHAPTER FIVE: DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

Discussion

The purpose of this study was to examine the influence of health assessments on motivating college students to become more physically active. The following sections discuss the findings of each research question in relation to extant literature.

Students' Physical Activity Stages of Change

Research question one examined the community college students' stage of change before and after participating in a health assessment in a Health and Personalized Fitness course. According to Hales (2009), TTM was developed to focus on an individual's decision-making. This model of change has stages that have been used as an effective approach to lifestyle self-management (Hales, 2009; Prochaska & Velicer, 1997). The stage of change focuses on both motivation and the actual behavior change. Individuals progress through the five stages of change as they process their motivational readiness (Marcus et al., 1992).

When the stages of change are used as a dependent outcome variable, it is commonly theorized as the section of individuals moving through stages or at a prespecified behavioral criterion. In addition, the stages of change can be viewed as systematic categorical variables, so analysis can illustrate stage differences (Welks, 2002).

ANCOVA was used to enhance statistical sensitivity to employ a normalizing and variance-stabilizing procedure (Rossi, 1990). For the main effects of the treatment/comparison group variable, the difference in adjusted means was 0.542 between the two groups and was statistically significant ($p = 0.006$). There was a significant effect between the covariate and the dependent variable, and the covariate pretest stage of change from PASCQ was linearly related to the dependent variable posttest stage of change from PASCQ. From the partial η^2 effect size value, the covariate pretest stage of change from PASCQ accounted for 27.0% of the variance in the posttest stage of change from PASCQ, controlling for the treatment/comparison group. The results of the analysis indicate that this hypothesis should be rejected [F (1, 60) = 15.264, p <0.01]. The model was significant at the 0.05 level [F (3, 60) = 12.628, p <0.01]. Students who received the health assessment reported more significant changes to their stage of change than students who did not receive the health assessments. The results in this study confirm those found by Pritchard et al. (2007) and Cardinal and Kosma (2004). The consideration to change was higher in participants developed knowledge of their current health status (Pritchard et al. (2007). Cardinal and Kosma's (2004) study revealed that the behavioral and cognitive processes of change were all essential contributors that indicated a possible change in stage of change for promoting fitness behaviors. Additionally, based on the results of this dissertation, a case can be made that physical assessment can be effective in moving levels students of their stage of change, which is critical for behavior changes. These results are significant because they add to the body of knowledge, and past research has been shown to lack replication.

Students' Level of Self-Determination

Research question two was analyzed for the community college students' level of self-determination before and after participating in a health assessment in a Health and Personalized Fitness course. SDT was developed to examine the different types of motivation to differing degrees of self-determination (Deci & Ryan, 1985). In other words, it provides an understanding as to those motives that lead people to adopt and maintain certain health behaviors (Deci & Ryan, 1985, 2000). SDT can be used as an indicator of a person's fitness level and desire to exercise in the future (Deci & Ryan, 1985; Vallerand & Losier, 1999). SDT as an individual's level, or intensity, of self-regulation will vary on a scale, and these variations have significant effects on an individual's physical and mental well-being (Biddle, 1999; Ryan & Deci, 2000). Researchers have been able to determine the initial level of motivation by applying SDT to physical activity research. BREQ-2 was used as a unidimensional index of the degree of self-determination, known as the relative autonomy index (Ryan & Connell, 1989; Vallerand & Losier, 1999).

The results of this study showed that there was no statistically significant difference in BREQ-2 results for those not in the health assessment and those who participated in the assessment and that the null hypothesis cannot be rejected [$F(1, 54) = 2.101$, $p = 0.153$]. The test assessed the differences among the adjusted means (posttest self-determination from BREQ-2) for the two groups. A preliminary test to the ANCOVA was a test of the covariate and evaluated the relationship between the covariate and the dependent variable, controlling for the factor (i.e., for any particular group). From these results, there was a significant effect between the covariate and the dependent variable, and the covariate pretest self-determination from BREQ-2 was linearly related to the dependent variable posttest self-determination from BREQ-2. From the value of the effect size, the covariate pretest self-determination from BREQ-2 accounted for about 30% of the variance in the posttest self-determination from BREQ-2, while controlling for the treatment/comparison group. There was no significant difference in the posttest level of self-determination between the two groups. Students who received the health assessment and students who did not receive the health assessment had no statistically significant differences in their self-determination. This research discovered that there was no statistically significant difference in level of self-determination between college students in the Health and Personalized Fitness course who participated in the health assessment (treatment/program group) and those not taking the assessment (comparison group). Unlike previous research by Standage et al.

