EFFECT OF COURSE DELIVERY MODES ON PHYSICAL ACTIVITY LEVELS: FACE-TO-FACE VS. ONLINE

by

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ABSTRACT

EFFECT OF COURSE DELIVERY MODES ON PHYSICAL

ACTIVITY LEVELS: FACE-TO-FACE

VS. ONLINE

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The purpose of this study was to determine physical activity levels in students enrolled in a walk/jog class that was delivered online and in a traditional face to face environment. Differences in voluntary exercise intensity and duration between the two delivery modes were examined as they specifically related to fulfilling the course requirements. Overall activity levels were determined for a 7 day period. Forty-three college students [mean (±SD) age: 24.7 ± 8.2 years; height: 65.7 ± 3.5 in; weight: 73.5 ± 17 kg] enrolled in a walk for fitness or walk for fitness class at the university level volunteered for the study. Subjects enrolled at the time of the study in an online or face-to-face section of walk/jog for fitness were recruited and classified into one of two groups [online group (n=18) and an on campus group (n=25)] based on their enrollment status. The subjects wore the accelerometer for a seven-day period and wore the polar heart rate chest strap only when they participated in their exercise for their designated class. There

was no significant difference in the amount of MVPA between the groups related to fulfilling the requirements of the course. A purposeful bout of exercise lasted 34.1 ± 10.4 minutes in the face-to-face class and 36.2 ± 21.3 minutes in the online class. Interestingly when the entire day was examined and not just class time, significant difference between the two groups existed on the amount of moderate to vigorous physical activity they achieved on a class day ($p=0.034$) with online getting 114.5 ± 94.5 minutes of MVPA and on campus getting 173.4 ± 80.5 minutes of MVPA. However, there were no significant differences between groups in their total week, during class, or non-class day spent in the moderate to vigorous range of physical activity. However both groups got significantly more physical activity on days they were fulfilling the course requirements (non-class day vs. class day).

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CHAPTER 1

INTRODUCTION

Over the last few decades, the levels of adult and childhood obesity in the United States have dramatically increased. [3,17,42,45,70,82] While poor nutrition has been found to be a contributing factor to this growing epidemic, the increasing prevalence of a sedentary lifestyle is also a major factor. Participation in regular physical activity has been shown to reduce a person's likelihood of becoming obese[46]. According to the Center of Disease Control and Prevention (CDC), forty percent of adults above the age of eighteen participate in no consistent leisure-time physical activity and only fifteen percent of adults participate in regular moderate to vigorous physical activity.[8,9]

According to Steele, Mummery, and Dwyer[60], "sufficient" physical activity was defined as participating in a minimum of 150 minutes per week of activity. The recommendations of the CDC reinforce this definition by suggesting a person participate in 150 minutes of moderate aerobic activity or 75 minutes of vigorous physical activity per week.[8,9] An increase in prevalence of sedentary behavior is exacerbated as schools and universities reduce physical activity requirements as part of the curriculum. One of the pressures dictating revision of core curriculum across the nation is related to the escalating costs of a K-12 and university education.

With the growth in technology, internet-based applications have been shown to have the potential to reach large numbers of the population, and offer the advantages of convenience, flexibility, and reduced costs. According to Steele, Mummery, and Dwyer[60], only a few studies have examined the efficacy of the Internet in producing physical activity behavior changes to date. There have been no studies reported to the investigators knowledge that have

examined the effectiveness of the Internet for physical activity behavior change compared to traditional approaches like face-to-face program delivery.

The purpose of this study was to examine differences in physical activity levels related to course delivery mode in college students enrolled in either an online of face-to-face section of the walk/jog for fitness class. More specifically, is there a difference in voluntary exercise intensity and duration between subjects enrolled in either online or face-to-face walk/ jog for fitness classes?

1.1 Definition of Terms

Accelerometry – The quantitative determination of acceleration and deceleration in the entire human body or a part of the body in the performance of a task.

MVPA – Moderate to vigorous physical activity; Activity that requires considerable amount of energy expenditure; ranges from 3.0 METs to above 9.0 METs; sum of moderate, vigorous, and very vigorous physical activity

Obesity – BMI 30kg/m^2 or higher

Acceleration – change in velocity over time; expressed in terms of gravitational force (ft/s^2)[75]

MET – metabolic equivalent used to describe resting metabolism;1MET= 3.5 mL O_2/kg per minute

Class Day – A day in which subjects exercise for their class workout; for online subjects, this day would be any day that they logged a workout for their class; for on campus subjects, this would be the days (Monday and Wednesday) that the participated in their scheduled class workouts

CHAPTER 2

REVIEW OF LITERATURE

2.1 Obesity Epidemic

2.1.1. Progression of Obesity

Obesity is a disease, according to the World Health Organization, and is defined as the impairment of health due to the condition of excess body fat.[70] Obesity is assessed by having a body mass index of greater than/or equal to 30kg/m^2.[1,27,29,41,42,71] Body mass index is closely correlated with body fat and obesity-related health consequences and is calculated from height and weight (Table 3.1).[41,42,70] The International Obesity Task Force (IOTF) suggested that, in 2004, at least 1.1 billion adults were overweight and 312 million were obese.[27] Twenty to thirty percent of adults were categorized as clinically obese in Europe.[27]

Increasingly high rates of obesity have emerged in the United States throughout the past decades.[3,17,42,70,82] For instance, obesity rates hovered around 10-15% of the population in the early 1980s. However in the last 30 years a steady increase in obesity rates has occurred such that today obesity rates are in excess of 30% in much of the country[41] Projection models made by Wang et al[71] estimate that by the year 2030, if the same increases are observed, ~90% of all American adults will be overweight or obese and 51.1% of those would be obese. Many causes and factors contributing to this rise in obesity throughout the United States must be evaluated to determine appropriate measures for not only decreasing the levels of obesity, but also for preventing any further increase.

2.1.2. Causes of Obesity

Variations exist between the contributing factors of obesity but Pi-Sumyer[52] attributes ~30% to 40% of the variance in BMI to genetics and the remaining 60%-70% to the environment. In the United States and other Western Countries, adverse environmental conditions like sedentary lifestyles and availability of foods with high-fat diets are thought to be a major contributing factor in the prevalence and rise of obesity.[52]

Genetics role in obesity can be seen by studying twins and weight such as a study conducted by Bouchard, Tremblay, Despres, et al, in which, groups of identical young-adult male-twins were overfed by 1000kcal/d over a period of 100 days.[52] The weight gain among participants ranged while the variance was significantly lower within the pairs of twins than among the pairs of twins.[52] Another study that illustrates the role of genetics was a study conducted by Stunkard, Berkowitz, Stallings, and Carter, which classified 540 adoptees as thin, median, overweight, or obese.[52] It was found that the weight class was unrelated to the BMI of their adoptive parents but strongly related to the BMI of their biological parents.[52]

An example of environmental contribution to the obesity of individuals is seen in study of Pima Indians. Pima Indians, who reside in Arizona, have among the highest prevalence of obesity.[52] There are two groups of Pima Indians, one resides in Arizona and the other in a remote section of Mexico, which were separate ~700-1000 years ago and now have different diets and energy expenditures in accordance with their environment. The study found that Pima Indians that lived in Mexico according to their traditional lifestyle had significantly lower BMI than those that lived in Arizona. Because the Pima Indians that lived in Mexico had greater energy expenditure and ate less animal fat along with more complex carbohydrates, they did not achieve BMIs as great as the Pima Indians who resided in Arizona.[52] As illustrated by this study, although populations may have a similar genetic make-up, environment contributes to the obesity rates seen in that population as well.

The lack of physical activity can be viewed as both a cause and a consequence of obesity. Individuals with high BMIs tend to partake in less physical activity which causes an increase in their BMI and further decrease in the amount of physical activity that they participate in. In Australia, a decline in physical activity has been observed with 62% partaking in 30 minutes of moderate physical activity daily in 1997 to 57% in 2000.[61] Achieving a healthy body weight is a combination of maintaining and sustaining a physically active lifestyle.[29,45] In a study conducted by Janssen et al[28], youth who were overweight participated in lower physical activity levels and higher amounts of television watching than normal weight children.[55]

2.1.3. Combating Obesity

Hill et al[24] estimate that weight gain in a majority of the population could be prevented by affecting energy balance by 100kcals per day through a combination of reductions in energy intake and increases in physical activity. Stubbs and Lee[61]indicate that physical activity and nutrition must be addressed together in order to counteract obesity. They suggest a national, coordinated, systematic approach to monitoring and addressing physical activity, dietary intake, and prevalence of overweight and obesity as being essential in providing informative feedback and interventions.[40,61] Hill and Peters[23] have offered suggestions such as control of portion size, regular physical activity, and altering diets to be low in fat and energy density as a means of protecting against obesity. Prevention is the key when combating obesity, of which, physical activity is a key component.[24,46]

2.2 Physical Activity

2.2.1. Past Recommendations

In a study conducted by Paffenbarger et al[48], it was found that men who expended 3500kcal per week or more, which was considered the most active, had half the risk of death as the least active. Men who engaged in moderately vigorous sports were found to have a higher physical-activity index and lower risk of death associated with a physically active lifestyle.[48] This

article noted that further information was needed to ascertain which kinds of physical activity should be promoted, the quantity of activity, the intensity of the activity, and the population for whom these recommendations are appropriate.[48] In 1995, the Centers for Disease Control and Prevention along with the American College of Sports Medicine recommended that every US adult should accumulate 30 minutes or more of moderate-intensity physical activity on most days of the week, preferably all.[50] The objective of this public health recommendation was to encourage participation in physical activity and increase this participation.[21,50] In 2005, nearly 25% of adults reported no leisure-time activity.[21] During data collected in 2005, less than half (49.1%) of adults in the United States met the physical activity recommendations set forth by the Center for Disease Control and Prevention and the American College of Sports Medicine.[21] This data found that younger people were more active than older people, while women were less likely to meet the recommendations than men, being 47.9% and 50.7% respectively.[21] The updated 1995 recommendation apply to healthy adults between 18 and 65 years old and people in this range with chronic conditions that do not relate to physical activity.[21] These recommendations are preventive measures that promote health and reduce risk of chronic disease and premature mortality.[21] Evidence for lower rates of cardiovascular disease in individuals who are physically active is substantial.[56] Although the exact dose-response curve is not well defined, the additional risk reduction in men and women is associated with increased amounts of physical activity.[56] It is recommended that adults participate in moderate-intensity aerobic physical activity for a minimum of 30 minutes for five days a week or vigorous-intensity aerobic activity for a minimum of 20 minutes for three days of the week.[21,22,26] Combinations of moderate and vigorous activity can be performed to achieve the recommended amounts of physical activity for the week. According to Nader et al[44] children need a minimum of 60 minutes of moderate-to-vigorous activity per day. Moderate-intensity aerobic activity is equivalent to a brisk walk and increase in heart rates at bouts of 10 minutes or longer.[21] The clarifications to the

1995 recommendations include the identification of five days per week as the recommended minimum, vigorous intensity activity has been identified and discussed, and that moderate and vigorous activities can be used in conjunction with each other to achieve the recommended amounts of physical activity.[21] These updated recommendations clarify that the aerobic activity is in addition to the activities performed in daily tasks which consist of light intensity activities.[21] Participating in exercise beyond the recommended amounts provides greater health benefits but the maximum benefit has not been determined for most health benefits.[21] In the recommendations established in 1995, there was confusion in terms of the minimum length of time that could be added toward the 30 minute goal.[21] To clarify, exercise bouts must consist of a minimum of 10 minutes to be counted toward the thirty minute goal.[21] In a study conducted by Weinstein et al[73], active women displayed a significant difference between normal-weight women and overweight or obese women. Being physically active was found to be associated with a reduction in risk of cardiovascular disease by greater than 50%.[72] The protective effects were seen with as little physical activity as walking 1 hour per week.[72] Evidence has suggested that the intensity of physical activity is both linearly and inversely related with mortality.[72]

2.2.2. Recommended Levels of Physical Activity

Moderately intense activities, defined as $\geq$ 5.5 METs by Warburton et al[72], for at least 40 minutes per week are effective strategies in preventing type 2 diabetes. In patients with type 2 diabetes, a reduction in the risk of premature death was seen with walking more than 2 hours per week.[72] In 2008, federal physical activity guidelines were set forth that require at least 150 minutes per week of moderate or 75 minutes per week of vigorous intensity aerobic physical activity.[56,65] It also recommends that additional benefits may be seen in health with up to 300 minutes per week of moderate activity or 150 minutes per week of vigorous aerobic physical activity.[56,60] The most physically active people are at the lowest risk but the greatest improvement is seen when less fit people become physically active.[26,51,72] Women with high

occupational physical activity displayed a 22% reduction in risk in all cause mortality.[4] Women who spent fifteen minutes or more daily walking or cycling to and from work had lower rates of cardiovascular disease and all-cause mortality than did women with low levels of activity achieved in commuting to and from work.[4]

2.2.3. Activities to Increase Physical Fitness

A study conducted by Wennberg et al[79] found that low occupational physical activity was seen among women. Car commuters, more common for men, were found to have higher BMI which was associated with higher mean cholesterol.[79] An association was discovered between occupational physical activity and myocardial infarction.[79] High physical activity during leisure time was found to have a protective effect.[79] Promoting occupational physical activity can aide in the prevention of premature CVD and all-cause mortality.[4]

In a study conducted by Nelson[45] in 2005, high school males were found to participate in larger amounts of physical activities than females. Although males did achieve higher amounts of physical activity, neither group was achieving enough physical activity.[45] A study conducted using students ages 9-10 also found that overall time spent participating in moderate-to-vigorous physical activity was significantly higher ($p<0.001$) in boys than girls.[68] Descriptive patterns and levels of physical activity assessed using valid and reliable means for large population-based samples is scarce.[68] Studies have indicated that a decline in physical activity occurs with age.[68]

In a study conducted by Puyau et al[53], moderate activities used to increase physical activity were ten minutes of Tae Bo exercises, twenty minutes of playtime, and ten minutes of walking at a speed of 4 mph for 8-16 year olds. Playtime consisted of numerous activities such as jumping jacks, basketball, and hula hoop.[53] Vigorous activity was seen in jogging, jumping rope, walking, skipping, and playing soccer. These activities provide examples of what categories of intensity each activity would be considered.

