PRELIMINARY EVALUATION OF A WEB-BASED PHYSICAL ACTIVITY COURSE

DISSERTATION

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By

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ABSTRACT

Rates of physical activity have been shown to decline across the lifespan. In an attempt to combat this decline, researchers have completed multiple descriptive and predictive studies on adolescents and adults. Unfortunately, there is little descriptive or intervention literature on college students.

The purpose of the study was to complete a construct validation of a web-based physical activity intervention for college students. A secondary purpose was to pilot-test the efficacy of the intervention in changing physical activity.

The study involved three groups: an online group (n=46), a traditional group (n=22), and a health group (n=22). The online group received a fitness and self-regulatory knowledge and skill intervention. Students in this group were required to complete at least three days of physical activity and record it in their weekly activity logs. Students in the traditional group attended a fitness lecture one day per week, as well as a three-day per week physical activity lab. Students in the health course received instruction on cancer, and were not required to be physically active for their course.

Self-regulation, family social support, friend social support, self-efficacy, outcome expectations and expectancies, physical activity, and estimated fitness measures

were collected at pretest, post-test, and six-week follow-up. A mixed between-within measures ANOVA was used to conduct the construct validation of the treatment. There was a significant interaction between time and group for self-regulation (Pillai's Trace = .235, $F(4,174)=5.789$, $p<.001$. A post-hoc One-Way ANOVA found the difference occurred at post-test, and that there was a significant difference between the online group and the health group. There were no group differences for any other variables.

The impact evaluation, though only a pilot test, was conducted to assess change in physical activity. There was a significant time effect on vigorous physical activity from pre-test to post-test $F(1,87)=11.434$, $p=.001$. There was no group effect for moderate or vigorous physical activity.

A regression analysis was conducted to assess if change in constructs led to a change in physical activity. Change scores for the constructs and physical activity were computed using pre and post-test scores. Constructs were regressed on vigorous physical activity. A regression model for the sample indicated that 16% of the variance in change in vigorous physical activity could be accounted for by change in self-regulation. In a group by group regression analysis, 10% of the variance in change in vigorous activity was accounted for by change in self-regulation for the online group. In the traditional group, 23% of the variance in change in vigorous physical activity was accounted for by change in self-regulation. There was no significant model for the health group.

This study adds to the literature on interventions for college students. It also advances the use of technology in physical activity intervention development and implementation.

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CHAPTER 1

INTRODUCTION

Rates of physical activity have been shown to decrease across the lifespan, while sedentary behaviors appear to be increasing (Bradley, McMurray, Harrell, & Deng, 2000; Caspersen, 2000; Gordon-Larsen, McMurray, & Popkin, 1999; McMurray et al., 2000). The following chapter will include two sections that will discuss these assertions in detail. The first section will discuss the public health significance of physical activity. The second section will consist of an overview of physical activity rates across the lifespan as well as current recommendations for physical activity.

Public Health Significance of Physical Activity

The benefits of regular physical activity are numerous – improved metabolism efficiency, improved immune function, and decreased risk for disease, including heart disease, stroke, high blood pressure, certain forms of cancer, diabetes, and osteoporosis. (Insel & Roth, 2002) On the other side, the Centers for Disease Control and Prevention have identified lack of physical activity as a risk factor for heart disease, diabetes, colon cancer, hypertension, obesity, osteoporosis, and muscle and joint disorders (CDC, 1999).

In 1996, cardiovascular diseases accounted for almost half of all deaths in the United States, and cost the United States roughly $286 billion in health care costs and lost wages in 1999 (CDC, 1999). Of all cardiovascular disease deaths, roughly half were due to coronary heart disease. The state of Ohio ranked eighth in the United States in deaths due to coronary heart disease.

Physical activity is also a risk factor for diabetes. Roughly 16 million Americans have diabetes, and it costs the United States about $98 billion dollars each year in medial costs and lost wages (CDC, 1999).

McGinnis and Foege (1993) discuss actual causes of death in the United States (McGinnis, 1993). Although the number one actual cause of death in 1990 was identified as tobacco, which was responsible for roughly 400,000 deaths, diet and physical activity were a close second, at roughly 300,000 deaths. Grundy (1999) estimates that the direct cost of a lack of physical activity is approximately 24 billion dollars (Grundy, 1999).

Physical Activity and Mortality

There have been a number of studies in the last few decades linking a lack of physical activity or a low fitness-level to an increase in all-cause mortality. Blair et al. (1995) looked at fitness level and death rates among healthy and unhealthy men (Blair et al., 1995). Men who were classified as fit had lower death rates than those classified as unfit. Men that were initially unfit that became fit by the end of the study had a 44% lower risk of all-cause mortality and a 52% lower risk for cardiovascular disease than men who began and remained unfit throughout the study. In terms of relative risk, using the unfit to unfit group as the reference (RR=1), the men who had moved from unfit to fit had a relative risk of dying of .56, and men who had been fit throughout the study had a relative risk of .33.

