EFFECTIVENESS OF A REQUIRED HEALTH-RELATED FITNESS COURSE ON PHYSICAL ACTIVITY AND DIETARY BEHAVIORS AMONG COMMUNITY COLLEGE STUDENTS

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MELISSA S. EVANS, B.S., M.S.

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DEDICATION

To my Mom and Pa for your incredible love and support my entire life. You instilled in me the desire for life-long learning, taught me the importance of a strong work ethic, and served as the absolute best role models. I can never thank you enough for everything and I love you more than I can ever express! Thanks Mom for working so hard in rehab after your broken hip to make sure you could attend my graduation – this means so much to me. Even though Pa will not be with us in person, we know he will be with us in spirit.

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ABSTRACT

MELISSA S. EVANS

EFFECTIVENESS OF A REQUIRED HEALTH-RELATED FITNESS COURSE ON PHYSICAL ACTIVITY AND DIETARY BEHAVIORS AMONG COMMUNITY COLLEGE STUDENTS

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College students are experiencing increased health risks, and researchers have called for interventions to increase health-promoting behaviors among this population. The purpose of this study was to: (a) evaluate the effectiveness of a required Health-Related Fitness (HRF) course in changing PA and dietary behaviors among community college (CC) students, and (b) explore student perceptions about the effectiveness of HRF curriculum activities in changing behaviors. Pre- and post-semester data were gathered from 76 students enrolled in four HRF courses during one semester on one Texas CC campus. Pre- and post-survey questions included questions from the *College Student Health Survey* about demographics, PA, and dietary behaviors. Open-ended questions were included on the post-survey to explore student perceptions about the effectiveness of HRF curriculum. Repeated measures Multivariate Analysis of Variance (MANOVA) found no significant changes in PA behaviors, but a significant decrease was reported in the use of handheld devices (sedentary behavior). Dietary behaviors produced significant changes in meal patterns, with breakfast eating increasing significantly. Sugar-sweetened beverages also produced significant changes, specifically in the decrease of sports drinks.

No significant changes were found in fruit and vegetable (FV) consumption. Repeated measures analysis of variance (ANOVA) found no significant increase in body fat percentage, yet significant increases were reported for weight and body mass index (BMI). Frequency statistics were run on themes developed from the open-ended question responses. A large majority of students (96.1%) felt the HRF course was beneficial due to the information provided and the types of activities they participated in during the class. Suggestions for improvements included increased class workout time and additional examples and preparation methods for healthier foods. Suggestions for sustainability of healthy behaviors included tracking, motivation, support, and continuing education. This study adds to the body of knowledge for the Scholarship of Teaching and Learning (SoTL), and results can be used to tailor activities to enhance HRF curricula. This study addresses several of the health education Areas of Responsibility including: assessing health behaviors of college-aged students, evaluating the HRF curricula, conducting research related to health education, and enhancing efforts to advocate for health education in the CC environment.

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CHAPTER I

INTRODUCTION

The college years comprise a significant developmental stage during which young people experience multiple transitions and engage in numerous health behaviors, many of which become lifelong patterns (Cluskey & Grobe, 2009; Myers & Mobley, 2004; Sparling & Snow, 2002). Young adults (aged 18-24 years) have numerous risk factors related to multiple chronic diseases, including obesity (body mass index [BMI] $\geq$ 30), metabolic syndrome, and diabetes mellitus (Dalleck & Kjelland, 2012; Morrell, Lofgren, Burke, & Reilly, 2012; Sacheck, Kuder, & Economos, 2010). In addition, college students are highly susceptible to significant weight gain (Kasparek, Corwin, Valois, Sargent, & Morris, 2008; Levitsky, Halbmaier, & Mrdjenovic, 2004; Racette, Deusinger, Strube, Highstein, & Deusinger, 2008). Two behaviors influential in the development of these health issues are physical inactivity and poor dietary habits.

To address these health-risk behaviors among the college population, many four-year colleges and universities added Physical Education (PE) and Health-Related Fitness (HRF) courses to their curricula. However, despite evidence pointing to the need for interventions to address physical activity (PA) and dietary strategies, health education, and weight-management strategies among young adults, only 18.2% of two-year institutions (community colleges [CC]) require students to take an HRF course (Morrell,

Carey, Burke, & Reilly, 2010; National Physical Activity Plan, 2010; Sparling, 2003; Strand, Egeberg, & Mozumdar, 2010; Wengreen & Moncur, 2009). This represents a significant gap as there are more than 7.5 million students enrolled in CC across the US (Knapp, Kelly-Reid, & Ginder, 2012). CC students are an important segment of the college population, and research focusing on the effectiveness of HRF courses on CC students' PA and dietary behaviors will make an important contribution to the knowledge base.

Statement of the Purpose

The purpose of this mixed-methods study was to: (a) evaluate the effectiveness of a required HRF course in changing PA and dietary behaviors among CC students, and (b) explore CC student perceptions about the effectiveness of HRF curriculum activities in changing PA and dietary behaviors.

Research Questions

The current study had the following research questions:

1. Will CC students change their PA behaviors after completing an HRF course?
2. Will CC students change their dietary behaviors after completing an HRF course?
3. Will CC students' body fat percentages change after completing an HRF course?
4. What curriculum activities in an HRF course did CC students find most beneficial in changing PA and dietary behaviors?

Hypotheses

The following null hypotheses was tested at the .05% significance level:

1. There will be no significant difference between pre- and post-PA behaviors among CC students completing a required HRF course.
2. There will be no significant difference between pre- and post- dietary behaviors among CC students completing a required HRF course.
3. There will be no significant difference between pre- and post-body fat percentage among CC students completing a required HRF course.

Delimitations

The current study had the following delimitations:

1. Participants ranged in age from 18-34 years.
2. Participants enrolled in multiple sections of a required HRF course on the same CC campus.
3. Full-time Health and PE instructors taught the HRF course sections, followed a designated curriculum, and used the same textbook.
4. Instructors used different teaching styles.
5. Dietary and PA survey items were a subset of the *College Student Health Survey* (Boynton Health Services, 2013) and were not developed exclusively for this study.

Limitation

The current study had the following limitation:

Full- and part-time students comprised a purposeful sample of nonrandom subjects within a single, Texas CC campus; therefore, external validity is limited, and study results cannot be generalized.

Assumptions

The current study had the following assumptions:

1. Students answered the surveys honestly and to the best of their ability.
2. Students were able to read and understand the English language.
3. Instructors implemented the same HRF curriculum in its designated format.

Definition of the Terms

Brain derived neurotropic factor (BDNF) – a powerful brain protein that aids in the growth, development, and connectivity of brain neurons as well as enhancing the formation of new brain cells, known as neurogenesis (Medina, 2009).

Curriculum activities - specific labs or class activities used in the HRF course to instruct, engage, or measure student participation, knowledge, and/or comprehension.

Dietary behaviors - specific survey questions related to fruit and vegetable (FV) consumption, meal patterns, and consumption of sugar-sweetened beverages (Boynton Health Services, 2013).

Health-Related Fitness (HRF) course – an academic course composed of fitness and health cognitive information along with PA and/or laboratory components. This type of course features a lecture-laboratory approach that is sometimes referred to as Conceptually-Based Fitness (CBF) or Conceptual PE (Corbin & Cardinal, 2008; Strand et al., 2010).

HRF Course Curriculum - class format (across all HRF courses) that includes 15 textbook chapters, exams covering the same chapters within a set timeframe, 10 textbook labs, diet analysis lab, two online labs, a personal fitness program, and exercise activities designed to assist students in meeting course objectives.

Physical activity (PA) - bodily movements produced by skeletal muscles resulting in the burning of calories and producing progressive health benefits (Hoeger & Hoeger, 2012).

Scholarship of Teaching and Learning (SoTL) - "the study of teaching and learning and the communication of findings so that a body of knowledge can be established" (Bishop-Clark & Dietz-Uhler, 2012, p. 1).

Transtheoretical Model (TTM) – a model for behavior change developed by Prochaska and DeClemente (1983) that theorizes that individual behavior change develops through a series of stages (precontemplation, contemplation, preparation, action, maintenance, and termination). The TTM has been used successfully with numerous health behaviors, including PA and dietary interventions (Wakui, 2002), and is sometimes referred to as the Stages of Change model.

Importance of the Study

College students are a vital part of the US as future parents, workers, and leaders. Therefore, the health and quality of life of college students are important concerns as health and quality of life influence intrapersonal, interpersonal, community, and societal issues. Post-secondary institutions provide an important setting for health education, prevention, and intervention strategies for young adults. Numerous researchers have called for interventions targeting college students to promote health education, lifetime PA and healthy eating strategies, skill development, and healthy weight-loss strategies (Brunt, Rhee, & Zhong, 2008; Gordon-Larsen et al., 2004; Larsen et al., 2008; Morrell et al., 2010; Sparling, 2003; Wengreen & Moncur, 2009). However, research examining the effectiveness of HRF courses in changing CC students' PA and dietary behaviors is minimal (Sullivan et al., 2008). The current study provides additional information on the effectiveness of an HRF course in modifying PA and dietary behaviors among CC students. In addition, this study adds to the SoTL knowledge base through the evaluation of an HRF curriculum and teaching strategies. In turn, this information can be used to plan, implement, and evaluate HRF college courses and interventions aimed at improving PA and dietary behaviors among young adults.

CHAPTER II

REVIEW OF LITERATURE

The college years are a transitional period for the development of health behaviors, and these health behaviors often become lifelong behavioral patterns with long-term adult health implications (Cluskey & Grobe, 2009; Myers & Mobley, 2004; Sparling & Snow, 2002). Research indicates that college students have increasing health risks associated with a variety of chronic diseases, including obesity, high blood pressure, high cholesterol, inactivity, metabolic syndrome, diabetes mellitus, and cardiovascular diseases (Burke, Reilly, Morrell, & Lofgren, 2009; Dalleck & Kjelland, 2012; Morrell et al., 2012; Sacheck et al., 2010). Seven out of every ten deaths in the US are attributed to chronic diseases and impact more than 75% of all medical care costs (U.S. Department of Health and Human Services [USDHHS], 2004). Behaviors in adolescence can influence health in adulthood as demonstrated by the study from Wennburg, Gustafssun, Dunstan, Wennburg, and Hammarstrom (2013), who reported that TV viewing and low leisure-time PA during adolescent years was independently predictive of metabolic syndrome in mid-adulthood. According to Dr. Ed Ehlinger, Director and Chief Health Officer of the University of Minnesota Boynton Health Services, "college students are so important for our economic development -- the development of our society. One way to protect that investment in our future is to help them stay healthy" (University of Minnesota, 2008,

para. 15). In order to promote the health and well-bing of college-aged students, national college health objectives have been established by the American College Health Association (2010) and include the following leading health indicators: physical activity, overweight and obesity, tobacco use, substance abuse, responsible sexual behavior, mental health, injury and violence, environmental quality, immunization, and access to health care.

Obesity

According to the Bipartisan Policy Center (2012), "our nation is in the midst of a public health crisis so profound that it is undermining our national well-being, our economic competitiveness, and even our long-term national security. In short, obesity is the most urgent public health problem in America today" (p. 5). As such, obesity is associated with many physical, emotional, and financial consequences (Trust for America's Health, 2009, 2010; World Health Organization [WHO], 2014b).

Research has shown that 35.7% of U.S. adults were obese in 2009-2010 (Ogden, Carroll, Kit, & Flegall, 2012). Schiller, Lucas, Ward, and Peregoy (2012) reported that among adults aged 18-44 years in 2010, 32.2% were overweight (BMI = 25.0-29.9) and 25.4% were obese (BMI $\geq$ 30). According to the American College Health Association (2013), self-reported data from U.S. college students revealed that 33.7% were overweight (21.9%) or obese (11.8%). Furthermore, in 2011, obesity rates for U.S. high school students were 15.6% (Trust for America's Health, 2013).

Obesity Among College Students

Research has shown that college students (aged 18-24 years), especially first-year students, gain weight more rapidly than the general population (Holm-Denoma, Joiner, & Vohs, 2008; Kasparek et al., 2008; Racette et al., 2008; Strong, Parks, Anderson, Winett, & Davy, 2008). Levitsky et al. (2004) reported weight gain during the first year of college was higher than the general population (11 times the average weight gain of 0.8 pounds per year among U.S. adults) and that the students studied gained 1.9 to 2.4 kg (4.2 to 5.3 pounds) during a 12-week period. Another study reported increased weight gain (mean increase 4.1 ± 3.6 kg; ~9 lbs., $p < .001$) in 70% of the 290 college students from the beginning of their freshman year to the end of their sophomore year (Racette, Deusinger, Strube, Highstein, & Deusinger, 2005). A prospective, longitudinal study supported the findings of Levitsky et al. and Racette et al. with both male and female first-year college students (males n = 226, females n = 341, aged 16 to 26 years) gaining weight during their freshman year of college (Holm-Denoma et al., 2008). Kasparek, Corwin, Valois, Sargent, and Morris (2008) also found weight gain among 57% of the college freshman subjects during a six-month period, but overweight students (BMI $\geq$ 25) gained almost twice as much weight (10.96 pounds vs. 6.21 pounds) when compared to the weight gain of students with starting weights within the recommended category (BMI $\leq$25).

Weight gain is not only a problem for first-year college students, but research also found that college students gain both weight and body fat throughout their college years (Gropper, Simmons, Connell, & Ulrich, 2012). In another study, Wetter, Wetter, and Schoonaert (2013) assessed changes in fitness and health indicators among three cohorts of college students over a 15-year period. They found that body weight and body fat significantly increased for males (4.5 kg in body weight; 3.3% in body fat) and females (5.4 kg in body weight; 3.2% in body fat). From 2005-06 to 2010-11, overweight levels among males increased from 24% to 27.6% while females increased from 30.2% to 30.7%. Obesity levels also increased for both males (7.4% to 10.6%) and females (10.4% to 14%) over this same time period.