2.3 Measuring Physical Activity

2.3.1. Accelerometry

Accelerometry is used to monitor the physical activity in free-living subjects.[3,5,32,39,43,49,65,68,77] They are tools used to monitor gait, postural sway, falls, and physical activity levels.[39,43] The development of portable accelerometers is that objective measurement of physical activity levels in free-living conditions was made possible.[5,6,10,32,44,75,77,78] Data collected from wearing accelerometers can be collected and stored for a considerable amount of time.[75] Although accelerometers have been used over the past 30 years, the growth in technology and sophistication of accelerometers has increased drastically over the past 10 years.[19,75] Accelerometers provide a pattern of movement based on the rate at which distances are covered.[75] Position of monitor placement on the body does not influence the prediction of energy expenditure.[75] Although differences may exist in the ability of the accelerometer to pick up all movement at various sites, they are reasonable accurate for measuring locomotor movement.[75] Using three-dimensional accelerometers reduces the amount of error that may be found in the positioning of the accelerometer on the subjects' body.[75] Data collection intervals of 60 seconds allow for the maximum capacity of data collection within 10 to 30 days.[13,75] The Computer Science and Applications (CSA) monitor is the most widely used accelerometer in research involving physical activity today.[75] The beginning of data collection occurs with an initialization process which is done on a computer using the accelerometer software.[75] Ensuring that the accelerometers are securely positioned tightly against the body allows for the most reproducible and accurate results to be obtained.[75] These accelerometers do not interfere with daily lifestyle activities, which ensures an accurate measurement of the daily activity of the subject.[75] Calibration refers to the conversion of counts into other established measurement units.[76] This calibration can be conducted to determine thresholds for sedentary, light, moderate, and vigorous physical activity.[63] MET thresholds used in the calibration process allow

for distribution of time in activity levels to be determined, with light (< 3METs), moderate (3 to 6 METs), vigorous (6 to 9 METs), and very vigorous (>9METs) respectively.[44,53,65,66] Activities representing sedentary, light, moderate, and vigorous intensities were minimal body movement, standing, low level exertion activities in standing position, walking briskly, and jogging, respectively.[53] According to Nader et al[44], no single accepted protocol has been used across studies as a means of setting accelerometer cut off points in activity levels. Differences observed between monitors were primarily attributed to differences in the accuracy of the calibration equations.[77] The relationship between CSA counts and VO_2 and the relationship between velocity and counts in the field were both found to be linear in a study by Nichols et al.[47]

In a study conducted by Page et al[49] subjects wore an accelerometer during waking hours for a seven day period. Based on the amount of literature referencing a seven-day "wear time" period, this protocol was used to ensure adequate amounts of data for analysis were available for the current study.[13,30,32,37,44,66,68] In a study by Treuth et al[64] subjects wore an accelerometer, which was used for the criterion for validity, for three consecutive days. Treuth, Hou, Young, and Maynard[63] conducted a study that found that greater body fat was associated with greater time spent being inactive. Cooper et al[13] found that differences in activity level were significant when comparing obese participants to non-obese participants.

2.3.2. Validation of Accelerometry

Accelerometers have been found to be both reliable and valid forms of measuring physical activity.[14,65,66] The CSA monitor was significantly correlated with scaled oxygen uptake for all activities, r=0.69.[14] Dale, Corbin, and Dale[14] found correlations between CSA counts·min^{-1} and oxygen uptake and heart rate. Although the gold standard for measuring energy expenditure in free-living environments is doubly labeled water, the CSA monitor is a valid and reliable instrument in assessing intensity of physical activity.[14,33] The CSA monitor was shown to

have acceptable reliability for most research application by Welk, Schaben, and Morrow.[78] The national Health and Nutrition Examination Survey (NHANES) began the use of accelerometers to objectively assess physical activity in 2003 with support from the National Cancer Institute of the National Institutes of Health.[44,65] The first objective measures of physical activity for the population of the United States was from accelerometer data collected in the 2003-2004 NHANES.[65] Accelerometry is a valuable instrument in assessing physical activity patterns on a minute-to-minute basis.[13]

2.4 Teaching Formats

2.4.1. Online Interventions

Web based teaching methodologies have been shown to have the potential for reaching large amounts of people while being convenient, flexible with time constraints, and reducing costs.[10,60] A few studies have examined the relationship between Internet interventions and their production of behavior changes in physical activity.[60] To our knowledge there has been no study that compared the effectiveness of online delivery of a walk/jog for fitness class in promoting physical activity. There have been even fewer studies to the investigators' knowledge that have compared web-based PA behavior changes to traditional classes such as face-to-face programs.[60] Steele, Mummer, and Dwyer[60] found that changes in physical activity were similar between intervention delivery modes. Web-delivered messages provide a means of delivering tailored messages aimed at achieving positive behavioral effects.[54] Woolf et al[80] suggest that offering a web site for the ability to administer vast amounts of information to patients. The question still remains whether or not the use of a web site with no further follow-up will result in adequate lifestyle changes for subjects' enrolled.[80] The use of computer-tailored interventions to mimic face-to-face counseling was evaluated by Spittaels and Bourdeaudhuij.[59] When evaluating the participation in the computer-tailored physical activity intervention, more women participated then men and more adults of medium socioeconomic status(SES) participated than

low SES.[59] The programs' aim was to reach all underserved populations, which it did not accomplish.[59] In a study conducted by Wagoner and Wijekumar[69], web-based course students in an online journaling class aimed at improving self awareness and lifestyle practices were found to have posted significantly higher ($p<0.001$) personal experiences than did their traditional classroom counterparts with which they were compared. Kosma et al[31] investigated a web based Leisure Time Physical Activity (LTPA) motivational program for physically inactive adults with disabilities that were physical in nature. In the study, no significant differences were observed between the two groups.[31] However, the experimental group that received web-based interventions did progress to a higher stage.[31] Carr et al[7] conducted research to determine if an internet-delivered physical activity intervention would increase short term physical activity and long term adherence. This study confirmed the notion that short-term increase in PA (~16%) was occurring in the web-based intervention.[7] Long term adherence, however, was not demonstrated through improved physical activity levels in middle-aged, sedentary, and overweight adult populations.[7] Physical activity levels decreased to those seen before the intervention process.[7] Web assisted interventions were found to be easy to administer and be highly accepted among students by Suminski and Petosa[62]. Students who received the web-based program were shown to have significant increases in Social Cognitive Theory strategies and were more likely to use these strategies than students without experience with the web based program.[62] Use of these strategies were seen to be utilized for planning, organizing, and managing physical activities in the group that received web-based activities.[62] A study conducted by Cook et al[12] explored a web based health promotion program that aimed to improve physical activity and other health issues. Based on the findings of this study retention rates were 85% and 87% for the web-based and print groups, respectively. The web-based group was found to have no significant differences in physical activity than the print group.[12]

CHAPTER 3

METHODS

3.1 Hypotheses

We hypothesized that the following differences would be observed between the online class and the on campus class: 1) The students enrolled in the online class would exercise for longer durations than the on campus class, 2) The groups would have a significantly higher amount of moderate to vigorous activity on days that they attended class compared to days when they did not have class, 3) The online students would achieve higher amounts of moderate to vigorous physical activity on class days than the students in the on campus class, and 4) The online class would participate in more total moderate-to-vigorous activity than the on campus class.

3.1.1 Rationale

The hypothesis that the online class would exercise for longer durations than the on campus class was due to our speculation that in the absence of time restraints associated with the exercise sessions, the online students may naturally choose to prolong a bout of exercise. For example the on campus classes are scheduled for a fifty minute time period while the online classes do not have a designated meeting time or duration. Therefore, the students enrolled in the online version of the walk/jog for fitness class could participate in their class workout for as long as they wished without the “end of class” cutting their workout short. Because additional moderate-to-vigorous physical activity was achieved during the students’ class time, it was hypothesized that class days would have significantly higher amounts of moderate-to-vigorous physical activity than non-class days. If our initial speculation held true that the online subjects would exercise for longer durations than the on campus subjects and that class days produced

higher amounts of moderate-to-vigorous physical activity than non-class days, the online group was projected to achieve higher amounts of moderate-to-vigorous physical activity on a class day than the on campus group. Thus we expected that, if the online group exercised for longer durations, class days produced higher amounts of moderate-to-vigorous physical activity than non-class days, and the online group achieved higher amounts of moderate-to-vigorous physical activity on class days than the on campus group, the subjects enrolled in the online class would achieve more total moderate-to-vigorous physical activity than the on campus group.

3.2 Inclusion Criteria

The criteria for inclusion in this study were: 1) Students from the University of Texas at Arlington, 2) Be at least 18 years of age at the time of enrollment in the study, 3) Enrolled in either the online or on campus version of walking for fitness or jogging for fitness class, and 4) Subjects participate fully in their designated class for the duration of the study.

3.3 Assumptions

The following assumptions were considered throughout the study: 1) The subjects accurately completed the demographic questionnaire, 2) The subjects wore the accelerometers appropriately throughout the study, and 3) The subjects participated in their classes as designated by their instructor.

3.4 Participants

Fifty-nine volunteer students were recruited, who were currently enrolled in a walk or jog for fitness class at the University of Texas at Arlington. In order to obtain volunteers for this study, the principle investigator visited the classes of the on campus walk for fitness and jog for fitness classes to inform them of the study and ask for volunteers. Because the online classes did not have a designated meeting time or destination, the students were informed of the study and asked to participate via email and telephone communication. In order to participate in the

study, the students had to be enrolled in either a walk for fitness or jog for fitness class at the University of Texas at Arlington (either online or on campus) and be at least eighteen years old at the time of the study. Of the fifty-nine volunteers, forty-three volunteers had data that was valid and able to be used for data analysis. The subjects in this study consisted of males and females (mean age ± SD = 24.7 ± 8.2 yrs; height ± SD = 65.7 ± 3.6 in; weight ± SD = 73.5 ± 17 kg). This study was approved by the Institutional Review Board for the use of Human Subjects at the University of Texas at Arlington.

3.5 Instruments

Subjects' height (in) and weight (kg) were determined utilizing a Hite-Rite Stadiometer (Ayrton 226 Hite-Rite) and a SECA Digital Scale (seca 869, Hamburg, Germany), respectively. Subjects stood with their feet together, shoes off, and back against the wall that the stadiometer was mounted on. Weight was obtained with shoes off and feet together on the same SECA digital scale. Body mass index was calculated using the using the formula BMI= $(wt(kg))/(ht(m)^2)$). Skinfold measurements were taken using Lange Skinfold Calipers. ActiGraph ActiTrainer accelerometers (research model, 2010 ActiGraph, LLC, Pensacola, FL) were used to assess physical activity during the study. Polar E600 Heart Rate Monitor Chest Straps were worn by the participants during their "class time" to monitor and record their heart rates (bpm) during exercise.

