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Efficacy of an Online, Concepts-Based Fitness and Wellness Course

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THE EFFICACY OF AN ONLINE, CONCEPTS-BASED FITNESS AND WELLNESS COURSE

By
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DEDICATION

This work is dedicated to my grandmother, Sue Townsend, whose work ethic and perseverance was exceeded only by her character, optimism, and love of family.

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The culmination of this work would remain an obsequious aspiration without the influence and support of my wife, Cynthia Mann, who held our family together during four relocations, three job changes, and all the other wonderful madness we experienced since this project began in 2014.

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ABSTRACT

With the sudden growth of distance education at the turn of the century, online offerings of fitness and wellness courses spread quickly across college curriculums. However, the emergence of rigorously designed research regarding the ability of online, concepts-based fitness and wellness classes to significantly improve student health has progressed at a more leisurely pace, leaving stakeholders within higher education unsure of its effectiveness. The purpose of this study was to examine changes of levels health-related fitness among 28 undergraduate students enrolled in an online, 15-week fitness and wellness course. The study centered around the concept of health-related fitness having five components: cardiovascular endurance, body composition, flexibility, muscular strength, and muscular endurance. Participants underwent a battery of fitness tests administered by a graduate assistant before and after a mandatory period of exercise that spanned 8 weeks of Lifetime Fitness & Wellness at Tennessee Technological University during the Fall 2018 semester. The assessments included the YMCA 3-Minute Step Test to measure cardiovascular endurance, bioelectrical impedance calculation of body composition, the Sit and Reach Test of trunk flexibility, the use of a dynamometer to determine grip strength, and the American College of Sports Medicine Push-Up Test to measure muscular endurance. Statistical analysis using paired samples *t*-tests revealed significant improvements among levels of cardiovascular endurance, flexibility, and muscular endurance. Changes to muscular strength and body composition were not statistically significant. The results of this study support the existing literature in that online, concepts-based fitness and wellness courses are an effective means of improving student health.

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CHAPTER I

INTRODUCTION

Background of the Problem

The number of people who are obese in the United States has risen dramatically over the past two decades as a direct result of inactivity and unhealthy eating behaviors (Hoeger & Hoeger, 2015; Wells & Buzby, 2008). Researchers at the Centers for Disease Control and Prevention (CDC), a federal agency dedicated to the goal of improving overall public health, have found that 35% of U.S. adults are obese and 69% of U.S. adults are overweight (CDC, 2012). These rates have skyrocketed from the obesity and overweight rates presented 40 years ago of 13% and 31%, respectively (Fryar, Carroll, & Ogden, 2015). This epidemic of obesity has an annual medical cost of $147 billion in the United States (CDC, 2015).

Despite this bulging social issue, the number of American four-year colleges and universities requiring mandatory physical education has dropped significantly (Grassgreen, 2012; Oregon State University News and Research Communications, 2013; Painter, 2013). In fact, researchers found that 97% of U.S. college students were required to take physical education courses in 1920, and today, that number has dropped to an all-time low of 39% (Oregon State University News and Research Communications, 2013).

Non-exercising, modern college students say that having more time for exercise and greater access to facilities would be the top circumstances to begin exercise (Ebben & Brudzynski, 2008). With online education considered by some scholars to be in its infancy (McPherson & Bacow, 2015), a trend toward health and fitness-related online

courses is rising, particularly in secondary schools (North Carolina Department of Public Instruction, 2015). A researcher opposed to online physical education courses argues that students simply cheat the exercise portion of such courses (Harvey, 2013), while another in support of online fitness courses argues that the freedom of exercise activity choices motivates students to become more active (Grayson, 2010).

Online physical education courses often include an exercise regimen, and researchers have shown that strenuous exercise leads to improved cognitive function (Griffin et al., 2011) and enhanced academic performance (Sallis, Patrick, & Long, 1999) among students. Other benefits of regular exercise experienced through college-level physical education courses can include weight control, reduced risk of cardiovascular disease, reduced risk of type 2 diabetes, reduced risk of some cancers, stronger bones and muscles, improved mental health and mood, and increased chances of living longer (CDC, 2015). Also, regular visits to campus fitness centers have a proven relationship with high grade-point averages (Neubert, 2013).

Because of the alarming rates of physical inactivity, obesity, and hypokinetic diseases, combined with the increasing number of college students learning online (Allen & Seaman, 2013), some movement toward post-secondary online physical education already exists, and educators need to be proactive and guide the process so that the result is well-conceived curricula (Kooiman & Sheehan, 2014). However, a large concern for the academic rigor of online physical education courses exists, according to researchers who conducted a survey of over 100 kinesiology department administrators (Mahar, Hall, Delp, & Morrow, Jr., 2014). For these reasons, this researcher proposed a study of the

effectiveness of an online, concepts-based fitness and wellness course to significantly change levels of health-related fitness among college students.

Statement of the Problem

Researchers have provided much evidence toward a need for concepts-based fitness and wellness courses as necessary components of a college curriculum. Unfortunately, an overwhelming number of universities are moving away from mandatory physical education requirements due to budget constraints, pressure to fast-track degree paths, and the emergence of online education. As online education surged forward, however, online physical education trends began to develop as institutional leaders who valued the benefit of such courses sought ways of keeping them in the emerging online curriculum. Higher education administrators then found these online physical education offerings to be highly cost effective, favorable among students, and a feasible way of providing students with the many temporary and lifelong benefits of college-level fitness and wellness courses. In short, online physical education became a seemingly quick remedy to a common issue across all of higher education.

However, very little is known about the efficacy of these courses. This researcher found very few studies whose authors focused upon the effectiveness of college-level online fitness and wellness courses. Further, as institutions rushed to put these online offerings into practice, these classes were often developed by instructors whose expertise lied within on-the-ground physical education, which may not necessarily lead to the highest quality online experiences for students. Although some research findings have led to a general belief among administrators that online physical education is effective in meeting learning outcomes and keeping students active, many administrators also believe

that instructors do not truly know whether the students are actually exercising. In online physical education courses, students keep an exercise journal that must be submitted for the instructor's review upon the closing of the semester, or students swipe an ID card at the university fitness center to keep an online log of visits (Ransdell, Rice, Snelson, & DeCola, 2008). Without recognizing whether students simply chose not to exercise but to write a mendacious journal or merely swipe into the fitness center and walk back out of the door, little is known regarding whether online physical education students are gaining any health benefits while enrolled in the course and the intended improvements in attitudes toward daily exercise.

Administrators also do not know what is most effective in regard to exercise requirements in online physical education courses (Mahar et al., 2014). Because the courses were often developed by instructors whose backgrounds lied in face-to-face or *traditional* physical education courses, activity requirements closely resembled the exercise requirements of a grounded classroom. Students would be required to carry out very strict exercise routines that involved very specific movements and specialized equipment. This method is problematic for several reasons. First, online students may not have access to a facility that provides the equipment necessary to follow the prescribed routine, or if they do, access includes a monthly membership cost (Van Niekerk, 2010). Second, college students enjoy a freedom of choice (Renn & Reason, 2013), and therefore, they often do not appreciate the standard routines typical of an online fitness and wellness course (e.g., a 5-minute warm up, 20 minutes of cardiovascular work, three sets of 8-10 repetitions of five resistance exercises, 10 minutes of flexibility training, and a 5-minute cool down). Third, students may be more willing to try or are already

involved in more recent trends of keeping fit, such as CrossFit training, rock climbing, yoga, or martial arts (Melton, Hansen, & Jonathan, 2010). Placing the aforementioned requirements of a strict exercise regimen poses the risk of either an interruption in a student's already healthy routine or worse, leading an already active student toward overexertion. Finally, many students simply are uncomfortable entering a gym (Hurley, Flippin, Blom, Hoover, & Judge, 2018) and may therefore perform better elsewhere.

With these concerns in mind, this researcher was interested in knowing simply what, then, actually occurs when online students are tasked with exercise. First, this researcher was interested in shedding some light toward whether students improve their health while enrolled in a concepts-based, online fitness and wellness course and not simply writing fictitious journals or swiping cards. Previous research regarding improvements in components of health-related fitness while enrolled in online fitness and wellness courses relied upon data retrieved from surveys and therefore depicts student perceptions of personal health rather than actual results drawn from true laboratory testing (Higgins, Lauzon, Yew, Bratseth, & Morley, 2009; Lockwood & Wohl, 2012; Wharf Higgins, Lauzon, Yew, Bratseth, & McLeod, 2010). Findings may consequently reflect student perceptions of personal fitness, rather than measured changes in fitness recorded through laboratory testing. Secondly, if students are somewhat free to be active within the guidelines recommended by the U.S. Department of Disease Prevention and Health Promotion (2018) and the American College of Sports Medicine (2014), rather than restricted to a specified exercise program, what, if any, physiological changes occur after 8 weeks of activity?

Research Questions and Hypotheses

In an effort to further what is known about online fitness and wellness courses in higher education, the researcher sought an answer the following overarching question.

Research Question: To what extent do differences occur among pretest and posttest measures regarding levels of health-related fitness among students enrolled in an online, concepts-based fitness and wellness course at Tennessee Technological University?

The researcher then developed the following sub-questions and hypotheses.

Sub-Question 1: To what extent do differences occur among pretest and posttest measures of cardiovascular endurance as measured by the YMCA 3-Minute Step Test among students in Lifetime Fitness & Wellness Online?

$H1_o$: Students who participated in Lifetime Fitness & Wellness Online will not demonstrate statistically significant changes among levels of cardiovascular fitness on the YMCA 3-Minute Step Test.

$H1_A$: Students who participated in Lifetime Fitness & Wellness Online will demonstrate statistically significant changes among levels of cardiovascular fitness on the YMCA 3-Minute Step Test.

Sub-Question 2: To what extent do differences occur among pretest and posttest measures of body composition as measured by bioelectrical impedance analysis among students in Lifetime Fitness & Wellness Online?

$H2_o$: Students enrolled in Lifetime Fitness & Wellness Online will not demonstrate statistically significant changes among levels of body composition as measured by bioelectrical impedance analysis.

$H2_A$: Students enrolled in Lifetime Fitness & Wellness Online will demonstrate statistically significant changes among levels of body composition as measured by bioelectrical impedance analysis.

Sub-Question 3: To what extent do differences occur among pretest and posttest measures of flexibility as measured using the Sit and Reach Test among students in Lifetime Fitness & Wellness Online?

$H3_o$: Students enrolled *in* Lifetime Fitness & Wellness Online will not demonstrate statistically significant changes among levels of flexibility as measured by a Sit and Reach Test.

$H3_A$: Students enrolled in Lifetime Fitness & Wellness Online will demonstrate statistically significant changes among levels of flexibility as measured by a Sit and Reach Test.

Sub-Question 4: To what extent do differences occur among pretest and posttest measures of muscular endurance as measured using an AssessPro Rep-Addition Push-Up Tester among students in Lifetime Fitness & Wellness Online?

$H4_o$: Students enrolled in Lifetime Fitness & Wellness Online will not demonstrate statistically significant changes among levels of muscular endurance as measured by an AssessPro Rep-Addition Push-Up Tester.

$H4_A$: Students enrolled in Lifetime Fitness & Wellness Online will demonstrate statistically significant changes among levels of muscular endurance as measured by an AssessPro Rep-Addition Push-Up Tester.

Sub-Question 5: To what extent do differences occur among pretest and posttest measures of muscular strength as measured using a hydraulic hand dynamometer among students in Lifetime Fitness & Wellness Online?

$H5_o$: Students enrolled in Lifetime Fitness & Wellness Online will not demonstrate statistically significant changes among levels of muscular strength as measured using a hydraulic hand dynamometer.

$H5_A$: Students enrolled in Lifetime Fitness & Wellness Online will demonstrate statistically significant changes among levels of muscular strength as measured using a hydraulic hand dynamometer.

Conceptual Framework

Because administrators and instructors are able to understand whether students are learning concepts of fitness, wellness, and overall health through traditional means of assessment, the intent of this study was to shed some light on whether changes in health actually occur as students complete an online, concepts-based fitness and wellness course. Using a quantitative, comparative method, the researcher compared pre- and post-measurements of the five components of health-related fitness to determine any changes to the levels of health among students enrolled in an online, concepts-based fitness and wellness course at Tennessee Technological University. These components are recognized by the American College of Sports Medicine as cardiovascular fitness, body composition, flexibility, muscular strength, and muscular endurance (American College of Sports Medicine, 2014), as displayed in Figure 1, Five Components of Health Related Fitness. Health-related fitness means the organic systems of the body are healthy and functioning efficiently. Health-related fitness exerts a positive influence on several risk

factors associated with cardiovascular diseases, and it is an effective way of avoiding the likelihood of developing diseases associated with sedentary lifestyles, such as low back pain, diabetes, osteoporosis, and obesity (Miller, 2014). In short, health-related fitness enables individuals to look better, feel better, and enjoy a healthy, happy, and full life.

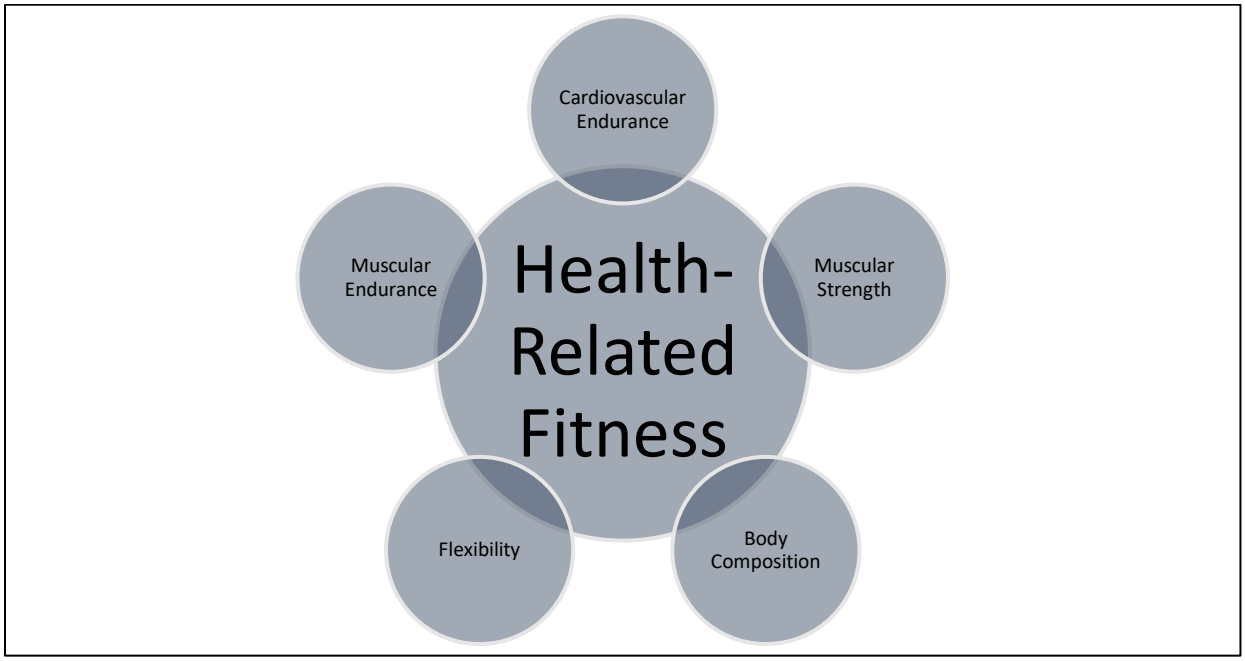

Figure 1. Five Components of Health-Related Fitness.

Lifetime Fitness & Wellness students were directed to follow physical activity guidelines set by the U.S. Department of Disease Prevention and Health Promotion for achieving substantial health benefits. These guidelines are represented in Figure 2, Physical Activity Guidelines. Every week, over the course of 8 weeks, students were tasked with performing and reporting either 150 minutes of moderate-intensity aerobic physical activity, or 75 minutes of high-intensity aerobic physical activity. Students could also perform and report an equivalent combination of moderate- and high-intensity aerobic physical activity. Examples of moderate-intensity exercises include brisk walking

and playing tennis. Examples of high-intensity exercises include jogging or swimming laps (Office of Disease Prevention and Health Promotion, 2018).