Obesity and Transition into Adulthood

As obese adolescents transition into adulthood, they are 16 times more likely to develop severe obesity as young adults as compared to normal-weight or even overweight adolescents, with the highest obesity rates found in non-Hispanic Black women (The, Suchindran, North, Popkin, & Gordon-Larsen, 2010). Gordon-Larsen, The, and Adair (2010) evaluated the longitudinal increase in obesity from adolescence into early adulthood. Obesity among adolescents increased from 13.3% in 1996 to 36.1% in 2008, with the highest obesity rates reported among non-Hispanic black females (54.8%). This study indicated a "strong tracking of obesity from adolescence into adulthood" (p. 1801) as the prevalence of obesity doubled from adolescence into the early 20s and doubled

again from the 20s to the 30s. Graff et al., (2011) also classified the period from adolescence into early adulthood as "a high risk period for weight gain" (p. 63) and reported that adolescents' sedentary activities may combine with some genetic factors to affect body mass changes during this transitional time.

Weight gain during the college years, as well as obesity-related behaviors such as dietary and PA practices, also contribute to the rising obesity rates among mature adults (Racette et al., 2008). As far back as 1997, the CDC claimed the dietary and activity habits of many college students predisposed them to future health problems; and this trend has continued as college students' report they struggle with adopting healthful eating and exercise behaviors (CDC, 1997; Cluskey & Grobe, 2009). In response to this challenge, the Bipartisan Policy Center (2012) recommended a variety of strategies to address the issues of obesity and preventive health that include having community colleges "engaged as a key potential provider of necessary training in the prevention workforce pipeline" (p. 70).

Physical Activity

Globally, physical inactivity is the fourth leading cause of death (WHO, 2014a). In the US, physical inactivity and poor diet rank second only to tobacco use as preventable causes of death among Americans (Mokdad, Marks, Stroup, & Gerberding, 2004). Hypokinetic diseases caused by a lack of PA, such as atherosclerosis, diabetes, and obesity, may develop as early as the second and third decades of life (Leslie,

Sparling, & Owen, 2001). At the 2014 American College of Sports Medicine (ACSM) annual meeting, acting Surgeon General Boris Lushniak stated, "Physical inactivity is the major public health issue in this country" (para. 1). Lushniak also announced there would be a major call to action about PA by the Surgeon General's office later in the year (Garber, 2014). The highest PA rates are reported among children and youth, yet PA dramatically declines into adolescence and adulthood (Caspersen, Pereira, & & Curran, 2000; Gordon-Larsen, Nelson, & Popkin, 2004; Gordon-Larsen, Adair, Nelson, & Popkin, 2004; Troiano et al., 2007).

Physical Activity Guidelines

In 2008, the USDHHS released the *Physical Activity Guidelines for Americans* (PAG), which provides guidelines for children, adults, and older adults about the types and amounts of PA scientifically proven to provide substantial health benefits. The PAG recommend that adults (aged 18 years and older) participate in a minimum of 150 minutes of moderate aerobic activities and/or 75 minutes of vigorous activities plus a minimum of two muscle-strengthening days per week, with older adults following these guidelines as much as their conditions allow. Recommendations for children and adolescents include 60 minutes or more of daily aerobic physical activity plus muscle- and bone-strengthening activities at least three days per week (USDHHS, 2008).

Physical Education in Schools

The school environment has been identified as an important component for promoting and increasing PA among children, adolescents, and young adults due to the amount of time students spend at school as well as the emerging research focusing on the relationship between PA and academic achievement (Physical Activity Guidelines for Americans Midcourse Report Subcommittee of the President's Council on Fitness, Sports & Nutrition [PA Guidelines Report], 2012). However, required PE in grades K-12 has been significantly reduced following the 2002 passage of the federal *No Child Left Behind Act*, which was designed to increase academic achievement among core subjects (American School Health Association, 2008). A study by Siedentop (2009) reported a 35% reduction in time designated for PE and a 28% reduction in recess in order to increase time in core subjects. According to Schneider and Zhang (2013), school accountability pressures had a significant, negative effect on PA levels of high school students and increased the probability of those students being classified as overweight.

Healthy People 2020 contains national health objectives for increasing PA among adults and adolescents and specific recommendations related to PA in school settings (USDHHS, 2013). However, in 2006, daily PE was only present in four percent of elementary schools, eight percent of middle schools, and two percent of high schools (CDC, 2006). In 2011, data from the National Youth Risk Behavior Survey revealed that only 29% of high school students met the 60-minutes-per-day PA guideline (boys = 38%;

girls = 19%); and 14% failed to meet this guideline (CDC, 2012). Other research has shown that one-third of students in grades 9-12 do not get the recommended amounts of PA, and more than 10% participate in no PA (Grunbaum et al., 2004). Furthermore, Sparling (2007) reported that almost 6 of 10 students participate in fewer than three days per week in moderate- or vigorous-intensity PA.

Physical Activity Levels

For American adults in general, 30.3% of adults (aged 18-24 years) and 24.5% (aged 25–44 years) reported meeting both aerobic and muscle-strengthening PA guidelines. However, larger percentages (36.2% of 18-24 year olds and 43.3% of 25-44 year olds) met neither aerobic nor muscle strengthening PA guidelines (National Center for Health Statistics, 2013).

College students are generally viewed as healthy and active young adults. However, a review of 19 studies revealed that PA levels of more than 50% of U.S. university students were insufficient to produce health benefits (Irwin, 2004). During the transition from high school to college, Han et al. (2008) found a significant decrease in PA for college women. The largest PA declines occurred during the summer between high school and college with additional decreases in the first semester of college. Therefore, Han et al. (2018) suggested that the transitional period between high school and college was a "critical time to promote physical activity among women" (p. 194).

College students recently reported that for moderate PA, 23.4% participate in no PA per week whereas 20.0% reported participating five to seven days per week. For vigorous PA, 38.4% reported no PA and 31.4% reported vigorous activity three to seven days per week. The number of college students meeting the recommended amounts of moderate and/or vigorous PA was 48.8% (American College Health Association, 2013). In addition, minorities, specifically Non-Hispanic Black and Hispanic college students, have reported lower PA participation rates despite having higher cardiovascular disease risk factors as compared to White students (Blanchard et al., 2008; McMahah et al., 2007).

Using the 2013 College Student Health Survey, researchers gathered data from 13,459 undergraduate and graduate students enrolled in 29 postsecondary institutions in Minnesota (Boynton Health Survey, 2013). Their study reported 72.4% of surveyed students reported moderate (31.4%) to high (41.0%) amounts of PA, while 20.3% reported low and 7.3% with no PA. Data collected on two-year colleges found even lower levels of PA, with 57.8% of surveyed students reporting either moderate (26.3%) or high (31.5%) levels of PA; in addition, 25.9% reported low and 16.3% reported no PA (Boynton Health Services, 2013).

Many studies use self-reported data to determine PA participation, yet studies comparing subjective (self-report) to objective (accelerometer) measures demonstrate a poor correlation between these measures. LeBlanc and Janssen (2010) found subjective

(self-report) measures of PA to yield higher estimates than objective (accelerometer) measures among youth (aged 12–19 years). Their study revealed that 65.4% of participants over-reported their moderate-to-vigorous PA with the greatest over-reporting occurring among inactive participants. Troiano et al. (2007) also found that self-reported PA was substantially higher than PA measured by accelerometers; only 8% of adolescents and 5% of adults met the recommended PA guidelines according to objective measurement. College students were also found to self-report higher amounts of PA than measured by accelerometers, and researchers warned that college students may be less active than previously considered (Downs, Van Hoomissen, Lafrenz, & Julka, 2014). Therefore, according to Troiano et al. (2007), "great care must be taken when interpreting self-reported physical activity in clinical practice, public health program design and evaluation, and epidemiological research" (p. 187).

Fitness Levels

Insufficient PA is a major health problem for adolescents and young adults. Research presented at the American Heart Association's Scientific Sessions 2013 found that globally, cardiovascular endurance fitness levels of youth (aged 9–17 years) declined about 15% in comparison to their parents' fitness levels at the same age. Between 1970 and 2000, U.S. children's' cardiovascular endurance fitness levels declined an average of six percent per decade as other nations decreased about five percent each decade (American Heart Association, 2013a).

This decline in fitness has also been documented among college students. A meta-analysis found that about 40% - 50% of college students were not physically active, and their PA levels were not higher than the general population (Keating, Guan, Pinero, & Bridges, 2005). Wetter, Wetter, and Schoonaert (2013) assessed changes in fitness and health indicators among more than 1800 college students (aged 18-19 years) over a 15-year period. Fitness profiles, including aerobic fitness, bicep strength, flexibility, blood pressure, body weight, and body mass, were analyzed among three cohorts of students (1995-96, 2005-2006, 2010-2011). Results indicated significant declines in the fitness and health indicator mean values from 2005-06 to 2010-11, with the greatest declines among women. Males significantly declined in aerobic fitness, strength, and flexibility, while females significantly increased in both diastolic and systolic blood pressure and significantly declined in aerobic fitness and flexibility.

Physical Activity and Neuroscience

Research by neuroscientists supports multiple, positive effects of exercise and PA on the brain and brain function across various age groups. Exercise and PA have been shown to aid positive mental health by reducing anxiety, lifting mood and self-esteem, managing depression, and improving learning, boosting memory, enhancing information processing speed, and slowing brain shrinkage in the elderly (Hillman, Erickson, & Kramer, 2008; Medina, 2009; Ratey, 2008).

Furthermore, exercise and PA optimize learning in numerous ways, including: bathing brain cells in oxygen and glucose, increasing neurotransmitters levels (dopamine, serotonin, norepinephrine), increasing brain derived neurotropic factor (BDNF), multiplying the growth of nerve cells, strengthening nerve connections, and protecting neurons from stress (Medina, 2009; Ratey, 2008). A recent review summarizing current neuroscience research in relation to educational approaches and interventions reported that exercise increases efficiency of neural networks important for learning and can improve cognitive function and memory (Howard-Jones, 2014).

Recent brain research has also linked gross-motor skills and early movement experiences with optimal brain development critical for learning (Gabbard & Rodrigues, 2008). However, the reduction in physical activity levels and PE classes may be creating limitations in these important movement experiences and gross-motor skills. Research has shown that people with basic skills in sport activities and movements, referred to as competent movers, are more likely to participate in PA on their own (Graham, Holt/Hale, & Parker, as cited in the National Association for Sport and Physical Education [NASPE], 2007). For many young adults, college may be the last opportunity to extensively experience and develop these movement skills and develop the confidence necessary for a lifetime of quality PA (NASPE, 2007).

Physical Activity and Academics

Although the goal of most college-level health education courses is focused on health education and shaping health behaviors of young adults, researchers are exploring the link between PA on overall academic achievement and performance. Recently, numerous studies have been conducted at all educational levels; and this topic continues to be a major focus for researchers in education as well as neuroscience.

A number of literature reviews have documented the positive influence of PA on academic achievement involving standard measures (grades, standardized test scores), executive function, cognitive skills, academic behavior, concentration and attention, and classroom behavior among a variety of ages and students (Sibley & Etnier, 2003; Singh et al., 2012; Tomporowski, Davies, Miller, & Naglieri, 2008). Trudeau and Shepard (2008) found no negative effects of PA on student academic performance (K-12) despite increasing PA time (up to an additional hour per day); and they also reported small absolute gains in grade point average with additional curricular emphasis on PE. Booth et al. (2014) reported that regular moderate-to-vigorous intensity PA resulted in long-term improvement in academic performance among adolescents, especially females in the area of science. A two-year longitudinal study concluded that greater academic achievement (defined by WESTEST standardized test scores) was associated with students' aerobic capacity (measured by FitnessGram); and for those students who stay in

the high fitness zone, the academic achievement appeared to be maintained over time (Wittberg, Northrup, & Cottrell, 2012).

The CDC (2010) also published a literature review and concluded that PA may impact cognitive skills and attitudes, enhance concentration and attention, and improve classroom behavior. They noted that studies reported PA as having either a positive or no effect on the academic and cognitive areas, with no data showing a decline in academic performance. These results are in direct conflict with the common argument and myth that time allocated for PE and other forms of school-based PA (e.g., recess) hinders student academic achievement. This misguided rationale has resulted in PE and PA being completely eliminated or drastically reduced in order to increase time in core academic areas such as math and science. However, there is growing evidence to dispel this myth, with some research actually supporting the increased time for PA, PE, and classroom-based movement breaks in order to enhance learning (Rasberry et al., 2011; Trost, 2009). A recent review summarizing neuroscience research in relation to educational approaches and interventions reported that exercise increases efficiency of neural networks important for learning and can improve cognitive function and memory (Howard-Jones, 2014). As for exercise in relation to academic achievement, the review found that exercise interventions had either positive effects or no effect, but "with a distinct lack of negative effects" (p. 20). Although the review pointed to "substantial likelihood of [exercise's] academic value" (p. 19), more research is needed regarding

factors that actually influence academic outcomes (Howard-Jones). In addition to exercise or PA, some researchers have studied the associations between physical fitness and obesity to areas related to academic performance (Chomitz, et al., 2009; Trost, 2009). Results from large studies involving students from both California and Texas found corresponding increases in the number of fitness tests passed with higher academic achievement on standardized academic tests (California Department of Education, 2005; Welk et al., 2010). Welk et al. (2010) reported a positive grade-level association among Texas students between academic achievement (TAKS test) and two indicators of health-related fitness (cardiovascular fitness and BMI), with stronger correlations for middle school students. Castilli, Hillman, Buck, and Erwin (2007) determined aerobic fitness to be positively associated with academic achievement, with BMI inversely related. Davis (2007) reported obesity was linked with lower cognition, achievement, and parents' behavior ratings, whereas fitness was associated with better cognition, achievement, and behavior among elementary children. However, some research did not obtain any association between fitness and academic performance (Trudeau & Shephard, 2008).