Stofan et al. (1998) completed a longitudinal study on men and women between the ages of 20 and 87 (Stofan, DiPietro, Davis, Kohl, & Blair, 1998). The study found that men who expended between 7 and 22 kcals $\cdot$ kg^{-1} $\cdot$ wk^{-1} , and women who expended between 7 and 21 kcals $\cdot$ kg^{-1} $\cdot$ wk^{-1} had higher levels of fitness. This roughly equates to completing at least 30 minutes on most days of the week, which is the current recommendation for physical activity.

Kushi et al. (1997) investigated the relationship between physical activity and mortality in women (Kushi et al., 1997). In regards to moderate activity, women who were moderately active one time per week to a few times per month had an age-adjusted relative risk of death equal to .63. Women who were moderately active two to four times per week had an age-adjusted relative risk of .51, and those that were moderately active four or more times per week had a relative risk of .48. In regards to vigorous activity,

women who exercised vigorously one time per week or a few times per month had a relative risk of .70. Women who exercised vigorously two to four times per week had a relative risk of .61, and women who exercised vigorously at least 4 times per week had a relative risk of .55. In investigating women who were less than 60, 60-64, and over 65, in almost all cases, the relative risk of dying decreased as activity level increased. The relative risk for cancer, cardiovascular disease, and respiratory illness also decreased as days per week (from 1time per week or several times per month to four or more days per week) increased.

Rockhill et al. (2001) completed a prospective study on female nurses from 1976 to 1996 (Rockhill et al., 2001). The researchers categorized physical activity into 5 groups: less than one hour per week, 1-1.9 hours per week, 2-3.9 hours per week, 4-6.9 hours per week, and 7 or more hours per week. The age adjusted relative risk for all-cause mortality for the five groups decreased from less than one hour per week (1.0) to 1-1.9 hours per week (.76), and increased further in the remaining three groups (.66, .64, .62, respectively). Decreases in relative risk generally occurred as physical activity hours per week increased for cardiovascular deaths and respiratory deaths. Cancer deaths did not show a clear trend.

Overview of Rates of Physical Activity

Adolescents have higher rates of physical activity than adults. According to the Youth Risk Behavior Survey, rates of vigorous physical activity have been relatively steady at 64% over the past few years (Grunbaum et al., 2002; Kann et al., 1998; Kann, 2000). Rates of moderate activity have been substantially lower, at about 27%. According to the Behavioral Risk Factor Surveillance System, only 12.6 percent of adults exercise vigorously, while 23.4% exercise moderately. This equates to roughly 28% of adults meeting current recommendations for physical activity (Pratt, 1999). In 1992, more than 60% of adults did not participate in the recommended amount of physical activity (Physical Activity and Health: a report from the Surgeon General). One-quarter of adults in the United States report that they engage in no type of physical activity.

Male adolescents typically have higher rates of participation in physical activity than do females, while white adolescents report higher rates of physical activity than do black or Hispanic adolescents (Grunbaum et al., 2002; Kann, 2000; Pratt, 1999). As is seen in adolescents, more white adults meet current recommendations for physical activity than do black or Hispanic adults (Pratt, 1999).

According to the National Health Interview Survey (1991 and 1992), 40% of 12-year-olds participated in regular, sustained activity (Caspersen, 2000). In the same study, it was found that roughly 24% of adults (21 and over) participated in this type of physical activity. The drop in vigorous activity is more pronounced. A drop in vigorous activity of more than 30% occurred from age 12 to ages 45+. The Behavioral Risk Factor Surveillance System found that rates of inactivity in 2000 were higher for those that were over 65 (34.6%) than for those that were 18-34 (21.3%) (Pratt, 1999).

In a prospective study of 350 college students (Petosa, Suminski, & Hortz, 2003), physical activity was measured over four weeks. Therefore, students that reported at least 12 bouts of physical activity over four weeks (three times per week) were considered active. Only 21.7% of students reported 12 or more bouts over four weeks. Over 45% of students reported zero to three bouts of activity over the four weeks. Over 78% of students did not get the recommended (3 days per week) amount of activity over four weeks.