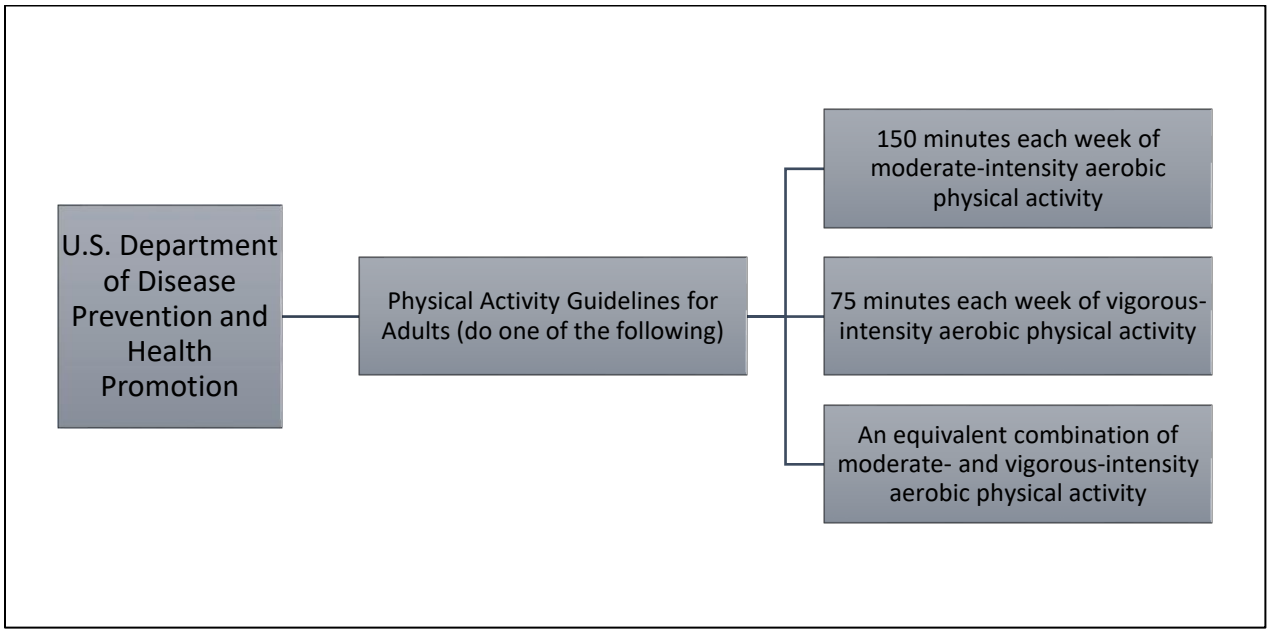

Figure 2. Physical Activity Guidelines.

Lifetime Fitness & Wellness students were also tasked with performing and reporting weekly strength and flexibility exercise. Students were instructed to follow the training guidelines recommended by the American College of Sports Medicine, and submit a report each week using MyFitnessPal. Students were instructed to perform a minimum of one set of 8 to 10 resistance exercises, 2 days per week. Students were also tasked with performing flexibility training at least two days each week. Figure 3, American College of Sports Medicine Guidelines for Physical Training, highlights the guidelines Lifetime Fitness & Wellness students must follow as they exercise for improvement or maintenance of muscular strength and endurance, body composition, and flexibility.

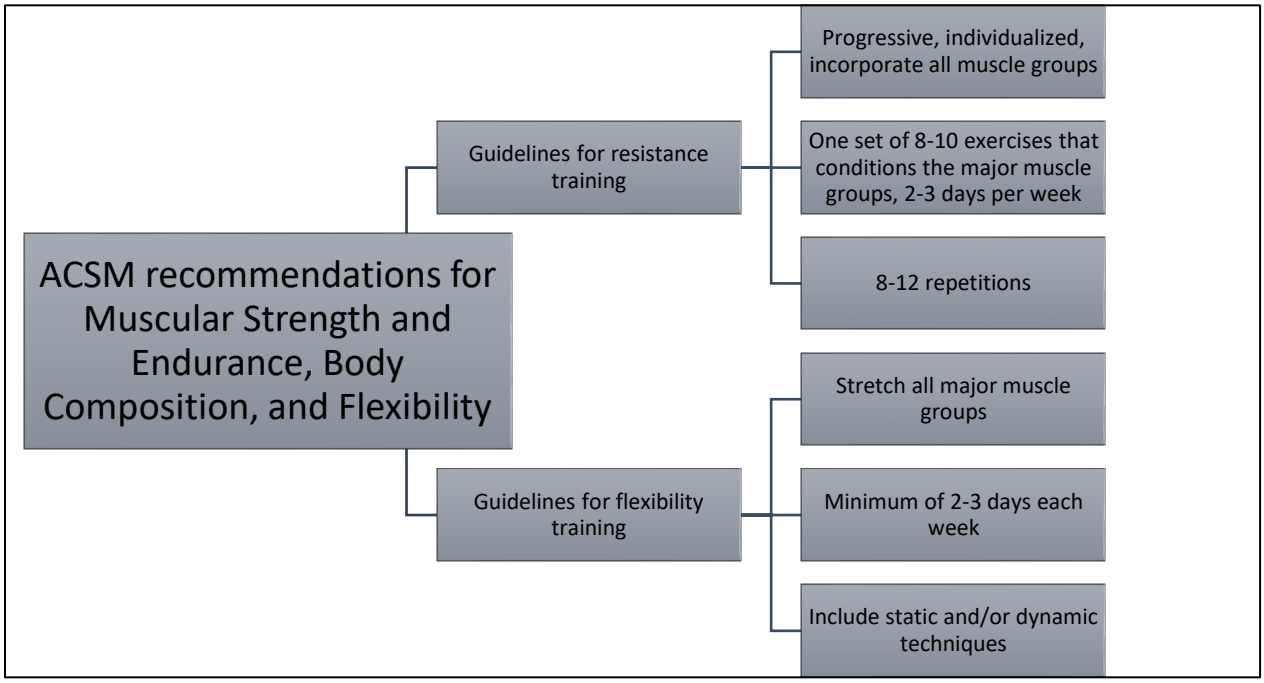

Figure 3. American College of Sports Medicine Guidelines for Physical Training.

Importance of the Study

This researcher anticipated the results of this study to have a positive influence the health and well-being of the modern college student, influence future educational practice and curriculum structure within higher education, and, to some extent, provide a means for changing the negative health trends that currently plague the U.S. society. Today's college student is treading along a path toward obesity, heart disease, diabetes, expensive health care and premature death due to poor nutrition, sedentary living, and unhealthy behaviors. The transition to college is typically accompanied by a decrease in already low levels of physical activity, and those exercise habits developed in the college years usually set the standard for physical activity after college. Levels of activity after graduation are then negatively affected by work and family demands. The loss of mandatory physical education within higher education has added fuel to the fire, setting ablaze a life riddled with significant health issues. Although researchers have found that

students can learn the benefits of a lifetime of physical activity through online education (Beauchemin, Gibbs, & Granello, 2018), students gain an appreciation for exercise by performing exercises and witnessing results. Unfortunately, whether students participate in any form of exercise or, instead, submit mendacious self-reports while enrolled in online physical education classes is not well documented. Whether any health benefits are achieved while enrolled in online physical education courses is, therefore, not well-known and previous researchers present a need for more rigorous study designs in this regard. The major purpose of this study was to examine these changes over time through the use of a rigorous design.

An improved understanding of the health benefits of online, concepts-based fitness and wellness should then have a significant effect the future practices of leadership and curriculum development in higher education. Ease of scheduling, cost effectiveness, and a means of keeping students active are some of the major reasons colleges and universities have adopted online physical education into the curriculum. However, most kinesiology departments doubt its validity, and, to this point, little research exists that examines whether students enrolled in college-level online physical education courses are meeting the minimal exercise requirements necessary for substantial health benefits. The results of this study could be used to determine whether online physical education is effective in improving the health of college students and thus strengthen the leadership's commitment to produce well-rounded, healthy graduates that are ready to enter the workforce.

Despite the advances of modern medicine, the average life expectancy of U.S. citizens continues to decline (National Center for Health Statistics). U.S. citizens are

becoming more obese, more likely to develop cancer, diabetes, and hypokinetic diseases, and less likely to have a high quality of life in their later years (Hoeger & Hoeger, 2015; CDC, 2015). The fitness levels of U.S. youth have dropped as well, leaving children in the U.S. ranked number 47 out of 50 developed nations (PHIT America, 2018). If higher education exists to serve society, improving health should be a priority. Fortunately, these issues can be reversed through changes in lifestyle. The major purpose for this study was to determine changes in health-related fitness among online, college students.

Procedures

Participants were students enrolled in Lifetime Fitness & Wellness at Tennessee Technological University. Lifetime Fitness & Wellness is a 2-credit hour, online, concepts-based fitness and wellness course. Tennessee Technological University is classified as having a large, four-year, residential setting. The university serves over 11,000 students, is predominately composed of undergraduates, and is considered a doctoral university with moderate research activity. Tennessee Technological University is located in Cookeville, a micropolitan area of the Upper Cumberland Plateau housing just over 30,000 residents.

On-campus fitness testing is a requirement of the Lifetime Fitness & Wellness course. Seven weeks into the semester, students enrolled in Lifetime Fitness & Wellness visit the University's exercise physiology laboratory for a brief series of pretests to measure the components of health-related fitness. These tests determine individual levels of health-related fitness among students prior to the commencement of required exercise. Students are then tasked with reporting weekly exercise for a period of 8 weeks before returning to the lab for a series of posttests. The YMCA 3-Minute Step Test measures

cardiovascular endurance. Bioelectrical impedance analysis measures body composition. Administrators use a Sit and Reach Test to measure baseline trunk flexibility. A push-up test using an AssessPro Rep-Addition Push-Up Tester measures muscular endurance. A hydraulic hand dynamometer measures grip strength. This cycle is presented in Figure 4, Pretest/Posttest Measurements in Lifetime Fitness & Wellness.

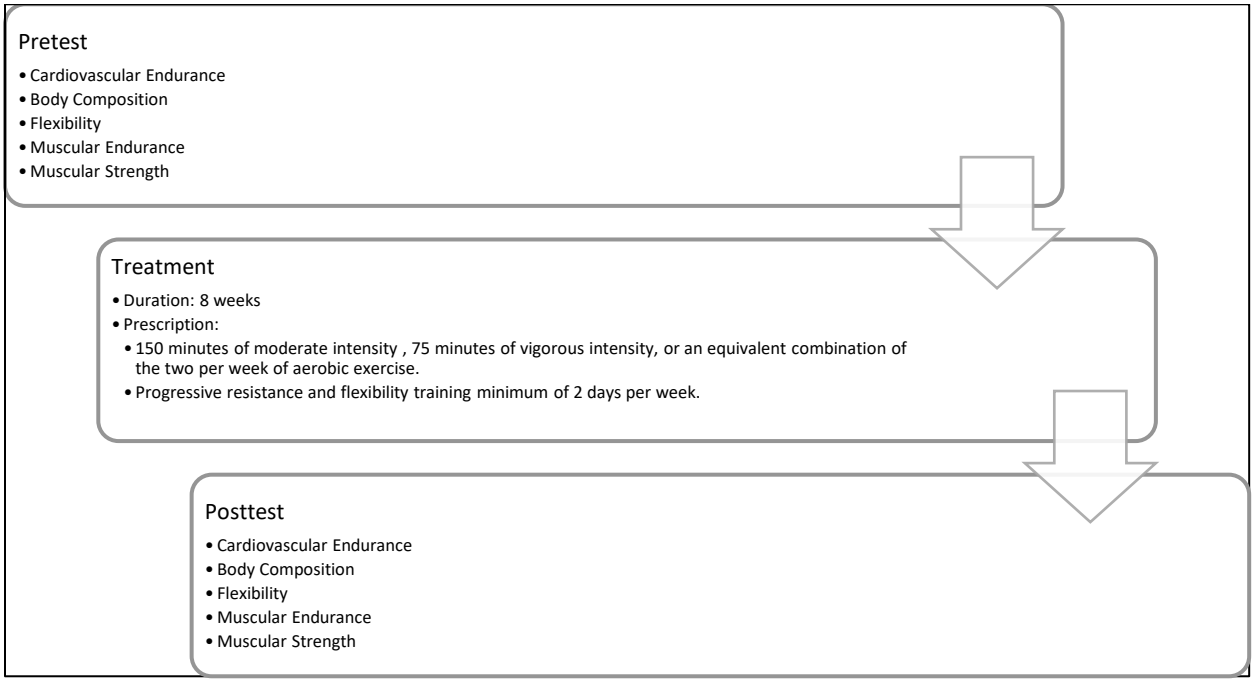

Figure 4. Pretest/Posttest Measurements in Lifetime Fitness & Wellness.

The researcher used paired samples *t*-tests for data analysis. Also referred to as the dependent *t*-test, paired *t*-test, or repeated measures *t*-test, paired samples *t*-tests are used to determine whether the means of two paired measurements, such as pretest and posttest scores, are significantly different. In a paired samples *t*-test, each participant is assessed twice, resulting in pairs of observations (Kent State University, n.d.). The purpose of the paired samples *t*-test is to determine whether there is statistical evidence that the mean difference between paired observations on a particular outcome is significantly different from zero (Kent State University, n.d.).

The instruments used among these participants to determine levels of health-related fitness are mentioned here. The researcher chose the YMCA 3-Minute Step Test to measure cardiorespiratory fitness because it is submaximal test, i.e., the step test is considered to safe to perform because participants are not required to exercise at maximal or near maximal levels of exertion. The validity of the YMCA 3-Minute Step Test is accepted because of linear relationships between workload, heart rate, and VO2 Max (Miller, 2014). To determine body composition, the researcher chose bioelectrical impedance analysis (BIA). BIA is based on the difference between the resistance of lean tissue to an electrical current and the resistance of fat tissue (Miller, 2014). It is a fast, noninvasive technique for body composition analysis. Using an AssessPro UltraFlex Tester, the Sit and Reach Test was used to determine flexibility of the lower back and posterior thighs. The Sit and Reach Test promoted by the American Alliance of Health, Physical Education, Recreation and Dance has been validated against several other tests, and coefficients between .80 and .90 have been found (Miller, 2014).

To measure muscular endurance, the researcher followed push-up test procedures provided by the ACSM (American College of Sports Medicine, 2014). The push-up test procedures require males to perform push-ups with a straight body, while female participants perform modified push-ups with their knees bent and touching the floor. Modified push-ups have a reliability coefficient of .93 (Miller, 2014). Static strength, also referred to as isometric strength or the force exerted against an immoveable object, was determined by grip strength using a handgrip dynamometer. Researchers have found grip strength to be a reliable predictor of upper body strength among both active and sedentary individuals (Farias, Teixeira, Tibana, Balsamo, & Prestes, 2012; Trosclair et al., 2011).

Graduate assistants scored these tests of health-related fitness among Lifetime Fitness & Wellness students at midterm for the fitness pretest and again near the conclusion of the semester as the fitness posttest. The scoresheets included charts of norms provided by the American College of Sports Medicine and the YMCA (American College of Sports Medicine, 2014; Golding, 2000) to provide participants the opportunity for further analysis and thus a more meaningful understanding of scores.

Limitations and Delimitations

There were limitations for this study including the following. The researcher had no control over the amount of effort the students put forth in their physical activities during the 8 weeks of exercise. The researcher was also limited by knowledge of outside physical activities the students may engage in during the period of time this study took place. The length of treatment was also a limitation as 8 weeks may not be a time period of sufficient length to get an accurate picture of how an online class may impact the students' performance on the five tests. The sample size was also a limitation because fewer than 30 participants limits the generalizability of the results to larger populations. The study was also limited to the student scores being recorded accurately and that the equipment used for testing purposes was functioning properly.

This study was delimited to only those students who were enrolled in the two online Lifetime Fitness & Wellness classes during fall semester of the 2018 school year as described in this study. The study was also delimited to only those students who completed the pretest and posttest components of the study.

Definition of Terms

In this section, the researcher provided a list of terms used in the study.

Aerobic activity – any physical activity that elevates heart rate for a prolonged period and trains the cardiovascular system and thus leads to the achievement of improved cardiovascular health if performed correctly (Hoeger, Hoeger, Fawson, & Hoeger, 2017).

Bioelectrical impedance analysis – refers to a noninvasive test used to determine body composition, or the measurement of body fat in relation to lean body mass (Miller, 2014).

Body composition – refers to the ratio of fat mass to lean body mass. Body composition is not to be confused with body mass index (BMI), which is a ratio of body weight to standing height (Payne & Isaacs, 2016).

Cardiovascular endurance – refers to the ability of the heart, lungs, and blood vessels to meet the demands of prolonged physical activity (Hoeger et al., 2017).

Concepts-based fitness and wellness – a curriculum-based approach that focuses on one's knowledge and understanding of physical activity, physical fitness, and wellness. In this model, students are involved in classroom, laboratory, and physical activity experiences that are designed to emphasize both the how and why of lifetime activity, physical fitness, and wellness (Lund & Tannehill, 2010).