Dietary Habits

Research documents the value of healthy foods, especially vegetables and fruits, in fighting many chronic diseases such as cardiovascular disease and cancer (WHO, 2004). Therefore, dietary recommendations by the WHO (2004; 2014b) include increased consumption of healthy foods (vegetables, fruits, legumes, whole grains, and

nuts) and limiting or eliminating foods containing high amounts of fats (saturated and trans-fatty acids), sugars, and sodium. The Institute of Medicine (National Academy of Sciences, 2009), Academy of Nutrition and Dietetics (2014), American Heart Association (2014a), American Cancer Society (2014), and The Dietary Guidelines for Americans (U.S. Department of Agriculture & U.S. Department of Health & Human Resources, 2010) mirror the WHO recommendations for a diet focused on nutrient-dense foods and beverages to promote health. In addition to the recommendations, these organizations also conduct scientific studies, develop a variety of educational materials for the public, and assist policymakers and educators with nutrition-related programs and information.

Dietary Habits of College Students

According to the American Institute for Cancer Research (2011), the food habits established during the college years will likely be sustained for life and influence not only the individual college student's health, but the health of future families as well. The American College Health Association (2013) reported that only 6.3% of college students eat five or more FV servings per day. A 2005 national survey also found that 9 of 10 students eat fewer than the recommended five servings of FV per day, and almost 6 of 10 students participate in fewer than three days per week in vigorous or moderate-intensity physical activity (Sparling, 2007). Documented behaviors associated with weight gain among college students include lack of adequate FV consumption, consumption of fried and fast foods ($\geq$ three or more times/week), and physical inactivity. These behaviors

appear to be common during the first two years of college for students and may be contributors to adult overweight and obesity (Racette et al., 2005).

College Dietary Environments

Numerous environmental changes have been found to contribute to overeating and unhealthy food choices among college students, including cafeterias, buffets, and 24-hour easy access to food (CDC, 2010a). Levitsky et al. (2004) documented factors associated with increased weight gain among college freshman, including eating in the "all-you-can-eat" dining halls, snacking on high-fat convenience foods, meal frequency, and number of snacks. Small, Bailey-Davis, Morgan, and Maggs (2013) tracked college students over seven semesters and found that few students met the recommendations for FV servings or exercise. Not only did the levels of these two behaviors significantly decline from the first to the seventh semester, but living off campus intensified this decline.

Trust for America's Health (2009) identified numerous factors related to the consumption of convenience foods: limited access to supermarkets and nutritious foods, especially in urban and rural areas; larger portion sizes; "value sizing" involving an emphasis on the amount of food versus the quality of the food for the money; decreased home cooking and increased restaurant eating or take-out foods; more processed foods designed to be prepared in microwaves for convenience and speed; increased access to convenience foods and beverages that are high in calories, fat, and sodium at schools;

limited health education classes; availability of unhealthy food options at work sites; increased numbers of people working outside the home, increased commuting times, and long work hours. Community college students routinely face many of these challenges as they strive to balance school, work, relationships, finances, and increased independent living conditions.

Nutrition Education

As college students obtain more independence, health behaviors, such as dietary patterns, often change. Several longitudinal studies found significant decreases in quality and changes in dietary habits during the transitional years into young adulthood (Demory-Luce et al., 2004; Larson et al., 2008; Niemeier, Raynor, Lloyd-Richardson, Rogers, & Wing, 2006). Ha, Caine-Bish, and Lowry-Gordon (2009) found that female college students who frequently ate at fast food restaurants displayed a diet that was lower in many nutrients and higher in sodium, soft drinks, and fat from evening snacks than college students not frequently eating at fast food restaurants. They stressed the importance of nutrition education and interventions targeting the college population to assist students in learning how to make healthier food choices, even when frequenting fast food restaurants.

In an effort to address some of the dietary changes and environmental influences challenging college students, some researchers have studied how college courses focusing on nutrition education and interventions influence college students' dietary

behaviors. Studies involving college-based, health-related courses reported increased levels of both healthy dietary patterns and PA among students (Ha & Caine-Bish, 2009; Kicklighter, Koonce, Rosenbloom, & Commander, 2010). In terms of nutrition, Ha and Caine-Bish (2009) found that a class-based nutrition intervention for college students (n = 80, aged 18 to 24 years) focused on nutrition knowledge related to prevention of chronic diseases, increased consumption of vegetables and fruits, and decreased the consumption of french fries among college students. Another study of college females (n = 70) also supported the effectiveness of a general nutrition course (15-week intervention) to lower the average total energy intake along with lower average intake from fats, proteins, and carbohydrates as well as an increase in dietary fiber (Ha, Caine-Bish, & Lowry-Gordon, 2009).

In addition, Shah, Amirabdollahian, and Costa (2011) found that students in health-related courses ate significantly more FV and had smaller waist circumferences versus students in non-health related courses. A study by Kobler (2013) found that a 16-week college seminar for first-year students focused on increasing self-efficacy in food preparation skills and dietary behaviors resulted in significant changes in food preparation skills (pre versus post), but self-efficacy did not increase significantly.

Health-Related Fitness Courses

History

During the 1920's and early 1930's, PE was a required course among 97% of U.S. four-year colleges/universities, yet dropped to 39.55% in 2010 (Cardinal, Sorensen, & Cardinal, 2012). Beginning in the late 1950's, a lecture-laboratory approach (Conceptual PE or HRF course), was implemented in college/universities (Corbin & Cardinal, 2008). In 2009, a Conceptually-Based Fitness (CBF) course was a general education requirement among 27% of two-year colleges, 61% of four-year colleges, and 44% of universities, (Kulinna, Warfield, Jonaitis, Dean, & Corbin, 2009). Another study found only 18.2% of two- and 57.8% of four-year institutions required an HRF course for graduation (Strand et al., 2010). A study looking at the availability and characteristics of CBF courses offered at U.S. colleges and universities found that a CBF course offered as part of the general education requirement had the greatest potential to reach a large portion of the student body and provide knowledge, skill development, and behavior modification, thus increasing the likelihood of promoting health behaviors among college students (Kulinna et al,, 2009).

Influence on Knowledge, Attitudes, and Behaviors

Numerous studies have shown that college courses or programs can improve students' knowledge, attitudes, and behaviors related to PA, nutrition, and other health-related behaviors (D'Alonzo, Stevenson, & Davis, 2004; McCormick & Lockwood,

2006; Sallis et al., 1999; Sullivan et al., 2008; Topp et al., 2011). Additionally, Mack and Shaddox (2004) demonstrated that a required personal wellness course resulted in significant improvements in attitudes towards PA and exercise. In a study involving small, private colleges, Adams, Graves, and Adams (2006) found that fitness and health knowledge gained in a CBF course was retained up to four years following graduation. Then, too, Bjerke (2012) compared the effectiveness of an activities-based education (APE) course, conceptually-based education (CPE) course, and a combined APE/CPE course on college students' health and behavioral outcomes. Results indicated that the combined APE/CPE course produced both significant and higher magnitude of gains in BMI, time spent involved in moderate PA, and days spent exercising vigorously. Ellis (2013) also found a significant correlation between completion of a postsecondary fitness and wellness course and weekly vigorous and moderate-to-vigorous PA among college students. Cardinal and Spaziani (2007) used a theoretical Lifetime Fitness for Health course to compare a traditional classroom-based and a web-based format on college students' leisure-time PA. They also studied strategies and techniques developed from the Transtheoretical Model and Stages of Change.. Results indicated weekly participation in leisure-time PA outside of class, measured in minutes, increased the greatest in the classroom group (35 minutes or 133% increase vs. control group), followed by the web-based group (23 minutes or 53% increase vs. control group). In another study, Medero (2012) discovered a positive, significant relationship between cardiorespiratory

endurance plus muscular strength and endurance and enrollment in a CBF course among two-year college students of predominately Hispanic ethnicity (69%). In addition, the students in the CBF class significantly increased their knowledge over health-related topics, desire to participate in PA, and exercise self-efficacy.

In another study, Blaser (2005) assessed the effectiveness of three types of wellness/PE courses students could choose from in order to meet the general education requirement at Brigham Young University. The first two courses were conceptually-based courses (entitled Fitness and Lifestyle Management) covering health, fitness, and nutrition with one in the traditional, face-to-face format and the other class option in an online format. The third choice was three PA courses that focused on sport skill development minus any lecture format. Across one semester, the conceptually-based class (face-to-face format) had the largest impact on both the PA behavior and nutrition improvements, whereas the online course had the least impact on students' nutrition and physical activity participation. The PA class resulted in a strong impact on PA behavior, yet still less than the face-to-face conceptionally-based format, with little impact on nutrition. However, a study by Cardinal, Jacques, and Levy (2002) found a required, lifetime fitness course resulted in minimal changes in both students' leisure time PA behavior and in their PA stage of change. It is important to note that similar research among CC students is even more limited. However, one study reported more leisure-time

PA among CC minority students taking a PE or general health course than among their CC peers (Sullivan et al., 2008).

Sustainability of Behaviors

Studies measuring long-term sustainability of increased PA and wellness behaviors among college students have been limited. One study of college alumni (mean time since graduation = 6.2 years [+ 2.8]) reported high exercise enjoyment (66.1 %) and confidence in creating personal fitness programs (79.4%). Despite the described enjoyment and confidence, only 34.3% reported engaging in the recommended levels of moderate or vigorous PA. The alumni reporting adequate levels of moderate/vigorous PA gained significantly less weight following graduation compared to those reporting insufficient PA (3.0 kg vs. 6.1 kg). There was also a strong positive association between PA patterns as college seniors and alumni PA behavior (Sparling & Snow 2002). Other research has shown that college alumni who completed an HRF course in college reported significantly higher PA behaviors, fitness knowledge, and attitudes as compared to alumni never having taken an HRF course (Adams & Brynteson, 1995; Pearman & Valois, 1997). Additional studies have revealed that self-reported PA behaviors and knowledge lasting from four to six years post-graduation (Adams et al., 2006; Sparling & Snow, 2002). Polacek, Erwin, & Rau (2013) found that a general education wellness course not only increased wellness behaviors between the freshmen and sophomore years, but also increased wellness knowledge over a nine-year period as they followed

students from their freshman year into alumni status four to five years beyond graduation. Another study found a significant correlation among women between leisure-time PA during the college years and leisure-time PA approximately 15 years post-college (Hultquist, Duckman, Stinson, & Thompson, 2009). This study used pedometers as an objective PA measure and supports the importance of developing strong initiatives and strategies that not only educate about the health benefits of PA, but also develop and promote PA mastery experiences during the college years.

According to a systematic review of effective interventions to increase PA, college-based-health-education and PE courses generally showed short-term increases in PA and aerobic capacity, yet PA declined back to previous levels (The Guide to Community Preventive Services, 2013*)*. Due to the limited number of studies, as well as study design limitations and executions, The Community Guide concluded there was insufficient evidence to assess the effectiveness of college-based health education and PE interventions to increase PA. On the other hand, Becker et al. (2008), who reported the results of a general education personal health course, made this salient point:

> Most importantly, students enrolled in this course reversed the negative trend regarding the health behaviors of college students. Not only did students from this class have a statistically significant increase in knowledge, but overall, emotional, and physical health behaviors trended healthier. Students also self-reported that

the personal health course was a valuable general education course that should be required for graduation (p. 72).

Scholarship of Teaching and Learning

Despite the widely recognized benefits of an HRF course, research evaluating effective teaching and learning processes in HRF courses is limited. This type of research falls within a larger category of research known as the Scholarship of Teaching and Learning. According to Nelson (2012), SoTL "has become a major force for transforming higher education" (p. xi). SoTL utilizes research-based principles (research questions and methodologies) applied to teaching and learning whereby studies are publically evaluated in order to add to the body of knowledge and provide opportunities to evaluate effective teaching and learning processes (Center for Teaching, Learning & Scholarship at Georgia Southern University, 2012)

Furthermore, pressure has increased to provide measures of accountability in higher education as well as with funding agencies. As a result, many institutions and agencies have turned to using or developing programs or strategies which involve rigorous evaluation, typically involving experimental or quasi-experimental designs with peer reviews, to produce what is known as evidence-based programs or strategies (Cooney, Huser, Small, & O'Connor, 2007). In his discussion of the directions for future research on how college affects students, Pascarella (2006) wrote about the importance of collecting data "that increases the probability of identifying causal linkages between the

postsecondary experience and student growth" (p. 509). He also emphasized the importance of "a concerted effort to rigorously examine the validity of our prevailing academic assumptions and beliefs, particularly as they find expression in academic and student affairs programs and interventions" (p. 513). In addition, Pascarella suggested the use of mixed-methods studies to focus on "understanding or explaining the processes and mechanisms underlying those causal linkages" (p. 516).

Enhancing Effectiveness in Physical Education

In addition to the SoTL, the Physical Activity Guidelines for Americans Midcourse Report Subcommittee of the President's Council on Fitness, Sports & Nutrition (PA Guidelines Report, 2012) described an effective and new approach to teaching PE in schools. This new approach, referred to as "enhanced PE" (p. 10), emphasizes increasing the amount of time actively engaged in PA, specifically moderate-to-vigorous intensity, during designated PE classes with the intention of enhancing student fitness levels. Another characteristic of "enhanced PE" involves adding additional PE classes as well as extending time in existing PE classes. An important characteristic of "enhance PE" is to provide opportunities for all students to participate in enjoyable activities as well as promote both knowledge and skills focused on developing a lifetime of PA.

Furthermore, there is sufficient evidence to suggest "that enhanced PE can increase overall PA among youth and can increase PA time during PE class" (PA

Guidelines Report, 2012), p. 11). Strategies for "enhanced PE" included a well developed and implemented PE curriculum along with effective instructional practices that promote participation in significant amounts of moderate-to-vigorous PA by qualified PE teachers with appropriate training (PA Guidelines Report, 2012).