Table 3.1 Body Composition Formulas

Type	Gender	Formula	Key
3-Site SF	Females	Density = 1.099421 – 0.0009929(X1) + 0.0000023$(X1)^2$–0.0001392(X2)	X1 = sum of triceps, iliac, and thigh SF X2 = age in years
	Males	Density = 1.10938 – 0.0008267(X3) + 0.0000016$(X3)^2$- 0.0002575(X2)	X2 = age in years X3 = sum of pectoral, abdominal, and thigh SF

Table 3.1 – *Continued*

Body Fat (%)	Females/Males	%Fat = [(4.95/density) – 4.50] x 100	*Equation derived from Siri Equation for % BF
Body Mass Index (BMI)	Females/Males	BMI = ((wt(kg)) / (ht(m)^2))	

♦ Denotes Significant Difference

3.6 Protocol

All protocols used in this experiment were approved by the Institutional Review Board for the use of Human Subjects at the University of Texas at Arlington. Each subject provided written consent to participate in the study. During the initial contact (class meeting, email, and/or telephone conversation), the students were informed of the study, what it entailed, familiarized with the protocol, and asked for their voluntary participation. Once the subjects agreed to participate in the study, the subjects were asked to meet with the principal investigator on two separate occasions. The first meeting was scheduled to take place on a Friday and the second meeting took place seven days later. The majority of the subjects followed the Friday-Thursday time frame while a few had to be set up Thursday-Wednesday due to scheduling conflicts. All subjects, no matter the day that the first meeting took place, participated in the study for a seven day period. Due to equipment availability, the study took place over the course of a one-month time period. The subjects were divided into two groups: Online (WEB) and on campus (F-F) based on which class they were enrolled in at the university. These two groups were further split into four subsets with each subset consisting of an equal number of participants from both the WEB and F-F groups. This subdivision of the groups allowed for maximal data collection with a limited amount of equipment. This study asked that, during the first meeting, the participants have their height, weight, and body composition measurement taken in the Exercise Physiology Laboratory at the University of Texas at Arlington along with completion of

a short demographic survey and informed consent document. Upon arrival to the first meeting, the subjects were again informed and familiarized with the protocol that would take place for the duration of this study. After indicating their consent to participate by signing an informed consent document (see Appendix A), they gained access to the questionnaire (see Appendix B), which contained seventeen questions pertaining to their demographic information. The survey took no longer than ten minutes to complete and was only administered once. After completion of the survey, height and weight were measured for demographic purposes. The subjects' body composition was then estimated utilizing skinfold calipers. Skinfold measurements were taken at three sites, which differed based on gender. Females' skinfolds were taken at the tricep, suprailiac, and thigh while males' skinfolds were taken at the chest, abdomen, and thigh. All of these measurements were taken on the right side of the subjects' body and in accordance with proper skinfold protocol found in Appendix D. These measurements were used to estimate the subjects' body fat percentage. During the first meeting, the subjects were set up with accelerometers that were initialized using their height, weight, age, gender, and race in the ActiLife Software system. The accelerometers were worn for a seven-day period (Friday-Thursday) via an arm-band secured tightly to their upper arm. The accelerometers allowed for the tracking of physical activity levels, steps per day, and as a means of determining when the subjects participated in exercise for their class. When initializing the accelerometers, the display screen was turned off, which lent itself to preventing the falsification of activity levels or higher than normal motivation levels by the students. If the subjects were enrolled in the on campus version of the walk for fitness or jog for fitness classes, they were also assigned with a Polar E-600 heart rate monitor chest strap and instructed on proper use and wear. The students were instructed to only wear the heart rate strap while participating in their on campus walk for fitness or jog for fitness class. The students enrolled in the online version of the classes wore the Polar E-600 heart rate monitor and chest strap that

was assigned to them for their class during their workouts that were logged for their class. The subjects enrolled in the study participated in their respective classes while wearing accelerometer and heart rate chest strap as mandated by the university and the instructor. The online students tracked, recorded, and submitted heart rates and durations of their class workouts to their professor as a part of their class protocol. By agreeing to participate in this study, they allowed this information to be used by the primary investigator in analysis and as a means of determining the workouts that were logged for their participation in their class. The heart rate chest straps were used only as a means of determining when the students were participating in exercise for the class, not as a means of recording and comparing heart rates. During this first meeting, the students were instructed on proper use of all equipment and any questions or concerns were addressed at this time. Accelerometers were worn all day, every day for the seven-day period except for when the subject was sleeping or showering/swimming while the heart rate straps were only worn during the class workouts. At the end of the first meeting, the subjects scheduled a designated time on the following Thursday for their second meeting.

The second meeting took place seven days after the first meeting in which the accelerometers were initialized. At this meeting, students returned their equipment to be downloaded and cleared from the device. This completed the study for the students who completed the week using accelerometers and heart rate straps. The principle investigator downloaded the data from the accelerometers and allowed them to charge over night. The next day (Friday) a second subset made up of an equal number of subjects from the WEB and F-F groups went through the process. This process was repeated throughout the month (4 subsets with a total of 59 subjects). All data collected was kept confidential and utilized for data analysis of the study. A coding system was put in place that ensured the confidentiality of the subject and did not allow for tracking of any of the participants.

3.7 Data Examination

Although 59 subjects volunteered for participation in the study, only 43 of the 59 had accelerometers that collected usable data. In order for data to be used, the dataset must have a minimum number of four days of activity with three of those days being weekdays and one being a weekend day. Each day must have a minimum of eight hours of wear time to be considered an acceptable day. A minimum of ten non-zero minutes per hour are required to be considered an acceptable hour.

3.8 Physical Activity Assessment

Physical activity measurements were taken using the ActiGraph ActiTrainer Accelerometer worn tightly strapped to their arm using the armband. The accelerometer was set to take data readings every 60 seconds. By taking readings at 60 second epocs, it allowed for most informative data with maximum amount of data. The physical activity levels used for analysis were those data in the moderate to vigorous range. However, the accelerometers collected data twenty-four hours a day for a seven-day period. The subjects' physical activity levels were classified into 6 different categories: sedentary, lifestyle, light, moderate, vigorous, and very vigorous. In the adult population, the cut points for each of the categories in counts per minute are as follows: sedentary (0-100 cpm), lifestyle (101-760 cpm), light (761-1951 cpm), moderate (1952-5724 cpm), vigorous (5725-9498 cpm), and very vigorous (> 9499 cpm).[20] Heart rates were used as a means of identifying when students were exercising for their class and as a demographic measure. Accelerometer data was downloaded to the same computer used to initialize them and saved on two external memory sources. The physical activity counts were then screened for inclusion using the criteria mentioned in Section 3.4. Invalid data (too short a measurement time, zero counts, without at least one usable weekend day, without three acceptable weekdays, or any record shorter than 4 days) was flagged for removal. The total

number of minutes spent wearing the accelerometer was calculated by summing the sedentary, lifestyle, light, moderate, vigorous, and very vigorous minutes. The amount of time the subjects were participating in MVPA was determined by combining the number of minutes of moderate, vigorous, and very vigorous.[65]

3.9 Statistical Analysis

A commercial software package (PASW version 18 for SPSS Inc, IBM, Chicago, IL) was used to perform statistical analysis of the data. A between-within ANOVA was used to determine if there was an interaction between class (on campus vs. online) and day (class day vs. non-class day). Independent T-tests were used to determine if significant differences existed between the groups in total minutes of MVPA, amount of minutes of MVPA achieved during class exercise bout, MVPA on a class day, and MVPA on a non-class day. Alpha was set at $p < 0.05$. Data are expressed as mean ± SD.

CHAPTER 4

RESULTS

4.1 Demographical Comparison of Classes

The eighteen online subjects were 27.4 ± 10.5 years old, 66.3 ± 2.7 inches in height, and weighed 71.9 ± 10.4 kg. The twenty-five on campus subjects were 22.7 ± 5.4 years old, 65.3 ± 4.1 inches in height, and weighed 74.6 ± 20.6 kg. Subjects' body composition measurements as determined by skinfold measurements are located in Table 4.1. No significant differences were found between the groups' body composition measurements.

Table 4.1 Body Composition Measurements By Group (N= 43)

	Tricep/Chest SKF (mm)	Suprailiac/Abdominal SKF (mm)	Thigh SKF (mm)	Body Density Estimated from SKF (g/ml)	Body Fat Percentage as Estimated from SKF (%)	BMI (kg/m^2)
On Campus Group (n=25)	23.51 ± 7.95	29.01 ± 10.38	31.23 ± 10.89	1.04 ± 0.02	28.35 ± 8.32	27.59 ± 7.05
Online Group (n=18)	20.70 ± 8.20	26.93 ± 7.39	27.11 ± 8.99	1.04 ± 0.02	25.33 ± 7.91	25.52 ± 3.61

♦Denotes Significant Difference

Table 4.2 Body Composition Measurements By Gender (N= 43)

	Tricep/Chest SKF (mm)	Suprailiac/Abdominal SKF (mm)	Thigh SKF (mm)	Body Density Estimated from SKF (g/ml)	Body Fat Percentage as Estimated from SKF (%)	BMI (kg/m^2)

Table 4.2 – *Continued*

Female (n=28)	24.17 ± 7.68	27.64 ± 9.72	33.71 ± 9.12	1.03 ± 0.01	31.35 ± 6.87	26.30 ± 6.17
Male (n=15)	19.66 ± 7.68	28.21 ± 7.26	21.64 ± 7.42	1.06 ± 0.01	19.12 ± 2.48	27.51 ± 5.46

♦Denotes Significant Difference

The subjects' answers to the demographic survey are located in Table 4.3. By having knowledge of the subjects' lifestyle, it may serve to provide an explanation to differences observed between the groups.

Table 4.3 Demographic Variables by Group (N=43)

Variables	Online (n=18)	On Campus (n=25)
Gender		
Male	8	7
Female	10	18
Ethnicity		**
Caucasian	9	9
African American	6	4
Hispanic/Latino	3	9
Asian	0	1
Classification		**
Freshman	2	6
Sophomore	4	4
Junior	5	9
Senior	5	2
Degreed Undergraduate	2	2
Work Hours		
Unemployed	6	9
0-15 hours	3	4
16-25 hours	2	7
26-35 hours	3	4
36-45 hours	2	1
More than 45 hours	2	0
Student Status		
Part time	6	1
Full time	12	24

Table 4.3 – *Continued*

Marital Status		
Single	15	23
Married	3	2
Children		
No Children	15	23
1-2 Children	2	2
3-4 Children	1	0
Living Location		**
On Campus	3	4
Less than 10 miles	7	6
10-40 miles	7	13
> 40 miles	1	1
Physical Involvement	**	
Intramural Sports	0	4
Recreational Sports	2	0
Other Fitness Class	3	6
None	10	11
Combination	2	4
CV or Resistance Training	**	
No Activity	3	6
1-3 days/week	11	14
3-5 days/week	1	4
More than 5 days/week	2	1

**Denotes survey topic that one or more subject in the group did not answer. Therefore, the number of responses to the survey topics did not add up to the total for the group.
♦Denotes Significant Difference

4.2 Physical Activity Comparison of Classes

The accelerometers worn by the subjects allowed for the physical activity between the two groups to be compared. The groups were compared on total activity levels achieved as per their physical activity profile, class activity contribution, class days compared with non class days, intensity of workouts, and duration of workouts.

4.2.1 Total Physical Activity

Total physical activity in the moderate-to-vigorous range was determined by taking the MVPA from three weekdays and one weekend day. This has been used throughout research to develop an accurate physical activity profile of the subject. This total physical activity was made up of one weekend day, one weekday that the subjects had class or logged a workout for class

in the case of the online group, one weekday that the subjects did not have class or log workouts for class, and a random weekday. Independent T-tests were run to determine if significant differences existed in the total physical activity levels of the students enrolled in the online walk for fitness and jog for fitness classes and the on campus walk for fitness and jog for fitness classes. Although the on campus class achieved more minutes of MVPA than the online class (506.6 ± 239.9 minutes and 389.9 ± 244.2 minutes, respectively), there was no significant difference between the two groups (p=0.126). This finding was in accordance with the hypothesis of the principal investigator that the online students achieve less total MVPA than the on campus group.