Dynamic stretching – is a series of challenging motions in which a muscle or group of muscles is stretched further with each motion. This mode of stretching is performed typically during a warm-up routine (Hoeger et al., 2017).

Flexibility – refers to the capacity of a joint to move freely through a full range of motion (Hoeger et al., 2017).

Moderate intensity exercise - refers to movement activities that cause an individual to burn off three to six times as many calories as he or she would by sitting quietly. Examples include brisk walking, doubles tennis, bicycling under 10 miles per hour, and gardening (Harvard T.H. Chan School of Public Health, n.d.).

Muscular endurance – the ability of a muscle or group of muscles to exert repeated force against a resistance for an extended period of time (American College of Sports Medicine, 2014).

Muscular strength – refers to the amount of force a muscle or group of muscles can exert in a single effort (American College of Sports Medicine, 2014).

Physical Activity – any bodily movement produced by the contraction of skeletal muscles that increases energy expenditure above a basal level (American College of Sports Medicine, 2014).

Progressive – refers to the overload principle of exercise. For an exercise program to be considered progressive, effort should increase through exercise duration, intensity, and/or frequency (Hoeger et al., 2017).

Repetitions – refers to the number of times a participant performs a specific exercise (Hoeger et al., 2017). Repetitions are often referred to as reps.

Sedentary diseases – refers to illnesses linked to inactive lifestyles, such as heart disease, obesity, chronic low-back pain, diabetes, depression, and cancer (Hoeger et al., 2017).

Sets – refers to the number of cycles of repetitions a participant may perform during exercise (Hoeger et al., 2017).

Static stretching – refers to a stretch that is held in a challenging, but not painful, position for a period of time that should range from 20 to 30 seconds (Miller, 2014). Static is the most common form of stretching.

Vigorous intensity exercise – vigorous intensity activities cause an individual to burn off more than six times as many calories as he or she would by sitting quietly. Such exercises are performed with a large amount of effort, and include race walking, jogging, running, swimming laps, jumping rope, and bicycling faster than 10 miles per hour (Harvard T.H. Chan School of Public Health, n.d.).

Summary

The obesity epidemic has led to an estimated annual cost of $147 billion as the number of obese U.S. citizens has risen dramatically over the past two decades as a direct result of inactivity and unhealthy eating behaviors. The obesity epidemic and sedentary living have led to a lowered average life expectancy for the second consecutive year. The fitness levels of youths in the U.S. have dropped to 47 out of 50 developed nations, and 93% of youths in the U.S. are not meeting the guidelines for daily physical activity recommended by the U.S. Office of Disease Prevention and Health Promotion in 2018.

Students are, therefore, entering college with poor levels of health, and researchers found that young people become even more inactive during the college years. Unfortunately, lifetime physical activity patterns also develop during the college years. Most colleges no longer require mandatory physical education courses. Institutions that value the health of their students and continue to offer physical education courses have found it necessary to offer them in online formats. Because of the recent emergence and

predicted growth of online physical education courses, more research is needed to understand the health benefits associated with participation in online physical education.

Therefore, the researcher intended to compare a battery of health-related fitness pretests and posttests among a group of participants previously enrolled in an online, concepts-based physical education course. Using a paired samples *t*-test for this quantitative study, the researcher will determine whether any changes have occurred among levels of cardiovascular fitness, body composition, flexibility, muscular strength, and muscular endurance following a course-required, 8-week training program.

The results of this study could guide faculty in the development of instructional practice within the discipline. More importantly, perhaps, higher education administrators could use the research findings to guide decisions regarding the inclusion of online fitness and wellness courses in college and university curriculums. These decisions could influence the health and well-being of future college students and lead to another means of changing the negative health trends that currently plague Western culture.

CHAPTER II

REVIEW OF LITERATURE

Introduction

Research related to the current study is presented in the subsequent pages. The following information is provided to explain the importance of physical exercise and nutrition, identify the modern college student, define online education, explore the development of online physical education, and examine empirical research closely related to this study.

College-Level Physical Education

On average, 35% of students on college campuses are overweight or obese, according to an assessment made by the American College Health Association in 2006. Also, 46% of college students are attempting to lose weight, indicating false perceptions regarding personal weight and body image (National Association for Sport and Physical Education, 2007a). Only one out of three of those college students attempting to lose weight indicated having any available coursework from their college or university regarding physical activity and dietary guidelines. These students are likely to make unhealthy choices regarding weight loss. College-aged students are ever increasingly at risk of making unhealthy choices due to influencers, such as pop-culture, peer pressure, and the newfound freedoms associated with college life (Moore, Werch, & Bian, 2012).

Further, physical activity, already at all-time lows among high-school students, continues to plummet when students transition to college, indicating a critical point in becoming sedentary (Pauline, 2013). The National Association for Sport and Physical

Education reports the most rapid decline in physical activity occurs during late adolescence and early adulthood. Among U.S. high school freshmen, 69% participate regularly within the recommended levels of physical activity. By their senior year of high school, that number will be reduced to 55%. By college-age, the number participating in regular, leisure time activity will drop to 36.6% (National Association for Sport and Physical Education, 2007a). These trends continue throughout their adult lives. Eighty-one percent of inactive college students report that their activity levels do not increase after leaving college, according to the National Association for Sport and Physical Education.

These unhealthy behaviors mean declining funds for institutions of higher education. The nation's health crisis has resulted in escalating costs of the federal Medicaid program. These costs have led to a declining percentage of state funding for public institutions (McGuinness, 2011). Although state governments and higher education institutions are aware of the need for increased physical activity, many researchers report diminishing numbers of college physical education programs.

The number of four-year colleges and universities in the United States requiring mandatory physical education has dropped significantly (Grassgreen, 2012; Oregon State University News and Research Communications, 2013; Painter, 2013). Presently, the amount of U.S. colleges and universities that require physical education courses is at an all-time low of 39% whereas in 1920, 97% of U.S. colleges and universities held mandatory physical education requirements (Oregon State University News and Research Communications, 2013).

This sudden decrease in quality physical activity programs may occur at a critical developmental stage. Researchers are suggesting that fitness levels among young adults are indicative of future levels of health and fitness as they enter their later years of life. For example, exercise physiologist and well-known running coach Jack Daniels tested the VO2 max (i.e., maximal oxygen consumption, a measurement of cardiovascular fitness) of 26 of U.S. top male runners in 1968. All of the athletes, who were in their early 20s, had aerobic capacities at or above the 98th percentile. Almost all of these athletes returned to the lab 45 years later for posttests, where researchers conducted the same assessments. All of the men had remained active, and although their fitness levels indicated an expected, age-related decline, the men continued to be among the top 10% of older men in the United States. The researchers concluded that a higher initial fitness level in younger years contributes to higher levels of fitness with aging (Everman, Farris, Bay, & Daniels, 2018). Unfortunately, few longitudinal studies exist to support or argue these conclusions.

However, researchers have long suggested that the biological processes that we typically associate with aging are similar to the changes that occur with disuse or physical inactivity (Bortz II, 1982). Researchers also noted that many U.S. citizens commonly have the misconception that the results of physical inactivity are the irreversible losses caused by aging; however, inactivity accelerates the reversible losses caused by the aging process (Mechling & Netz, 2009). This finding is good news for physical educators because although we cannot correct aging, we can correct the biologic changes that occur due to physical inactivity. No drug offers as much promise for sustained health and quality of life as a lifetime of physical activity.

Unfortunately, very little research exists regarding the actual physical activity behaviors of college students. Authors of a meta-analysis of studies on college students' physical activity behaviors found that about 40% to 50% of U.S. college students are physically inactive, but, due to subjective and inconsistent measures of physical activity, the pattern of physical activity behaviors is difficult to determine. They also noted that efforts by health and physical activity professionals in higher education to increase the physical activity behaviors of college students effectively were unsuccessful as of 2010 (Keating, Guan, Pinero, & Bridges, 2005). Additionally, the authors of this meta-analysis also noted that college students' physical activity seriously has been neglected as a research topic.

History and Current State of Physical Education

Modern physical education is a course of study that focuses upon providing students with the knowledge needed to develop and maintain an active and healthy lifestyle through physical activity and health-related information (Williams, 2010). Its development largely stemmed from the early work of Edward Hitchcock, who in 1861 was appointed director of Hygiene and Physical Culture at Amherst College. Scholars credit Hitchcock as the creator of the first physical education program in the United States with an emphasis on a scientific base and consistent measurement of progress. Hitchcock's program focused upon the physical development of students and measured individual development. Activities in his program included marching, unison calisthenics, some sports, and games. Equipment included horizontal bars, ladders, ropes, and vaulting horses (Siedentop & van der Mars, 2012).

Physical education continued its emergence within the U.S. liberal arts college curricula, culminating in the World War II/Korean Wars years when universities required two to four semesters of physical education for reasons including a perceived need to get men fit for war (Sparling, 2003). The decline in mandatory physical education manifested in the early 1960s when much of higher education began to change in the U.S. Demands for student choice, a less perceived need for fitness for war, and a large influx of students that made required courses more difficult to administer precipitated changes of college-level physical education. These changes, combined with a need to make physical education more academic, led to the development of the conceptually based fitness and wellness courses that we see in modern programs (Kulinna, Warfield, Jonaitis, Dean, & Corbin, 2009).

Conceptually based fitness and wellness courses are sometimes also commonly referred to as lecture-laboratory courses, and they serve as an alternative to the traditional, skills-based physical education courses. The course lecture component is designed to promote learning of conceptual information related to fitness and wellness and health behavior change theory as well as learning of self-management skills that result in real world application (Corbin & Lindsey, 2005). More specifically, lectures primarily cover the importance of the varied types of exercise, such as aerobic, muscular and flexibility training, body composition, nutrition, avoidance of chronic diseases, and other lifestyle issues, including stress management and prevention of substance abuse (Pearman et al., 1997). Conceptually based fitness and wellness courses have gained their popularity over the traditional skills-based physical education activity courses because they are designed to improve student knowledge, attitudes, behaviors, and skills

necessary to adopt or enhance a healthy lifestyle (Dale & Corbin, 2000). Researchers have shown that conceptually based fitness and wellness courses are effective in developing positive behavioral and attitude changes among college students. For example, Slava, Laurie, and Corbin (1984) compared students taking these courses with students taking traditional, activity-based courses. The researchers found that students taking conceptually based fitness and wellness courses had knowledge, activity, and attitude profiles that were significantly better than the profiles of students taking traditional physical education classes (Slava, Laurie, & Corbin, 1984).

In a study comparing the impact of a required course on health knowledge, attitudes, and behaviors of alumni, Pearman et al. (1997) showed that alumni who took the concepts course were more likely to know their blood pressure, blood cholesterol, and recommended dietary fat intake than the comparison group. The alumni also reported that the course positively influenced their attitudes toward exercise, diet, and smoking. The alumni were more likely to engage in aerobic exercise and less likely to smoke, and they had lower intakes of dietary fat, cholesterol, and sodium. The researchers also noted a positive relationship between the number of physical education classes taken and alumni knowledge and attitudes toward healthy living and physical fitness in adulthood (Pearman et al., 1997).

Current Issues in College-Level Physical Education

The effects of The Great Recession had a tremendous impact on the potential quality of college-level physical education. The severe financial crisis led to negative issues including low workplace morale, the elimination of teaching (and coaching) positions, an increase in physical education class size, and a decline in resources

(Schneider, Konukman, & Stier Jr., 2010). These issues have a potential to overburden physical educators, with a possible result of less educated students. Tired teachers are giving in to what some scholars refer to as the *Busy, Happy and Good Syndrome* (Siedentop & van der Mars, 2012). This behavior is the oft cited *rolling the ball out for gym class*, whereas instructors ignore the educational component of a class that may lead to healthier eating habits and life-long physical activity, and instead simply see that students are actively engaged in an activity.

Furthermore, class sizes are increasing while funding for equipment either remains stagnant or decreases, resulting in very difficult teaching situations for physical educators. As class sizes increase above recommended levels, teachers report that safe and effective instruction is becoming compromised. Overcrowding can result in decreased instructional time due to management issues, insufficient amounts of equipment and activity space, slower learning rates due to decreased opportunities for practice, decreased time for students to learn and be active, decreased ability for teachers to provide individualized instruction, increased risk of student injury, and increased opportunity for off task student behavior (National Association for Sport and Physical Education, 2006).

Despite the increasing amount of less-than-ideal work environments, physical educators, as is the current trend among faculty within higher education, are finding themselves responsible for increasing levels of accountability. This increased workload is creating a whole new set of challenges for the future of the profession, as there exists a lack of effective measures to demonstrate the importance of physical education in the development of learners (Edginton, Chin, & Bronikowski, 2011). Physical educators are

finding themselves called upon more than ever to be able to demonstrate students' proficiency in developing the skills and knowledge needed to achieve a healthy, active lifestyle. Finding a reliable way to assess and demonstrate this information has proved challenging. Also, future physical educators should be prepared to demonstrate that physical education is as an important part of the college curriculum as writing, mathematics, and other core studies. To be valued as part of the core college curriculum, physical education will need to evolve in a way that links movement studies to learning areas in the vein of critical thinking, problem solving, and effective communication (Edginton et al., 2011).

The Modern U.S. College Student

The current generation of students in higher education is the largest and most diverse that the United States has ever witnessed. U.S. institutions of higher education incurred a surge in enrollment over the past decade, and much of this enrollment growth is driven by populations of students who have been traditionally underrepresented in higher education (Renn & Reason, 2013). Since 1979, the majority of college students have been women, and this trend is likely to remain unchanged. The percentage of college students who are minorities continues to increase. The modern college student is represented in today's working adult learners, online learners who may never step onto a physical college campus, traditional students who enter college directly after high school, and veterans returning home. Today's students come from varied socioeconomic, racial, and spiritual backgrounds (Renn & Reason, 2013).

Students make college choices based on a number of factors. Donald Hossler may have best outlined the process with his three-stage model of predisposition, search, and

choice (Hossler, 1987). His predisposition stage regards students' decision whether to attend college after graduation from high school. The following stage is influenced by individual characteristics regarding academic achievement, gender, race and ethnicity, language of origin, parental income and educational levels, location of residence and high school, and extracurricular participation (Renn & Reason, 2013). The final stage follows the students' determination to attend college and their gathering of information regarding colleges. Student choice is based upon the institutional characteristics of colleges and universities, rankings, socioeconomic status and financial aid, and public policy (Renn & Reason, 2013).

Student enrollment patterns are extremely varied, complex, and difficult to track. What was once considered traditional (i.e., graduation from high school, enter a university, and progress there through completion of a bachelor's degree) may no longer be the norm. In modern times, part-time and online students are becoming what we refer to as traditional (Renn & Reason, 2013). Researchers are finding that many of today's students are *swirling* and *double-dipping* their ways through college, either by way back-and-forth attendance patterns among varying colleges or by enrolling in more than one institution simultaneously.

Also, students are beginning college with higher levels of fatigue and lower levels of vigor due to physical inactivity, according to authors of a study that focused upon the well-being of college freshmen (Bray & Born, 2004). These authors investigated levels of vigorous physical activity and psychological well-being among 145 participants during their transitions from high school to their freshman year of university study. They found that although two-thirds of the participants reported adequate levels of vigorous activity

in their last 2 months at high school as recommended by the U.S. Department of Health and Human Services' standards, only 44% met the standards during their first 2 weeks of college. One-third of the students were active in high school but became insufficiently active once beginning college, one-third were active at both times, and 23% consistently fell short of recommend levels. Perhaps most notable, only 11% became active as they began their freshman year of study. This resulting level of fatigue may lead to later wake-up times, which has been linked to lower grade-point averages among freshmen. Trockel, Barnes, and Egget (2000) analyzed the effect of several health behaviors on grade point averages of a random sample of 200 freshmen at a large, private university, and found that of all the variables considered, sleep habits accounted for the largest variance. Of particular interest, they also noted that strength-training was associated with first-year students' higher grade point averages (Trockel et al., 2000).

The majority of today's students work at least part-time throughout their undergraduate careers. Some researchers perceive that working full-time while taking a full course load is becoming the norm for modern students. These working students are often the most likely elect to enroll in online course offerings (Cote & Allahar, 2011).

The number of modern students enrolled in distance education courses continues to grow. According to the latest data from the National Center for Education Statistics, 27.1% (5,552,194) of college students enrolled in distance education in fall 2013. Nearly half of these 5,552,194 college students who enrolled in distance education courses were exclusively taking their college courses online. We will further discuss this trend in the following section.