Research on successful methods of teaching HRF courses is limited as much of the research has focused on measuring the accruement and retention of knowledge as well as documenting the levels and changes of various health behaviors. Research by Keating et al. (2005) found that higher education health and PA professionals have had little success in increasing PA behaviors among the college population as interventions for promoting PA among college students are still in the developing stages, and effective means are still unknown. Primary research problems include:

- PA among the college population is a neglected area of research;
- There is a lack of multiple-level approaches that influence college student PA; and
- PA measures are subjective and inconsistent, thus creating comparisons problems (Keating et al., 2005).

Some researchers have offered suggestions for higher education programs to promote PA and other health behaviors. Adams and Bryntenson (1995) suggested a format involving knowledge related to the benefits of PA combined with actual participation in PA. Dale and Corbin (2000) reported positive results from courses that

emphasize health-related fitness concepts and self-management skills along with personalized fitness testing. More specifically, their research indicated that this type of class format may be successful in advancing lifetime PA among high school students.

The National Association for Sport and Physical Education (2007) recommended college PA instruction programs to: (a) encourage student choice to foster exploration of new and different PA experiences and opportunities; (b) "teach empirically supported behavior change methods" (par. 5) to assist student skill development for overcoming barriers to PA, building confidence, and promoting a lifetime of PA; (c) develop careful curriculum planning; and (d) cultivate intrinsic motivation for PA.

CHAPTER III

METHODOLOGY

Population and Sample

Subjects included a purposeful, nonrandom sample of participants (aged 18-34) enrolled in a required HRF course during the Fall 2013 semester (16 weeks) on a single CC campus in North Texas. Students from multiple disciplines were enrolled in the selected HRF course that is required for graduation. Four sections of the course were surveyed. All four sections were taught by full-time PE faculty and followed the same HRF curriculum. All HRF instructors, regardless of participation in this study, were required to follow the designated curriculum. Of the 400 total points possible, only 55 points were at the instructors' discretion, thereby increasing internal validity of the study. The four class sections were limited to the face-to-face format with two sections meeting on Mondays, Wednesdays, and Fridays for 55 minutes and the other two sections meeting Tuesdays and Thursdays for 80 minutes. Sections on this campus were limited to a maximum of 28 students per section due to space and equipment limitations.

Protection of Human Participants

Approval for the study was obtained first from the Tarrant County College Office of Institutional Research and Planning (see Appendix A) and followed by the Texas

Woman's University Institutional Review Board (see Appendix B). At the beginning of the Fall 2013 semester, instructors were contacted individually in person by the researcher to explain the purpose and design of the study. The primary researcher attended the four selected classes (Week 2) to explain the study and recruit participants. Every student completed a consent form indicating their decision as to whether they would participate in the study, which was returned directly to the researcher; this procedure was followed to protect student anonymity because neither students nor instructors knew which students agreed to participate in the study. Study participants were informed (verbally and in writing) they could opt out of the study at any time without penalty. Participation in the study was voluntary, and anonymity and confidentiality were protected throughout the study.

All students completed the surveys used in the study as part of the course curriculum (Weeks 3 and 14), but only the data from students agreeing to participate in the study were used in the study analysis. Instructors submitted all surveys (pre and post) to the researcher who assigned a special ID number to each of them and separated the study participants' surveys. The research data from participants was entered into the Statistical Package for Social Sciences (SPSS) program version 20.0 for Windows (IBM Corporation, 2011) on a password-protected computer.

In addition, height, weight, and body composition (body fat percentage and BMI) were assessed (Weeks 3 and 14) as part of the class curriculum. The researcher recorded

participants' heights and weights as measured by a digital scale; and she also assessed body fat composition by using a handheld, non-invasive bioelectrical impedance instrument. To ensure privacy, a private room in the PE department was used to measure height, weight, and body composition. For confidentiality purposes, a coding system was used to identify all student personal data. Only the researcher had access to the list linking individual names to ID codes. The researcher stored the surveys, personal data forms, and name/ID code list in a locked cabinet in her locked, private office.

Data Collection Procedures

At the beginning of the Fall 2013 semester, the researcher met individually with HRF full-time faculty who taught face-to-face sections to explain the study and recruit faculty volunteers. Three full-time faculty members volunteered, which gave the researcher access to four face-to-face HRF course sections. The three participating instructors provided the researcher with class rolls of the four HRF classes (Week 2). The rolls were used to generate a coding system to provide a unique and special ID number for each individual in each class. Only the researcher had access to the coding system. The unique ID number was used to properly link the pre- and post-surveys and measurements and served as identification on the measurements form to help ensure confidentiality. The primary researcher attended selected classes during the second week of class to explain the study and consent form to students. As part of the regular class curriculum, all students in attendance completed the survey in addition to the physical

measurements in a private room in the PE Department (pre-course = Week 3; post-course = Week 14). Students who were absent the initial day of survey and measurements completed the survey and measurements during the next scheduled meeting of that class. Only the data from those students agreeing to participate in the study and signing the consent form were included in the research study. Once surveys and measurements were completed, the researcher separated the surveys of the study participants and entered the data (survey answers and measurements) into the SPSS program.

Instrumentation

This study utilized a mixed-methods approach incorporating pre- and post-course surveys accompanied by height, weight, and body composition assessment. A demographic profile was collected as part of the pre-survey and included gender, age, international and relationship status, living arrangements, and number of hours spent on academic activities and working. The quantitative aspect of the study involved the use of pre-post surveys to measure pre- and post-differences in aerobic and muscle-strengthening activities, sedentary activities, meal patterns, FV consumption and sugar-sweetened beverage intake, as well as pre-post height, weight, and body composition (body fat percentage and BMI) measurements. The researcher received approval from Boynton Health Services to use selected survey questions (see Appendix C). The *College Student Health Survey* measures eight key areas of student health and has been administered to college populations since 1995 (Boynton Health Services, 2013);

however, there are no reliability or validity data available. The post-survey also contained six open-ended questions developed by the primary researcher, advising professor, and prospectus committee. These questions added a qualitative dimension to the study and were designed to assess students' perspectives about effective curriculum activities, recommendations for curriculum changes, and suggestions for sustainability of PA and healthy dietary behaviors.

For the pre- and post-body composition assessments, a handheld, non-invasive bioelectrical impedance instrument (Omron model HBF-306C) was used to assess body fat percentage and BMI (Omron Healthcare, 2006). This instrument was used as part of the HRF curriculum to assess body fat in addition to other body composition analysis methods. Height and weight were collected following traditional protocols using a digital scale and measured without shoes. Height was entered to the nearest quarter-inch, and weight was entered to the nearest half-pound as required by the Omron HBF-306C. Every attempt was made to have consistent measuring conditions for each test (pre- to post-test). The efficiency of this process was augmented because the researcher has more than seven years of experience in gathering and assessing a variety of body composition techniques, including the use of the Omron 306C instrument.

Published studies validating hand-held bioelectrical impedance devices have been limited with mixed results and therefore are inconclusive (Wheeler, 2012). Wheeler also reported that the Omron HBF-306C is a valid device for estimating body fat percentage

on the population level according to clinical standards, yet not on the individual level. In addition, Loenneke et al. (2013) compared the reliability of the Omron 306C instrument with the three-site skin fold (SF) method among college students. Results indicated the SF method had the best reliability if used by an experienced tester. The Omron 306C, when used in the athlete mode, was comparable to the SF method and an acceptable alternative, especially when testing experience or skill in accurately performing SF measurements by a tester was in question.

Data Analysis

The software used for data analysis was SPSS 20.0 for Windows (IBM Corporation, 2011). Demographic data was analyzed using descriptive statistics. Dietary behavior questions were grouped according to meal patterns (breakfast, fast food, restaurant eating), FV consumption, and sugar-sweetened beverage intake. The PA behaviors were grouped according to cardiorespiratory (moderate or strenuous) and strength building. Sedentary activities were also grouped together for analysis.

A repeated measures Multivariate Analysis of Variance (MANOVA) was used to analyze PA, dietary behaviors, and sedentary behaviors. Wilk's Lambda was interpreted for the overall model significance with effect size calculated using eta-squared (η^2). Body fat, BMI, and body weight were analyzed using repeated measures Analysis of Variance (ANOVA). Responses to open-ended questions were entered into an Excel spreadsheet where themes were developed and coded. Inter-rater reliability was established by

having an expert to serve as a second coder of a random subset of 10 participants' answers (n = 60). The researcher and expert agreed on any discrepancies in themes and coding. The entire qualitative data set was then recoded, and frequency statistics were run on the developed themes.

Summary

A purposeful, nonrandom sample of community college students (aged 18-34) enrolled in a required HRF course at Tarrant County College - Southeast Campus completed pre- and post-surveys (Weeks 3 and 14) during the Fall 2013 semester. A mixed methods approach was used to assess PA and dietary behaviors and body fat, as well as student perceptions about the effectiveness of the HRF curriculum activities in changing their PA and dietary behaviors. Data were analyzed using descriptive statistics for demographic data. Repeated measures Multivariate Analysis of Variance (MANOVA) was run on PA, sedentary behaviors, and dietary behaviors (FV, meal patterns, sugar-sweetened beverages). A repeated measure Analysis of Variance (ANOVA) was used for body fat, BMI, weight, and self-descriptions of body weight and body satisfaction. Themes from open-ended questions were analyzed using frequency statistics.

CHAPTER IV

RESULTS

The purpose of this study was to evaluate the effectiveness of a required HRF course in changing PA and dietary behaviors as well as body fat percentages among CC students. Another purpose was to explore CC student perceptions about the effectiveness of HRF curriculum activities in changing PA and dietary behaviors.

Demographics

A total of 83 students met the qualifications and agreed to participate in the study, with 76 (91.6%) completing both the pre- and post-surveys and physical assessments. The majority of students (77.1%) ranged in age from 18 to 21 years of age (M = 20.06 years, SD = 3.5), and 57.8% were females (see Table 1). The majority of study participants described their ethnicity as Latino/Hispanic (38.6%), followed by White (27.7%), Asian (14.5%), Black (9.6%), Other (6.0%), and Middle Eastern (3.6%). Only one participant (1.2%) reported being an international student. The majority of participants described themselves as single (69.6%) and living at their parents' home (83.1%) (see Table 2).

Table 1

Frequencies and Percents for Age and Gender

Groups	Frequency	Percent
Age		
18	11	13.3
19	23	27.7
20	21	25.3
21	9	10.8
22	4	4.8
23	4	4.8
24	4	4.8
25	4	4.8
26	1	1.2
27	2	2.4
Gender		
Female	48	57.8
Male	35	42.2

Table 2

Frequencies and Percents for Relationship Status and Living Arrangements

Groups	Frequency	Percent
Relationship Status		
Single	58	69.9
Engaged/Committed	22	26.5
Married/Domestic partner	2	2.4
Widow	1	1.2
Living Arrangements		
Parent's home	69	83.1
Rent	14	16.9

As part of the demographic profile, the amount of time spent on academics and working was also assessed. The greatest percent of participants reported spending 1-10

hours studying (50.6%), followed by 11-20 hours (28.9%). Time spent working for pay at a job was categorized as on-campus (none = 89.9%) or off-campus, with only 19.5% reporting no time spent working off-campus, and 48.8% working between 21 - 40 hours per week (see Table 3).

Table 3

Frequencies and Percents of Time Spent on Academic Activities, Working On-Campus and Off-Campus

Time	Frequency	Percent
Time Spent on Academic Activities		
0	1	1.2
1-10	42	50.6
11-20	24	28.9
21-30	8	9.6
31-40	5	6.0
41+ hours	3	3.6
Time Spent Working On-Campus		
0	71	89.9
1-10	3	3.8
11-20	3	3.8
21-30	1	1.3
31-40	1	1.3
41+ hours	0	0
Time Spent Working Off-Campus		
0	16	19.5
1-10	7	8.5
11-20	16	19.5
21-30	19	23.2
31-40	21	25.6
41+ hours	3	3.7

Quantitative Results

Research Question 1 explored whether changes would occur in CC students' PA behaviors after completing an HRF course. The three behaviors of PA included strenuous, moderate, and strength activities. In the surveys, a brief explanation was given for strenuous (heart beats rapidly) and moderate (not exhausting) PA. All three PA behaviors listed examples of appropriate activities to assist participants in understanding each level of PA. Comparison of pre- to post-survey results found that participants' mean scores increased for the moderate and strength PA activities, but decreased for strenuous PA (see Table 4). However, no statistically significant multivariate differences were found across time for PA behaviors [Wilks' $\lambda = .929$, $F(3, 73) = 1.863$, $p = .143$, $\eta^2 = .07$].

Table 4

Means and Standard Deviations (SD) for PA Behaviors

	Pre-Survey	Post-Survey
PA Behaviors	Mean (SD)	Mean (SD)
Strenuous PA	2.43 (1.30)	2.30 (1.30)
Moderate PA	2.58 (1.28)	2.84 (1.43)
Strength PA	2.13 (1.69)	2.43 (1.81)

In addition to PA behaviors, sedentary behaviors were examined. Students were asked to gauge sedentary behaviors by responding to three questions related to time spent: (a) watching television, (b) using a computer for non-work or school-related

activities, and (c) using a handheld device for non-work or school-related activities. Mean scores for each of the three sedentary behaviors declined (see Table 5).

Multivariate tests across time found no statistically significant differences among the sedentary behaviors [Wilks' $\lambda = .930$, $F(3, 72) = 1.803$, $p = .154$, $\eta^2 = .07$], yet univariate tests of within-subjects contrasts found a statistically significant decrease in time spent using a handheld device for something not work- or school-related [$F(1,74) = 4.88$, $p = .03$, $\eta^2 = .06$]. The effect size of .06 signifies a medium effect, indicating that 6% of the difference in scores can be attributed to the time of the survey (pre or post).

Table 5

Sedentary Behaviors Means and Standard Deviations

Sedentary Behaviors	Pre-Mean (SD)	Post- Mean (SD)
Television watching	2.55 (1.67)	2.40 (1.64)
Computer (not for work or school)	2.60 (1.77)	2.44 (1.48)
Handheld device (not for work or school)*	3.96 (1.74)	3.60 (1.80)

* = This difference was significant at $p \leq .05$.