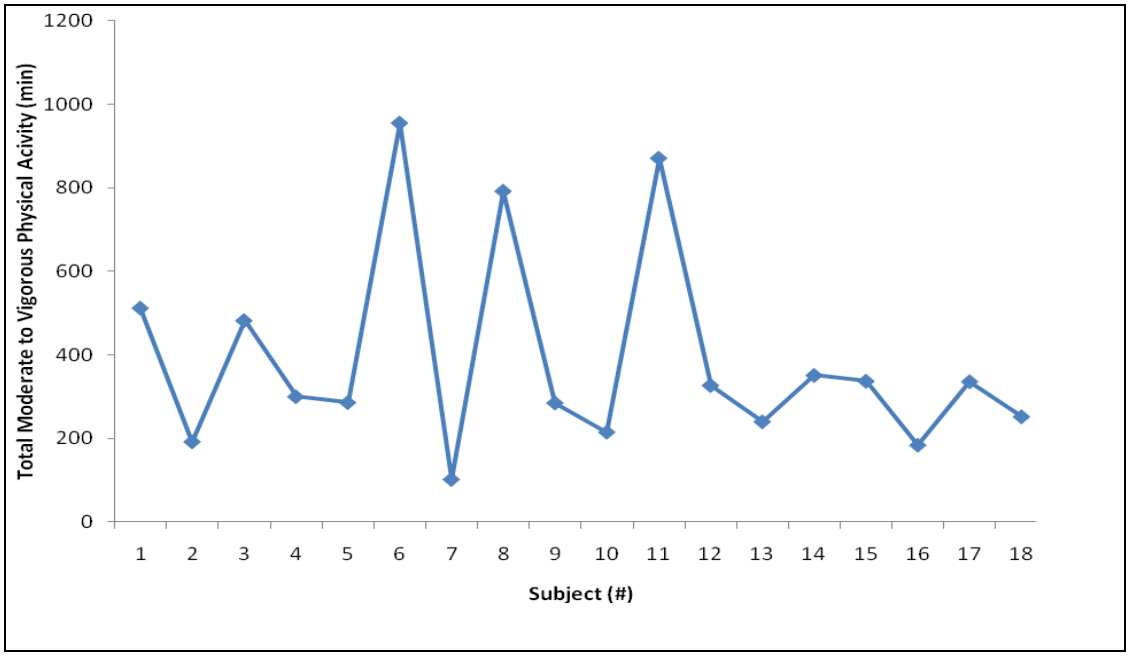

Figure 4.1 Total Moderate To Vigorous Physical Activity For Individuals In Online Group
♦Denotes Significant Difference

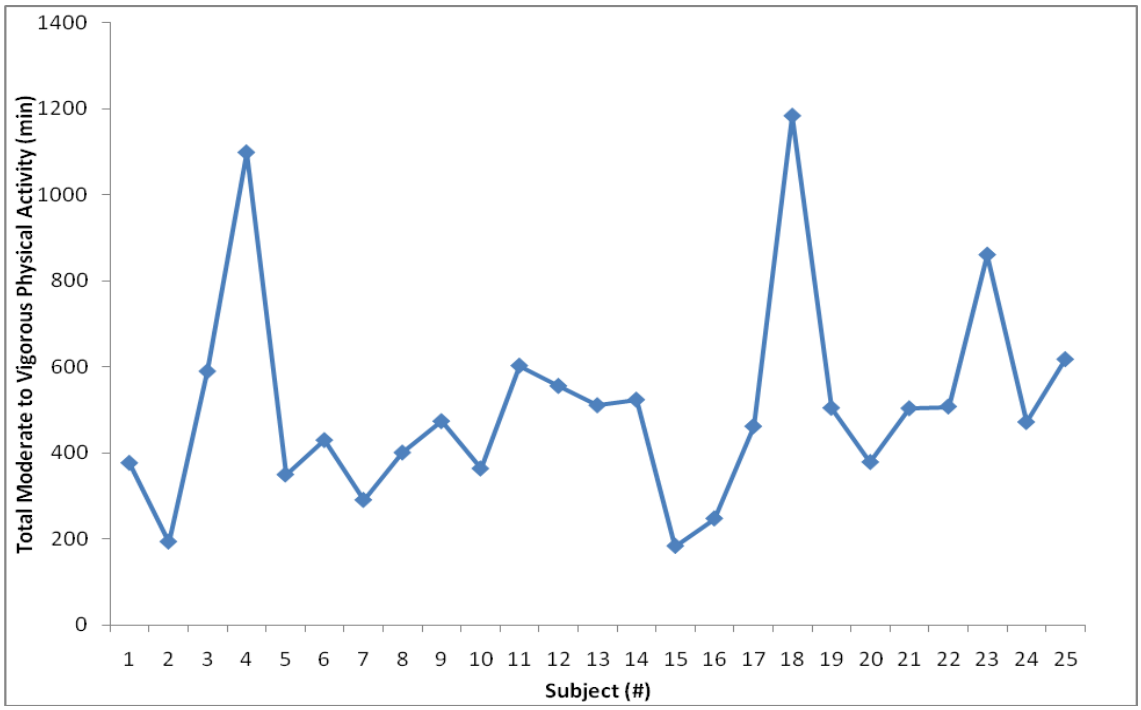

Figure 4.2 Total Moderate To Vigorous Physical Activity For Individuals In On Campus Group
♦Denotes Significant Difference

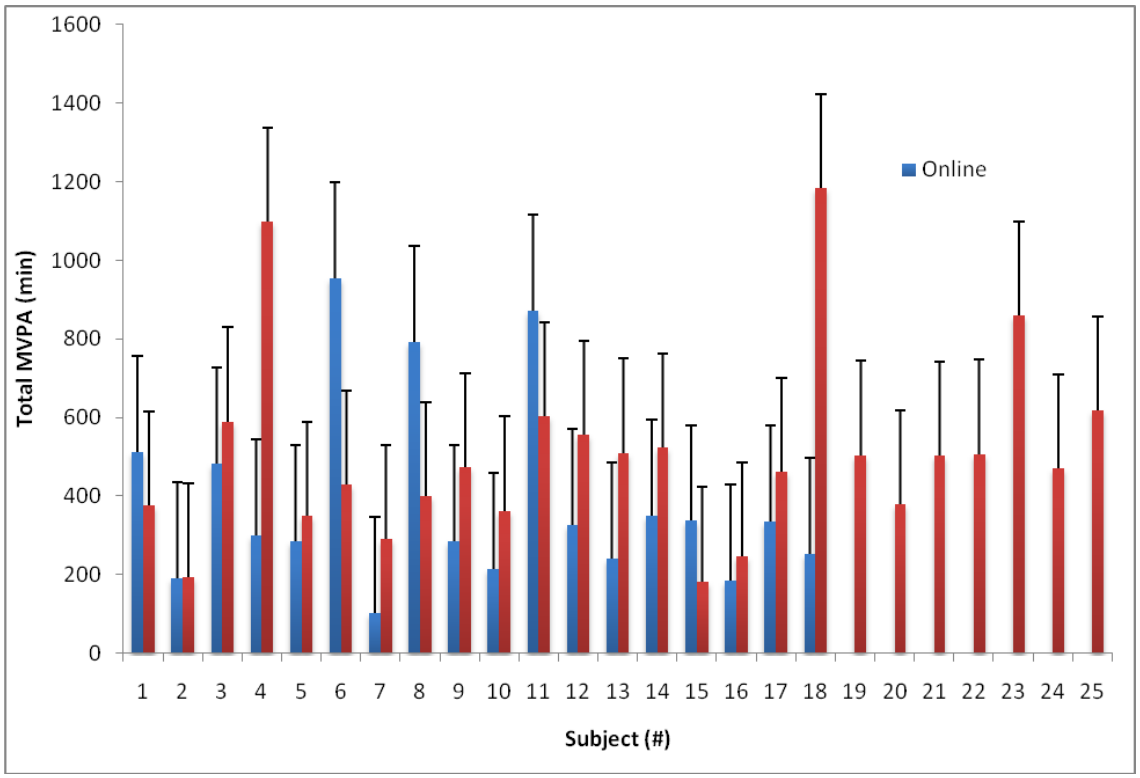

Figure 4.3 Comparison Of Total MVPA Between Group Members
♦Denotes Significant Difference

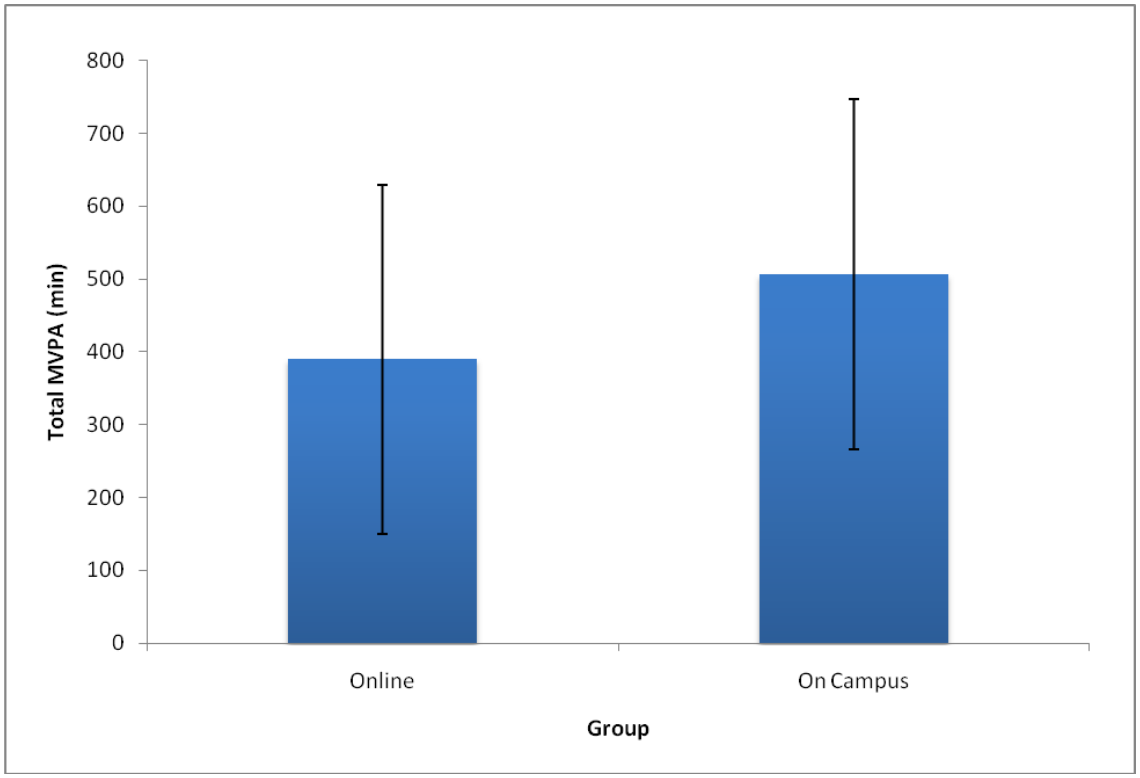

Figure 4.4 Comparison Of Total Moderate To Vigorous Physical Activity Between Groups
♦Denotes Significant Difference

4.2.2 Class Contribution to Physical Activity

On a purposeful day, MVPA achieved from the workouts of the class contributed a different percentage of the total MVPA for the day depending on the group. By knowing the contribution of the class, it could potentially provide additional incentive for students to enroll in the class as an effort to improve their health and physical activity levels. On average, the MVPA achieved by the class workout contributed to 42 ± 24.9% of the students MVPA for the day. The largest contribution of the class was 81.5% of the MVPA with the lowest contribution being 3.8% of the day. Eleven out of the eighteen subjects in the online class contribute more than 25% of their daily MVPA to the class exercise. The F-F class did not contribute as greatly to the daily MVPA as did the WEB class. The on campus class contributed on average of 23.4 ± 11.9% of

the daily MVPA. Ten of the twenty-five students enrolled in the on campus walk for fitness and jog for fitness class get over 25% of their daily MVPA from their class workouts.