Online Education in U.S. Colleges and Universities

Online courses are described as courses whose content is provided at least 80% online (Allen & Seaman, 2011). In contrast, courses relying on face-to-face delivery methods or otherwise in a classroom are now known as traditional classes. Classes that incorporate 1 to 29% of web-based technology are called web facilitated, and the more common hybrid courses blend online and face-to-face delivery formats and are typically 30 to 70% web-based (Allen & Seaman, 2011).

Although colleges began to embrace internet-based distance learning in the 1990s and 2000s, scholars still consider online education to be in its infancy (McPherson & Bacow, 2015). While higher education faculty and students still consider the traditional classroom to be more effective than online education, perceptions regarding the efficacy of online education are improving, especially those faculty and students who have experienced at least one online course (Seirup, Tirotta, & Blue, 2016). Through a pair of Pew Research Center surveys, researchers found that only 29% of the public believe online courses offer the same value as courses taken in a traditional classroom; however, half of college presidents feel that the two formats are of equal value to learners (Parker, Lenhart, & Moore, 2011).

Historically, two-year institutions granting associate's degrees have been the leaders in providing online instruction as they seek to attract non-traditional students (Bichsel, 2013). However, 89% of four-year public colleges and 60% of private four-year colleges reported offering online classes in 2011 (Parker et al., 2011).

Nearly one-in-four college graduates report having taken at least one class online. However, among students who graduated between 2001-2011, 46% have taken an online course (Parker et al., 2011). Penn State designed a study to identify what features of

online courses are most important, and least important, to students. Montana State University participated in the study and found that most online students desire easy access to required technologies, clearly written grading criteria and policies, ease of course navigation, clear instructions on how to get started within the course, clear learning objectives that are linked to assessments and relevant course activities, and clearly explained requirements for interaction with the instructor and other students (Montana State Online, 2011).

Participants who responded to the Montana State University survey found interactive games, audio/video content, web conferencing, and video chat to be of least importance in an online course. Students then appeared to be more interested in how to navigate online courses and expectations for successful completion of courses. They were less interested in technological tools that appear to pace learning behavior (Montana State Online, 2011).

Student engagement patterns in online courses are directly linked to student success. In a partnership study performed by the Midwest Virtual Education Research Alliance and the Regional Education Laboratory Midwest, researchers found existing patterns between time spent within online courses and student success. Students who engaged in their online course for at least 1.5 hours per week typically passed the course. They also found that students who engaged in their online course for 2 hours or more each week had better course outcomes than students who participated less than 2 hours per week (Pazzaglia, Clements, Lavigne, & Stafford, 2016).

Online Physical Education

Although the term *online physical education* may at first glance seem to be an oxymoron, a trend toward health and fitness-related online courses is rising, particularly in secondary schools (North Carolina Department of Public Instruction, 2015). Over the past decade, it has increasingly become a delivery alternative for physical education, and although there are many opinions regarding online physical education from within and outside the field, the reality is that "the train has left the station" (Mohnsen, 2012, p. 42).

The National Association of Sport and Physical Education has embraced the movement toward online physical education and released a position paper in its regard in 2007. The National Association for Sport and Physical Education considers online physical education to be neither inherently good nor bad and emphasizes that the value of any new educational technology or pedagogical strategy must always raise the question of learning (National Association for Sport and Physical Education, 2007b). In online physical education courses, the instructor assumes a role that includes guiding and personalizing learning, assessing student understanding of learning objectives, creating and facilitating group discussions, developing group projects, making constant adjustments to course resources, and responding to students' questions and elucidating concepts that they are finding most challenging (Wicks, 2010).

Online physical education offers many opportunities to reach modern students. Online physical education courses, if correctly designed and delivered, can provide access to students who may be unable to attend school-based settings, including students located in remote areas, students with special needs, or students who work while attending school. Schools that lack proper equipment, facilities, or faculty could benefit from online instruction as well. Students who may feel shy or intimidated by traditional

physical education classes due to poor health, low levels of sports-related fitness, or other factors may feel more motivated to participate in an online course (National Association for Sport and Physical Education, 2007b).

However, online physical education faces many challenges. Academic rigor, unwillingness to fully buy-in from college faculty, lack of state-approved standards, and student-preparedness are all concerns noted in the literature (Mahar, 2014). *Kinesiology Review* published a study whose researchers found that 61% of college-level kinesiology department administrators felt that their faculty had concerns regarding the academic rigor of online physical education courses. Of those administrators, 42% felt that totally online courses were as rigorous as face-to-face classes, and 65% indicated that tests for these classes were not proctored (Mahar, 2014). Teachers find it difficult to determine whether students enrolled in online courses are actually participating in physical activity (National Association for Sport and Physical Education, 2007b).

Although little has surfaced regarding online physical education courses from the perspectives of college students, researchers indicate success in the ability of online courses to provide knowledge of health and wellness. In Hager's (2012) landmark study at Brigham Young University that involved nearly 3,000 participants, 91% of students indicated that participation in a health and wellness course increased their knowledge of how a regular exercise program and a proper diet can enhance a person's health and fitness, and 94% of the participants indicated a desire to maintain a healthy life, regardless of delivery method. Hager compared traditional classroom lecture to the online course delivery and noticed no difference in the students' perceptions of how the health and wellness course changed their knowledge of how a regular exercise program and a

nutritious diet can enhance a person's health and level of physical fitness. The researcher did, however, notice that students in the traditional, face-to-face course indicated that they improved their levels of physical activity and their diets to a greater extent than did the students in the online course (Hager, 2012).

Empirical Research

Though a thorough review of the literature uncovered no previous research using laboratory tests to measure changes within health-related fitness among college students enrolled in an online fitness and wellness course, research in this area continues to develop. Researchers have attempted to further their understanding of not only the physiological changes that may occur among students enrolled in online fitness and wellness courses but also perceived changes in students' motivation to exercise and attitudes toward exercise. Figure 5, located near the end of this chapter, provides a concept analysis chart as a guide to the empirical research reported.

At a small northeastern public university, researchers Everhart and Dimon (2013) used pre- and post-surveys to determine whether students improved their physical activity habits more by completing wellness courses delivered on the ground, in a hybrid format, or through fully online instruction. The researchers used a quasi-experimental design with course delivery format considered the treatment for each pre-existing group, or class. The sample consisted of 103 students enrolled in multiple required wellness courses. During the first and final weeks of the semester, participants completed an emailed wellness patterns survey that was developed by the principle investigator and based upon the training guidelines of the American College of Sports Medicine. The researchers used a

multivariate analysis of variance with repeated measures to determine if significant differences existed between the three delivery format groups.

Everhart and Dimon's primary finding was that participants who completed the hybrid delivery format or the traditional, on-the-ground delivery format increased their weekly cardiovascular exercise engagement significantly more than participants who completed the fully-online format (Everhart & Dimon, 2013). This finding is problematic for online students because cardiorespiratory fitness is the most important aspect of an exercise program (American College of Sports Medicine, 2014). Cardiorespiratory fitness decreases the risk of obesity, coronary artery disease and stroke, diabetes, and certain cancers (Miller, 2014). Everhart and Dimon (2013) explained their finding by suggesting that course instructors in the wellness courses using traditional and hybrid formats can more easily get students to be physically active when they see them in class than can be done in an online format.

Also, all students engaged in more muscular strength workouts per week regardless of wellness course delivery format, and all students reported dietary improvements of consuming less red meat and increasing grain consumption. Everhart and Dimon (2013) concluded that completing a wellness course, regardless of delivery method, can have a positive impact on college students' wellness patterns. The researchers stated that online delivery is, therefore, effective but leads to fewer improvements in cardiovascular health and cardiovascular workout patterns among college students when compared to traditional and hybrid course formats (Everhart & Dimon, 2013). The researchers called for further research and additional controls to be

incorporated in subsequent research before an answer is reached regarding which delivery format is better consistently.

Other researchers have found that the perceptions of personal, physical wellness among students enrolled in an online Lifetime Physical Activity and Wellness course are not significantly different than perceptions of students enrolled in the same offering via an on-the-ground, traditional format (Milroy, Orsini, D'Abundo, & Sidman, 2013). In a study involving college students enrolled in a required physical activity and wellness course, Milroy, Orsini, Abundo, and Sidman (2013) assessed six domains of perceived wellness among 378 participants enrolled in various combinations of traditional, online, and hybrid delivery formats of Lifetime Physical Activity and Wellness. The researchers used the Perceived Wellness Survey (Adams, Bezner, & Steinhardt, 1997) to collect data and reported no significant differences among self-reported physical wellness of students across all course formats. The researchers considered self-reported data to be a limitation of their study, and they called for further research examining the self-directed, autonomous aspect of physical activity behaviors among students in online course formats (Milroy et al., 2013).

The literature revealed that the primary source of data in research regarding fitness and wellness course efficacy has been self-reports of perceived fitness and wellness. In a quasi-experimental study at Washburn University, Lockwood and Wohl (2012) used a convenience sample of 71 students enrolled in a Lifetime Wellness course to examine changes in wellness behaviors. The research team used a repeated measures design and paired samples *t*-tests to analyze data recorded by a wellness inventory questionnaire. The researchers found that a lifetime wellness course can successfully

change physical activity behaviors (Lockwood & Wohl, 2012). Higgins, Lauzon, Yew, Bratseth, and Morley (2009) also examined perceptions of wellness among college students enrolled in a 15-week course. Rather than using a validated wellness measure, Higgins et al. analyzed reflective papers submitted by students on the final day of class and found increased physical activity to be a common theme (Higgins, Lauzon, Yew, Bratseth, & Morley, 2009). Wharf Higgins, Lauzon, Yew, Bratseth, and McLeod (2010) also used questionnaires to determine wellness practices including physical activity among university students enrolled in Personal Health and Wellness courses in Canada (Wharf Higgins, Lauzon, Yew, Bratseth, & McLeod, 2010) and found that the courses were successful in increasing physical activity during the time of student enrollment.

Beauchemin, Gibbs, and Granello (2018) examined the literature published from 2000 until 2017 regarding courses designed to enhance wellness among college students. The research team found that previous research regarding wellness courses lacked rigorous design. Beauchemin et al. (2018) determined that in order for stakeholders to improve the acceptance and distribution of wellness-promoting courses across higher education, “research design needs to move beyond the assessment of students’ perception of personal wellness” (Beauchemin et al., 2018, p. 40).

STUDY	PURPOSE	PARTICIPANTS	DESIGN/ ANALYSIS	OUTCOMES
Everhart & Dimon (2013)	Compare self-reported physical activity habits among students enrolled in traditional, hybrid, and online wellness courses	103 undergraduate students	Quantitative: MANOVA with repeated measures	• Online delivery is effective, but leads to fewer improvements in cardiovascular health and workout patterns. • Completing the course improved physical activity and nutritional habits regardless of format.
Lockwood & Wohl (2012)	Examine changes in perceived wellness behaviors among students in a required physical activity and wellness course delivered in a traditional format	71 undergraduates enrolled in Lifetime Wellness in an urban setting	Quantitative: TestWell Wellness Inventory, and Physical Self-Efficacy Scale; Paired samples *t*-tests	• Significant changes in fitness and nutrition, physical self-perception, perceived physical ability, and physical self-efficacy.
Wharf Higgins, Lauzon, Yew, Bratseth, & McLeod (2010)	Examine wellness practices among students at university in western Canada; assess impact of a health and wellness course	1,855 undergraduates	Mixed method: TestWell Wellness Inventory; *t*-tests and One-way ANOVA	• Physical activity increased during enrollment in the course. • Nutrition improved during course enrollment.

Figure 5. Concept Analysis Chart for related research.

Summary

A thorough review of the literature led to the following conclusions: health levels among U.S. college students are deteriorating, mandatory physical education requirements among colleges are on the decline, physical educators are facing increased work demands, and the modern college student balances academic, work, and family life and is no longer what has been known as traditional. As administrators searched for answers to these issues and problems of declining funds for state institutions, online physical education classes became a seemingly quick fix.

As online physical education became increasingly popular over the last decade as a means of keeping students active, the development of associated, online concepts-based fitness and wellness classes occurred. Concepts-based fitness and wellness classes became a means of providing college students with cognitive and behavioral intervention strategies for improved health-related fitness and other components of wellness. Online offerings quickly developed among U.S. institutions as these courses allowed institutions to keep mandatory physical education or wellness requirements while offering fully online degrees. Also, online offerings seemed to be a fit for students who studied from a distance or required flexibility in scheduling due to work or family demands. Although the literature revealed many pros for adopting online, concepts-based fitness and wellness courses into curriculums, these relatively new courses face many challenges. College faculty do not fully buy-in to the idea of online fitness, there is a perceived need for increased academic rigor, and little is known regarding whether online fitness and wellness students are increasing daily physical activity or achieving health-related fitness benefits while enrolled.

As online fitness and wellness classes emerge, they have gained attention in the literature. Researchers found that health-related fitness improvements occur during concepts-based fitness and wellness courses regardless of delivery method; however, changes in cardiovascular health occur at higher levels for students enrolled in traditional and hybrid format courses than for students enrolled in fully online courses. These findings and others are challenged, however, as studies regarding the efficacy of online fitness and wellness focus largely upon student perceptions of health and wellness and attitudes toward exercise or data are collected from self-reports rather than laboratory testing. If the cardiovascular exercise habits and fitness levels of online students are inferior to cardiovascular exercise habits and fitness levels of their peers enrolled in traditional and hybrid courses, and yet the perceptions of cardiovascular fitness are not significantly different regardless of delivery format, then this conclusion could indicate false perceptions of personal cardiovascular health among online students. The latest research efforts call for more rigorous designs that are beyond the assessment of student perceptions.

CHAPTER III

METHODOLOGY

Introduction

A need exists for further examination of the efficacy of online, concepts-based fitness and wellness courses. The researcher investigated whether students experience changes to health-related fitness during online enrollment in Lifetime Fitness & Wellness at Tennessee Technological University. By comparing pretest and posttest results, the researcher examined whether changes occurred in regard to cardiovascular fitness, muscular endurance, muscular strength, flexibility, and body composition. The following pages contain descriptions of these components:

1. Research Questions and Hypotheses
2. Research Design
3. Population represented by this research project
4. Participants
5. Instrumentation
6. Assumptions
7. Data Collection
8. Data Analysis
9. Reporting the Data
10. Summary

Research Questions and Hypotheses

In an effort to further what is known about online fitness and wellness courses in higher education, the researcher sought to answer the following overarching question and sub-questions.

Research Question: To what extent do differences occur among pretest and posttest measures regarding levels of health-related fitness among students enrolled in an online, concepts-based fitness and wellness course at Tennessee Technological University?

Sub-Question 1: To what extent do differences occur among pretest and posttest measures of cardiovascular endurance as measured by the YMCA 3-Minute Step Test among students in Lifetime Fitness & Wellness Online?

$H1_o$: Students who participated in Lifetime Fitness & Wellness Online will not demonstrate statistically significant changes among levels of cardiovascular fitness on the YMCA 3-Minute Step Test.

$H1_A$: Students who participated in Lifetime Fitness & Wellness Online will demonstrate statistically significant changes among levels of cardiovascular fitness on the YMCA 3-Minute Step Test.

Sub-Question 2: To what extent do differences occur among pretest and posttest measures of body composition as measured by bioelectrical impedance analysis among students in Lifetime Fitness & Wellness Online?

$H2_o$: Students enrolled in Lifetime Fitness & Wellness Online will not demonstrate statistically significant changes among levels of body composition as measured by bioelectrical impedance analysis.

$H2_A$: Students enrolled in Lifetime Fitness & Wellness Online will demonstrate statistically significant changes among levels of body composition as measured by bioelectrical impedance analysis.

Sub-Question 3: To what extent do differences occur among pretest and posttest measures of flexibility as measured using the Sit and Reach Test among students in Lifetime Fitness & Wellness Online?

$H3_o$: Students enrolled in Lifetime Fitness & Wellness Online will not demonstrate statistically significant changes among levels of flexibility as measured by a Sit and Reach Test.

$H3_A$: Students enrolled in Lifetime Fitness & Wellness Online will demonstrate statistically significant changes among levels of flexibility as measured by a Sit and Reach Test.

Sub-Question 4: To what extent do differences occur among pretest and posttest measures of muscular endurance as measured using an AssessPro Rep-Addition Push-Up Tester among students in Lifetime Fitness & Wellness Online?

$H4_o$: Students enrolled in Lifetime Fitness & Wellness Online will not demonstrate statistically significant changes among levels of muscular endurance as measured by an AssessPro Rep-Addition Push-Up Tester.