(2006), Lonsdale et al. (2009), and Kilpatrick et al. (2005), these results are markedly different. Past studies hypothesized that the self-determined motivation might be particularly vital when students have free choices. Additionally, researchers found that self-reported levels of self-determined motivation positively corresponded with teacher ratings of student participation and perseverance. Past results found that participants were more motivated to engage in physical activity for enjoyment and to achieve positive health benefits. However, the results of this study revealed that students never developed or achieved the need to grow or gain fulfillment from more physical activity.

Students' Level of Physical Exercise Self-Efficacy

Research question three examined the community college students' self-efficacy before and after participating in a health assessment in a Health and Personalized Fitness course. Self-efficacy is the belief or awareness regarding a person's ability to engage a given behavior or task (Bandura, 1982). Furthermore, "self-efficacy can be described as a person's self-confidence to perform a specific task in challenging and tempting situations" (Marshall & Biddle, 2001, p. 229). An individual's self-efficacy can be influenced by multiple factors, such as motor skills and ability, motivation, personal feelings, mood, decision-making, goal realization, and family health behaviors and habits (Bandura, 2004, 2005; Kołoło, Guszkowska, Mazur, & Dzielska, 2012). Two foundations have been determined by Bandura and other researchers. Individuals who are highly motivated have a high degree of self-efficacy and are capable of achieving their goals, whereas individuals who are amotivated have a low self-efficacy and need additional support and direction (Bandura, 2004). Bandura (2006) and Kołoło et al. (2012) also determined that individuals with a low self-efficacy believe that the effort to change is overwhelming; however, individuals with a high self-efficacy will demonstrate a high determination.

The test of the covariate evaluated the relationship between the covariate and the dependent variable, controlling for the factor (group). The relationship was statistically significant, and the researcher rejected the null hypothesis [$F (1, 59) = 23.581$, $p < 0.01$]. Additionally, a significant effect was found between the covariate and the dependent variable, and the covariate pretest PE self-efficacy was linearly related to the dependent variable posttest PE self-efficacy. From the value of the effect size, the covariate pretest PE self-efficacy accounted for about 29% of the variance in the posttest pretest PE self-efficacy, while controlling for the treatment/comparison group (partial $\eta^2 = 0.286$). However, the ANCOVA results showed that there was no statistically significant difference in the posttest levels of physical exercise self-efficacy between college students taking the health assessment (treatment-program group) and those not taking the assessment (comparison group).

Other scholars have had different results. Past research found that a person's perceptions of exercise and his or her mood had a negative association with an adult's physical activity level (Markus et al., 2003). Additionally, studies found that as self-efficacy and outcome expectations improved, self-regulatory behaviors increased and self-regulatory behaviors increased (Anderson et al., 2006). Others' research hypothesized that self-efficacy is a strong predictor of developing and maintaining physical activity. However, the results of this dissertation indicated that students never developed the confidence in their ability to exert control over their own motivation and behavior.

Students' Behavior Change

Research questions four and five were evaluated for the community college students' level of body fat and level of $V0_2MAX$ before and after participating in a health assessment in a Health and Personalized Fitness course. Chen et al. (2011) defined health-related physical fitness as the physical capability that individuals have to enable heart, blood vessels, lungs, and muscles to function effectively. Health-related physical fitness consists of functional ability and is affected by an individual's level of physical activity and lifestyle behaviors. The researcher opted for two health assessments to retest the treatment group to assess behavior change. Cardiorespiratory fitness was chosen because it was directly related to an individual's functional ability, whereas body fat percentage was selected because it was a good indicator of health (ACSM, 2010; Fahey et al., 2010).