Research question 2 explored whether CC students would change their dietary behaviors after completing an HRF course. The survey addressed three major areas of dietary behaviors: FV consumption, meal patterns (breakfast, fast food, restaurant eating) and intake of sugar-sweetened beverages. High breakfast and FV consumption are considered healthy dietary behaviors, whereas eating out at fast food establishments and restaurants along with sugar-sweetened beverage consumption are considered unhealthy dietary behaviors.

The first dietary behavior area, FV, did not produce statistically significant changes in the number of times vegetables and fruits were consumed [Wilks' $\lambda = .955$, $F(5, 71) = .676$, $p = .643$, $\eta^2 = .05$]. Despite mean score increases for each of the five individual questions comprising the FV category, univariate tests found no statistically significant differences (see Table 6).

Table 6

Means, Standard Deviations, and Significance for Dietary Behaviors

	Pre-Survey	Post-Survey	
Dietary Behaviors	Mean (SD)	Mean (SD)	Significance
FV			.643
100% Fruit Juice	1.18 (1.16)	1.51 (1.50)	.084
Fruit	2.18 (1.52)	2.33 (1.49)	.432
Potatoes	1.22 (0.96)	1.41 (1.17)	.192
Carrots	1.17 (1.19)	1.28 (1.18)	.408
Other Vegetables	2.30 (1.41)	2.33 (1.46)	.861
Meal Patterns*			.024*
Breakfast	4.18 (2.50)	4.64 (2.20)	.033*
Fast Food	3.76 (1.17)	3.55 (1.20)	.062
Restaurants	3.37 (1.07)	3.39 (.994)	.779
Sugar-Sweetened Beverages*			.045*
Soda	1.01 (1.13)	1.05 (1.15)	.658
Diet Soda	0.25 (.695)	0.18 (.582)	.357
Fruit Drinks	1.08 (1.22)	1.05 (1.19)	.862
Sports Drink	1.04 (1.04)	0.75 (0.93)	.005*
Coffee Drinks	0.84 (1.13)	1.09 (1.16)	.058
Other Sweetened Beverages	1.07 (1.08)	1.00 (1.23)	.629

* = This difference was significant at $p \leq .05$.

The second dietary behavior area, meal patterns, did produce a statistically significant multivariate change across time [Wilks' $\lambda = .880$, $F(3, 73) = 3.33$, $p = .024$,

η^2 =. 12]. The effect size of .12 represents medium practical significance, indicating that 12% of the variance in scores can be attributed to the time of the survey (pre or post). Univariate analysis revealed a statistically significant increase in the number of day's students reported eating breakfast [F (1, 75) = 4.71, p = .033, η^2 = .06]. The medium effect size of .06 showed that this change in breakfast habits has some practical significance for this study. The mean scores for number of times breakfast was eaten increased and fast food consumption decreased, both of which were desired outcomes. However, the mean score for eating in restaurants did rise slightly (see Table 6).

In addition to mean scores for meal patterns, frequencies for breakfast, fast food consumption and restaurant eating were also calculated to provide another way to view the data. Table 7 represents the percentage of participants' responses for the breakfast meal pattern. Low breakfast eating (0 - 2 days per week) decreased from 33.7% of participants pre-survey compared to 23.6% post-survey while high breakfast eating (5 – 7 days/week) increased from 51.8% pre-survey compared to 55.3% post-survey. Some of the most notable changes in breakfast eating were reported for zero days (8.4% pre vs. 2.6% post) and seven days (28.9% pre to 35.5% post).

Table 7

Percentages of Breakfast Eating

Days per week	Pre-Survey %	Post-Survey %
0	**8.4**	**2.6**
1	12.0	3.9
2	13.3	17.1
3	8.4	11.8
4	6.0	9.2
5	13.3	13.2
6	9.6	6.6
7	**28.9**	**35.5**

Table 8 represents frequency percentages for the fast food and restaurant eating meal patterns. Study participants reported a decrease in weekly fast food consumption from 62.6% in the pre-survey (1+ times/week = 27.7%; 2+ times/week = 34.9%; daily = 0%) to 48.7% post-survey (1+ times/week = 21.1%; 2+ times/week = 26.3%; daily = 1.3%). However, consumption of fast food one-to-two times per month increased from 25.3% (pre-survey) to 34.2% (post-survey). The increase in consumption percentages (pre- to post-survey) was also found in the lower consumption categories of "a few times per year" (8.4% pre vs. 13.2% post) and "less than one time per year" (2.4% pre vs. 2.6% post). As with fast food, restaurant frequency decreased in percentages for weekly categories (1/week and 2+/week). Overall, reductions were found from pre- to post-survey among all restaurant categories except "0", "1-2 times per month", and "daily".

Table 8

Percentages of Fast Food and Restaurant Eating

	Fast Food		Restaurant	
Measurement Category	Pre-Survey %	Post-Survey %	Pre-Survey %	Post-Survey %
0	1.2	1.3	0	1.3
≤ 1/year	2.4	2.6	2.4	0
Few times/year	8.4	13.2	15.7	10.5
1-2/month	25.3	34.2	37.3	50.0
1/week	**25.7**	**21.1**	**28.9**	**25.0**
2+/week	**34.9**	**26.3**	**13.3**	**10.5**
Daily	0	1.3	2.4	2.6

The final dietary behavior category, intake of sugar-sweetened beverages, also produced a statistically significant change across time [Wilks' $\lambda = .836$, F (6, 70) = 2.29, $p = .045$, $\eta^2 = .16$]. The univariate tests within sugar-sweetened beverages found that there was a statistically significant change in sports drinks consumption [F (1, 75) = 8.29, $p = .005$, $\eta^2 = .10$]. The effect size of .10 for this result indicates that 10% of the variance in number of sports drinks consumed can be attributed to the time of the survey (pre or post). Consumption of four of the six individual sugar-sweetened beverage areas declined, and two areas increased in mean scores. Table 6 displays the changes in mean scores and univariate significance for the six individual questions comprising the sugar-sweetened beverages category.

Research question 3 investigated whether CC students' body fat percentages would change after completing an HRF course. The repeated measures analysis found no statistically significant differences across the semester for changes in body fat [Wilks' λ

= .967, F (1, 73) = 2.46, p = .12, η^2 =. 03]. Mean scores for body fat increased from 22.77 (SD 8.32) during week three to 23.21 (SD 8.28) during week 14 (see Table 9). Body fat percentages ranged from 5.2 to 46.2 percent. Three male participates were unable to obtain a body fat percentage with the Omron bioelectrical impedance instrument (Omron model HBF-306C) as their body fat was too low. The Omron bioelectrical impedance instrument displays body fat percentages ranging from 4.0% to 50.0% (Omron, 2006). In order to maintain consistency with body fat measurement methods between participants, no other methods of body fat analyses were used to collect this data. Therefore, the three participants' data was omitted from the body fat analysis.

The three male participants without body fat percentage data were able to obtain BMI data as the Omron instrument displays BMI measurements from 7.0 to 90.0 (Omron, 2006). BMI is a widely used indicator and screening tool for overweight and obesity and correlates to other direct body fat measures (CDC, 2011). However, BMI is not a direct measure of body fat, but is a calculation based on height and weight. A repeated measures analysis of variance found the increases in BMI to be statistically significant [Wilks' λ = .715, F (1, 76) = 30.26, p < .001, η^2 = .29] with means increasing from 23.78 (SD 5.44) to 24.25 (SD 5.45). The large effect size of .29 for BMI signifies a large practical significance. Changes in weight [Wilks' λ = .709, F (1, 76) = 31.18, p < .001, η^2 = .29] were also statistically significant with means increasing from pre- to post-survey (see Table 9). Weights ranged from 88.5 to 297.3 pounds.

Table 9

Means, Standard Deviations, and Significance for Body Fat Percentage, BMI and Weight

Body Composition	Pre-Survey Mean (SD)	Post-Survey Mean (SD)	Significance
Body Fat Percentage	22.77 (8.32)	23.21 (8.28)	.121
BMI	23.78 (5.44)	24.25 (5.45)	< .001*
Weight	145.97 (41.32)	149.12 (41.59)	< .001*

* = This difference was significant at $p \leq .05$.

As part of the *College Student Health Survey* (Boynton Health Services, 2013), participants were asked to describe their body weight as well as their body satisfaction during the previous 30 days (pre- and post-surveys). Table 10 illustrates the results of self-described weight with increases reported in the pre- to post-number and/or percentage of responses among all categories except for the category "about right" (62.7% pre; 55.3% post). For body satisfaction, increases occurred in post-survey responses in "most of time" and "always." The mean score for body satisfaction on the pre-survey was 2.50 (SD = .872), and the post-survey mean was 2.72 (SD = .903). This was a statistically significant increase in self-reported body satisfaction [Wilks' $\lambda = .897$, $F(1, 75) = 8.591$, $p = .004$, $\eta^2 = .10$]. Practical significance of these results can be determined by the effect size. Cohen's (1988) effect size guidelines (.01 = small, .06 = medium, .14 = large) suggest the effect size of .10 results in a medium effect size. This indicates that 10% of the variance in scores can be attributed to the time of the survey (pre or post), and could be related to participation in the class.

Table 10

Changes in Self-Described Body Weight and Body Satisfaction (Pre- to Post-Survey)

	Pre-Survey		Post-Survey	
Self-Descriptions	Frequency	Percent	Frequency	Percent
Body Weight				
Very Underweight	0	0.0	1	1.3
Slightly Underweight	10	12.0	11	14.5
About Right	52	62.7	42	55.3
Slightly Overweight	16	19.3	16	21.1
Very Overweight	5	6.0	6	7.9
Body Satisfaction*				
Never	11	13.3	6	7.9
Sometimes	32	38.6	25	32.9
Most of the Time	30	36.1	30	39.5
Always	10	12.0	15	19.7

* = This difference was significant at $p \leq .05$.

Qualitative Results

Six open-ended survey questions were included in the post-survey to gather the qualitative data. The six questions were designed to explore CC student perceptions about the effectiveness of the HRF curriculum activities in changing PA and dietary behaviors and garner their suggestions for sustainability of the PA and dietary behaviors following the HRF course.

Once the post-surveys were completed, the responses to the open-ended questions were entered into an Excel spreadsheet. If participants gave multiple answers for a given question, multiple cells within Excel were used for each answer. The cells were then reviewed to establish themes for each question, and each cell was coded based on an established theme.

To enhance inter-rater reliability, a random sample of 10 participants' answers (*n* = 60) was collected and given to an expert to code. The expert was a full-time Health and PE instructor with more than five years of experience in teaching the HRF course. The expert was familiar with the HRF course curriculum and also taught HRF courses on the same campus, yet was not one of the instructors involved in the study. The researcher and expert compared and discussed the themes and coded answers. Agreements were reached on any discrepancies in themes and coding within the sample set of responses. The researcher then reviewed, and recoded as needed, the entire data set based on the agreed themes. Frequency statistics (number and percent of responses) were then calculated for the themes of each of the six open-ended questions.

Benefits of Health-Related Fitness Course

The first open-ended, post-survey question focused on benefits from the HRF course. Question 1 asked participants if the HRF course was beneficial to them and to explain their answer. As shown in Table 11, a very large majority of participants (n = 73, 96.1%) responded positively as to the benefits of the HRF course.

Table 11

Question 1: Was Class Beneficial?

Response (N=76)	Number of Responses	Percent of Responses
Yes	73	96.1%
No	2	2.6%
Other	1	1.3%

A large percentage (60.3%) of the explanations of course benefits revolved around knowledge acquisition, particularly concerning health and healthy lifestyle knowledge along with PA and diet-related knowledge. Other explanations given by participants included increased awareness and changes in dietary and PA behaviors (see Table 12).

Table 12

Question 1: Class Benefit Explanations

Response (N = 149)	Number of Responses	Percent of Responses
Knowledge of health/healthy lifestyle	40	26.8%
Knowledge of PA	27	18.1%
Knowledge of diet	23	15.4%
Awareness of health	11	7.4%
Changed diet	8	5.4%
Awareness of diet	6	4.0%
Started/increased PA	6	4.0%
Motivation for PA	5	3.4%

Note. Only categories with 5 or more responses were included.

Effective Course Activities

Qualitative questions 2 and 3 focused on effective course activities related to two specific health behaviors (PA and healthy dietary habits). Question 2 asked for specific

course activities that were effective in helping increase participants' PA. Table 13 displays the list of activities and their corresponding number and percent of responses. The curriculum labs and the science supporting PA were the most frequently listed effective course activities (n = 20, 13.4%). Other effective activities included traditional PA methods such as the cardio room, which contains a wide variety of cardiovascular fitness equipment (e.g., treadmills, stationary bikes, elliptical machines) and walking/running as well as strength training equipment and activities (weight room). Responses also indicated that the use of new or novel equipment or activities (e.g., gliding disks, elastic bands, yoga), and the incorporation of a variety of activities were perceived as effective. In addition, participants specifically mentioned that the use of a variety of fitness balls (medicine, stability, Bosu stability trainer) fostered an increase in their PA. Some participants also mentioned team games or sports involving competition as course activities that helped them increase PA. Even though question 2 focused on PA, some participants viewed diet-related activities as effective in helping to increase PA behaviors as well (see Table 13).

Table 13

Question 2: Class Activities that Increase PA

Response (N=149)	Number of Responses	Percent of Responses
Curriculum labs and science supporting PA	20	13.4%
Cardio room activities	19	12.8%
New or varied activities and equipment	16	10.7%
Weight room and strength activities	10	6.7%
Walking/running	9	6.0%
Team games or sports/competition	7	4.7%
Diet related activities	7	4.7%
Balls (medicine, stability, Bosu)	6	4.2%

Note. Only categories with 5 or more responses were included.