$H4_A$: Students enrolled in Lifetime Fitness & Wellness Online will demonstrate statistically significant changes among levels of muscular endurance as measured by an AssessPro Rep-Addition Push-Up Tester.

Sub-Question 5: To what extent do differences occur among pretest and posttest measures of muscular strength as measured using a hydraulic hand dynamometer among students in Lifetime Fitness & Wellness Online?

$H5_o$: Students enrolled in Lifetime Fitness & Wellness Online will not demonstrate statistically significant changes among levels of muscular strength as measured using a hydraulic hand dynamometer.

$H5_A$: Students enrolled in Lifetime Fitness & Wellness Online will demonstrate statistically significant changes among levels of muscular strength as measured using a hydraulic hand dynamometer.

Research Design

The researcher employed a quantitative, casual-comparative research design. Causal-comparative research design pursues relationships between independent and dependent variables following the occurrence of an action or event (Salkind, 2010). The researcher compared pretest and posttest results to determine whether the independent variable affected the outcome. In this study, the independent variable was time. The outcome was levels of cardiovascular endurance, muscular strength and endurance, body composition, and flexibility.

The researcher used secondary data collected within a laboratory setting (methods used for data collection are shared in a later subsection). Results from fitness testing were expressed numerically, which led the researcher to perform a quantitative study. Quantitative methods are used to examine the relationship between variables with the primary goal being to analyze and represent that relationship mathematically through statistical analysis (Center for Innovation in Research and Teaching, n.d.).

The researcher considered another approach to gathering data regarding activity levels of students enrolled in the Lifetime Fitness & Wellness course using activity-tracking bands. Researchers have reported that activity devices used to count steps or simply "moves" (e.g., swinging of the wrist, as in throwing, rowing, and walking and other movements) are an accurate means of tracking activity (Case, Burwick, & Volpp, 2015; Pharm & Nounou, 2015). However, like the self-administered fitness tests mentioned in the previous chapter, data collected through the use of these bands and their accompanying software may not accurately depict the activity levels of the actual student performer. This issue is concerning because the wearer could indeed be another individual without the instructor's knowledge due to the nature of online learning.

Therefore, to accurately determine whether any health-related changes accompany enrollment in an online fitness and wellness course, the researcher chose to use pretest and posttest data collected in a laboratory setting. These data were further analyzed using a paired samples *t*-test, as discussed in a later subsection of this chapter.

Lifetime Fitness & Wellness is a 2-credit hour, fully online course available to undergraduate students. The course spanned the full 16 weeks of the semester. The first 6 weeks of the course were devoted to topics related to physical fitness, including types, benefits and assessment of fitness, exercise prescription, proper methods and techniques of training, and the evaluation of fitness activities. During this initial 6 weeks, students were actively engaged in the course through online discussions, quizzes, and weekly assignments. During the seventh week of Lifetime Fitness & Wellness, students were tasked with an online exam and a visit to campus for fitness testing of all five components of health-related fitness conducted by graduate assistants. The following

week marked the beginning of an 8-week period of exercise. During these 8 weeks, the online content delivery shifted to a study of nutrition and weight management, and students submitted a weekly activity report using the MyFitnessPal website or smart-device application. MyFitnessPal is a free, online tool that allows users to monitor and track food consumption and exercise (MyFitnessPal, n.d.). Students generated a weekly report of all exercise modalities undertaken during the course of the week, including descriptions of duration, intensity, and frequency. These reports were examined by the course instructor who then provided feedback. After 8 weeks, students returned to the exercise physiology lab for the posttest.

Population

Undergraduate students at Tennessee Technological University represented the population of this research. Tennessee Technological University is located in Cookeville, Tennessee. Although it is bisected by Interstate 40, Cookeville is considered a remote area connecting the Highland Rim to the Upper Cumberland Plateau. As of July 2017, the city population was 33,452, with nearly one-third of its population living in poverty (United States Census Bureau, n.d.).

Tennessee Technological University is a 4-year, public university offering bachelor's, master's, and doctoral degrees. The student population at the time of this study was 10,504, and 9,365 of whom were undergraduates. Eighty-eight percent of the institution's undergraduate students attended full-time, and 89% of the undergraduates at Tennessee Technological University were traditional students aged 24 and under. Two out of three undergraduate students at Tennessee Technological University were enrolled in some distance education (National Center for Education Statistics, n.d.).

Participants

Participants in this study were Tennessee Technological University undergraduate students who completed a Fall 2018 Lifetime Fitness & Wellness course online. Two sections of this course were available to Tennessee Technological University students. Because this particular concepts-based fitness and wellness course emerged as a pair of courses at Tennessee Technological University in Fall 2018, these two sections comprised the entire population available. The researcher used data collected from all students who completed pretests and posttests ($N = 28$). Although 30 students completed pretests, two students did not report for posttests, and their scores were not included in the study.

The participants were 17 female and 11 male students. Ages spanned 18 to 46, with a mean age of 22.4, a mode of 20, and median of 21. Of the participants, 96% were Caucasian, and 4% were Hispanic.

Instrumentation

The instruments used among these participants to determine levels of health-related fitness are mentioned here. The researcher chose the YMCA 3-Minute Step Test to measure cardiorespiratory fitness because it is submaximal test, i.e., the step test is considered to be safe to perform because participants are not required to exercise at maximal or near maximal levels of exertion. The validity of the YMCA 3-Minute Step Test is accepted because of linear relationships between workload, heart rate, and VO2 Max (Miller, 2014). The YMCA 3-Minute Step Test is advocated by the American College of Sports Medicine (American College of Sports Medicine, 2014). The reliability and validity of step tests have been demonstrated (Buckley, Sim, Eston, Hession, & Fox,

2004; McArdle, Katch, Pechar, Jacobson, & Ruck, 1972; Montgomery, Reid, & Koziris, 1992; Ritchie, Trost, Brown, & Armit, 2005). Adhering to test protocols, participants step on and off of a 12-inch step 24 times per minute for 3 minutes. The endeavor is supported by a metronome set at 96 beats per minute, which assists participants in maintaining 24 ascent-descent cycles per minute. After 3 minutes, participants immediately sit upon the step and heart beats are counted for 1 minute, with the total number of beats serving as the participants test score.

To determine body composition, the researcher elected to use bioelectrical impedance analysis (BIA). BIA is based on the difference between the resistance of lean tissue to an electrical current and the resistance of fat tissue (Miller, 2014). It is a fast, noninvasive technique for body composition analysis. The researcher used an Omron 306c Handheld Digital Fat Analyzer to test participants. The researcher selected this device because it is inexpensive, quickly provides a measurement, and it is a common tool among physical education departments.

The Sit and Reach Test was used to determine flexibility of the lower back and posterior thighs. The Sit and Reach Test, promoted by the American Alliance of Health, Physical Education, Recreation and Dance, has been validated against several other tests, and coefficients between .80 and .90 have been found (Miller, 2014). All test participants completed the 3-Minute Step Test before attempting the Sit and Reach Test. This method allowed the cardiovascular test to serve as a warm up and thus minimize injury risk. The researcher applied a pair of AssessPro Ultra-Flex Testers when taking measurements. Test protocols require participants to remove their footwear, sit on the floor with legs fully extended forward, and place the soles of their feet against the base of the

instrument. With palms facing down and hands together, participants then reach forward along a measuring line as far as possible. Each participant attempted the test three times, then the results were averaged to develop a final score.

To measure muscular endurance, the researcher followed push-up test procedures provided by the American College of Sports Medicine (American College of Sports Medicine, 2014). The push-up test procedures require males to perform push-ups with a straight body, while female participants perform modified push-ups with their knees bent and touching the floor. Modified push-ups have a reliability coefficient of .93 (Miller, 2014). The researcher used a pair of AssessPro Rep-Addition Push-Up Testers to ensure accuracy and proper form.

Static strength, also referred to as isometric strength or the force exerted against an immoveable object, was determined by grip strength using a handgrip dynamometer. Researchers have found grip strength to be a reliable predictor of upper body strength among both active and sedentary individuals (Farias, Teixeira, Tibana, Balsamo, & Prestes, 2012; Trosclair et al., 2011).

Scores from these tests were recorded onto individual fitness pretest or posttest scoresheets. Scores were applied to norms provided by the American College of Sports Medicine and the YMCA for further analysis (American College of Sports Medicine, 2014; Golding, 2000). Participants in this study completed fitness pretests at midterm and, 8 weeks later, undertook the same battery of tests as fitness posttests. Students were advised to report to their instructor any injuries or harm suffered as a result of participating in the testing procedures.

Assumptions

In establishing whether changes occur among components of health-related fitness among students, the researcher made the following assumptions. The researcher assumed that the students put forth a reasonable amount of effort during fitness testing. The researcher assumed all of the testing equipment used was functioning properly.

Data Collection

Following the reception of conditional approval from the Columbus State University Institutional Review Board (IRB), the researcher contacted the Tennessee Technological University IRB for further approvals. The Tennessee Technological University and Columbus State University IRBs then developed an Institutional Authorization Agreement in which Tennessee Technological University would serve as the relying institution and Columbus State University would represent the reviewing institution. After receiving authorization from both parties, the Tennessee Technological University Registrar informed the Columbus State University IRB that the requested data would be de-identified, and the conditional approval was lifted. The Tennessee Technological University Registrar then removed names from the data and assigned random numbers to participants before emailing the dataset as an Excel spreadsheet to the researcher. Therefore, the students' identities were not known to the researcher throughout the study.

Data Analysis

In an effort to further what is known about online fitness and wellness courses in higher education, the researcher attempted to answer the following over-arching question and sub-questions. The data source and method of analysis are provided for each.

Research Question: To what extent do differences occur among pretest and posttest measures regarding levels of health-related fitness among students enrolled in an online, concepts-based fitness and wellness course at Tennessee Technological University?

Sub-Question 1: To what extent do differences occur among pretest and posttest measures of cardiovascular endurance as measured by the YMCA 3-Minute Step Test among students in Lifetime Fitness & Wellness Online?

$H1_o$: Students who participated in Lifetime Fitness & Wellness Online will not demonstrate statistically significant changes among levels of cardiovascular fitness on the YMCA 3-Minute Step Test.

$H1_A$: Students who participated in Lifetime Fitness & Wellness Online will demonstrate statistically significant changes among levels of cardiovascular fitness on the YMCA 3-Minute Step Test.

Data source: The researcher used secondary data collected from two Fall 2018 sections of Lifetime Fitness & Wellness Online consisting of 28 students at Tennessee Technological University.

Method of analysis: The researcher selected the paired samples *t*-test to determine if there was a statistically significant change in the pretest-posttest scores of the students for cardiovascular endurance. The researcher set alpha at $p \leq .05$ level of significance, which is widely used in studies of this type.

Sub-Question 2: To what extent do differences occur among pretest and posttest measures of body composition as measured by bioelectrical impedance analysis among students in Lifetime Fitness & Wellness Online?

$H2_o$: Students enrolled in Lifetime Fitness & Wellness Online will not demonstrate statistically significant changes among levels of body composition as measured by bioelectrical impedance analysis.

$H2_A$: Students enrolled in Lifetime Fitness & Wellness Online will demonstrate statistically significant changes among levels of body composition as measured by bioelectrical impedance analysis.

Data source: The researcher used secondary data collected from two Fall 2018 sections of Lifetime Fitness & Wellness Online consisting of 28 students at Tennessee Technological University.

Method of analysis: The researcher elected to use a paired samples *t*-test to determine if there was a statistically significant difference in the pretest-posttest scores of the students for body composition. The researcher set alpha at $p \leq$ at the .05 level of significance, which is widely used in studies of this type.

Sub-Question 3: To what extent do differences occur among pretest and posttest measures of flexibility as measured using the Sit and Reach Test among students in Lifetime Fitness & Wellness Online?

$H3_o$: Students enrolled in Lifetime Fitness & Wellness Online will not demonstrate statistically significant changes among levels of flexibility as measured by a Sit and Reach Test.

$H3_A$: Students enrolled in Lifetime Fitness & Wellness Online will demonstrate statistically significant changes among levels of flexibility as measured by a Sit and Reach Test.

Data source: The researcher used data collected from two Fall 2018 sections of Lifetime Fitness & Wellness Online consisting of 28 students at Tennessee Technological University.

Method of analysis: The researcher elected to use a paired samples *t*-test to determine if there was a statistically significant change in the pretest-posttest scores of the students for a Sit and Reach Box Test. The researcher set the alpha level at $p \leq .05$ level of significance, which is widely used in studies of this type.

Sub-Question 4: To what extent do differences occur among pretest and posttest measures of muscular endurance as measured using an AssessPro Rep-Addition Push-Up Tester among students in Lifetime Fitness & Wellness Online?

$H4_o$: Students enrolled in Lifetime Fitness & Wellness Online will not demonstrate statistically significant changes among levels of muscular endurance as measured by an AssessPro Rep-Addition Push-Up Tester.

$H4_A$: Students enrolled in Lifetime Fitness & Wellness Online will demonstrate statistically significant changes among levels of muscular endurance as measured by an AssessPro Rep-Addition Push-Up Tester.

Data source: The researcher used data collected from two Fall 2018 sections of Lifetime Fitness & Wellness Online consisting of 28 students at Tennessee Technological University

Method of analysis: The researcher elected to use a paired samples *t*-test to determine if there was a statistically significant change in the pretest-posttest scores of the students for muscular endurance. The researcher set the alpha level at $p \leq$ at the .05 level of significance, which is widely used in studies of this type.

Sub-Question 5: To what extent do differences occur among pretest and posttest measures of muscular strength as measured using a hydraulic hand dynamometer among students in Lifetime Fitness & Wellness Online?

$H5_o$: Students enrolled in Lifetime Fitness & Wellness Online will not demonstrate statistically significant changes among levels of muscular strength as measured using a hydraulic hand dynamometer.

$H5_A$: Students enrolled in Lifetime Fitness & Wellness Online will demonstrate statistically significant changes among levels of muscular strength as measured using a hydraulic hand dynamometer.

Data source: The researcher used data collected from two Fall 2018 sections of Lifetime Fitness & Wellness Online consisting of 28 students at Tennessee Technological University.

Method of analysis: The researcher elected to use a paired samples *t*-test to determine if there was a statistically significant change in the pretest-posttest scores of the students for the muscular strength test using a hand held dynamometer. The researcher set the alpha level at $p \leq .05$ level of significance, which is widely used in studies of this type.

The researcher used Microsoft Excel for Mac Version 16.16.6 to assist with the data analysis. Because of its sophisticated spreadsheet format, Excel efficiently allows users to organize and interpret data. The researcher also chose Excel because it is widely popular and therefore likely accessible for future researchers who may desire to replicate this study.

The significance level is the probability of rejecting a null hypothesis when it is true. A significance level of $p \leq .05$ indicates a 5% risk of incorrectly concluding that a difference exists. This phenomenon is commonly referred to as a Type 1 error. This level is commonly accepted and can be interpreted as meaning that a researcher would incorrectly reject the null hypothesis only 5% of the time (Statistics Solutions, n.d.)

Reporting the Data

Upon completion of the data analysis, the researcher reported findings in Chapter IV. The researcher used figures displaying test scores and statistics regarding each domain of health-related fitness. The researcher also developed consistent, descriptive summaries of each finding to assist readers.

Summary

To determine whether any health-related changes occurred among online students enrolled in a concepts-based, fitness and wellness course, the researcher performed a quantitative, causal-comparative study using a pretest and posttest design. The researcher used secondary data collected from two Fall 2018 sections of Lifetime Fitness & Wellness Online at Tennessee Technological University. Data consisted of fitness test scores as measured by graduate assistants in a laboratory setting preceding and concluding 8 weeks of required exercise among 28 students. Participants completed tests for cardiovascular efficiency, muscular strength and endurance, body composition, and flexibility. The researcher used paired samples *t*-tests to determine statistical significance among pretest and posttest scores for each of these components of health-related fitness.

CHAPTER IV

RESULTS

Introduction

The researcher attempted to identify changes regarding measurements of health-related fitness following an assigned 8 weeks of exercise among students enrolled in an online, concepts-based fitness and wellness course at Tennessee Technological University. The researcher collected data from all students (*N*=28) who participated in pretests and posttests of cardiovascular fitness, body composition, muscular endurance, flexibility, and muscular strength during the Fall 2018 semester. The researcher conducted paired-samples *t*-tests to examine statistical significance among pre- and posttest scores for each measured component of health-related fitness.

Research Questions and Hypotheses

In an effort to further what is known about online fitness and wellness courses in higher education, the researcher sought answers to the following over-arching question and sub-questions.