The results of this dissertation showed a statistically significant difference between the pretest and posttest percentage of BFP. The null hypothesis was rejected [$t\ (32) = 3.235$, $p = 0.003$]. There was a significant reduction in body fat percentage from before the course ($M = 19.63$, $SD = 8.18$) to after the course ($M = 18.79$, $SD = 7.54$).

These results confirm those found by other researchers. Sira and Pawlak (2010) showed that just fewer than six of 10 students (57%) surveyed had BFP scores below or within normal limits. In addition, males or African Americans were more likely to be overweight and obese. Over one-half of adults were found not to meet the minimum activity guidelines necessary for good health and lowered disease risk (Haskell et al., 2007). This decline led to the detrimental impact of being overweight and obesity among college students (Bjerke, 2012). The negative relationship on physical activity from behavior lifestyle was documented with regard to age, race or ethnicity, and being overweight or obese (Milroy, 2010). Huang et al. (2003) found that college students perceived themselves as healthy; however, a high percentage of students surveyed were classified as overweight and engaged in a low level of physical activity. Unfortunately, the study by Huang et al. was delimited with a lower prevalence of overweight students (90% Caucasian). The rate of obesity in Caucasians may be only 60% of that in African

Americans. The dissertation clearly confirmed the previous research concerning the relationship between obesity and physical activity. Unlike most previous studies, this dissertation was confined to college students.

Conclusions

The results of this study extended the knowledge base concerning motivating college students to become more physically active. Prior research has indicated that positive changes were found to occur in students' physical ability, body composition, and perception; however, other studies found that college students with the highest perceived self-efficacy were most likely to have the highest improvements (Lockwood & Wohl, 2012; Patterson et al., 2006). Therefore, self-determination and self-efficacy must be addressed to improve lasting behavior change. Based on the findings in this dissertation, students' motivation and self-efficacy did not emerge as essential to lasting behavior change—even though the students were active and developing fitness skills to improve their efficacy. However, the findings of this study did support a change in a person's stage of change. The exposure to the assessments did increase their current level stage of change. In addition, the research showed a significant change in physical activity behavior.

Implications

It is clear that effective methods to motivate college students must be developed so this population can adopt a lifelong healthy and active lifestyle. The results from the study, which show the effectiveness of health assessment, can be used to help move individuals to a higher stage of change, and to develop the initial behavior change. Colleges have a great opportunity to enhance physical activity levels using interventions that have been validated through research, including the present study (ACHA, 2009; Bian et al., 2011; Hackman & Mintah, 2010; Hutto &

Russell, 2011; Milroy, 2010). Health courses offered at the college level can result in increased confidence levels to engage in positive health behaviors or to develop a positive behavior change that leads to a healthier adult life. Colleges, which traditionally offered physical activity courses, are now offering health-related fitness courses that combine lectures on fitness and wellness (Adams & Brynteson, 1995; Adams et al., 2006; Bjerke, 2012). As Strand, Egeberg, and Mozumdar (2010) maintained, health-related fitness courses are offered at approximately 89.2% of community colleges and 82% of four-year colleges or universities. Although both physical activity courses and HRF courses have yielded positive behavior change, research shows that there are more benefits over a longer period from HRF (Bjerke, 2012).

This study also examined whether participation by college students in health-related fitness classes made a significant difference in their willingness to change their behavior, their self-efficacy and self-determination, and their body fitness. Prior research has shown that behavior change involving only the acquisition of knowledge about wellness behavior does not necessarily lead to behavior change (Fahey et al., 2010; Lockwood & Wohl, 2012). In fact, in this study, the students never developed a significant change in the motivation or their confidence.

Although the statistical tests for the hypotheses in the dissertation may not have resulted in significant differences for all outcomes, it is important not to overlook the practical significance of the study's findings. The results from the study indicated effectiveness in students attaining higher levels within their stage of change together with some critical behavior changes. There was a significant change in students' body composition, which could be because the health class increased physical fitness activities during class.