Table 14 contains the results from the third open-ended question that explored the specific course activities viewed as effective in helping increase healthy dietary behaviors. The curriculum activities involving diet analysis, food logs, and labs had the highest number and percentage of responses (n = 25, 24.3%). The diet analysis activity utilized a computer software program included in the textbook bundle that was required as part of the class curriculum. The diet analysis program provided an individualized analysis of the nutritional value of foods entered into the program. The second highest number and percentage of responses for effective course activities were the PA activities and assessments. The reciprocal influence of PA and dietary behaviors on each other was observed and indicated by participants in both questions 2 and 3. Other effective activities included the health risks associated with dietary habits along with class lectures and information related to nutrition. The textbook chapter on nutrition, nutrition-related

media (videos, movies, You-tube clips), plus healthy food choices and examples were also mentioned as effective course activities. x

Table 14

Question 3: Class Activities that Increase Healthy Dietary Behaviors

Response (N=103)	Number of Responses	Percent of Responses
Diet curriculum activities (diet analysis, food log, labs)	25	24.3%
PA activities and assessments	18	17.5%
Health risks	10	9.7%
Nutrition lectures/nutrition information	10	9.7%
Nutrition videos, movies, clips	7	6.8%
Healthy food choices and examples	7	6.8%
Nutrition chapter/textbook	6	5.8%

Note. Only categories with 5 or more responses were included.

Suggestions for Increasing Behaviors

Post-survey questions 4 and 5 asked for suggestions on ways the HRF course could better assist CC students in increasing the health behaviors of PA and dietary behaviors. The fourth question asked for suggestions to increase PA. Almost a quarter of the responses (n = 21; 24.7%) involved the suggestion of increasing the actual workout time with fewer lectures or less time spent in the classroom. Numerous participants viewed the course and/or the course instructor as being very beneficial as well as the variety of activities that were infused into the curriculum. Three themes each garnered 9.4% of the responses: importance of emphasizing diet and lifestyle choices, increasing sports and/or competitive games, and increasing personal instruction on working out

properly. Five participants also mentioned the importance of self-motivation and responsibility for their own actions and behaviors (see Table 15).

Table 15

Question 4: Suggestions for Increasing PA

Response (N=85)	Number of Responses	Percent of Responses
Increase workout time with less lecture	21	24.7%
Instructor/Course beneficial	10	11.8%
Variety of activities	10	11.8%
Importance of diet and lifestyle choices	8	9.4%
Increase sports and competitive games	8	9.4%
Personal instruction on how to workout properly	8	9.4%
Student motivation and responsibility	5	5.9%

Note. Only categories with 5 or more responses were included.

While question 4 focused on increasing PA, question 5 focused on increasing healthy dietary behaviors. Suggestions included continued use of the curriculum activities involving the diet analysis and food logs. Almost a third of suggestions (n = 24, 31.6%) revolved around the themes of increased information and examples of healthy foods, ways to prepare healthy foods, healthy eating strategies, as well as more time devoted to the nutrition topic. The influence of diet on health and the consequences of unhealthy dietary behaviors were also suggested. Several participants also suggested diet planning as well as decreasing or eliminating fast food consumption and purchases from vending machines (see Table 16).

Table 16
Question 5: Suggestions for Increasing Healthy Dietary Behaviors

Response (N=76)	Number of Responses	Percent of Responses
Diet curriculum activities (diet analysis, food log, labs)	13	17.1%
Increase healthy examples/How to prepare healthy foods	12	15.8%
Health influences and consequences	8	10.5%
Healthy eating strategies	6	7.9%
Increase nutrition information/time spent on topic	6	7.9%
Diet planning	5	6.6%
Decrease/eliminate fast food or vending machines	5	6.6%

Note. Only categories with 5 or more responses were included.

Suggestions for Sustaining Behaviors

The final qualitative question asked for suggestions regarding how the HRF course can better assist CC students in sustaining their PA and healthy dietary behaviors. Three major themes emerged from the participants' suggestions. The first theme revolved around tracking, practicing, and planning both diet (n = 16, 16.3%) and PA (n = 14, 14.3%). The second theme involved motivation and support for healthier habits related to PA and diet. The third theme focused on continued education and knowledge acquisition as well as constant reminders of healthy behaviors. A small percentage of participants (n = 5, 5.1%) acknowledged personal responsibility for sustaining PA and healthy dietary behaviors (see Table 17).

Table 17

Question 6: Suggestions for Sustaining PA and Healthy Dietary Behaviors

Response (N=98)	Number of Responses	Percent of Responses
Track/practice/plan diet	16	16.3%
Motivation and support for healthier habits	15	15.3%
Track/practice/plan PA	14	14.3%
Continuing education and knowledge/Constant reminders	13	13.3%
Student responsibility	5	5.1%

Note. Only categories with 5 or more responses were included.

Summary

This mixed-methods study evaluated the effectiveness of a required HRF course in changing CC students' PA, dietary behaviors, and body fat along with participants' perceptions of effective activities and suggestions for increasing and sustaining behaviors. No significant changes were found in PA behaviors; yet among sedentary behaviors, significant decreases were reported for the use of handheld devices. Within dietary behaviors, FV showed no significant changes. Significant changes were reported for meal patterns, with breakfast increasing significantly. Sugar-sweetened beverages also showed significant changes, especially in the decrease of sports drinks. Body fat did not significantly increase, whereas BMI and weight did increase significantly. Qualitative data revealed that participants reported the HRF course to be extremely beneficial in increasing their knowledge of health, PA, and dietary behaviors. Participants also reported that curriculum activities were effective in increasing their PA and dietary behaviors. Suggestions for increasing PA and dietary behaviors included

increasing time and activities related to these topics. Suggestions for sustainability of behaviors focused on continued tracking of the behaviors as well as continued motivation, support, and knowledge acquisition.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Summary

One purpose of this mixed-methods study was to evaluate the effectiveness of a required HRF course in changing PA and dietary behaviors among CC students. A second purpose was to explore CC student perceptions about the effectiveness of HRF curriculum activities in changing PA and dietary behaviors. Subjects included a purposeful, nonrandom sample of participants (aged 18-34) enrolled in a HRF course during the Fall 2013 semester (16 weeks) on a single CC campus in North Texas. Students from multiple disciplines were enrolled in the selected HRF course that is a graduation requirement. Four sections of the course (maximum of 28 students each) were surveyed, and all sections followed the same HRF curriculum. The surveys, physical measurements (height and weight), and body composition assessments (body fat percentage and BMI) were a component of the course curriculum. However, only the data from students who volunteered to participate in the study were analyzed. The pre- and post-surveys measured meal patterns, FV consumption, sugar-sweetened beverage intake, aerobic and muscle-strengthening activities, and sedentary activities. The post-survey also contained six open-ended questions to explore student perceptions and recommendations for effective curriculum activities that stimulate and sustain healthier

PA and dietary behaviors among CC students. Additionally, pre- and post-physical assessments (height and weight) and body composition assessments (body fat percentage and BMI) were collected and analyzed by the researcher.

Conclusion

Physical Activity Behaviors

A repeated measures MANOVA was computed to examine differences between pre- and post-PA behaviors among CC students completing a required HRF course. The three behaviors of PA included strenuous, moderate, and strength activities. No significant changes occurred in PA behaviors across the semester.

Dietary Behaviors

A repeated measures MANOVA was computed to examine differences between pre and post-dietary behaviors among CC students completing a required HRF course. Dietary behaviors were analyzed by FV consumption, meal patterns (breakfast, fast food, restaurant eating) and intake of sugar-sweetened beverages. Analysis of the data found no significant changes in FV consumption. However, there were significant changes in both meal patterns and sugar-sweetened beverage intake across the semester.

Body Fat Percentages

A repeated measures ANOVA was computed to examine differences between pre- and post-body fat percentages among CC students completing a required HRF. No statistically significant differences were found in body fat percentage across the semester.

However, there were statistically significant changes in BMI and weight across the semester.

Qualitative Data: Student Perspectives

Six open-ended questions explored students' perceptions about the effectiveness of the HRF curriculum activities in changing PA and dietary behaviors. Question 1 focused on the benefits of the HRF course. Participants reported the HRF course was extremely beneficial in increasing their knowledge of health, PA, and dietary behaviors. Question 2 focused on effective course activities related to increasing participants' PA. Participants reported effective PA activities included curriculum labs and the science supporting PA, participation in cardiovascular PA activities, as well as new and varied activities or equipment. Questions 3 targeted effective course activities related to increasing participants' healthy dietary behaviors. Responses to Question 3 included curriculum activities involving diet analysis, food logs, and labs and PA participation. Other effective activities included nutrition-related health risks, lectures, and information. Suggestion for increasing PA (Question 4) and dietary behaviors (Question 5) included increasing time and activities related to these topics. Question 6 explored sustainability of PA and dietary behaviors with suggestions focused on continued tracking of the behaviors as well as continued motivation, support, and knowledge acquisition.

Discussion and Implications

Physical Activity Behaviors

Null Hypothesis1 stated there would be no significant difference between pre- and post-PA behaviors among CC students completing a required HRF course. Results comparing the pre- to post-survey results for the three PA behaviors (strenuous, moderate, and strength activities) found no statistically significant differences across the semester. Therefore, Null Hypothesis 1 was not rejected (see Table 18). This finding is consistent with reports of college students struggling with the adoption of healthy PA behaviors (Cluskey & Grobe, 2009). This study also had a higher percentage of minorities and females, who often self-report lower PA participation levels (American College Health Association, 2013; Blanchard et al., 2008; McMahah et al., 2007). The results from this study are also consistent with Keating et al. (2005), who revealed that higher education professionals were not successful in increasing college students' PA behaviors. However, the lack of significant increases in PA from this study is in contrast to other studies of HRF courses reporting areas of increased PA (Bjerke, 2012; Ellis, 2013). Despite the lack of significant changes, participants' mean scores did increase for both moderate and strength PA activities, suggesting slight, but not significant improvements in these behaviors. However, mean scores for strenuous PA declined pre to post.

Table 18

Null Hypotheses Summary: Rejected or Not Rejected

Null Hypotheses	Rejected or Not Rejected
1. There will be no significant difference between pre- and post-PA behaviors among CC students completing a required HRF course.	
Strenuous PA	Not rejected
Moderate PA	Not rejected
Strength PA	Not rejected
2. There will be no significant difference between pre- and post-dietary behaviors among CC students completing a required HRF course.	
FV	Not rejected
Meal Patterns	Rejected
Sugar-Sweetened Beverages	Rejected
3. There will be no significant difference between pre- and post-body fat percentage among CC students completing a required HRF course.	Not Rejected
BMI	Rejected
Weight	Rejected

One possible explanation for the lack of changes in PA levels in this study could be changes in knowledge as to what constitutes moderate and strenuous PA. As part of the course curriculum, participants learned how PA is measured and defined according to moderate and strenuous levels. Curriculum activities involved calculating and measuring heart rate intensity as moderate or strenuous. Therefore, changes could have occurred in the participants' knowledge and perception of moderate and strenuous PA from pre- to post-survey. This is supported by Canning et al. (2014) who reported that subjects

underestimated both moderate and vigorous PA intensity efforts, with younger adults underestimating intensity levels more than middle-aged adults. Another possible explanation for the slight increase in strength activities is that the actual PA activities included in the course curriculum encompass a variety of activities and equipment that target strength development.

Much of the HRF course emphasis on PA involves increasing the knowledge of the importance of PA for promoting health and reducing the risk of chronic diseases. Students regularly participate in PA activities embedded in the course and are exposed to a variety of activities and equipment throughout the semester. However, strong emphases on strategies or skill development activities for PA participation outside of course are less common in the current HRF course curriculum. Participation in PA outside of the HRF course is discussed and encouraged, but not regularly assessed or reviewed with consistent accountability measures other than some self-reports. However, self-reported PA levels have been found to be less reliable in comparison to objective (accelerometer) measures as self-reporting tends to overestimate PA amounts (Downs et al., 2014; LeBlanc & Janssen, 2010; Troiano et al., 2007). Therefore, PA levels may actually be lower due to overestimates from self-reporting.

In addition to increasing PA behaviors, another emerging and important health emphasis is the reduction of sedentary behaviors. Katzmarzyk, Church, Craig, and Bouchard (2009) reported a dose–response association between time spent sitting and all-

cause mortality and CVD, independent of leisure time physical activity. They also recommended that physicians not only promote increasing PA levels, but also discourage extended periods of sitting or sedentary activity. Therefore, in this study, sedentary behaviors were also analyzed in addition to PA behaviors. The sedentary questions on the *College Student Health Survey* (Boynton Health Services, 2013) include the specification of time spent engaged in non-work or school-related activities, thereby providing a clearer picture of physical inactivity than more generic statements of screen time that do not differentiate between academic or work-related activities and leisure time activities.

The sedentary behaviors in this study focused on time spent: (a) watching television, (b) using a computer for non-work or school-related activities, and (c) using a handheld device for non-work or school-related activities. Results found that mean scores for each of the three sedentary behaviors declined pre- to post-survey, indicating improvement in participants reducing their sedentary time (see Table 5). However, no statistically significant differences were found for multivariate tests across time. Univariate tests of within-subjects contrasts did find a statistically significant decrease in time spent using a handheld device for something not work- or school-related with a medium effect (effect size $\eta^2 = .06$). The reduction in sedentary time is one step towards increasing the health of college students as increased physical inactivity has been linked with increased risks of many chronic diseases (cardiovascular, type 2 diabetes, and some

cancers) as well as mortality (Lee et al., 2012). In addition, the use of cell phones has been found to interfere with PA opportunities and reduce cardiorespiratory fitness among college students (Lepp, Barkley, Sanders, Rebold, & Gates, 2013).

Dietary Behaviors

Null Hypothesis 2 stated there would be no significant difference between pre- and post-dietary behaviors among CC students completing a required HRF course. In this study, dietary behaviors were analyzed by FV consumption, meal patterns (breakfast, fast food, restaurant eating), and intake of sugar-sweetened beverages. Results indicated a partial rejection of Null Hypothesis 2 (see Table 18).