Recommendations

Pate et al. (1995) recommend that adults should accumulate at least 30 minutes per day of moderate intensity physical activity, or at least 200 calories per day (Pate et al., 1995). This recommendation is important for two reasons. First, it emphasizes the importance of moderate rather than vigorous activity. It is not disputed that vigorous activity is beneficial to health. Rather, the recommendation regarding moderate activity is more realistic. Many people find vigorous activity unpleasant, and therefore do not exercise. However, if people realize that moderate activities can also have health benefits, then they may be more likely to attempt to meet the recommendation.

This recommendation also acknowledges that an *accumulation* of activity can have health benefits. Many Americans feel that they do not have the time to devote to regular exercise. This new recommendation helps people understand that they do not have to dedicate a large block of time for exercise. They can accrue smaller bouts, 10 minutes or so, of activity to reap health benefits.

Cale and Harris (2001) review the current recommendations for young people's physical activity [Cale, 2001 #64]. It is recommended that all young people (children and adolescents) should participate in at least one hour of moderate activity each day. Further, those that are not active should attempt to increase their activity to at least 30 minutes per day. As with the adult recommendation, both of these recommendations include accumulated activity.

Rationale for Choosing the Selected Population

It is generally well known that rates of physical activity decline over the lifespan. Younger children are more active than adolescents, adolescents are more active than college students, and college students are generally more active than adults. Although it is important to promote physical activity adherence at all ages, promotion of physical activity during college is crucial. Although children and adolescents are still forming an identity and a way of looking at their health, they are more confined as to what they can actually control. Children and adolescents are usually controlled by their parent's schedules, rules, and way of life. They may not be able to drive or walk to a park, recreation facility, or other place where they can be active. Some children and adolescents live in rough areas, and may not be allowed to stray far from the house. Others may be told that they have to find a job, study, or help with chores.

College students have much more freedom. They are learning to live on their own, by their own rules, keep their own schedules, and make their own money. They have more control over their leisure-time, and are typically in an environment where they can explore new activities. If college students can find activities that they enjoy, find time to regularly participate in physical activity, and learn skills that will help them maintain this activity across the transition to adulthood, then they may be more likely to be physically active adults.

According to the National Center for Educational Statistics (NCES), enrollment in colleges and universities increased by 14% from 1980 to 1990, and increased by 11% from 1990 to 2000. In 2000, there were 15.3 million college students, and enrollment numbers are expected to increase to 17.7 million by 2012 (U.S. Department of Education).

The health of college students has also become a concern. When one thinks of the common health problems of college students, health problems such as sexually transmitted diseases, alcohol abuse, and other communicable diseases typically come to mind. Chronic diseases, such as heart disease and diabetes are not typically mentioned. However, as found by Spencer et al (2002), risk factors for cardiovascular disease can be found in people as young as college age. In a sample of 226 students, 29% were found to have "undesirable" (over 200 mg/dL) total cholesterol levels. Also, over 10% had at risk diastolic blood pressure readings (over 90 mm). Over 50% of college students reported consuming two or more servings per day of high saturated fat foods (Spencer, 2002).

This information is extremely important in discussing the health of the nation's college students and future adults. Though the sample was relatively small (226), and from only one university, it is important to discuss the implications of these findings. If people have risk factors for cardiovascular disease this early in life, this could lead to compounded risk later in life. In other words, if college students continue their current lifestyle behaviors that have already led to increased risk, they are likely to exacerbate this unhealthy lifestyle throughout their adult life. Physical activity is one way to control some of the risk factors mentioned above (cholesterol, blood pressure).

In a study of college alumni by Pearman et al. (1997), it was found that students who had taken a health and physical activity course had more favorable attitudes toward physical activity and were more likely to be joggers than those that did not take the course (Pearman, 1997). It is important to note that the course in question involved jogging, and that the students who took the course were more likely to jog into their adult lives than those that did not take the course. The authors point out that their measurement of physical activity was not specific for other types of activities such as aerobics. The significance of this study is that there may be some transfer of learning in regards to health and physical activity from college to adulthood. In other words, if students make physical activity a priority in their life while they are in college, they may find it easier to transfer this view to their adult lives.

Adams and Brynteson (1992) compared alumni from four colleges, each of which had differing requirements for physical activity courses(Adams II & Brynteson, 1992). When comparing the colleges, it was found that alumni from the college with the most requirements for physical activity courses had better knowledge, attitudes and exercise habits than the other three. The group with the most requirements also was more active as alumni than those with no requirement. This study illustrates the idea that students who are more active in college will be more active as adults.