Limitations

A few delimitations and limitations emerged after conducting the analyses and reporting the results from this research. First, interpretation and reporting could pose potential problems because the instruments used were self-reported measures. Students' responses may reflect their propensity to offer the desired response, which could result in responses that are not truly reflective of students' confidence levels and intentions to engage in a healthy behavior. One limitation to this study is that it did not offer a randomized design due to researcher selection of a convenience sample of the participating classes, which is a potential threat to external validity and a lack of generalizability of results. Therefore, it would be difficult to generalize these results to other colleges or even other community college campuses. An additional limitation pertains to nonresponse bias or students being absent on days that assessments were administered. The spring semester chosen for the study offered some factors beyond the control of the researcher that could have affected students' behaviors and decisions. The region had an unusually brutal winter that lasted for a prolonged period, which caused multiple missed days from school.

Recommendations for Future Research

In the context of the results, the limitations provide the foundation for recommendations for future study. When combining this study with other research, a gap remains in the knowledge on health assessment interventions for college students. Colleges have a great opportunity to enhance physical activity levels using interventions that have been validated through research (ACHA, 2009; Bian et al., 2011; Hackman & Mintah, 2010; Hutto & Russell, 2011; Milroy, 2010). Individuals between the ages of 18 and 24 experienced a sharp decline in physical activity levels (Butler et al., 2004; Grim et al., 2011; Huang et al., 2003).

Consequently, this research underscores the growing need to improve physical activity levels for those ages.

In future studies to yield a more accurate outcome of health assessment effects on behavior change, a longitudinal study is warranted. The researcher should track the participants for an entire school year. By tracking students for the fall and spring semesters, multiple evaluation steps can be developed that may produce better results for students' motivation and self-efficacy—both needed for lasting change. Such a study would eliminate the possibility that the positive changes in behavior and increased stages of change were only present while students were enrolled in the health class. Additionally, this research would be useful in the future to determine if students have developed lasting positive physical activity behaviors and have continued to increase to a maintenance stage of change. An even longer-running study would entail the researcher following the college student during his or her entire college career and beyond into adulthood. Additionally, future research replicating this study should concentrate on subgroups present on college campuses and consider differences such as those between males and females, ethnic groups, members of organization, and so forth, or differences based on a major: business, education, social sciences, the arts, engineering, etc. Any sampling of classes and students should be dictated by random selection procedures to increase generalizability of study results.

College health-related fitness courses are ubiquitous. They serve as the required physical education or wellness course (Strand et al., 2010). There is a clear need for further investigation of the effectiveness of health-related fitness courses to develop the knowledge, confidence, and motivation to adopt healthy active lifestyles. Currently, there is not adequate research to support the case that health-related courses have any effect at all (Bjerke, 2012; Delong, 2006; Strand et al., 2010).

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APPENDICES

Appendix A: IRB Approval Letter

LIBERTY UNIVERSITY.
INSTITUTIONAL REVIEW BOARD

February 4, 2014

Keith McKelphin
IRB Exemption 1747.020414: The Influence of Health Assessments on Motivating College Students to Become More Physically Active

Dear Keith,

The Liberty University Institutional Review Board has reviewed your application in accordance with the Office for Human Research Protections (OHRP) and Food and Drug Administration (FDA) regulations and finds your study to be exempt from further IRB review. This means you may begin your research with the data safeguarding methods mentioned in your approved application, and that no further IRB oversight is required.

Your study falls under exemption category 46.101 (b)(1,2), which identifies specific situations in which human participants research is exempt from the policy set forth in 45 CFR 46:

(1) Research conducted in established or commonly accepted educational settings, involving normal educational practices, such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

(2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless:
(i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.

Please note that this exemption only applies to your current research application, and that any changes to your protocol must be reported to the Liberty IRB for verification of continued exemption status. You may report these changes by submitting a change in protocol form or a new application to the IRB and referencing the above IRB Exemption number.

If you have any questions about this exemption, or need assistance in determining whether possible changes to your protocol would change your exemption status, please email us at irb@liberty.edu.