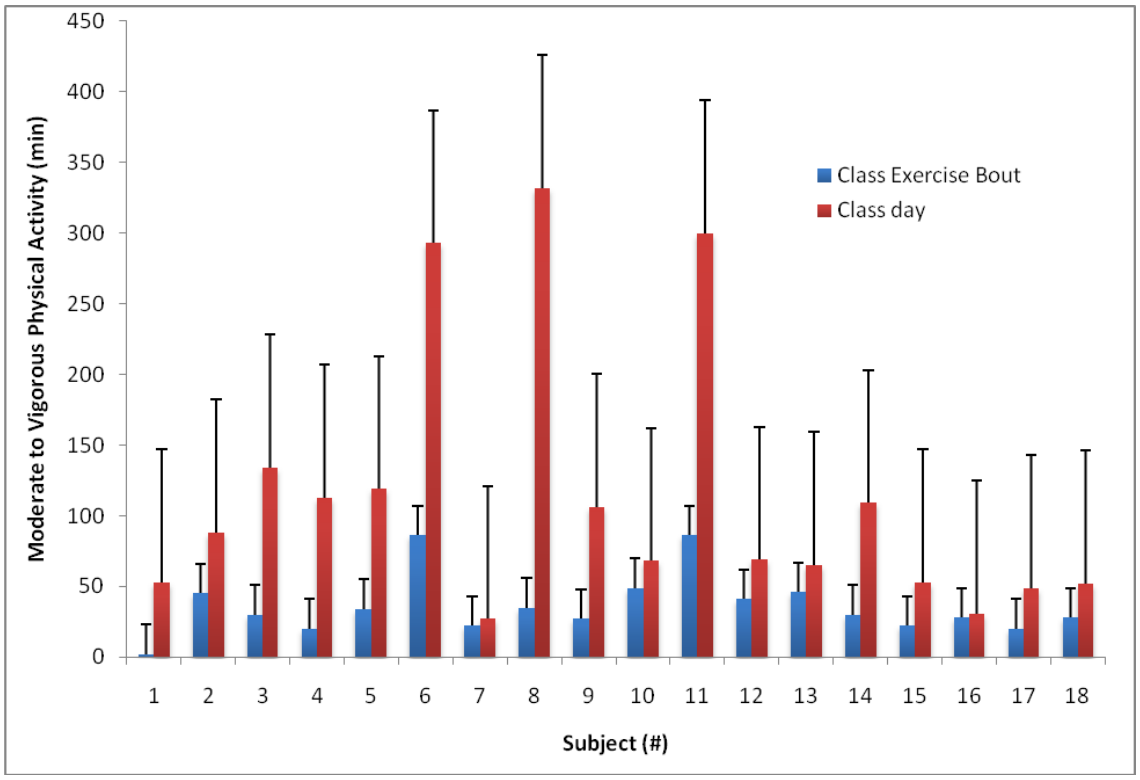

Figure 4.5 Contribution Of Class Exercise Bout To Class Day Moderate-Vigorous Physical Activity For Online Subjects ♦Denotes Significant Difference

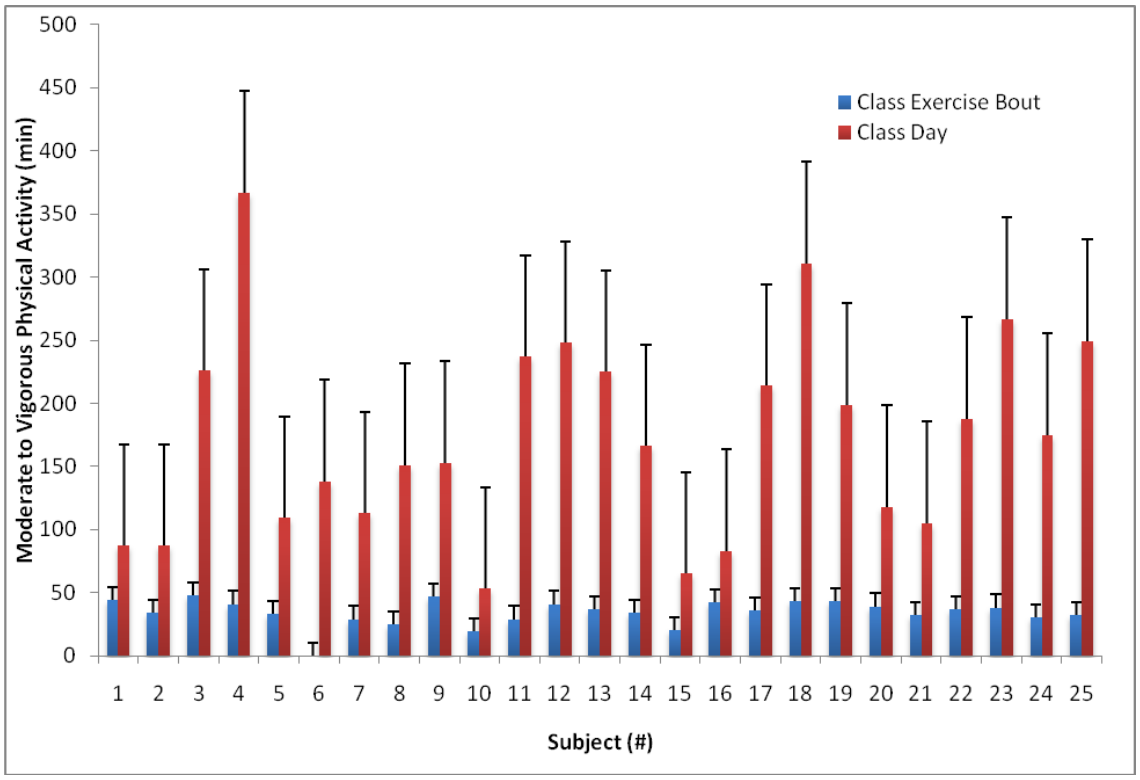

Figure 4.6 Contribution Of Class Exercise Bout To Class Day Moderate-Vigorous Physical Activity For On Campus Subjects ♦Denotes Significant Difference

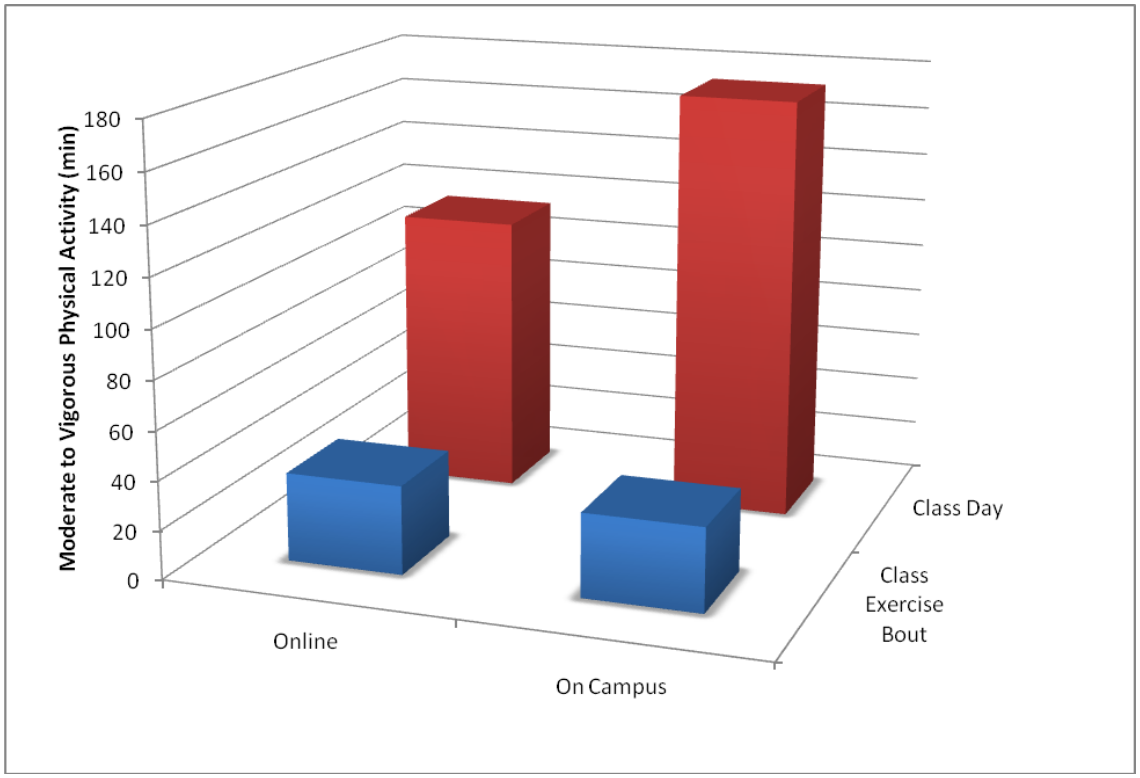

Figure 4.7 Contributions Of Class Exercise Bout To Class Day Moderate-Vigorous Physical Activity Compared Between Groups ♦Denotes Significant Difference

4.2.3 Class Day Compared With Non-Class Day

A between-within ANOVA was performed to determine if there was a significant interaction between the groups and the days. No significant interaction (group x day; p=0.100) was observed. However, the on campus group participated in 173.4 ± 80.5 minutes of MVPA while the online group participated in 114.5 ± 94.5 minutes of MVPA. This was found to be significantly longer amounts of MVPA (p=0.034) than did the online group. On days that the students did not have class, the online group got 80.6 ± 57 minutes of MVPA. The on campus group did achieve more MVPA on the non-class days (102.8 ± 62.8 minutes) than the online group. Although there was a difference in the amount of time spent doing MVPA, there was not a significant difference (p=0.240) between the two groups for days that the subjects did not

have class. A significant difference (p=0.000) was seen between class day (148.7 ± 90.5 minutes of MVPA) and non-class day (93.5 ± 60.8 minutes of MVPA).

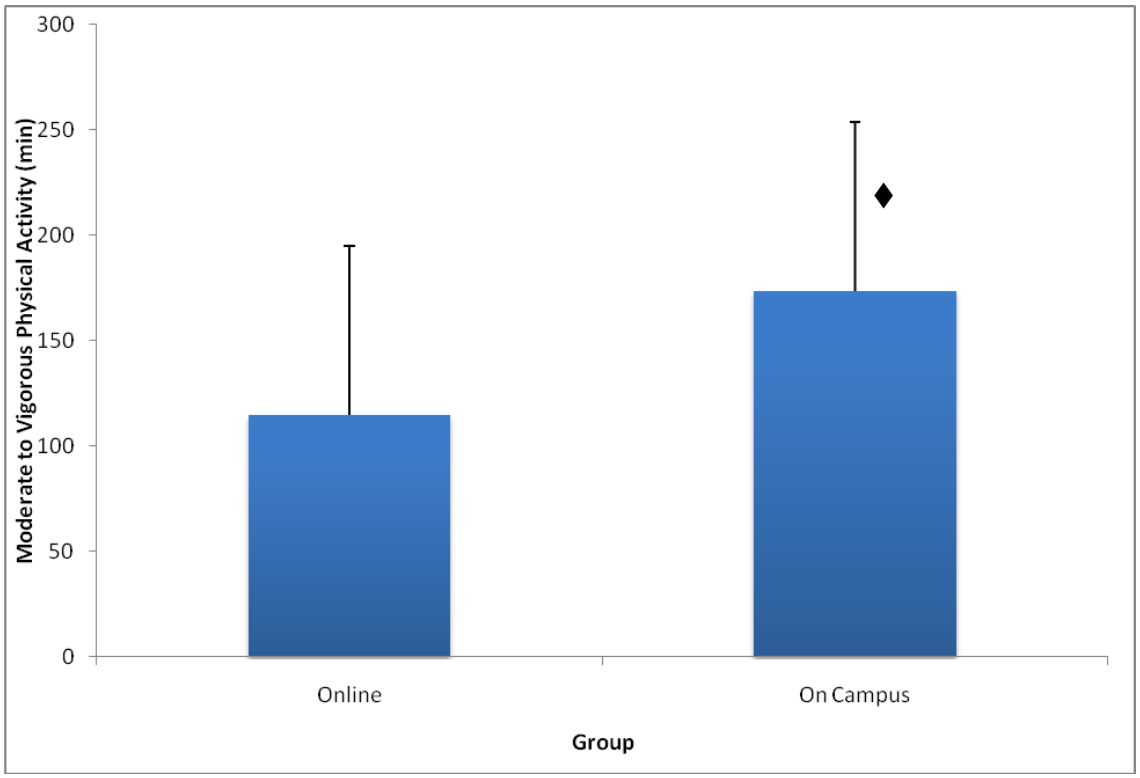

Figure 4.8 Comparison Of Moderate-Vigorous Physical Activity Achieved During A Class Day Between Groups ♦Denotes Significant Difference