Research Question: To what extent do differences occur among pretest and posttest measures regarding levels of health-related fitness among students enrolled in an online, concepts-based fitness and wellness course at Tennessee Technological University?

Sub-Question 1: To what extent do differences occur among pretest and posttest measures of cardiovascular endurance as measured by the YMCA 3-Minute Step Test among students in Lifetime Fitness & Wellness Online?

$H1_o$: Students who participated in Lifetime Fitness & Wellness Online will not demonstrate statistically significant changes among levels of cardiovascular fitness on the YMCA 3-Minute Step Test.

$H1_A$: Students who participated in Lifetime Fitness & Wellness Online will demonstrate statistically significant changes among levels of cardiovascular fitness on the YMCA 3-Minute Step Test.

Sub-Question 2: To what extent do differences occur among pretest and posttest measures of body composition as measured by bioelectrical impedance analysis among students in Lifetime Fitness & Wellness Online?

$H2_o$: Students enrolled in Lifetime Fitness & Wellness Online will not demonstrate statistically significant changes among levels of body composition as measured by bioelectrical impedance analysis.

$H2_A$: Students enrolled in Lifetime Fitness & Wellness Online will demonstrate statistically significant changes among levels of body composition as measured by bioelectrical impedance analysis.

Sub-Question 3: To what extent do differences occur among pretest and posttest measures of flexibility as measured using the Sit and Reach Test among students in Lifetime Fitness & Wellness Online?

$H3_o$: Students enrolled in Lifetime Fitness & Wellness Online will not demonstrate statistically significant changes among levels of flexibility as measured by a Sit and Reach Test.

$H3_A$: Students enrolled in Lifetime Fitness & Wellness Online will demonstrate statistically significant changes among levels of flexibility as measured by a Sit and Reach Test.

Sub-Question 4: To what extent do differences occur among pretest and posttest measures of muscular endurance as measured using an AssessPro Rep-Addition Push-Up Tester among students in Lifetime Fitness & Wellness Online?

$H4_o$: Students enrolled in Lifetime Fitness & Wellness Online will not demonstrate statistically significant changes among levels of muscular endurance as measured by an AssessPro Rep-Addition Push-Up Tester.

$H4_A$: Students enrolled in Lifetime Fitness & Wellness Online will demonstrate statistically significant changes among levels of muscular endurance as measured by an AssessPro Rep-Addition Push-Up Tester.

Sub-Question 5: To what extent do differences occur among pretest and posttest measures of muscular strength as measured using a hydraulic hand dynamometer among students in Lifetime Fitness & Wellness Online?

$H5_o$: Students enrolled in Lifetime Fitness & Wellness Online will not demonstrate statistically significant changes among levels of muscular strength as measured using a hydraulic hand dynamometer.

$H5_A$: Students enrolled in Lifetime Fitness & Wellness Online will demonstrate statistically significant changes among levels of muscular strength as measured using a hydraulic hand dynamometer.

Participants

Twenty-eight students (61% female and 39% male) completed assessments at both time points and were included in these analyses. Ages ranged from 18 to 46 years, with a mean of 22.4 years of age. Twenty-two students (79%) were under the age of 24. The racial/ethnic distribution was 96% Caucasian and 4% Hispanic. Demographic data are presented in Table 1, *Age, Gender, and Ethnicity of Participants.*

Table 1

Age, Gender, and Ethnicity of Participants (*N*=28)

Demographics	Percentage	Mean
Male	39	
Female	61	
Caucasian	96	
Hispanic	4	
Age		22.4

Findings

In this section, findings are given in regard to each component of health-related fitness as assessed by pretests and posttests and then analyzed using paired samples *t*-tests. The researcher posed the overarching question of whether significant changes occur, and if so to what extent, regarding levels of health-related fitness among students enrolled in an online, concepts-based fitness and wellness course.

Restatement of Research Sub-Question One: To what extent do differences occur among pretest and posttest measures of cardiovascular endurance as measured by the YMCA 3-Minute Step Test among students in Lifetime Fitness & Wellness Online?

Restatement of the Alternate Hypothesis One: Students who participated in Lifetime Fitness & Wellness Online will demonstrate statistically significant changes among levels of cardiovascular fitness on the YMCA 3-Minute Step Test.

Data Source: The researcher used data collected from two Fall 2018 sections of Lifetime Fitness & Wellness Online consisting of 28 students at Tennessee Technological University.

Method of analysis: The researcher selected the paired samples *t*-test to determine if there was a statistically significant change in the pretest-posttest scores of the students for cardiovascular endurance. The researcher set alpha as $p \leq .05$ level of significance, which is widely used in studies of this type.

Findings: The results of testing for cardiovascular endurance resulting from an analysis of the paired samples *t*-test provided a *t*-statistic of 2.533, which was greater than the critical *t*-value of 2.052 and therefore indicative of statistical significance. The pretest mean was 124.25 heart beats. The posttest mean was 114.25, which is an average improvement of 10 beats. Table 2, Pretest/Posttest Analysis of Cardiovascular Endurance, displays the results of the analysis.

Table 2

Pretest/Posttest Analysis of Cardiovascular Endurance

	Pretest	Posttest
Mean	124.25	114.25
Variance	879.083333	682.564815
Observations	28	28
t Stat	2.53373972	
t Critical two-tail	2.05183052	

Note. $*p < .05$

Eighteen students (64%) showed improved scores during the posttest. Thirteen students (46%) improved their posttest scores by at least 10%. Four students (14%) improved scores by at least 20%. Participant 14 showed the greatest gain in

cardiovascular endurance (38%) by lowering heart rate from 176 to 109 beats. On average, students improved cardiovascular fitness by 6%.

Ten students (36%) showed no improvement among posttests of cardiovascular endurance. Participant 18 showed the greatest decline (35%) in cardiovascular fitness by increasing heart rate from 81 to 109 beats.

Therefore, based on an analysis of the data obtained in this study regarding changes in cardiovascular endurance, it is appropriate to reject the null hypothesis and accept the alternate hypothesis. Rather, students enrolled in Lifetime Fitness & Wellness Online demonstrated statistically significant changes among levels of cardiovascular fitness.

Restatement of Research Sub-Question Two: To what extent do differences occur among pretest and posttest measures of body composition as measured by bioelectrical impedance analysis among students in Lifetime Fitness & Wellness Online?

Restatement of Null Hypothesis Two: Students enrolled in Lifetime Fitness & Wellness Online will not demonstrate statistically significant changes among levels of body composition as measured by bioelectrical impedance analysis.

Data Source: The researcher used data collected from two Fall 2018 sections of Lifetime Fitness & Wellness Online consisting of 28 students at Tennessee Technological University.

Method of analysis: The researcher selected the paired samples *t*-test to determine if there was a statistically significant change in the pretest-posttest scores of the students for body composition. The researcher set alpha as $p \leq$ at the .05 level of significance, which is widely used in studies of this type.

Findings: Results of the paired samples *t*-test indicated no statistically significant difference among pretest and posttest scores of body composition. The analysis provided a *t*-statistic of 1.49, which is below the critical *t*-value of 2.052 and therefore not indicative of statistical significance. The pretest mean was 23.19, and the posttest mean was 22.45. Table 3, Pretest/Posttest Analysis of Body Composition, displays the results of the analysis.

Table 3

Pretest/Posttest Analysis of Body Composition

	Pretest	Posttest
Mean	23.18928571	22.4571429
Variance	113.8521032	103.044021
Observations	28	28
t Stat	1.490047876	
t Critical two-tail	2.051830516	

Seventeen students (61%) demonstrated improved scores among posttests. Nine students (32%) improved scores by at least 10%. Three students improved scores by at least 20%. Participant 2 showed the greatest improvement (23%) and lowered body composition from 21% to 16%. On average, students decreased body composition by 0.3%.

Eleven students (39%) showed no improvements in body composition. Ten of the 28 participants (36%) increased body fat percentages. Five students (18%) increased body composition scores by at least 10%. Two students (7%) increased body composition scores by at least 20%. Participant 29 had the greatest percent increase in body composition (63%) and increased body composition from 7% to 12%.

Therefore, based on an analysis of the data obtained in this study it is appropriate to fail to reject the null hypotheses concerning body composition. Students enrolled in Lifetime Fitness & Wellness Online demonstrated no significant changes among levels of body composition.

Restatement of Research Sub-Question Three: To what extent do differences occur among pretest and posttest measures of flexibility as measured using the Sit and Reach Test among students in Lifetime Fitness & Wellness Online?

Restatement of Alternate Hypotheses Three: Students enrolled in Lifetime Fitness & Wellness Online will demonstrate statistically significant changes among levels of flexibility as measured by a Sit and Reach Test.

Data Source: The researcher used data collected from two Fall 2018 sections of Lifetime Fitness & Wellness Online consisting of 28 students at Tennessee Technological University.

Method of analysis: The researcher selected the paired samples *t*-test to determine if there was a statistically significant change in the pretest-posttest scores of the students for flexibility. The researcher set alpha as $p \leq .05$ level of significance, which is widely used in studies of this type.

Findings: Results from a paired samples *t*-test indicated statistically significant differences among pretest and posttest scores of flexibility. The analysis provided a *t*-statistic of -2.62, which expressed as an absolute value, is greater than the critical *t*-value of 2.052 and therefore indicates a statistical significance. The pretest mean was 13.21 inches, and the posttest mean was 14.03 inches. Table 4, Pretest/Posttest Analysis of Flexibility, displays the results of the analysis.

Table 4

Pretest/Posttest Analysis of Flexibility

	Pretest	Posttest
Mean	13.2142857	14.025
Variance	6.04034392	8.42953704
Observations	28	28
t Stat	-2.6290824*	
t Critical two-tail	2.05183052	

Note. *$p < .05$

Eighteen students (64%) demonstrated improved scores of flexibility. Eight students (29%) improved flexibility by at least 10%. Four students (14%) improved flexibility by at least 20%. Participant 2 demonstrated the greatest percentage of improvement (37%), increasing flexibility scores from 13.5 to 18.5 inches. On average, students improved flexibility by 6.3%.

Ten students (36%) showed no improvements in flexibility. Two students (7%) decreased flexibility scores by at least 10%. Participant 27 had the greatest percent decline in flexibility (18.75%) and decreased flexibility scores from 8 to 6.5 inches.

Therefore, based on the data obtained in this study regarding changes in flexibility, it is appropriate to reject the null hypothesis and accept the alternate hypotheses.

Restatement of Research Question Four: To what extent do differences occur among pretest and posttest measures of muscular endurance as measured using an AssessPro Rep-Addition Push-Up Tester among students in Lifetime Fitness & Wellness Online?

Restatement of Alternate Hypotheses Four: Students enrolled in Lifetime Fitness & Wellness Online will demonstrate statistically significant changes among levels of muscular endurance as measured by an AssessPro Rep-Addition Push-Up Tester.

Data source: The researcher used data collected from two Fall 2018 sections of Lifetime Fitness & Wellness Online consisting of 28 students at Tennessee Technological University.

Method of analysis: The researcher selected the paired samples *t*-test to determine if there was a statistically significant change in the pretest-posttest scores of the students for muscular endurance. The researcher set alpha as $p \leq .05$ level of significance, which is widely used in studies of this type.

Findings: Results from a paired samples *t*-test indicated statistically significant differences among pretest and posttest scores for muscular endurance. The analysis provided a *t*-statistic of -3.773, which expressed as an absolute value, is greater than the critical *t*-value of 2.052 and therefore indicative of statistical significance. The pretest mean was 24 pushups, and the posttest mean was 28.7 pushups. Table 5, Pretest/Posttest Analysis of Muscular Endurance, displays the results of the analysis.

Table 5

Pretest/Posttest Analysis of Muscular Endurance

	Pretest	Posttest
Mean	24	28.7142857
Variance	211.777778	232.433862
Observations	28	28
t Stat	-3.7738825*	
t Critical two-tail	2.05183052	

Note. $*p < .05$

Eighteen students (64%) demonstrated improved scores of muscular endurance. Eight students (29%) improved muscular endurance scores by at least 10 pushups. Participant 13, who was unable to complete a pushup in the pretest, demonstrated the greatest improvement by completing 23 pushups in the posttest. On average, students performed nearly five (n = 4.7) additional pushups during posttests.

Ten students (36%) showed no improvement among scores of muscular endurance. Five students (18%) maintained stable (did not increase or decrease) muscular endurance scores among pretests and posttests. Five students (18%) exhibited declines in muscular endurance. Participants 10 and 24 showed the greatest declines, and each performed five fewer pushups during posttests.

Therefore, based on the data obtained in this study regarding changes in muscular endurance it was appropriate to reject the null hypothesis and accept the alternate hypothesis.

Restatement of Research Sub-Question Five: To what extent do differences occur among pretest and posttest measures of muscular strength as measured using a hydraulic hand dynamometer among students in Lifetime Fitness & Wellness Online?

Restatement of Null Hypothesis Five: Students enrolled in Lifetime Fitness & Wellness Online will not demonstrate statistically significant changes among levels of muscular strength as measured using a hydraulic hand dynamometer.

Data source: The researcher used data collected from two Fall 2018 sections of Lifetime Fitness & Wellness Online consisting of 28 students at Tennessee Technological University.

Method of analysis: The researcher selected the paired samples *t*-test to determine if there was a statistically significant change in the pretest-posttest scores of the students for muscular strength. The researcher set alpha as $p \leq .05$ level of significance, which is widely used in studies of this type.

Findings: The results from a paired samples *t*-test indicated no statistically significant difference among pretest and posttest scores of muscular strength. The analysis provided a *t*-statistic of 0.117, which is below the critical *t*-value of 2.052, and therefore not indicative of statistical significance. The pretest mean was 164.6 lbs., and the posttest mean was 164.25 lbs. Table 6, Pretest/Posttest Analysis of Muscular Strength, displays the results of the analysis.

Table 6

Pretest/Posttest Analysis of Muscular Strength

	Pretest	Posttest
Mean	164.607143	164.25
Variance	2215.95106	1954.71296
Observations	28	28
t Stat	0.11719823	
t Critical two-tail	2.05183052	

Fifteen students (54%) demonstrated improved scores of muscular strength. Nearly half ($n = 7$) of the students showing improvements exhibited muscular strength gains of less than 5%. Four students (14%) improved muscular strength by at least 10%. Participant 20 demonstrated the greatest percentage of improvement (18%), increasing muscular strength scores from 132 lbs. to 156 lbs. On average, however, student scores decreased by 10 lbs.

Thirteen students (46%) showed no improvement among scores of muscular strength. Four students (14%) exhibited a minimum of a 10% decrease in muscular strength. Participant 5 demonstrated the highest percentage of decline (16%), dropping from a pretest score of 226 lbs. to a posttest score of 189 lbs.

Therefore, based on the data obtained in this study regarding muscular strength it was appropriate to fail to reject the null hypothesis.

Discussion

Students enrolled in Lifetime Fitness & Wellness Online at Tennessee Technological University during the Fall semester of 2018 demonstrated statistically significant changes in 3 out of 5 tests of health-related fitness. After 8 weeks of prescribed exercise, statistically significant changes occurred among levels of cardiovascular fitness, flexibility, and muscular endurance. There were no significant changes in areas of body composition and muscular strength.

Cardiovascular endurance significantly improved among participants. Results from a paired samples *t*-test indicated that changes among pretest and posttest means were statistically significant. This finding suggests that student who participated in the online, concepts-based fitness and wellness course demonstrated improved capabilities of the heart, lungs, and blood vessels to supply oxygen to the cells to meet the demand of prolonged physical activity. The following null hypothesis was rejected:

> $H1_o$: Students who participated in Lifetime Fitness & Wellness Online will not demonstrate statistically significant changes among levels of cardiovascular fitness on the YMCA 3-Minute Step Test.

Body composition did not significantly improve among participants. Results from a paired samples *t*-test indicated no significant differences among pretest and posttest means. This finding suggests that students who participated in the online, concepts-based fitness and wellness course did not significantly reduce body fat percentage. The following null hypothesis were accepted:

> $H2_o$: Students enrolled in Lifetime Fitness & Wellness Online will not demonstrate statistically significant changes among levels of body composition as measured by bioelectrical impedance analysis.

Flexibility significantly improved among participants. Results from a paired samples *t*-test indicated significant differences among pretest and posttest means. This finding suggests that students who participated in the online, concepts-based fitness and wellness course demonstrated improved range of motion. The following null hypothesis was rejected:

> $H3_o$: Students enrolled *in* Lifetime Fitness & Wellness Online will not demonstrate statistically significant changes among levels of flexibility as measured by a Sit and Reach Test.