Bynteson and Adams (1993) also investigated the effect of a combination "concepts" lecture and a physical activity lab on college alumni (Brynteson & Adams II, 1993). The concepts course provide fitness information to students through a lecture setting. The researchers compared four colleges, three of which included some level of a "concepts" course. The alumni who did not take a "concepts" course had significantly

lower knowledge, attitudes, habits, and exercised fewer days per week than alumni who had taken a "concepts" course. This study showed that including a knowledge component to the physical activity lab potentially increases knowledge, attitudes, and physical activity to a greater degree in alumni who have taken this version of the activity course as opposed to those that only take a physical activity lab.

A retrospective study was conducted on college alumni by Sparling and Snow (Sparling & Snow, 2002). College alumni from one university, who graduated in either 1988 or 1996, were asked to describe their current activity level, as well as their activity level when they were seniors in college. Levels of activity were classified as follows: "regular exercisers" were those who exercised at least three times per week; "irregular exercisers" were those that exercised one to two days per week; and "nonexercisers," who exercised less than one day per week. The study found that over 80% alumni who were "regular exercisers" during their senior year of college reported exercising as much or more as adults than they did in college. On the other hand, over 80% of alumni who were "nonexercisers" during their senior year of college reported the same or less exercise as adults.

The proposed study involves a type of fitness "concepts" course, behavioral skill building, and required physical activity. The purpose of the course is to promote long-term adherence to physical activity in those students who elect to take the course. The studies reviewed above suggest that this type of course can be an important step in promoting continued adherence to physical activity into adulthood.

The college or university setting is a prime setting for physical activity promotion programs. In this setting, it is potentially easier to reach more people than in a community-based setting. The web-based format of this course has the potential to reach even more students, since students will not (after the first few quarters) be required to meet on campus. Therefore, this course could be offered to students involved in a distance-learning program. Through this media, thousands of students could be reached if the study is found to be effective in helping students maintain physical activity.

CHAPTER 2

INTRODUCTION

The purpose of this study is to complete a construct validation of an online physical activity intervention to increase college student's knowledge and use of self-regulation, social support, self-efficacy, and outcome expectations and expectancies. A secondary purpose is to pilot test the intervention's efficacy in increasing students' physical activity. Therefore, it is necessary to look at relevant literature regarding rates of physical activity, correlates of physical activity, interventions, and other studies attempting to complete construct validation of treatments.

This chapter includes five sections. The first section discusses rates of physical activity among college students. The second section includes a review of articles regarding correlates of physical activity. The third section reviews physical activity interventions, both traditional interventions in a college population and online interventions in other populations. The fourth section includes information on construct change across health behaviors, and the fifth section briefly reviews web-based education studies.

Searches were conducted using Medline, Psychinfo, ERIC, and PubMed. Only articles that used the English Language, were available at the Ohio State University Library, online, or borrowed access from OhioLink libraries were included.

Rates of Physical Activity

Rates of physical activity in college students are surprisingly low. Rates of inactivity ranged from 40-55% in college students (Petosa et al., 2003; Suminski, Petosa, Utter, & Zhang, 2002). This means that roughly half of college students are not getting enough, if any, physical activity. In the College Health Risk Behavior Survey, only 19.5% of college students engaged in five or more days of moderate activity (Douglas et al., 1997). The same survey found that 37.6% engaged in at least three days of vigorous physical activity per week. Another student of college students at one large university found that only 22% of students exercised vigorously three days per week (Petosa et al., 2003). Clearly, there is a need to increase physical activity in this population. The following section reviews studies that investigated rates of physical activity in college students.

Petosa et al. (2003) used a prospective study to predict vigorous physical activity in college students using Social Cognitive Theory constructs(Petosa et al., 2003). The results of the regression analysis are reported in the next section. In the sample of 350 college students, the investigators collected physical activity data for four weeks using a seven-day recall of physical activity. Over the course of four weeks, roughly 45% if the sample averaged one day or less of physical activity, and 78% of the sample did not meet the current ACSM recommendation for vigorous physical activity.

Douglas et al. (1997) completed a health risk behavior survey of college students in 1995 (Douglas et al., 1997). Of the 7,442 students that were mailed the questionnaire,

4,838 students completed it. Another 229 student questionnaires were excluded, since the students identified themselves as graduate students. Students were asked questions regarding various health behaviors. The results of the physical activity portion of the questionnaire are reported here.

The article did not detail the validity and reliability of each set of questions, but mentioned that prior reliability data for "many of the questions" was established on the youth risk behavior survey. Vigorous activity was assessed by asking students if they participated in an activities that made them sweat and breathe hard for at least 20 minutes on at least three out of the past seven days. According to the study, 37.6% of college students reported exercising vigorously on 3 of the past 7 days. Males reported vigorous exercise more than females (43.7% versus 33%), and white students reported more vigorous activity (38.7%) than black (36.6%) or Hispanic (35.4%) students.