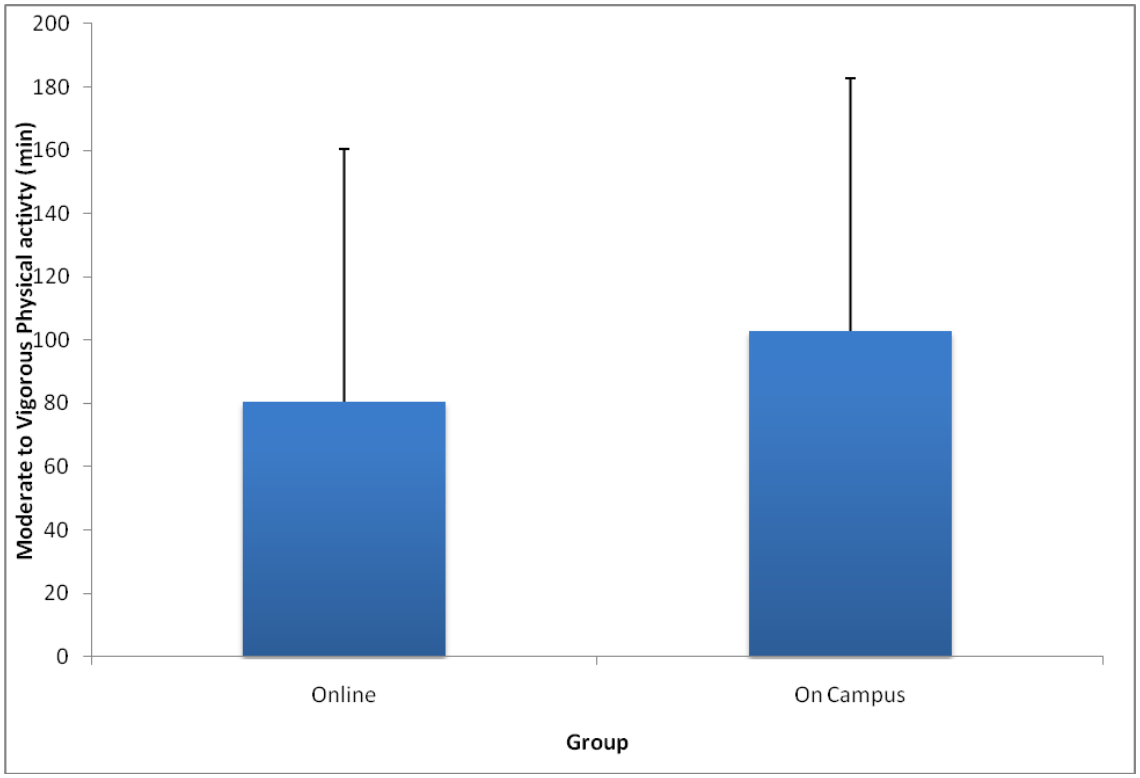

Figure 4.9 Comparison Of Moderate-Vigorous Physical Activity Achieved During A Non-Class Day Between Groups ♦Denotes Significant Difference

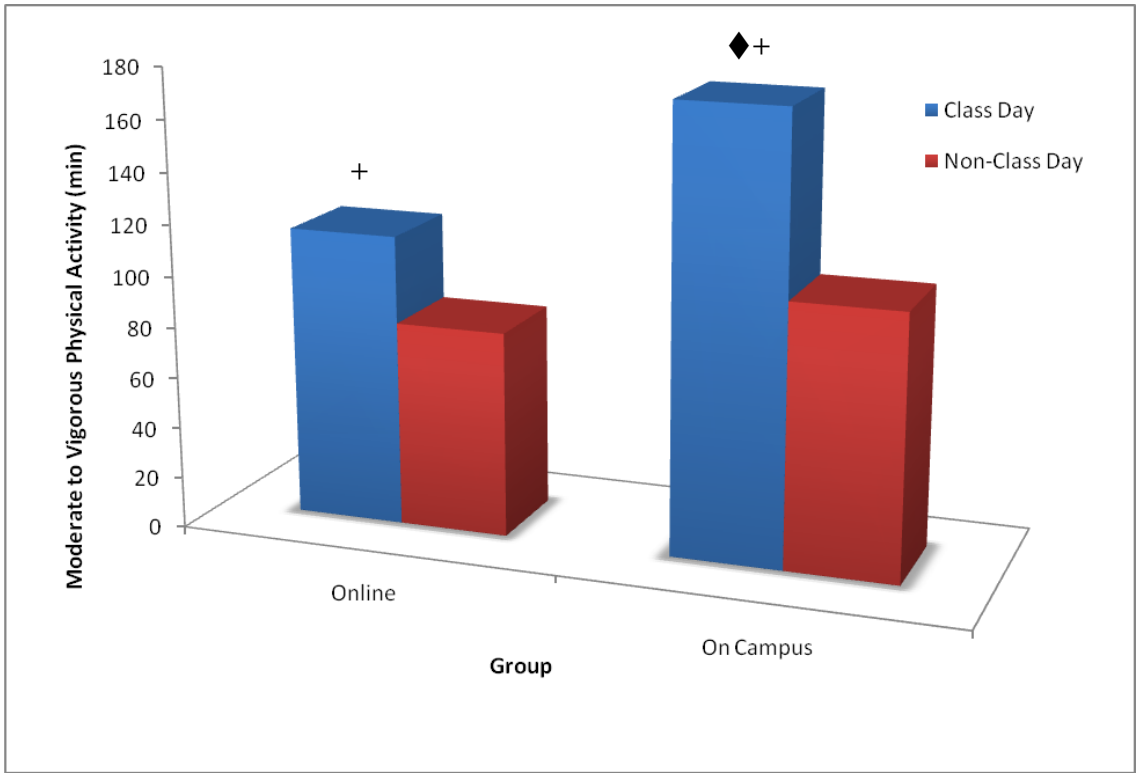

Figure 4.10 Comparison Of Class Day Versus Non-Class Day Within Groups
♦Denotes Significant Difference

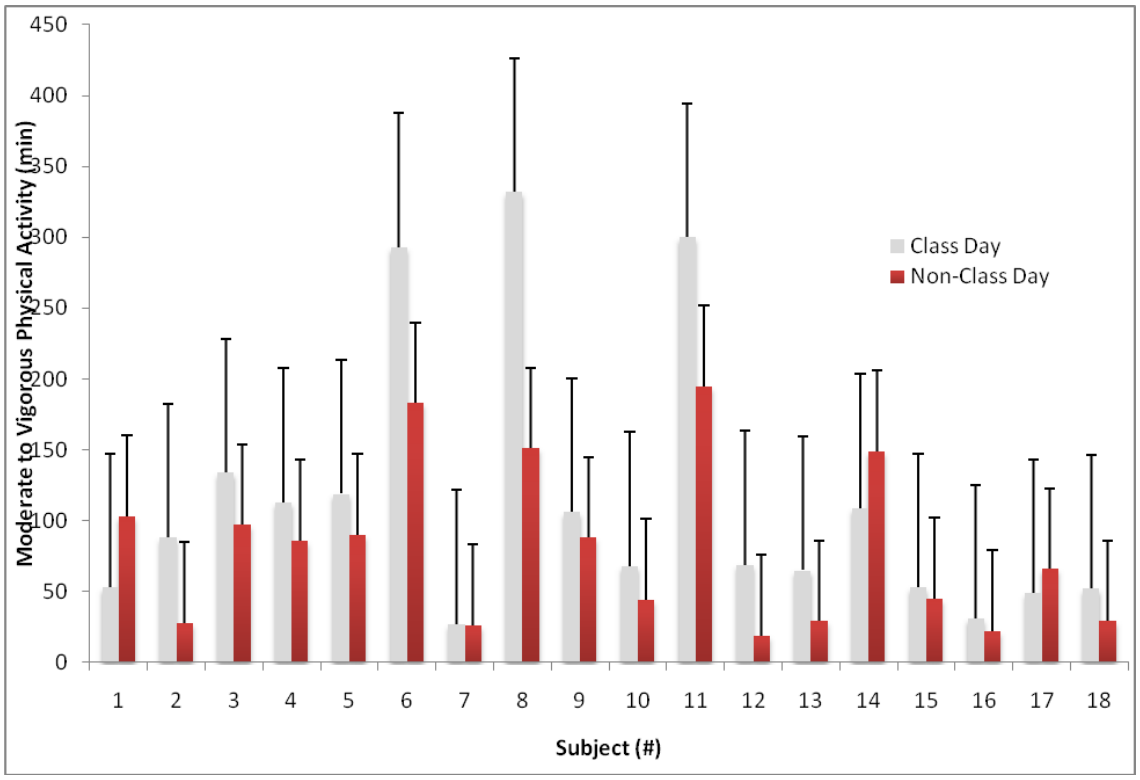

Figure 4.11 Comparison Of MVPA Between Class Day And Non-Class Day For Online Subjects
♦Denotes Significant Difference

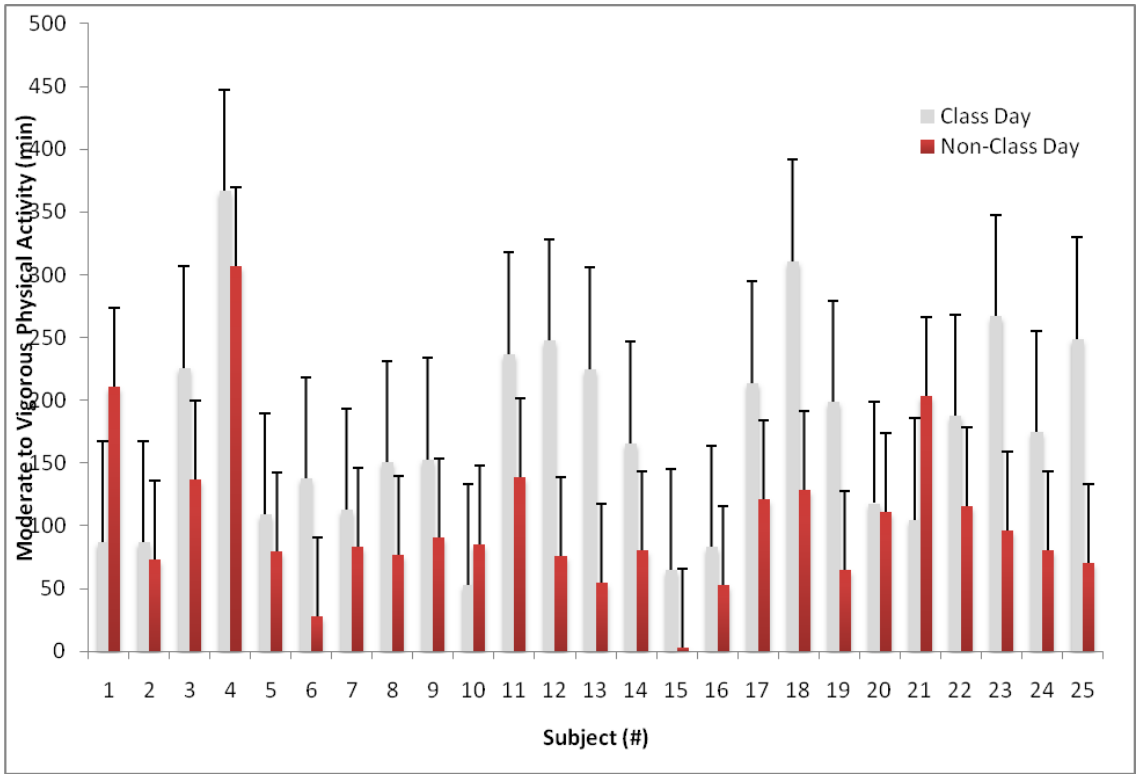

Figure 4.12 Comparison Of MVPA Between Class Day And Non-Class Day For On Campus Subjects ♦Denotes Significant Difference

4.2.4 Class Exercise Bout

It was hypothesized that the online group would spend more time exercising at the moderate to vigorous level because there were no time constraints on their class exercises. However, it was found that, while they may have spent longer amounts of time in light activity, the online group spent 36.2 ± 21.3 minutes of moderate to vigorous physical activity for the exercise bouts logged for their class. Even though the on campus group had a time constraint of 50 minutes for their class exercise bout, the subjects in this group achieved 34.1 ± 10.4 minutes of MVPA for the class exercise bouts. The amount of time spent participating in MVPA during the class exercise bouts did not differ significantly (p=0.678) between the two groups.