Muscular endurance significantly improved among participants. Results from a paired samples *t*-test indicated significant differences among pretest and posttest means. This finding suggests that students who participated in the online, concepts-based fitness and wellness course gained significant improvement in the ability to repeatedly exert force. The following null hypothesis was rejected:

$H4_o$: Students enrolled in Lifetime Fitness & Wellness Online will not demonstrate statistically significant changes among levels of muscular endurance as measured by an AssessPro Rep-Addition Push-Up Tester.

Muscular strength did not significantly improve among participants. Results from a paired samples *t*-test indicated no significant differences among pretest and posttest means. This finding suggests that students who participated in the online, concepts-based fitness and wellness course did not develop significant changes in static strength. The following null hypothesis was accepted:

$H5_o$: Students enrolled in Lifetime Fitness & Wellness Online will not demonstrate statistically significant changes among levels of muscular strength as measured using a hydraulic hand dynamometer.

Summary

The researcher used paired samples *t*-tests to compare fitness pretest and posttest means to detect statistically significant changes within the five components of health-related fitness among students enrolled in Lifetime Fitness & Wellness Online at Tennessee Technological University. Students enrolled in the online, concepts-based fitness and wellness course significantly improved cardiovascular fitness, flexibility, and muscular endurance. Changes to levels of body composition and muscular strength were not statistically significant. The results of this study are further interpreted and discussed in the following, concluding chapter.

CHAPTER V

DISCUSSION

Summary of the Study

A synopsis of the total study with specific considerations for the future, including implications and recommendations for further study, is presented in the following pages. The researcher examined the efficacy of an online, concepts-based fitness and wellness course by investigating whether significant changes occurred to levels of health-related fitness among Tennessee Technological University students enrolled in *Lifetimes Fitness and Wellness* online during the Fall of 2018.

The research began with a thorough review of the literature. Existing literature led to the following conclusions: health levels among U.S. college students are deteriorating, mandatory physical education requirements among colleges are on the decline, physical educators are facing increased work demands, and the modern college student balances academics, work, and family life and is no longer what has been known as *traditional*. As administrators searched for answers to these issues, online, concepts-based fitness and wellness courses emerged as a solution. However, the literature review led to the conclusion that little is known regarding whether students achieve any health benefits while enrolled in online, concepts-based fitness and wellness courses.

The researcher collected deidentified data and compared pretest and posttest scores of student fitness. Scores were recorded among students of Lifetime Fitness & Wellness Online near midterm and again, 8 weeks later, at the close of the Fall 2018 semester in a laboratory setting at Tennessee Technological University. The test battery consisted of The YMCA 3-Minute Step Test, bioelectrical impedance analysis using an

Omron 306c Handheld Digital Fat Analyzer, the Sit and Reach Test, measures of static strength using a handgrip dynamometer, and the American College of Sports Medicine Push-up test. The researcher analyzed pretest and posttest results using paired samples *t*-tests.

Analysis of Research Findings

The researcher examined results from fitness pretests and posttests to detect significant differences within cardiovascular endurance, flexibility, body composition, muscular strength, and muscular endurance among students enrolled in Lifetime Fitness & Wellness at Tennessee Technological University. Although the course delivery was online, measurements of student fitness were recorded within a laboratory setting on the Tennessee Technological University Campus in Cookeville, Tennessee as part of the course requirements. Pretests and posttests were separated by a period of 8 weeks. Data from all students who completed both tests during the Fall 2018 semester were collected.

The researcher used paired samples *t*-tests for statistical analysis. The researcher found that significant changes occurred to levels of cardiovascular endurance, flexibility, and muscular endurance among participants. No significant changes occurred among participants regarding levels of body composition and flexibility.

Discussion of Research Findings

The review of current literature revealed that more research is needed regarding the activity levels of online college students; however, the findings of this study generally align with those of existing studies with a few contradictions. The relationships among the current study and the most impactful studies mentioned in Chapter II are mentioned below (See Figure 6). These comparisons are also provided in the following figure.

STUDY	OUTCOMES	OUTCOMES FROM CURRENT STUDY	RELATIONSHIPS BETWEEN OUTCOMES
Everhart & Dimon (2013)	• Online delivery is effective, but leads to fewer improvements in cardiovascular health and workout patterns. • Completing the course improved physical activity and nutritional habits regardless of format.	• Completing the course improved physical activity behaviors as determined by improvements in fitness. • Completing the course did not significantly change body composition despite improvements in physical activity behaviors, leading to conclusion that nutrition behaviors did not improve.	• Completing the course improved physical activity behaviors. • Completion of the online course improved cardiovascular health.
Lockwood & Wohl (2012)	• Significant changes in fitness and nutrition, physical self-perception, perceived physical ability, and physical self-efficacy.	• Completing the course did not significantly improve muscular strength. • Completing the course improved cardiovascular endurance, muscular endurance, and flexibility.	• Participation in course led to improved levels of fitness.
Wharf Higgins, Lauzon, Yew, Bratseth, & McLeod (2010)	• Physical activity increased during enrollment in the course. • Nutrition improved during course enrollment.		• Completion of the course resulted in increased physical activity behaviors.

Figure 6. Relationship Chart regarding current and previous studies.

The results of this research, although noting no significant changes to body composition or muscular strength, aligned with the findings mentioned in the literature. Pretest and posttest measurements of cardiovascular endurance, flexibility, and muscular endurance indicated statistically significant changes, which can be interpreted as results of increased physical activity. Researchers previously found that wellness courses, regardless of delivery method, can have a positive impact on college students' wellness patterns. Everhart and Dimon (2013) found that although secondary to hybrid and traditional, on-the-ground delivery formats, students enrolled in online fitness and wellness courses experienced improved levels of overall wellness. Lockwood and Wohl (2012), who also examined students taking a Lifetime Wellness course online, found that the course positively changed physical activity behaviors. Higgins et al. (2009) found increased physical activity to be a common theme among students enrolled in a 15-week course. Wharf Higgins et al. (2010) found that students enrolled in Personal Health and Wellness at a Canadian university increased levels of physical activity.

The results of this study also contradicted a number of findings provided in the literature. Everhart and Dimon (2013) found that regardless of delivery format, fitness and wellness students engaged in more muscular strength workouts per week and reported positive dietary changes. Their work contradicted the findings of this study, in which nearly half (46%) of participants showed no improvement in muscular strength, and 39% of students showed no improvement in body composition. Rather, several participants in this study showed signs of regression. In fact, 10 students (36%) showed losses of muscular strength, with declines as great as 16%.

Further, a lack of significant change in body composition among participants may indicate that although physical activity increased, eating behaviors were not positively affected by enrollment in the course. Rather than improvement, 11 of the 28 participants (39%) increased total body fat to some degree while enrolled in the course. The largest percent increases were among lean individuals. Although 17 participants (61%) improved body composition scores, the broad analysis indicated no statistical significance. This finding contracted previous studies whose researchers found that students enrolled in fitness and wellness courses reported positive changes to personal eating behaviors (Everhart & Dimon, 2013; Lockwood & Wohl, 2012; Wharf Higgins et al., 2010).

It should be noted that the contradictory findings of previously mentioned studies all developed from survey research that measured student perceptions of health, rather than pre- and post-measurements of health-related fitness components used as data for this research. Perhaps student perceptions of healthy eating changed, while actual behaviors did not improve. More research is needed regarding eating habits and effects of interventions among college students.

Conclusions

The researcher concluded that during enrollment within the online fitness and wellness course, the participants increased physical activity and thus improved overall physical health significantly. Also, somewhat unexpectedly, the researcher hypothesized that the participants did not improve eating behaviors or the participants did not properly perform strength training exercises in a manner that would generate significant gains or they simply did not visit a fitness center to perform resistance exercises.

Because the participants significantly improved levels only of cardiovascular endurance, flexibility, and muscular endurance, and developed no significant gains of muscular strength, this result could be interpreted as meaning that the participants likely chose not to perform exercises in a typical fitness facility. This conclusion is supported by the National Association for Sport and Physical Education (2007b), who indicated that some students who choose to enroll in online courses do so because they may feel shy or intimidated due to poor health or low levels of sports-related fitness. Rather it appears that the participants developed exercise routines that could be performed at home and without the costs, associated stigmas, or travel time necessary for the use of a gym or expensive resistance-training equipment. It appears that students may have chosen to simply become more active, or they may have chosen to meet at least the minimum requirements for daily physical activity as directed by the Office of Disease Prevention and Health Promotion and as recommended within the guidelines of the online course under study. These guidelines advise that adults complete 150 minutes per week of moderate-level physical activity, or 75-minutes per week of vigorous physical activity, to achieve significant health benefits (Office of Disease Prevention and Health Promotion, 2018). The achievement of meeting these guidelines is possible without the use of specialized equipment typically found in fitness facilities.

An alternative explanation would be that the participants indeed visited facilities, such as a campus fitness center, but did not perform resistance exercises correctly. Failure to perform strength training exercises within the principles of training frequency, duration, type, intensity and progressively overloading the muscles would limit and possibly degrade training effect. It would seem likely that participants perform higher

quality strength-training movements under the direct observation of an experienced instructor. More research regarding strength training habits of college students and their perceptions of college fitness centers is needed.

Because body composition did not significantly change from pretest to posttest, it appears that although improvements occurred among cardiovascular health, range of motion, and muscular endurance among participants, eating behaviors were unaffected or negatively affected. The behaviors that are necessary to improve the previously mentioned domains of health-related fitness that were positively changed during the course enrollment would all necessitate a greater caloric expenditure among participants. A greater caloric expenditure coupled with a diet that had previously maintained a stable body weight should give way to a decreased level of body fat and significant improvement in body composition. This caloric imbalance was not the case among participants in the study. Rather, although activity levels appeared to increase significantly enough to improve cardiovascular health, muscular endurance, and flexibility, body composition was not significantly altered. Considering the current obesity trends that plague Western culture, this finding is troublesome because it is likely due to poor eating behaviors that may outweigh the effects of exercise among the participants.

Implications

Poor eating behaviors and sedentary lifestyles are directly linked to hypokinetic diseases such as heart disease, diabetes, and obesity and have led the United States into a multi-billion-dollar healthcare crisis. The modern college student is no exception to these negative behaviors. The transition to college is often accompanied by a decline in already

low levels of physical activity, and the exercise habits developed during the college years are those habits that are most likely carried on throughout the lifespan. Change is needed.

Regardless of this issue, the number of institutions of higher education that require some level of physical education courses before graduation continues to decline. This decline is partly because most kinesiology departments doubt the validity of online physical education, institutions have been pressured to shorten time to graduation and have thus dropped physical requirements, and because of the decline of state funds and the high costs associated with building and maintaining physical education facilities.

The results of this study support the existing literature in that online, concepts-based fitness and wellness courses are an effective means of improving student health. Improved student health, as mentioned in Chapter II, is linked to improved student retention and graduation rates. Therefore, leaders within higher education are urged to consider the results of this study when discussing curricular changes and the possible implication of an online, concepts-based fitness and wellness course as an intervention among student populations.

Administrators who seek to develop positive, health-related changes among student populations through academic rigor may consider an online course, such as Lifetime Fitness & Wellness as a cost-effective, far-reaching method of modification that fits into students' schedules. The two-hour course format, consisting of online content delivery, active discussions, cognitive assessments, and the weekly reporting of exercise, improves awareness of the biological need to be an active adult, and effectively increases daily physical activity during enrollment. It appeared that the students who participated in this study were willing to meet the CDC minimum guidelines of 150 minutes of

moderate-intensity exercise per week while enrolled in the course, as indicated by the positive changes in cardiovascular endurance, flexibility, and muscular endurance.

The findings of this study support the idea of distance education in that it is far-reaching. An online fitness and wellness course may be of benefit to students in rural areas, such as the Upper Cumberland Plateau, where limited availability of facilities and the associated membership costs may hinder student exercise habits. A well-designed concepts of fitness and wellness online course could develop positive lifestyle changes and promote health through increased physical activity among participants.

In this regard, the result of this study may precede pedagogical changes within Lifetime Fitness & Wellness at Tennessee Technological University. Because significant changes to muscular strength and body composition were not evident, perhaps course objectives need to be reconsidered to reflect only the clearly attainable goals of improved cardiovascular endurance, flexibility, and muscular endurance. Perhaps, Tennessee Technological University online students often have no access to a facility to perform basic weight training, and changes in body composition among online students require more than increased physical activity. Determining a better strategy to effectively promote healthy eating habits within the required content of the course, however, would be in the best interest of student health. This topic rests upon the agenda of the earliest exercise science faculty meeting of the Fall 2019 semester at Tennessee Technological University, where it may be discussed in detail before classes resume. The researcher anticipates changes to the course content that would lead to healthier student outcomes.

The results of this study may also benefit future research regarding the effects of online education and the effectiveness of online physical education courses. As revealed

in Chapter II of this study, few researchers have delved into the efficacy of online physical education, although these courses are increasing in popularity. Most previous research has utilized self-reports as sources of data or has measured and analyzed student perceptions of personal health and fitness. It is the hope of this researcher that the results of this study may be useful to future researchers in that the collected data were derived from a laboratory setting where measurements are gathered by trained instructors and that the rigidness of this causal comparative method of research adds to the literature a better view of what occurs in an online fitness course without the cloudiness caused by the bias potential of self-reported data.

Limitations

In Chapter I, the researcher mentioned limitations including, most notably, uncontrollable factors, such as fatigue and lack of motivation that could negatively impact fitness test scores. In this section, however, further explanation is given regarding observed limitations of this study. The most prominent limitation may have been the timing of the study.

The fall sections of Lifetime Fitness & Wellness required participants to exercise during the final 8 weeks of the semester. The 2018 Thanksgiving break (officially) began Wednesday, November 21, and ended that following Sunday, November 25. Following the holiday break, participants then had a single week to continue exercise before posttests began on Monday, December 3. A disruption in participants' schedules likely occurred during the week of Thanksgiving, which may have had a detrimental effect upon levels of health-related fitness due to training inconsistencies and the negative eating behaviors associated with the Thanksgiving holiday and travel.

With negative eating behaviors in mind, other limitations of the study were its setting and a lack of data regarding caloric intake. Tennessee has the 15th highest obesity rate in the United States, and the highest obesity rate for children aged 10 to 17 (Robert Wood Johnson Foundation, 2019). Also, keeping track of personal diets was not a required component of Lifetime Fitness & Wellness Online. Therefore, this study may have overly focused upon eliminating sedentary behaviors to improve health-related fitness rather than what may be the larger issue – improper diet. Without having a better understanding of the caloric intake of the participants during the time of the study, it is difficult to accurately pinpoint why levels of body composition did not significantly change. Given the indirect data regarding obesity in Tennessee, it is easy to assume that the negative eating behaviors of the participants outweighed the benefits of increased levels of exercise and therefore hindered improvements in body composition. The study would lead to a stronger conclusion, however, had data regarding caloric intake among participants been available.

Recommendations

Much is left to be discovered regarding the efficacy of online, concepts-based fitness and wellness courses within higher education. In this section, recommendations for future research are offered.

Though challenging, performing a longitudinal study regarding exercise habits after completion of an online, concepts-based fitness and wellness course would be of great benefit. The results of the study could provide insight regarding whether the behavioral changes that occur during enrollment are simply transient or continue throughout the college years and the lifespan (as desired). Perhaps another study similar

to this design that would include a battery of fitness tests given after a specified interval ranging from 6 months to a number of years would significantly add to the literature.

A replication of this study that would include a larger sample size would be of great benefit as well. Results would therefore be more generalizable.

Also, more research is needed regarding nutrition in conjunction with exercise behaviors among online students. Lifetime Fitness & Wellness Online included not only content regarding proper exercise, but proper nutrition as well. Participants in this study experienced significant improvements in cardiovascular health, flexibility, and muscular endurance. The body composition of participants, however, remained stagnant, which led the researcher to hypothesize that the course was insufficient in changing negative eating behaviors. Further research is needed regarding what online course content is effective in promoting positive changes in diet. The recommendation would be for a rigid method of research that surpasses student perceptions and provides accurate measures of health to determine what pedagogy would serve as much needed intervention.

Concluding Thoughts

It will take more than a single semester of coursework to change the negative health behaviors that have become the new norm for college students. However, if the university is to maintain its role of serving the greater good of society, then a sincere, research-based effort toward that end is of the utmost importance.

The odds of avoiding sedentary diseases are stacked against college students. The modern student is no longer what was once considered traditional, and time available for physical activity is often replaced by part- or full-time jobs, family needs, or other obligations. Physical education requirements are disappearing from the curriculum,

leaving students less likely to be sufficiently active and, unfortunately, less likely to develop an appreciation for an active lifestyle. Highly processed foods laden with sugar, high-fructose corn syrup, and simple carbohydrates dominate the average diet. Sedentary living and negative eating behaviors have led the United States into an obesity epidemic that has an annual cost of $147 billion, and that figure continues to escalate.