Sincerely,

[redacted]
Professor, IRB Chair
Counseling

[redacted]

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1971 UNIVERSITY BLVD. LYNCHBURG, VA. 24515 IRB@LIBERTY.EDU FAX (434) 522-0506 WWW.LIBERTY.EDU

Appendix B: Letter of Permission

[redacted]

Office of Institutional Research & Analysis

January 31, 2014

Dear Keith McKelphin,

Based on our review of your research proposal, I give permission for you to conduct the study entitled ***The Influence of Health Assessments on Motivating College Students to Become More Physically Active*** using participants in Health Education courses at [redacted] As part of this study, I authorize you to engage in the participant recruitment, survey administration, and data collection activities as described in the materials you have submitted.

We understand that you will take appropriate steps to ensure the confidentiality of research participants' responses that include using only researcher-generated subject identification codes in order that neither a participant's name nor ID number will be used

I authorize you to engage in the data collection you have proposed with the understanding that individuals' participation will be voluntary and at their own discretion, and that the proposed Informed Consent content will be obtained from individuals before participation in the study begins.

It is understood that supervision of your research study is being conducted by your dissertation Chair, [redacted] a faculty member at Liberty University, and that [redacted] is not providing supervision of the research. You are authorized to disseminate the results of this study in your dissertation, subsequent scholarly journals, educational materials, or community news outlets.

The College's responsibilities include allowing you to recruit research participants and administer the survey instruments to research participants

I confirm that I am authorized to approve research in this setting.

Please inform the College's IRB, through communication with me, if any circumstances in the conduct of your research change or become problematic. Best wishes for a successful research endeavor!

Sincerely,

[redacted]

Director, Institutional Research & Analysis, and
Chair, Institutional Review Board
15400 Calhoun Drive #230
[redacted]

Appendix C: Consent Form

Consent Form

The Influence of Health Assessments on Motivating College Students to Become More Physically Active

[redacted]
Department of Education
Liberty University

You are invited to volunteer your participation in my dissertation research designed to analyze the influence of health assessments on motivating college students to become more physically active. You were selected as a possible participant because your health and personalized fitness class uses health assessments to develop a personal fitness plan. I ask that you read this form and ask any questions you may have before agreeing to be in the study.

As a graduate student in the education department at Liberty University, I am conducting dissertation research as part of the requirements for a Doctorate of Educational Leadership.

Background Information:

The purpose of this study is to analyze the influence of health-related physical fitness assessments (cardiorespiratory, muscle strength, muscle endurance, flexibility, and body composition) on motivating college students to become more physically active. Therefore, health related physical fitness components have a relationship to good health and, an individual's level of physical activity and lifestyle behaviors. The study will test the theory that college students' awareness of their current health fitness assessment scores will motivate them to become more physically active.

Procedures:

If you agree to be in this study, I would ask you to do the following things:

Initial data collection will take place at the start of the semester. During the second week of class, students will receive a mass email to remind them to fill out the web-based surveys and the links will be provided. Classes will continue as normal. Students will have no additional task other than coming to class. The differences in the classes is some classes will receive their assessments after each health-related physical fitness component has been taught and others will received their assessment at one time after all health-related physical fitness have been taught and their post-test survey received. For all of the classes the post-test surveys will occur around mid-term. When the post-test is due, a mass email will be sent as a reminder that the post-test surveys need to be filled out. It should take about 10 minutes of your time for you to complete the questionnaires for Behavioral Regulation in Exercise Questionnaire-2 (BREQ-2), Physical Activity Stages of Change Questionnaire (PASCQ), and Physical Exercise Self-Efficacy Scale (PESES).

Risks and Benefits of being in the Study:

The study has several risks: When you enrolled in the Health and Personalized Fitness course (HE 109), your guidance counselor informed you, or you read it in the College catalog that this class has activity labs that are required. There are risks in this protocol because injury may occur during the performance of the health-related physical fitness assessment (exercise tests). To minimize the possibility of injury, certified fitness professionals will monitor all research participants, and all subjects will be taught proper form. Participants will be adequately warm-up and proper form will be used at all times.

All students must complete the Department of Health Enhancement, Exercise Science, and Physical Education's Physical Activity Readiness Questionnaire (PAR-Q) and student agreement and student waiver form.