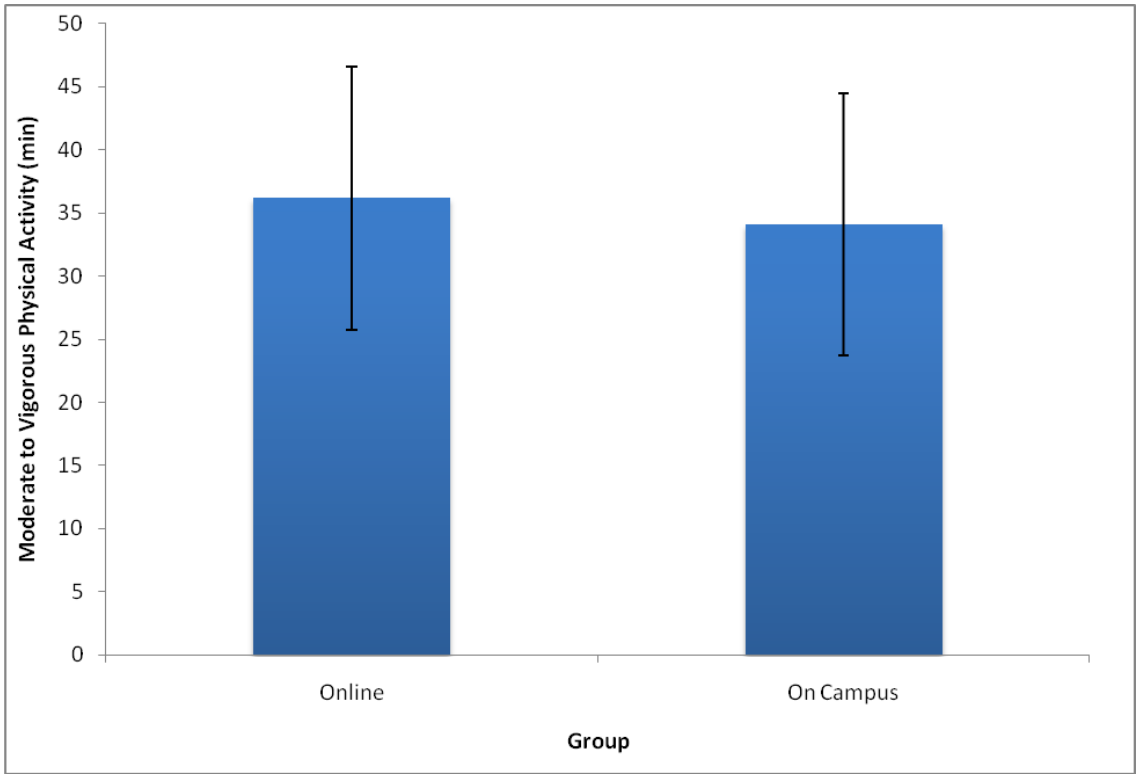

Figure 4.13 Comparison Of MVPA During Class Exercise Bout Between Groups
♦Denotes Significant Difference

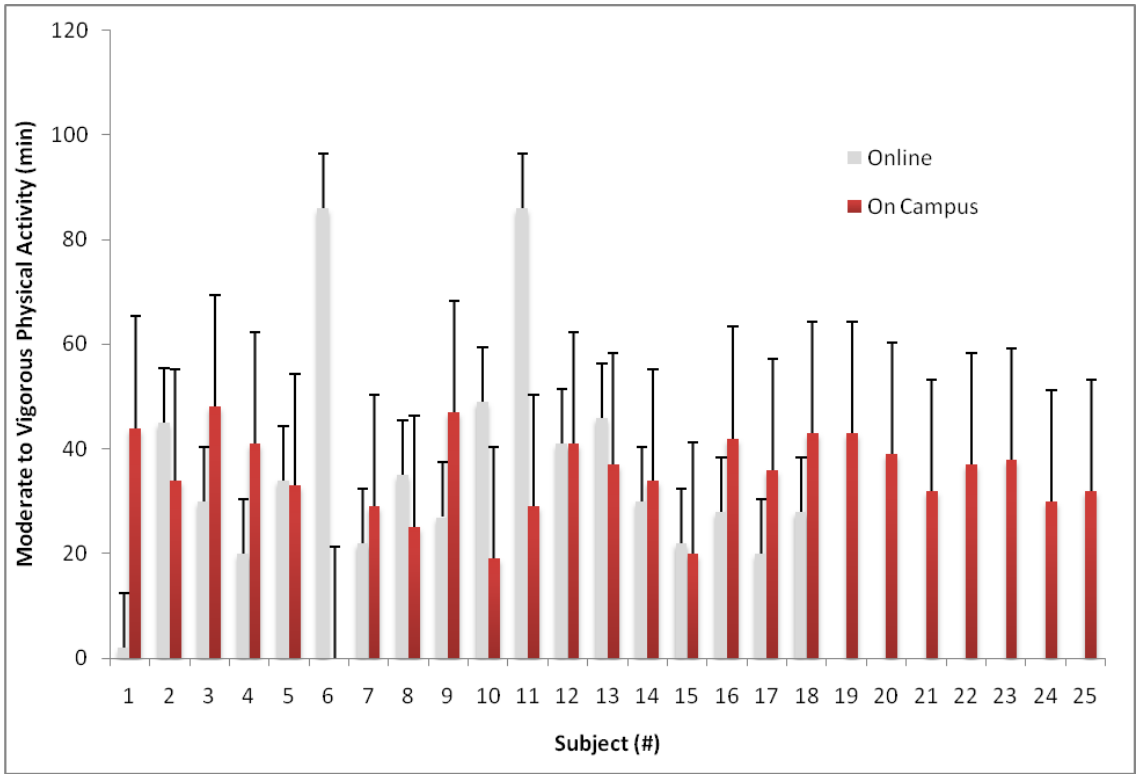

Figure 4.14 Individual MVPA Achieved In Class Exercise Bout
♦Denotes Significant Difference

CHAPTER 5

DISCUSSION

To the investigator's knowledge, this is the first study to examine the amount of moderate to vigorous physical activity elicited by a web based walk/jog fitness class compared with traditional face to face mode of delivery in college students. Determining if web based delivery methods are as effective as face to face methods is essential as more and more classes move to an online format. The ability to disperse information via the Internet has been suggested to be more convenient, flexible in terms of time constraints, and economically advantageous than traditional methods all while reaching a vast number of people.[10,60] However, the attractiveness of online course delivery is irrelevant if the product is not at least as effective as the traditional mode of course delivery. The present study provides strong evidence that in terms of the amount of time the student spent performing MVPA directly related to the course requirements; there was no difference in delivery modes. However, the particularly innovative aspect of this study was the use of accelerometers to track physical activity not just during the class period but for an entire week. These data revealed an unexpected finding. That is, even though the magnitude of physical activity directly related to the course requirements was not different between the two groups, students enrolled in the face-to-face section got more overall MVPA on the days they had to come to class than online students did on the days they chose to exercise. This finding has implications for the overall contribution of an activity class to the amount of physical activity students achieve related to daily living activities.

Other studies have looked into the behavior changes, such as retention rates and Social Cognitive Theory strategies, associated with physical activity.[60,62] These studies have

investigated the differences in receiving information via the web versus print[12], the incorporation of cognitive strategies in the planning and organization processes[62], adherence to a web-based activity intervention[7], and online journaling classes at improving self awareness and lifestyle practices[69]. Participation in an online program has been investigated to determine if the theory, that the increased availability of the program would lead to an increase in amount of participation, is valid.[59] The study conducted by Spittaels and Bourdeaudhuij[59] found that higher participation was seen in women and adults from medium SES compared to men and low SES. The participants in the current study consisted of 28 women and 15 men, which fell in line with the findings of the Spittaels and Bourdeaudhuij. However, the online group consisted of nearly equal number of males and females, 8 and 10 respectively. It is possible that the trend found by Spittaels and Bourdeaudhuij could also be observed in the online group of the current study if the subject pool had been larger. Kosma et al[31] investigated the changes in leisure time physical activity in adults with physical disabilities achieved from an online motivational program.

The major finding of this study was that no significant differences existed in the amount of moderate to vigorous exercise that was completed during class between the online and on campus groups. That is to say that with this specific course, students completed the same amount of moderate to vigorous physical activity whether they were enrolled in an online section or a face to face section of the course. Steele, Mummery, and Dwyer[60] found that behavior changes associated with changes in physical activity were similar between groups of face-to-face, internet-mediated, and internet-only through self-reported measures. These findings were further strengthened by the findings that web-based groups had no significant differences in PA than a group receiving interventions via print materials.[12] We had originally hypothesized that the on campus group would log less physical activity than the online group because of the time constraints of the course set up. The on campus groups had class times that were 50 minutes in

duration while the online groups had no time constraints on the duration of their activity. It was assumed that the on campus group would be more likely to have another class that would preclude them from lingering for a longer workout even if they were so inclined. Interestingly, the on campus group exercised at a moderate to vigorous intensity for 34.1 out of 50 minutes, which is 68.2% of the class time. Although the online group may have exercised for a slightly longer time period (36.2), the amount that was spent at a moderate to vigorous intensity was not significantly greater than that spent in the on campus group. Furthermore these durations were well under the 50 minute time constraint. We posit that even with warm up and cool down activity a students' desire for a longer exercise bout was not restrained by a time limit.

An important strength of the current study is that the use of accelerometers provided a valid, objective means of measuring the moderate to vigorous physical. [5,6,10,32,44,75,77,78] Accelerometers are useful in monitoring the physical activity of subjects in free-living conditions. [3,5,32,39,43,49,65,68,77]Three-dimensional accelerometers, which were used in the current study, reduce the amount of error produced in accelerometer positioning.[75] The thresholds for activity categories is used in relation to METs, which allows for accurate assessment of intensity of activity.[43,54,65,66] Although no single protocol for activity level cut points has been accepted, according to Nader et al[44], the activity cut points used in the current study were based on a study conducted by Hagstromer, Oja, and Sjostrom[20] and were used consistently between the participants. The accelerometers were worn by the subjects for a seven-day period to provide an in-depth and accurate physical activity profile in accordance with previous literature.[13,30,32,37,44,66,68] Because the subjects were required to wear accelerometers instead of self-reporting their activity, the participants could not deceive the investigator on the amount of physical activity they participated in. Another attempt to deter from any falsification of information was made by disabling the display screen on the accelerometers. The intent of the

investigator in this process was to eliminate any additional motivation that would cause the participant to increase their activity beyond levels that they would normally participate in.

5.1 Limitations

A limitation of this study was the size of the subject pool. Although a larger amount of subjects had been recruited, the number of valid subject data was smaller than originally anticipated. By having a larger subject size, the power of the study would have increased. This leads to the limitation that technology imposed on this study. Technological issues experienced by the accelerometers such as batteries not holding a charge for the duration of the study, accelerometers not connecting with the software to download information, and heart rate chest straps not communicating heart rates to the accelerometers limited the amount of valid data that was able to be recovered from the subjects. Subject adherence was also a limitation in the study. Some of the issues seen with the subjects were forgetting to wear the accelerometer, wearing it incorrectly, not participating in their class during the week of data collection, or terminating their enrollment in the class. Another limitation in this study was that, other than when the subjects participated in their class, there was no way of knowing what activities they were doing that were resulting in the data collected by the accelerometers. If a log was kept of activities, for example, work from a certain time to a certain time, class from a certain time to a certain time etc., then the investigator would be able to determine if differences existed due to class, school, work, or leisure-time physical activity.

5.2 Possible Explanations

When we examine the results of the present study in a larger context it is apparent that enrollment in a physical activity course positively influenced the amount of physical activity the student completed. For example, the finding that a significant difference existed in the amount of MVPA achieved on a class day indicated that, in the absence of required physical activity, significantly less physical activity was accomplished. According to the CDC, 37.7% of adults

achieved insufficient amounts of physical activity while an additional 13.5% were inactive in the United States.[9] These statistics are even larger in Texas, where 38% of adults get insufficient amounts of physical activity and another 15.3% are inactive.[9] These national statistics and the finding that the students completed significantly more moderate to vigorous physical activity on days that they were fulfilling course requirements led the investigator to the inference that if students were not enrolled in the walk/jog class there would be a high probability that they would not be achieving the recommended amounts of physical activity. On non-class days there was a significant reduction in overall physical activity. As per the answers to the demographic survey provided by the subjects, 21 out of the 43 (48.8%) subjects reported no participation in a structured physical activity program on a regular basis. Twenty-five out of the forty-three subjects reported participating in cardiovascular or resistance training 1-3 days per week in the month prior to the start of the class. Nine of forty-three participants, or 20.9% of the participants, reported no participation in cardiovascular or resistance training in the month prior to the beginning of the class. If we specifically look at the contribution of the walk/jog class to the amount of moderate to vigorous physical activity that a student completed on a class day we found that the on campus group was active at the moderate to vigorous intensity for a significantly larger amount of time on a class day than was the online group, 173.4 minutes and 114.5 minutes respectively. This difference may be partially explained by the physical activity it took to arrive to class, for example the walking from the parking lot or the dorm room to the class. This difference in duration of intense activity could also be due to the fact that the students enrolled in the on campus portion of the class were on campus and attending other classes in various buildings. Because there are at least ten minutes between the end of one class and start of another, a student could, depending on their class schedule, have to make it from one to another class across campus in a limited time frame. Not every student enrolled in the on campus class has this schedule but it could help explain the increase in moderate to

vigorous activity of the students on the days that they have class and are known to be on campus.

These suppositions may also explain why the groups were significantly more active on the class day when compared to the non-class day. This finding suggests that the students enrolled in the walk for fitness or jog for fitness class, either the on campus or the online version, could attribute their increased physical activity to being enrolled in the class. Therefore, on days when the students are not attending class, they are not achieving the levels of activity by supplementing the class with additional workouts or physical activities. The exercise bouts achieved during their class account for 31.6% of their daily MVPA for online students and 19.7% for the on campus students. Because the online class makes up such a large percentage of its' students' physical activity, it is effective in eliciting greater amounts of moderate to vigorous physical activity than its' students would partake in without the class.