However, change can occur. By increasing daily physical activity to meet the minimal guidelines recommended by the Office of Disease Prevention and Health Promotion, significant changes to health can occur in only 8 weeks. This finding is good news for institutions of higher education. Intervention is possible. It is the sincere hope of this researcher that the results of this study are used, at least in some minor way, to help the emerging college graduate avoid the plague of sedentary diseases and, instead, prosper with a fulfilling, active, and disease-free life. To pursue this goal, the researcher intends to continue to share the findings of this study upon several platforms after completion of the dissertation.

The researcher began teaching a concepts-based fitness and wellness course as an online offering at what was then a small community college in South Georgia in 2007. Within only 5 years, the course became very popular among students and the number of course offerings grew from two to over a dozen per semester, with each section limited to 30 students. Therefore, over the course of a single academic year, over 600 students likely participated in the online course during fall and spring semesters alone. Presently at the researcher's home institution, Lifetime Fitness & Wellness is a new course; however, sections fill quickly, and somewhat similar growth is anticipated. When faculty convene before the start of the Fall 2019 semester, the researcher will present the findings of this

study to colleagues within the Department of Exercise Science. We can conclude from this study that students enrolled in Lifetime Fitness & Wellness are, in fact, exercising. However, changes in body composition and muscular strength did not occur, and therefore, the researcher will seek input from colleagues regarding ideas for changing the course to bring about improvements in all components of health-related fitness for participating students. Perhaps, the period of exercise needs to extend beyond 8 weeks to develop significant gains in muscular strength. Including a series of videos in the course content that introduce the campus fitness center and demonstrate proper lifting techniques may improve outcomes. In addition to providing a weekly summary of physical activity, students may benefit from tracking personal diets. The researcher expects these ideas and others to develop from the faculty meeting, and ultimately, an improved Lifetime Fitness & Wellness course is anticipated.

Also, with approval the researcher will present this study at the Tennessee Alliance of Health, Physical Education, Recreation and Dance annual conference in Murfreesboro, Tennessee. The conference is an annual event that brings together professionals and students from fields of exercise science, physical education, health and wellness, and recreation for a 3-day event to promote education, research, pedagogy, physical activity for all, and camaraderie. The researcher will also submit proposals to the Georgia Education Research Association Conference and the Society of Health and Physical Educators National Convention & Expo.

Finally, the researcher plans to perform a similar study in 2021. Following the previously mentioned exercise science faculty meeting, the researcher intends to make changes to Lifetime Fitness & Wellness that will reflect the input from colleagues and

personal experience gained from this research. Results from a replicated study among students enrolled in the Fall 2020 semester could be compared to the current research to provide insight regarding how changes in pedagogy influenced outcomes. It would be beneficial to continue performing a similar study, perhaps upon a 3-year cycle, to continue the development of this growing course and have the greatest possible impact upon the health of college students.

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APPENDICES

APPENDIX A

LIFETIME FITNESS & WELLNESS PRE/POST TEST

Health-Related Fitness Assessment Form

Name:_____ Age:_____ ___ Male ___ Pretest
Date: _____ Race:_____ ___ Female ___ Posttest

Test/Result	Level
Body Composition Bioelectrical impedance _____ % Estimated Body Fat	___ Very Lean ___ Excellent ___ Good ___ Fair ___ Poor ___ Very Poor
Aerobic Fitness 3-Minute Step Test _____ HR	___ Excellent ___ Good ___ Above Average ___ Average ___ Below Average ___ Poor ___ Very Poor
Flexibility Sit & Reach Best of 3 Trials: _____	___ Excellent ___ Good ___ Average ___ Fair ___ Poor
Muscular Strength Grip Dynamometer RH best:_____ (lbs.) LH best:_____ (lbs.) SUM: _____ (lbs.)	___ Excellent ___ Very Good ___ Good ___ Fair ___ Poor
Muscular Endurance ACSM Pushup Test Total: _____	___ Excellent ___ Good ___ Average ___ Poor ___ Very Poor

APPENDIX B

LIFETIME FITNESS & WELLNESS SYLLABUS

PHED 1005 Lifetime Fitness & Wellness Online
Tennessee Technological University
Department of EXPW
Fall 2018

Course Description:
This course is designed to explore and apply principles of lifetime physical fitness, with a key focus upon optimal wellness, nutrition, and disease prevention. Topics include methods for self-assessment, personalized fitness program development, proper dieting and healthy lifestyle choices. Students will improve or maintain personal levels of cardio-respiratory endurance, muscular strength and endurance, flexibility and body composition through structured exercise participation.

Required Text/ Materials:

- *Fitness & Wellness,* 13th ed., Hoeger. Cengage Learning. ISBN 1-337-39290-1

Objectives of the Course:

- Demonstrate an understanding of the importance of good physical fitness and a wellness lifestyle in the achievement of good health and quality of life and a more productive and longer life.
- Determine whether medical clearance is needed for personal, safe participation in exercise.
- Apply behavior modification techniques to help adhere to a Lifetime Fitness & Wellness program.
- Identify and assess the health-related components of fitness.
- Analyze personal diets and associate the principles that govern sound nutrition.
- Develop sound diet and weight-management programs.
- Create and implement a cardiovascular disease risk-reduction program.
- Apply guidelines to reduce personal risk of developing cancer.
- Discern between myths and facts of exercise and health-related concepts.

Safety Considerations:

1. It is extremely important that safety is observed when participating in physical activities.
2. Warm up properly at the beginning of each session.
3. Be alert at all times – use caution if wearing earphones.
4. Stay properly hydrated.

Dress Requirements:
No open-toed footwear, boots, heels, sandals and so forth. Running/walking shoes are a must.
Clothing should be appropriate for physical activity (no street clothes, jeans, plastic suits or sweats).
Follow rules of the campus Fitness Center (if applicable).

Assessment of Course Objectives:

Quizzes (6 @ 5 pts. each)	30
Assignments (4 @ 5 pts. each)	20
Discussions (8 @ 5 pts. each)	40
Fitness Tests (2 @ 45 pts. each)	90
Exams (2 @ 50 pts. each)	100
Workout Journals (8 @ 15 pts. each)	120
Total Points Possible	**400**

Grading Scale:

360-400 points	A
320-359 points	B
280-319 points	C
240-279 points	D
Less than 240 points	F

Quizzes:
Quizzes are all multiple choice and true/false. Each quiz is 10 questions and has a specified time limit. All quizzes are open for a total of 7 days - the duration of their associated weekly modules. Therefore no makeup quizzes are given.

Assignments:
Like quizzes, each of the four assignments is available during the 7-day period of its associated learning module. No makeup assignments are given.

Discussions:
Discussions are also attached to a weekly module and are therefore only available for a period of 7 days. No makeup discussions are given. Students are expected to post a discussion in response to the provided topic, and then respond to the posts of at least two other student posts for full credit (5 points). Students will receive up to 3 points for their initial post, and an additional point (up to 2 points) for responding to student posts.

Please be considerate of the thoughts and ideas of other students here. Challenging each other with the intent of learning from one another is encouraged, but this MUST be done in a respectful manner.

The use of outside sources is highly recommended when developing original posts.

Fitness Tests:
Two fitness tests are required. A fitness Pre-Test occurs prior to the start of exercise credit. A fitness Post-Test occurs after 8 weeks of regular exercise. These tests are given in the Memorial Gym either by the course instructor or a graduate assistant, and results are kept confidential. Dates and times will be announced by the instructor.

Students residing outside of the Cookeville area will need to contact the instructor well in advance to schedule alternative fitness testing sites.

These tests measure components of health-related fitness. These tests are mandatory for completion of this course.

Students receive full credit simply for completion of the Fitness Pre-Test. Students must show improvement or, if already fit, successful maintenance of fitness levels to receive credit for the Fitness Post-Test. The post-test provides information about whether a student has successfully met exercise requirements.

Exams:
Exam One covers the first four chapters of our text. Exam Two covers Chapters 5 and 6.

Both exams are 50 questions (T/F and M/C), completely online, and have a 1-hour time limit.

Each exam is available for the 7-day duration of their associated modules. Therefore no makeup exams are given.

Exams are “open book” and do not require a proctor.

Workout Journals:
After four weeks of study, students will complete a fitness pre-test and begin exercising for credit.

Completing 8 weeks of regular exercise is a mandatory component of this course. Students will begin an exercise routine at a date specified by the instructor (typically after completing the first exam), and finish at a date also specified (typically at the close of the term).

Students must submit a weekly exercise report to receive credit. Late submissions are not accepted.

Students are expected to perform **aerobic** activity for a **minimum** of 150 minutes per week at a moderate intensity, as recommended by the U.S. Dept. of Disease Prevention and Health Promotion. If capable of performing safely, students may instead do 75 minutes per week of vigorous-intensity cardiovascular training. See examples below:

Moderate Intensity
Walking briskly (3 miles per hour or faster, but not race-walking)
Water aerobics
Bicycling slower than 10 miles per hour
Tennis (doubles)
Ballroom dancing
General gardening
Vigorous Intensity
Racewalking, jogging, or running
Swimming laps
Tennis (singles)
Aerobic dancing
Bicycling 10 miles per hour or faster
Jumping rope
Heavy gardening (continuous digging or hoeing, with heart rate increases)
Hiking uphill or with a heavy backpack

Students must also perform **strength-training exercises**, and follow the recommendations of the U.S. Dept. of Disease Prevention and Health Promotions and the American College of Sports Medicine. Muscle-strengthening exercise should be conducted at least **twice weekly**.

- For more information regarding the Guidelines: go here: https://health.gov/paguidelines/guidelines/chapter4.aspx

- Further information on strength training effectively can be found here: https://exrx.net/WeightTraining/Guidelines

Weekly training must include methods of enhancing all components of health-related fitness. Your instructor may provide further guidelines prior to the start of the 8-week exercise period.

Students must track their exercises using MyFitnessPal. Ideally, following a training session, students will enter each exercise performed, number of sets and reps completed, intensity, duration and so forth. A weekly summary is then generated using the MyFitnessPal website and then submitted through the appropriate dropbox for assessment.

All students are responsible for adhering to an 8-week program. If further clarification is needed following the Fitness Pre-Test, it is the responsibility of the student to contact the instructor for further details.

Communication Policy:
To contact the course instructor, students should send an email through iLearn. The course instructor typically responds within 24 hours during weekdays. Students who need to speak to the instructor can either schedule an office appointment or send their phone number to the instructor with preferred calling times.

School Sponsored Activity:
All absences due to school sponsored activities which would include athletics (student-athletes, managers, trainers, etc.), field trips, student body, etc. will be excused with prior notification from the coach, professor, or governing body. However, it is the responsibility of the student to contact the professor before the absence to clarify any missed assignments, quizzes, or exams. All assignments, quizzes, and exams must be turned in or taken before the absence. **NO assignments, quizzes, or exams will be accepted or allowed after the absence unless agreed upon by the instructor.**

Securing Instructional Material Due to Absence:
On a regular basis, the instructor will provide students with instructional material. If a student is absent, he/she is expected to acquire the supplemental materials and any needed class notes from a classmate or from the course web page (if applicable), NOT from the instructor! Students are strongly urged to exchange contact information with several classmates for the purpose of securing knowledge about missed class sessions.

Deadlines:
ALL assignments must be completed by the dates specified. Without PRIOR ARRANGEMENT, work submitted past the specified deadline will receive a grade of zero (0). ALL assignments must be turned in to the instructor and must be completed in the required format.

Student Academic Misconduct Policy
Maintaining high standards of academic integrity in every class at Tennessee Tech is critical to the reputation of Tennessee Tech, its students, alumni, and the employers of Tennessee Tech graduates. The Student Academic Misconduct Policy describes the definitions of academic misconduct and policies and procedures for addressing Academic Misconduct at Tennessee Tech. For details, view the Tennessee Tech's Policy 217 – Student Academic Misconduct at Policy Central

Academic Integrity Policy:
Academic dishonesty is defined as:

1. Giving, receiving, or using unauthorized aid on any academic work.
2. Plagiarism, which includes the copying of language, structure, or ideas of another and attributing the work to one's own efforts.
3. Attempts to copy, edit, or delete computer files that belong to another person or use of Computer Lab account numbers that belong to another person without the permission of the file owner, account owner, or file number owner. All academic work submitted for grading contains an implicit pledge and may contain, at the request of an instructor, an explicit pledge by the student that no unauthorized aid has been received. It is the responsibility of every member of the Tennessee Tech University community to enforce the Academic Integrity Policy.

Plagiarism:
All work submitted under your signature in this course is pledged as being your own work. This applies to quizzes, exams, and homework. Plagiarism will not be tolerated. Any student caught plagiarizing or cheating will receive an F in the course and will be reported to the Chair of the EXPW department.

Fire Safety: The fire exit for MG 125 is out the classroom door; turn left, and go out the glass doors immediately to your left.

H1N1 Swine Flu:
Should normal classroom activities be disrupted by a flu outbreak, the format for this course may be modified to enable completion. In that event, you will be given new instructions for continuation of the course.

Class Conduct:
All students are expected to conduct themselves in a manner becoming mature adults and aspiring professionals. They are expected to take their assignments, class attendance, and class participation seriously. This class should never be referred as, "just a PE course, or Motor Learning is a blow-off class." Such comments will result in the lowering of your final grade.

Students will not converse among themselves during class except when instructed to do so. When a student creates a disturbance in the classroom, the instructor will either ask the student to desist immediately or speak to the student at the conclusion of class. If the

disturbances persist, the instructor retains the right to dismiss the student from the class meeting.

Privacy Policy:

In compliance with the college and federal regulations, without specific college directive, the instructor is not permitted to discuss a student's course status or grade with any third party, including parents, guardians, or relatives. The Family Educational Rights and Privacy Act of 1974 (FERPA) affords eligible students certain rights with respect to their education records. Among them is the right to consent to the disclosure of personally identifiable information contained in the student's education records, except to the extent that FERPA authorizes disclosure without consent.

One exception, which permits disclosure without consent, is disclosure to school officials with legitimate educational interest. A school official is a person employed by the college; a person or company with whom the college has contracted (such as an attorney, auditor, or collection agent); a person serving on the board of trustees; or a student serving on an official committee, such as a disciplinary or grievance committee, or assisting another university official in performing his or her tasks. A school official has a legitimate educational interest if the official needs to review an education record in order to fulfill his/her professional responsibilities. Upon request, the college discloses education records without consent to officials of another school in which a student seeks or intends to enroll.

Student-athletes' grades will be provided to coaches, athletic department personnel, and/or any university official upon request. Students will NOT receive grades via e-mail, telephone, fax or posting.

Disability Accommodations:

Students with a disability requiring accommodations should contact the Office of Disability Services (ODS). An Accommodation Request (AR) should be completed as soon as possible, preferably by the end of the first week of the course. The ODS is located in the Roaden University Center, Room 112; phone 372-6119. For details, view the Tennessee Tech's Policy 340 – Services for Students with Disabilities at Policy Central.

Internet and Email:

All students in this course will be required to maintain and use an iLearn account, which supports E-mail and which allow them access to the World Wide Web (www). This account will be used for instructor – student communication in addition to delivery of course material.

Classroom Atmosphere:

- All students are expected to conduct themselves in a manner becoming mature adults and aspiring professionals. They are expected to take their assignments, class attendance, and class participation seriously.

- No use of profanity at any time once you enter the online classroom environment and particularly within course discussions.

APPENDIX C

COLUMBUS STATE UNIVERSITY IRB LETTER OF APPROVAL

Institutional Review Board
Columbus State University

Date: 3/7/19
Protocol Number: 19-060
Protocol Title: The Efficacy of an Online, Concepts-Based Fitness and Wellness Course (Dissertation)
Principal Investigator: David Mann
Co-Principal Investigator: Michael Richardson

Dear David Mann:

The Columbus State University Institutional Review Board or representative(s) has reviewed your research proposal identified above. It has been determined that the project is classified as exempt under 45 CFR 46.101(b) of the federal regulations.

Conditional approval is granted pending the approval from the listed outside performance site(s).
Please note any changes to the protocol must be submitted in writing to the IRB before implementing the change(s). Any adverse events, unexpected problems, and/or incidents that involve risks to participants and/or others must be reported to the Institutional Review Board at irb@columbusstate.edu or (706) 507-8634.

If you have further questions, please feel free to contact the IRB.

Sincerely,

Amber Dees, IRB Coordinator

Institutional Review Board
Columbus State University