Confidentiality:

The records of this study will be kept private. In any sort of report I might publish, I will not include any information that will make it possible to identify a subject. Research records will be stored securely and only the researcher will have access to the records. The confidentiality of all data and materials will be maintained by the researcher through keeping such information locked in a file in his home office.

Voluntary Nature of the Study:

Participation in this study is voluntary. Your decision whether or not to participate will not affect your current or future relations with Liberty University and [redacted] you decide to participate, you are free to not answer any question or withdraw at any time without affecting those relationships.

Contacts and Questions:

The researcher conducting this study is Keith McKelphin. You may ask any questions you have now. If you have questions later, **you are encouraged** to contact Keith McKelphin at (240) 567-7980 or Kmckelphin@liberty.edu. In addition, you may also contact my dissertation chair, Dr. [redacted]

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, **you are encouraged** to contact the Institutional Review Board, 1971 University Blvd, Suite 1837, Lynchburg, VA 24515 or email at irb@liberty.edu, or [redacted]

You will be given a copy of this information to keep for your records.

Statement of Consent:

I have read and understood the above information. I have asked questions and have received answers. I consent to participate in the study.

Signature of Investigator:____________________________ Date: ________________

IRB Code Numbers: 1747.020414 **IRB Expiration Date:** 02/04/2015

Appendix D: Assessment Tests

1.5-mile walk-run test. This test was used to determine the student's cardiorespiratory fitness by determining a student's maximum oxygen consumption (MAX $V0_2$).

Equipment required. A running track or course that is flat and provides exact measurements of up to 1.5 miles, and a stopwatch, clock, or watch with a second hand.

Instructions.

1. Warm up before taking the test. Do some walking, easy jogging, and stretching exercises.
2. Try to cover the distance as fast as possible without overexerting yourself. If possible, monitor your own time, or have someone call out your time at various intervals of the test to determine whether your pace is correct.
3. Record the amount of time, in minutes and seconds, it takes you to complete the 1.5-mile distance.

Muscle strength test.

Leg press and bench press exercise. The two exercises were used to determine muscle strength fitness. This test determined a person's one-rep max (1-RM). This method determined 1-RM by doing a maximum or submaximal effort.

***Instructions*.**

1. One-rep max (1-RM) testing had an experienced spotter, or weight-training professional assisting you.
2. To find your 1-RM for the bench press or leg press, you need to familiarize yourself with the proper technique to perform a bench or leg press correctly, begin by

selecting a weight that you can lift easily. Perform a light warm-up of 5 to 10 repetitions with that weight.

3. Follow with a l-minute rest with light stretching (if you do not feel warmed up, repeat with a slightly heavier weight).
4. Then, perform the one-rep-max attempt with proper technique. Your goal is to complete the lift to failure between 1-10 reps. Anything over 10 reps is considered an unsuccessful attempt at finding your 1-RM. Rest for another two to four minutes and increase the load 5–10%, and attempt another lift. If you fail to perform the lift with correct technique, rest two to four minutes and attempt a weight 2.5–5% lower.

Flexibility tests.

Sit-reach. This test measures the flexibility of the lower back and hamstring muscles.

Equipment required. Sit and reach box (alternatively, a ruler can be used and held between the feet).

Instructions. The sit and reach test involved sitting on the floor with legs out straight ahead. Feet (shoes off) are placed with the soles flat against the box, shoulder-width apart.

1. Warm up your muscles with a low-intensity activity such as walking, and then perform slow stretching movements.
2. Remove your shoes and sit facing the flexibility-measuring device with your knees fully extended, and your feet flat against the device.
3. Reach as far forward as you can, with palms down, arms evenly stretched, and knees fully extended; hold the position of maximum reach for about two seconds. Make sure feet are held flat against the floor.

4. Perform the stretch two times, recording the maximum reading to the nearest 0.5 inches.

Ankle flexibility. The objective of this test was to monitor the development of a person's ankle flexibility.

Equipment required. Yardstick or tape measure.

Shoulder flexibility.