Other possible explanations for the difference that has been observed in the amounts of moderate-to-vigorous physical activity between class days and non-class days can be inferred by evaluating the subjects' answers to the demographic survey. The differences observed could be explained by examining other areas of the subjects' life that may influence their physical activity levels such as work, student status, marital status, and participation in regular physical activity. The subjects were found to have higher amounts of moderate-to-vigorous physical activity on days that they had class when compared to days that they did not have class. A possible explanation for differences in MVPA could be the amount of moderate-to-vigorous physical activity that is achieved while the subject is at work. In this study, 34.9% of the subjects were unemployed, 20.9% worked 16 – 25 hours per week, 16.3% worked 0 – 15 hours per week, 16.3% worked 26 – 35 hours per week, and only slightly under 5% working over 45 hours per week. The amount of physical activity achieved during work can be further explained by determining the subjects' occupation. If subjects work at a job that has high physical demands

and requires them to be physically active for extended periods of time, then an increase in their physical activity for the day would be expected to be seen. Age also could be a potential factor influencing the physical activity that was observed between the subjects. It could be suggested that the younger students (39% of the subjects enrolled in the study were freshmen and sophomores) have less responsibilities than the older students (51.2% of the subjects were juniors and seniors) which would provide a possible explanation to difference in physical activity between the subjects.

5.3 Future Research Opportunities

Future research areas that can stem from this investigation and be used as a means of further explaining the differences seen between the groups would be to look into the physical activity levels between students who are enrolled in on campus classes and students who are enrolled at a strictly online university. This research would allow a deeper look into the physical activity that merely being on campus provides to its students. This study has provided the data that reinforces the thought that by being enrolled in an activity class, whether it was the traditional on campus version or the online version, students will see increases in the amount of moderate to vigorous physical activity they participate in. As a way to improve this study and determine whether the increased amounts of moderate-to-vigorous physical activity observed on class days was due to being on campus, physical demands of the subjects' occupation, or another factor, a daily log of activity could have been reported by the subject to associate changes in physical activity with their causes. Both of the methods of course delivery were effective at producing increased amounts of physical activity on days that they had class compared to days that they did not. Because a vast numbers of Texans and Americans are getting insufficient amounts of physical activity or no physical activity, 53.3% and 41.2% respectively[9], the enrollment in an online or traditional physical activity could be suggested as a means of increasing physical activity in adults, specifically college students. Increasing physical

activity is found to be a preventative measure in reducing obesity.[24,46,61] Therefore, online and face-to-face methods of providing physical fitness classes are effective means of increasing the physical activity of students enrolled in the courses.

APPENDIX A

STATEMENT OF INFORMED CONSENT

SEP 2 1 2010
APPROVED
MAY 3 1 2011
Institutional Review Board

INFORMED CONSENT

PRINCIPAL INVESTIGATOR NAME:
Chelsea Foster

TITLE OF PROJECT:
Effects of Teaching Modes on Physical Activity Levels: Face-to-Face vs. Online

INTRODUCTION
You are being asked to participate in a research study. Your participation is voluntary. Please ask questions if there is anything you do not understand.

PURPOSE:
The purposes of the study is to answer the following questions:

1) Do differences in demographics exist between populations of students who enroll in an online and face-to-face walk/jog class.

2) Is there a difference in voluntary exercise intensity and duration between online and face-to-face walk/jog class?

3) Is there a difference in total physical activity levels between online and face-to-face students?

DURATION:
You will participate in your respective walk/jog for fitness class that you voluntarily enrolled in. You will meet with the primary investigator on two occasions (the first on a scheduled Friday and then on the following Thursday). You will have your height, weight, and skinfolds measured on the first meeting and fill out a survey, which will only be done at this first meeting. The entire process in the first meeting has an estimated completion time of fifteen (15) to twenty (20) minutes. The second meeting (on Thursday) will only last for as long as it takes for you to turn in your equipment that was given to you during the first meeting. The entire research process will last for one week but does not require you to complete any other activity than you would normally do except to wear the equipment.

PROCEDURES:
After being contacted by the primary investigator and indicating your consent to participate in this study, you will be asked to schedule a time on a designated Friday to sign the consent form, have your height and weight measured, have skinfold measurements taken, complete a short survey (which contains 17 questions pertaining to your demographic information and will only be administered once), and be given the equipment (accelerometer and heart rate monitor). Your responses in the survey will be kept confidential and only used for the research study. You will be asked to wear the accelerometer for an entire week (only taking it off while you sleep) and wear the heart rate monitors while you workout and/or participate in your walk/jog class. At the end of the first meeting, you will be asked to schedule another time on the following Thursday to come and return your equipment. The second meeting should last five minutes or less.

If you are enrolled in the online class, you will be submitting your workout information (heart rates and times) for your class over the course of the semester as required by your instructor. By agreeing to this study, you will be permitting the investigator access to this information to be used in analysis and compared to the intensities (measured by heart rate) and durations of workouts from the other classes. If you have not been submitting or logging their heart rates and durations, you will still be allowed to participate in the study and your information will be used in analysis of the demographic data. Once again, your information will be kept confidential and only used in the research study. Every attempt will be made to ensure that your information is kept confidential this will occur through removal of your name and use of a coding system. A copy of the records from this study will be stored in the principal researcher's office at PEB room 308 for at least five (5) years after the end of this research study.

POSSIBLE BENEFITS:
You will unlikely benefit from any immediate results other than gaining knowledge of your height, weight, BMI, and physical activity levels. This information will also be useful to the investigator by providing insight into the effectiveness of the classes, as well as, determining if there are demographic differences between the classes.

COMPENSATION :
You will not receive compensation for participation in this study.

POSSIBLE RISKS/DISCOMFORTS:

The possible risks associated with this study are minimal. All measurements methods and testing procedures are non-invasive. Many safeguards will be put in place in order to reduce the risk of your confidentiality being violated.

ALTERNATIVE PROCEDURES/TREATMENTS:
There are no alternatives to participating in the study. Participation or declining to participate in this study will have no effect on your class standing.

WITHDRAWAL FROM THE STUDY:
You may discontinue participation at any time without penalty or loss of benefits to which you are otherwise entitled.

NUMBER OF PARTICIPANTS: We expect 80 of participants to enroll in this study.

CONFIDENTIALITY:

If the results of this research are published or presented at scientific meetings or utilized in further studies, your identity will not be disclosed. Upon completion of the data analysis for the study, all original data from this study will be secured for five years in a confidential cabinet in the principal investigator's office located at the Physical Education Building (PEB) in room 310. The faculty mentors of the investigator will be the only other ones to view the data. If in the unlikely event it becomes necessary for the Institutional Review Board to review your research records, then The University of Texas at Arlington will protect the confidentiality of

those records to the extent permitted by law. Your research records will not be released without your consent unless required by law or a court order. The data resulting from your participation may be made available to other researchers in the future for research purposes not detailed within this consent form. In these cases, the data will contain no identifying information that could associate you with it, or with your participation in any study.

CONTACT FOR QUESTIONS:
Questions about this research or your rights as a research subject may be directed to Chelsea Foster at (817) 272-0570. You may contact the Chairperson of the Institutional Review Board at 817-272-3723 with questions related to you rights as a research participant.

CONSENT:
Signatures:
As a representative of this study, I have explained the purpose, the procedures, the benefits, and the risks that are involved in this research study:

_____
Signature and printed name of principal investigator or person obtaining consent Date

By signing below, you confirm that you have read or had this document read to you.
You have been informed about this study's purpose, procedures, possible benefits and risks, and you have received a copy of this form. You have been given the opportunity to ask questions before you sign, and you have been told that you can ask other questions at any time

You voluntarily agree to participate in this study. By signing this form, you are not waiving any of your legal rights. Refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled, and the you may discontinue participation at any time without penalty or loss of benefits, to which you are otherwise entitled.

_____
SIGNATURE OF VOLUNTEER DATE

SEP 2 1 2010

APPROVED
MAY 3 1 2011
Institutional Review Board

APPENDIX B

DEMOGRAPHIC SURVEY

Demographic Survey

Please fill out the following information to the best of your knowledge. This will help to compile data about the populations of the walking for fitness and jogging for fitness classes. Your information will be kept confidential and used solely for conducting the study.

Date of Birth (m/d/y): _____ Age: _____

Height: _____ (feet) _____(inches) Weight: _____(pounds)

Place a check mark in the appropriate box for the following questions:

Gender: ☐Male ☐Female

Ethnicity: ☐Caucasian ☐African American ☐Hispanic/Latino ☐American Indian/Alaskan Native ☐Asian ☐Hawaiian/ Pacific Islander ☐Middle Eastern

Classification: ☐Freshman ☐Sophomore ☐Junior ☐Senior ☐Degreed Undergraduate ☐Graduate

How many hours do you work a week?

☐Unemployed ☐0-15 hours ☐16-25 hours
☐26-35 hours ☐36-45 hours ☐more than 45 hours

This semester, which are you considered?

☐Part-Time Student ☐Full-Time Student

How many hours of classes are you currently enrolled in? _____
Of these hours, how many hours are online classes? _____

Are you?

☐Single ☐Married

How many children do you have living at home?

☐No children ☐Expecting ☐1-2 children
☐2-4 children ☐More than 4 children

How far away from campus do you live?

☐On-campus ☐less than 10 miles ☐10-40 miles
☐More than 40 miles

Are you regularly involved in any of the following:

☐Intramural Sports ☐Recreational Sports ☐Collegiate Sports
☐Fitness classes other than this one ☐None of the above

In the month prior to starting the class, how many days did you do cardiovascular or strength training activities per week?

☐No activity ☐1-3 days/week ☐3-5 days week
☐More than 5 days/week

APPENDIX C

BODY COMPOSITION MEASUREMENT FORM

HEIGHT: _____ WEIGHT: _____ lbs AGE: _____

GENDER: MALE FEMALE BMI: _____

SKINFOLD:

	Pre-Class Test			SUM:
Chest/Tricep:	_____	_____	_____	_____
Abdomen/Suprailiac:	_____	_____	_____	_____
Thigh:	_____	_____	_____	_____

	Post-Class Test			SUM:
Chest/Tricep:	_____	_____	_____	_____
Abdomen/Suprailiac:	_____	_____	_____	_____
Thigh:	_____	_____	_____	_____

Body Fat Percentage (as estimated by skinfolds): _____

APPENDIX D

BODY COMPOSITION MEASUREMENT PROTOCOL

Standardized Testing Procedures

SKINFOLDS

1. All measurements are taken on the right side of the body to ensure consistency between trials, tests, and technicians.
2. Carefully identify, measure, and mark (with an 'X') the following sites:
    a. Triceps: a vertical fold with the arm held freely to the side of the body, measure halfway between the acromion and olecranon processes, the fold should be located on the posterior of the upper arm
    b. Abdomen: a vertical fold located two to three cm lateral of the umbilicus
    c. Chest: a diagonal fold located one-half of the distance between the anterior axillary line and the nipple in men or one-third the distance between the anterior axillary line and the nipple in women
    d. Suprailiac: a diagonal fold located in line with the iliac crest taken in the anterior axillary line superior to the iliac crest
    e. Thigh: a vertical fold located on the anterior midline of the thigh midway between the inguinal crease and the proximal border of the patella
3. Grasp the skinfold firmly using the thumb and index finger of your left hand. Place the thumb and index finger eight centimeters apart when grasping the skinfold.
4. Lift the skinfold one centimeter above the site that is being measured.
5. Be sure to keep the fold elevated while taking the measurement.
6. Open the jaws of the calipers with the right hand and place the jaws of the calipers one centimeter below the thumb and index finger, perpendicular to the fold, and release the jaws pressure slowly.
7. Take the skinfold measurement after four seconds.
8. Open the jaws of the caliper to remove it from the site and close jaws slowly to prevent damaging the equipment or its' accuracy. Two tests were run.

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BIOGRAPHICAL INFORMATION

Chelsea Senee' Foster was born on September 9, 1987 in Wichita Falls, TX, and in May 2005, she graduated from Joshua High School in Joshua, TX. Chelsea attended Midwestern State University, where she was on the cheerleading squad, before receiving her Bachelor of Arts in Kinesiology from the University of Texas at Arlington in Arlington, TX in 2009. Chelsea accepted a graduate teaching assistantship in the Department of Kinesiology at The University of Texas at Arlington from 2009-2011, where she received a Master of Science degree in Physiology of Exercise in May 2011. She plans to build her career in a university setting and, eventually, become a tenured faculty member and department chair. Chelsea will begin her pursuit of a doctorate degree in the area of Sport and Exercise Education at The Ohio State University in August of 2011.