For FV consumption, no significant changes were reported across the semester despite slight increases in mean scores for each of the five variables comprising the FV dietary category (100% fruit juice, fruit, potatoes, carrots, and other vegetables). This result is not consistent with the findings of Ha and Caine-Bish (2009), who concluded that a class-based nutrition intervention for college students resulted in increased FV consumption. Because nutrition is only a portion of the current HRF curriculum, perhaps the amount of time and appropriate activities were inadequate to stimulate changes in these students' FV behaviors. Nationally, 20.3% of young adults (aged 18 to 24 years) reported eating five of more FV per day as compared to 23.4% of adults (CDC, 2011). A recent report found that only 16% of two-year college students ate five or more FV per day (Boynton Health, 2013).

This study did reveal significant changes across the semester for meal patterns, the second of three dietary behaviors analyzed. Meal patterns included breakfast, fast food, and eating at restaurants. It is important to note that the mean score for breakfast increased significantly. Subjects in this study reported an increase in eating breakfast from 4.18 (pre-survey) to 4.64 days per week (post-survey). Both pre- and post-survey results were higher than the results of a study by Niemeier (2006) indicating that young adults (aged 18 to 27 years) ate breakfast an average of 3.1 days per week. The largest changes in breakfast eating occurred in zero days (8.4% pre vs. 2.6% post) and seven days (28.9% pre vs. 35.5% post). Analysis of changes in percentages seem to indicate a positive movement from zero to one day of breakfast eating to two, three, or four times per week; and those eating breakfast five or six times per week increased to eating breakfast daily.

Fast food consumption decreased across the semester, but not significantly. However, both of the changes in mean scores for breakfast and fast food consumption represent desired behaviors for improving overall dietary health. Fast food is often high in sodium, fats (saturated and trans fats), and/or calories that contribute to health conditions such as obesity and insulin resistance (Jacobs, 2006; Pereira et al., 2005). Study participants reported the largest reduction in fast food consumption on the weekly basis (1 and 2+ times per week; 60.6% pre vs. 47.4% post), while a few times a year and 1-to-2 times per month increased (33.7% pre vs. 47.4% post). This may indicate study

participants are not willing to completely give up fast food, but are willing to reduce their consumption frequency. Niemeier (2006) reported young adults consume fast food an average of 2.5 days per week, so the results of the current study are encouraging.

This study found a very slight increase across the semester in the mean scores for eating at restaurants. However, closer analysis of eating frequency among the various time frames found that weekly restaurant eating declined (42.2% pre vs. 35.5% post), while 1-to-2 times per month restaurant eating increased (37.3% vs. 50.0% post). As with fast food, this may indicate a willingness to reduce restaurant eating, but not eliminate it completely. One possible explanation for the slight mean increase could be that some students may have swapped eating at restaurants in place of fast food in an attempt to eat healthier and lower caloric intake. Foods at restaurants are not always healthier or lower in calories, but several of the HRF course activities involved information about the nutritional content of fast food items. Because the course curriculum contained more information about fast food, some students may have assumed eating at restaurants would be healthier. Therefore, it is important for HRF course instructors to include discussions and analysis of restaurant foods as well as fast foods.

Significant changes were also reported for sugar-sweetened beverage intake across the semester in this study. For the purposes of this study, sugar-sweetened beverages included soda, diet soda, fruit drinks, sports drinks, coffee drinks, and other sweetened beverages. Diet soda was included due to the sweet taste from artificial

sweeteners. Research indicates that despite the reduction of calories due to artificial sweeteners, artificial sweeteners do not aid weight loss efforts and may actually contribute to weight gain and potentially increase sugar cravings, sugar dependence, and appetite by stimulating a portion of the brain involved in the food reward pathways (Yang, 2010). Excessive sugar is now being connected to increased risk of cardiovascular disease, some cancers, type 2 diabetes, and obesity (Quinn & Lustig, 2011). The American Heart Association (2014b) recommend that American women consume no more than 100 calories per day (about 6 teaspoons per day) from sugar and for men, no more than 150 calories per day (about 9 teaspoons per day) from sugar. Based on these recommendations, many of the study participants are consuming much more sugar than is recommended for health.

In this study, sports drink consumption declined significantly. Many students may believe sports drinks are a healthier option due to advertising efforts focusing on the need for electrolytes when engaged in strenuous PA, especially for extended periods involving extensive sweating. However, according to national statistics, American adults are not engaging in high amounts of strenuous/vigorous PA; nor are high percentages of Americans involved in occupations involving extensive periods of sweating (e.g., landscaping during Texas summers), which may foster the need for sports drinks. Despite some benefits of sports drinks for a small segment of the population, sports drinks are often high in sugar.

Interestingly, sweetened coffee beverages increased almost significantly (p = .058) over the semester. One explanation is that some students may be exchanging energy drinks for coffee drinks to get the caffeine, but without some of the other ingredients included in energy drinks. The dangers of energy drinks are discussed as part of the HRF course curriculum. Energy drinks were not specifically stated in the questions, but could have been included in the "other sweetened beverages" category that did show a slight decrease from pre- to post-survey. Another possible explanation for the increase in coffee beverages is the enhanced advertising and availability of these beverages, especially on college campuses. Coffee beverages are bottled and sold cold along with other sugar-sweetened beverages in the campus bookstore, and popular coffee shops are often located in or near high-traffic areas including colleges and universities.

Body Composition

Null Hypothesis 3 stated there would be no significant difference between pre- and post-body fat percentage among CC students completing a required HRF course. Mean body fat percentages did increase slightly from pre- (22.77) to post-survey (23.21), but not significantly. Therefore, Null Hypothesis 3 was not rejected (see Table 18). The insignificant amount of body fat gained by the participants in this study may be viewed as progress as this finding is in contrast to several studies reporting significant increases in body fat among college students (Edmonds et al., 2008; Gropper et al., 2012; Hajhosseini et al., 2006; Wetter et al., 2013). One possible explanation for this finding is due to the

fact that the community college in this study does not have on-campus housing, and demographic data showed that 83.1% of students lived at home. Therefore, the majority of students in this study may not face some of the environmental influences that have been identified as barriers to weight management and healthier eating that many college students face. Some of these barriers include "all-you-can-eat" dining halls, snacking on high-fat convenience foods, "value sizing," increased access to convenience foods and fast foods at or near schools, and changes in dietary patterns due to more independent living (CDC, 2010a; Levitsky et al., 2004; Trust for America's Health, 2009). Therefore, efforts to eliminate or reduce some of these barriers may prove to be beneficial to college students in managing their dietary behaviors, body fat, and weight.

Despite the lack of significant increase in body fat, this study did find a significant increase in both BMI and weight. Although BMI was not included in a research question or hypothesis, the bioelectrical impedance instrument used in the study automatically calculated it. While unable to directly assess amounts of body fat, BMI is generally considered a valid indicator and screening tool for overweight and obesity and has been shown to correlate to direct body fat measures (CDC, 2011). Numerous studies have analyzed changes in weight and/or BMI of college students, with several studies reporting the college years as a time of increased weight gain among college students (Kasparek et al., 2008; Levitsky et al., 2004; Strong et al., 2008). However, weight and BMI cannot distinguish whether weight gained or lost may be due to changes in fat

versus changes in muscle mass. Gaining muscle helps burn additional calories and increases a person's metabolism (Hoeger & Hoeger, 2012). Because of the age of many college males, they could be maturing and gaining muscle, not fat, which would not be properly reflected with only weight or BMI measurements. Therefore, slowing the increase in body fat can be viewed as a positive result from the HRF course, particularly when compared to increases in body fat that have been noted in other studies of college students.

Qualitative Data: Student Perspectives

Qualitative question 1 explored participants' perceptions of the benefits of the HRF course. A large majority (96.1%) of participants reported they believed the HRF course to be beneficial to them. Examples of students' statements when asked to explain any benefits of the HRF course included:

- *The PHED 1164 course has been highly beneficial to me. I thought in the beginning taking this course would be all about exercising, but that's only partial. This class taught me so much more about health.*
- *Yes, I learned more about my fitness and health in a more detailed perspective, which allowed me to become more knowledgeable.*
- *Yes, the course taught me a lot about a healthy lifestyle and how it really impacts your life.*

- *I learned more than I thought I would have and I think I will use what I have learned later in life.*

The leading reasons given for the benefits included knowledge acquisition about health, PA, and diet-related knowledge (60.3%) followed by increased awareness and changes to dietary and PA behaviors. Knowledge acquisition is a major objective of the HRF course curriculum and is consistent with research over similar courses (D'Alonzo, Stevenson, & Davis, 2004; McCormick & Lockwood, 2006; Medero, 2012).

Qualitative question 2 focused on students' perceptions of effective course activities related to helping increase their PA. Curriculum activities involving the labs and the science supporting PA were the most frequently listed effective course activities. These comments pointed to the knowledge aspect of the course as indicated by this statement: *The science behind exercise really helped me understand standards I needed to reach when working out.* Perhaps the decline in PE and Health courses among K-12 has left a gap in the scientific knowledge among the current generation of college students regarding the many health benefits of PA. Additional effective course activities identified by students' focused on the skill-related aspect, such as participation in traditional activities involving cardiovascular fitness equipment, walking/running, and strength training equipment and activities (weight room). Other student responses revolved around the use of new equipment or activities to participants and a variety of activities, including individual as well as competitive team games and sports. The HRF

course curriculum tries to emphasize exposure and participation in a variety of activities, including activities and equipment popular in local health clubs. This emphasis on exposure and variety was confirmed in these student statements:

- *Going to the gym and being shown different PA is the most helpful. It shows people exercises they might not have known were out there*.
- *You can use just about anything to exercise*.

Several participants also reported diet-related activities, such as class lectures, as effective in helping to increase their PA behaviors. This result is consistent with research by Annesi and Porter (2013), who reported a transfer effect from primary weight-loss behaviors (exercise and healthy eating) and psychosocial variables (mood and self-regulation) among obese individuals.

Qualitative question 3 focused on effective course activities related to healthy dietary habits. The course curriculum activities involving dietary analysis and keeping a food log were viewed as effective. Student statements about effective course activities related to healthy dietary habits included:

- *Being educated about what types of food to eat as well as giving examples of healthy food*
- *The nutrition lab really helped me out because I was actually recording what I was eating and I was able to see what was unhealthy*.

- *I think the nutrition lab helped increase one's awareness of what they ate and how much they should be consuming.*
- *. . . when we went over the nutrition section in the book and went over food labels and how to read them. This helped me with my sodium intake and is getting me on track with being healthier.*

Additional class activities reported as helping to increase healthy dietary behaviors include nutrition lectures, video clips and movies, and examples of healthy foods. The textbook chapter on nutrition had the lowest percentage of responses, while PA activities and assessments were reported as the second highest percentage. An interesting and positive result is the mention of both PA and dietary behaviors positively influencing the opposite behavior (transfer effect) as reflected in qualitative questions 2 and 3. This suggests that students are engaged in critical thinking and supports the concept of the HRF students understanding the importance of both areas (PA and diet) on health. Some examples of statements included:

- *Working out in general can help with a healthy diet just because working out feels good in the end and you don't want to ruin it.*
- *Strength training requires a lot of energy, which means eating the right food.*

The fourth qualitative question explored students' suggestions on ways the HRF course could better assist CC students in increasing PA. Almost a quarter (24.7%) of

responses suggested increased class time spent actually working out rather than in the classroom and in lecture. Some of the comments given regarding this issue included:

- *Have more time to exercise and put the PowerPoints online so we have more time for physical and learning new ways to exercise*
- *Allowing the students to work out more during class hours*

Research indicates that PA dramatically declines into adolescence and adulthood (Caspersen, Pereira, & Curran, 2000; Gordon-Larsen, Nelson, & Popkin, 2004; Gordon-Larsen, Adair, Nelson, & Popkin, 2004; Troiano et al., 2007). College students, especially women and minorities, often struggle with adequate amounts of PA necessary for health benefits (American College Health Association, 2013; Blanchard et al., 2008; Boynton Health Survey, 2013; Han et al., 2008; Irwin, 2004; McMahah et al., 2007). The HRF course is focused on building knowledge of the importance of PA in reducing chronic diseases, PA intensity measurement, and exposure to a variety of activities and inexpensive equipment designed to promote a lifetime of PA. The challenge for instructors is to balance the exposure and presentation of lecture material to increase knowledge and still provide opportunities for active participation in PA. Perhaps more effort should be placed on finding ways to "flip the classroom" where more of the knowledge activities are assigned outside of class time so more time can be devoted to actual workout activities during class hours. Another option could be to develop class

activities that incorporate simultaneous movement with knowledge acquisition in place of the current format of classroom lecture followed by a PA workout session.

Aside from the suggestion of increased workout time, other student suggestions included offering a variety of activities, including sports and competitive games. Increased personal instruction on working out properly was also suggested. Furthermore, several students addressed the concept of personal motivation and responsibility regarding diet and lifestyle choices along with student motivation and responsibility as illustrated by this statement: *Don't just exercise when the class does, get out & be active if you want to increase your PA*.

To address stronger skill development and accountability of PA outside of the HRF course, perhaps more emphasis should be focused on helping students learn how to overcome barriers, strategize, and develop skills necessary for participating in PA outside of the actual class (NASPE, 2007). The use of technology, such as accelerometers or pedometers, could provide a more reliable method for assessing and reviewing PA activities outside of the HRF course. The use of easily accessible accelerometers can provide immediate feedback and serve as a motivational tool, potentially increasing PA and reducing sedentary periods of time. This is important because sedentary time, independent of leisure time PA, has been associated with increased mortality and CVD (Katzmarzyk et al., 2009). In addition to the knowledge of chronic disease risk reduction, perhaps more emphasis should be focused on the benefits of PA to relieve stress and

enhance academic endeavors and learning as these are two areas of particular interest to many college students. The topics of PA as a stress reliever and the effects on brain function and learning are both presented as part of the HRF curriculum. However, perhaps more and earlier emphasis of the importance of PA in these two areas should be emphasized as stress management is addressed around week 12 (16-week semester), and PA effects on the brain and learning are only briefly addressed.