Equipment required. Tape measure.

Instructions.

1. Raise one arm, bend elbow, and reach down across back, with palm facing upper back. Position opposite arm down behind back and reach up across back with back of hand against back.
2. With fingers extended, try to cross fingers, upper hand over lower hand. Repeat with arms in opposite position.
3. Measure distance from fingertip to fingertip. If fingers overlap, score as a plus. If fingers fail to meet, score as a minus.

Muscle endurance.

Push-up. This test assesses an individual's endurance of muscles in his or her upper body. The participant performs either standard push-ups or modified push-ups, in which he supports him or herself with his or her knees. For an accurate assessment of upper-body endurance, men should perform standard push-ups, and women should perform modified push-ups.

Instructions.

1. For push-ups: Start in the push-up position with your body supported by your hands

and feet. For modified push-ups*:* Start in the modified push-up position with your body supported by your hands and knees. For both positions, your arms and your back should be straight and your fingers pointed forward.

2. Lower your chest to the floor with your back straight, and then return to the starting position.
3. Perform as many push-ups or modified push-ups as you can without stopping.

Curl-up. This test is used to assess the endurance of the abdominal muscles.

Equipment required. Four 6-inch strips of self-stick Velcro or heavy tape ruler, and mat (optional).

Instructions. Affix the strips of Velcro or long strips of tape on the mat or testing surface, then place the strips 3 inches apart.

1. Start by lying on your back on the floor or mat, arms straight and by your sides, shoulders relaxed, palms down and on the floor, and fingers straight. Adjust your position so that the longest fingertip of each hand touches the end of the near strip of Velcro or tape. Your knees should be bent about 90 degrees, with your feet about 12 to 18 inches from your buttocks.
2. To perform a curl-up, flex your spine while sliding your fingers across the floor until the fingertips of each hand reaches the second strip of Velcro or tape. Then return to the starting position; the shoulders must be returned to touch the mat between curl-ups, but the head need not touch. Shoulders must remain relaxed throughout the curl-up, and feet and buttocks must stay on the floor. Breathe easily, exhaling during the lift phase of the curl-up; do not hold your breath.

3. Once your partner says, “go,” perform as many curl-ups as you can at a steady pace with correct form. Your partner counts the curl-ups you perform and calls a stop to the test if she or he notices any incorrect form or drop in your pace.

Squat endurance test. This test is used to assess the endurance of muscles in the lower body.

Instructions.

1. Stand with your feet placed slightly more than shoulder-width apart, toes pointed out slightly, hands on hips or across your chest, head neutral, and back straight. Center your weight over your arches or slightly behind.
2. Squat down, keeping your weight centered over your arches, until your thighs are parallel to the floor. Push back up to the starting position, maintaining a straight back and neutral head position.
3. Perform as many squats as you can without stopping.

Body composition.

Body mass index (BMI). BMI was used to classify the health risks of body weight.

Equipment required. Weight scale and tape measure or other means of measuring height.

Hip and waist circumference and waist circumference and waist-to-hip ratio. This test determined health risk based on the distribution of body fat.

Equipment required. Tape measure or other means of measuring height.

Stand with your feet together and your arms at your sides. Raise your arms only high enough to allow for taking measurements. Your partner should make sure the tape is horizontal around the entire circumference and pulled snugly against your skin. The tape should not be pulled so tight that it causes indentations in your skin. It is important to record measurements to the nearest millimeter or one-sixteenth of an inch.

Waist. Measure at the smallest waist circumference. If you do not have a natural waist, measure at the level of your navel.

Hip. Measure at the largest hip circumference.

Waist-to-hip ratio. You can use any unit of measurement (for example, inches or centimeters), as long as you are consistent. Waist-to-hip ratio equals waist measurement divided by hip measurement.

Body fat percent. A body fat analyzer was used to estimate the percent of body fat of participants.

Instructions.

1. All you need to do is grip the machine handles for about 7 seconds—you are then required to feed in the required information regarding your height, weight, age, and gender. The body fat analyzer uses electrical impedance to measure your body fat against your lean body weight, thereby calculating your BFP.