Lack of time has been reported as a major barrier to PA among college students (Ebben & Brudzynski, 2008). In the current study, a high percentage of participants (80.5%) reported working off-campus with almost half (48.8%) working 21-40 hours per week. The number of hours working combined with school responsibilities provides little free time for many students. Therefore, HRF courses should emphasize time management assignments, strategies, and skill development to help students learn not only why, but also *how* to increase PA as part of their busy lives. This concept was also mentioned by a student who stated: *Perhaps show students how to manage their time and still have time to exercise because lots of students have jobs also*.

Qualitative question 5 explored students' suggestions for ways the HRF course can help increase healthy dietary behaviors. The course curriculum activities involving the individual diet analysis and food log along with the health influences and consequences were mentioned. However, students desired additional information in the areas of increased examples of healthy foods, preparation techniques, healthy eating

strategies, more time for this topic and diet planning, as well as suggestions for decreasing and/or eliminating fast foods and vending machine availability. Examples of comments on this topic include:

- *I think it would help if instructors taught students alternative recipes to the foods we already eat.*
- *Giving examples of healthy foods that are at a good price range and where to buy them*
- *Teach students that eating healthy doesn't have to be nasty.*

Providing time, content, and practice to increase knowledge and skills for identifying, planning, and preparing healthier foods can provide important information for college students as the food habits established during the college years often become lifelong habits influencing the health of these young adults as well as their future families (American Institute for Cancer Research, 2011). Research of the college population, especially the first two years, indicates that few students eat the recommended servings of FV and consume high amounts of fast food and fried foods that often contribute to obesity (American College Health Association, 2013; Racette et al., 2005; Sparling, 2007). Due to the low consumption and lack of changes in FV consumption, perhaps the HRF course can emphasize more strategies for shopping and preparing FV in a variety of healthy methods. As suggested earlier with PA, this would support the recommendations

for HRF courses to emphasize strategies and skill development to help students learn not only why, but also how to eat healthier as part of their busy lives.

The final qualitative question asked for suggestions on the sustainability of the PA and healthy dietary behaviors developed during the HRF course. Three major themes emerged from the responses: (1) tracking, practicing, and planning diet and PA; (2) motivation and support; and (3) continued education and knowledge acquisition plus constant reminders of healthy behaviors. Examples of student comments include the following:

- *Make a workout schedule for yourself and write down everything you eat.*
- *By giving them the every day easy choices and promet [sic] more in the schools!*
- *Installing vending machines with more water and healthier snacks could help students sustain their healthy dietary behavior.*
- *Learning more in detail about the items we put in our body's [sic] & more detail about certain physical activities.*

In addition to these three major themes, a small number of students also mentioned personal responsibility. For example:

- *That's really up to the student. initializing [sic] the change is all the class can do. Post class behaviors is [sic] impossible to dictate.*

- *You can inform the student of how they take care of their health. It is really up to the student if they choose to keep a fit & healthy lifestyle after the course*.

The curriculum activities appear to involve all of the major themes identified by students to some degree. Students appear to believe that additional strategies and practice are necessary if they are to sustain PA and healthy dietary behaviors. To potentially assist with tracking, planning, and motivation, perhaps inclusion of technology such as affordable accelerometers and smart phone apps can be integrated into the HRF curriculum. Currently, the HRF instructors often promote registration in elective PA courses offered by the PE department to enhance participation, motivation, and continued knowledge acquisition in both individual fitness as well as sports activities (e.g. weight training, yoga, basketball). Some colleges and universities require students to enroll in one to two PA courses focused on a specific activity or group of activities following or in conjunction with the HRF course. However, the reduction in the total number of credits required for graduation have made this option more difficult and has resulted in many colleges and universities dropping the HRF course as well. Ultimately, it behooves HRF instructors to implement additional activities that show promise for promoting the sustainability of these health-promoting behaviors.

Students seem to desire not only knowledge and personal application of that knowledge, but also continued support and motivation from their environments.

Furthermore, students' sustainability suggestions are consistent with several strategies supported by the American Heart Association (2012). The AHA has identified six optimal population-level approaches to promote PA and healthier dietary habits including: (1) media and educational campaigns; (2) labeling and consumer information; (3) taxation, subsidies, and other economic incentives; (4) school and workplace approaches; (5) local environmental changes; and (6) direct restrictions and mandates. Organizations such as the WHO and the CDC continue to promote multi-level approaches to improve PA and healthy dietary behaviors, such as the *Global Strategy on Diet, Physical Activity and Health: Obesity and Overweight (WHO, 2004).*

Health Education Areas of Responsibility

Besides adding to the body of knowledge for HRF courses and the SoTL, this study also addresses the Areas of Responsibility developed and promoted by the National Commission for Health Education Credentialing, Inc. [NCHEC]. The seven areas of responsibility, along with competencies and sub-competencies, are used to define the role and responsibilities of a health educator. The seven areas of responsibility include:

- Area I: Assess Individual and Community Needs for Health Education
- Area II: Plan Health Education Strategies, Interventions, and Programs
- Area III: Implement Health Education Strategies, Interventions, and Programs
- Area IV: Conduct Evaluation and Research Related to Health Education
- Area V: Administer Health Education Strategies, Interventions, and Programs

- Area VI: Serve as a Health Education Resource Person
- Area VII: Communicate and Advocate for Health and Health Education (NCHEC, 2010)

This study provided an opportunity to assess the health behaviors of college-aged students, evaluate the HRF curricula, and conduct research related to health education. The published results from this study can help with future planning, implementation, evaluation, and administration of HRF courses and enhance efforts to communicate and advocate for health and health education in the CC environment.

Recommendations

This study limited participation to students aged 18-34 years. Future recommendations include expanding the age range to accommodate older students because there may be differences in the perceived course benefits, effective activities, and recommendations for changing PA and dietary behaviors with different age groups. This is especially true for community colleges as they often have a sizeable number of nontraditional students. Other recommendations include analysis to determine whether there are any significant gender or ethnic differences in the areas of this study. It is important to address any unique needs, challenges, and effective strategies for these sub-groups. Another recommendation involves comparing four-year college students and CC students on these health behaviors, as there may be important differences between these

two groups. Future research can also examine whether attendance and grades in an HRF course and distance traveled to and from campus impact these health behaviors. Conducting longitudinal studies to analyze any long-term influences of the HRF course on students' health behaviors over various periods of time is also critically important. After all, the ultimate goal of any HRF course is a long-term positive influence on the health of college students. Therefore, research on specific sustainability strategies and the necessary skill development will be crucial.

Another recommendation is to include the use of focus groups as part of the qualitative research. Focus groups provide an opportunity to gather descriptive information not readily available from the quantitative data and yield more in-depth information of participants' perceptions, beliefs, attitudes, and experiences (CDC, 2008). Focus groups can provide an opportunity to ask follow-up questions to gather additional information about the effectiveness of specific course strategies as well as suggestions for improving the course. The use of focus groups can be especially helpful in discussing strategies for sustaining the new behaviors learned as part of the HRF course.

The current study used self-reported PA levels. Self-reported (subjective) PA levels have been found to be higher as compared to objective (accelerometer) measures, with a poor correlation between these measures (Downs et al., 2014; LeBlanc & Janssen, 2010; Troiano et al., 2007). Therefore, another recommendation includes using objective

measures, such as accelerometers, in place of or in addition to self-reports to enhance the measurement accuracy of PA levels.

Another problem in measuring PA across time and populations is the variance in measurement tools for measuring PA in survey formats. The use of various PA measurement tools provides variety, yet creates consistency and comparison problems when comparing different studies or reports using different PA measurement tools. One recommendation includes developing a valid and reliable PA questionnaire based upon the PAG recommendations. Furthermore, because all body fat measurement techniques have a margin of error, using additional body fat measurement techniques, such as skin fold calipers with trained and experienced experts or hydrostatic weighing, can enhance the accuracy of body fat measurement utilized in this study. Another recommendation includes adding the specific category of energy drinks to the analysis of sugar-sweetened beverages as these drinks are often popular among college students.

Despite the limitation of this study in using a purposeful, nonrandom sample with limited external validity where study results cannot be generalized, this study adds to the body of knowledge related to HRF courses and their influence on college students' health behaviors. This study is unique in that it contributes to the literature by including students' perceptions of the HRF course, including effective curriculum activities and suggestions for improving PA and healthy dietary behaviors. This study also adds to health research on a neglected population. Continued research on the college population

is important, as they are our future leaders. College students are often assumed to be healthy, yet research indicates they are actually at risk for a variety of health issues (Burke et al., 2009; Dalleck & Kjelland, 2012; Morrell et al., 2012; Sacheck et al., 2010).

The HRF course is often the *only* and last area in the college curriculum to address the health and health behaviors of college students. Therefore, Health and PE professionals must be willing to critically look at the curriculum and strategies used in HRF courses to make these courses as effective as possible. Higher expectations, along with more stringent evaluation methods, are being placed on higher education in an effort to provide a more valuable educational product and engage in ongoing assessment and institutional improvement. Therefore, if HRF courses are to survive, they must show they are effective.

This study indicates that students believe the HRF course is beneficial and that it is effective in positively influencing some behavioral changes. However, more work is necessary to assist students in making additional behavioral changes and then to sustain those changes over time. The results from this study and other research can provide HRF course instructors with additional knowledge and curriculum ideas and strategies for improving college students' health behaviors. Utilizing research-based principles to evaluate teaching and learning and publishing the findings, as promoted by SoTL, can broaden and advance the body of knowledge to help produce more effective HRF courses that can better assist college students in changing health behaviors. In addition, the HRF

curriculum addresses many of the NCHEC Areas of Responsibility for quality health education. According to the WHO (2010), PA and unhealthy diets are major modifiable factors that influence a variety of chronic health issues. Due to mandated reductions in required curriculum hours, budget cuts, and falling educational rankings, required HRF courses are being eliminated on many campuses. Yet, effective HRF courses are indispensable in the development of the physical, mental, financial, and academic health of college students. Utilizing SoTL principles can help health and PE professionals enhance and promote HRF courses so they meet the critical objective of assisting college students improve their health behaviors, thus helping to promote a healthier future for these students and the nation as a whole.

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APPENDIX A

Approval Email from Tarrant County College

From: DAY, TERRI
Sent: Wednesday, August 14, 2013 1:46 PM
To: EVANS, MELISSA
Subject: RE: research study question

Hi Melissa,

Thanks for letting us know. I will put this email in your file to note the modification. No need for additional signatures. Please contact me if you have any additional questions.

Terri Day, PhD
Executive Director of Institutional Research, Planning and Effectiveness
Tarrant County College District | Office: TREF 5340T
300 Trinity Campus Circle | Fort Worth, TX 76102
817-515-1514 | Fax 817-515-0759
terri.day@tccd.edu | www.tccd.edu

From: EVANS, MELISSA
Sent: Wednesday, August 14, 2013 12:21 PM
To: DAY, TERRI
Subject: research study question

Hi Terri,

I submitted and was approved for my dissertation study several months back with a planned start at the beginning of the fall semester. Originally, I planned to do a pre- and post-survey with focus groups. If I now wanted to adjust my study to eliminate the focus groups and use open-ended questions (using the same questions from the focus group proposal) in the final survey, would I need to resubmit my research proposal? The only major difference is the way I will ask the questions (no focus group and use written questions added to the post-survey). Can you approve that or will I need all the signatures again? Thanks and have a great day!

Melissa Evans
Assistant Professor Health & Physical Education
Tarrant County College Southeast
2100 Southeast Parkway | Arlington, Texas 76018
Office: ESEC 1521A
Phone: 817-515-3601 | Fax 817-515-3944
melissa.evans@tccd.edu www.tccd.edu

APPENDIX B

Approval Letter from Texas Woman's University

TWU
TEXAS WOMAN'S UNIVERSITY
DENTON DALLAS HOUSTON

Institutional Review Board
Office of Research and Sponsored Programs
P.O. Box 425619, Denton, TX 76204-5619
940-898-3378 FAX 940-898-4416
e-mail: IRB@twu.edu

August 26, 2013

Ms. Melissa S. Evans
[redacted]

Dear Ms. Evans:

Re: Effectiveness of a Required Health-Related Fitness Course on Physical Activity and Dietary Behaviors Among Community College Students (Protocol#: 17444)

The above referenced study has been reviewed by the TWU Institutional Review Board (IRB) and was determined to be exempt from further review.

If applicable, agency approval letters must be submitted to the IRB upon receipt PRIOR to any data collection at that agency. Because a signed consent form is not required for exempt studies, the filing of signatures of participants with the TWU IRB is not necessary.

Any modifications to this study must be submitted for review to the IRB using the Modification Request Form. Additionally, the IRB must be notified immediately of any unanticipated incidents. If you have any questions, please contact the TWU IRB.

Sincerely,

Rhonda R Buckley

Dr. Rhonda Buckley, Chair
Institutional Review Board - Denton

APPENDIX C

Permission to Use Boynton Survey Questions

EVANS, MELISSA

From: Lust, Katherine <KLust@bhs.umn.edu>
Sent: Monday, May 02, 2011 7:48 AM
To: EVANS, MELISSA
Subject: RE: College Student Health Survey information

Hi Melissa:

You are free to use that section of the survey, the only stipulation is that you give Boynton Health Service credit for the survey questions. The two questions regarding personal safety are not in the Nutrition Physical Activity section, there is an error in the PDF which I will get corrected this week.

Good luck on the dissertation.

Katie

Katherine Lust, PhD, MPH, RD
Director of Research
Boynton Health Service-University of Minnesota

410 Church Street S.E.. N217