Moderate activity, assessed by asking students if they walked or biked for at least 30 minutes on five of the last seven days, was less promising. Only 19.5% of college students reported moderate activity on at least 5 of the last 7 days. Males reported slightly more moderate activity than females (19.7% versus 19.3%). Black students reported the highest amount of moderate activity (27.6%), followed by Hispanics (21.4%), while whites reported the least amount of moderate activity (18.2%).

Lowry et al. (2000) presented further findings from the national college health risk behavior survey (Lowry et al., 2000). Strength training was assessed in the survey by asking students if they had completed strengthening or toning exercises on at least three of the last seven days. The researchers found that 29.9% of students reported strength training on at least 3 of the last seven days. Males reported more strength training than females (33.9% versus 26.8%).

There seems to be a drop in activity from high school to college. Using the same question to assess vigorous activity, the youth Risk Behavior Surveillance has reported a relatively stable rate of vigorous activity, roughly 64%, for the past several years (Grunbaum et al., 2002; Kann, 2000). The college survey found that rates of vigorous activity among college students was appreciably lower, around 38% (Douglas et al., 1997).

In a study investigating ethnic differences in physical activities, it was found that, using the Self-Report of Physical Activity Questionnaire, 40-55% of the men and women in the study did not report any vigorous physical activity in previous month (Suminski et al., 2002). Between 11 and 20% of the men and women did not engage in any activity in the previous month. The researchers found that rates of physical activity among women differed according to ethnicity – Asian women reported the least amount of activity, followed by African American women, White women, and Hispanic women. Asian men reported the least amount of activity, followed by African American men, White men, and Hispanic men.

Adame et al. (2001) examined self-report physical activity among college students in 1987 and in 1997 (Adame, Johnson, Nowicki, Cole, & Matthiasson, 2001). Freshmen students enrolled in a health education course in a mid-sized, southeastern university formed the sample. In 1987, 243 students participated in the study, while 250 freshmen in 1997 participated in the study. Physical fitness and amount of exercise were assessed. Amount of exercise was assessed using a 9-point Likert scale that asked students how much time they spent doing activity (examples were brisk walking, jogging, etc), from "no regular exercise" to "10 or more hours per week". From this instrument, researchers categorized physical activity into three groups – less than two hours, two to 4.9 hours, and five or more hours per week. Reliability for the measure ranged from r=.8 for women to r=.70 for men. Men's hours of exercise in the 1987 and 1997 samples were not significantly different. However, women in 1987 reported two hours or less of activity (51.7%) to a greater degree than women in the 1997 sample (19.5%). In 1987, 10.8% of women exercised five hours or more. In 1997, 32.5% of women reported five or more hours per week of exercise.

A few differences in this study, as compared to the previous study, need to be addressed. First, the researchers in this study grouped both moderate and vigorous activity together. As shown in the first study, it is more likely that these two levels of activity are quite different. Second, this study categorized hours of physical activity. The previous study measured how many students completed a certain amount of days per week. Other studies on other populations look at hours per day or days per week, but as continuous variables. Although all of the situations mentioned claim to measure physical activity, it is easy to see that different measures are likely to produce different results.

Brown et al. (2003) examined rates of physical activity among women through life transitions (Brown & Trost, 2003). Baseline data was collected from 14,779 women of college age. A follow-up was conducted four years later, where only 9657 women completed the follow-up. Life-events that were focused on were: marriage, having a first baby, having a subsequent baby, divorce, becoming a single parent, return to college, beginning to work, changing jobs, and working full-time. The study found that, although the proportion of women who were considered "active" was similar between baseline and follow-up, there was a drop in physical activity among participants who were considered "active" at baseline. The life events that were related to inactivity were marriage, having a child, becoming a single parent, or beginning work.

Care must be taken, however, to compare rates of physical activity over the lifespan. If researchers are using different measures of physical activity, they may be measuring a different type of physical activity than another study. Sarkin et al. (2000) looked at the discrepancies between physical activity measures in a study comparing the Youth Risk Behavior Survey (YRBS), the National Health Interview Survey (NHIS), and the Physical Activity Recall Interview (PAR) in satisfying the national guidelines for physical activity (Sarkin, Nichols, Sallis, & Calfas, 2000). For vigorous activity, roughly 30% of students met the recommendation for vigorous physical activity (3 days per week for at least 20 minutes per bout) according to the NHIS instrument. Roughly 40% of students met the recommendation according to PAR interview. Using the YRBS instrument, roughly 37% of people, met the guideline. For moderate activity, 39% of people met the guideline (5 days per week, 30 minutes per bout) according to the PAR

interview. Roughly 34% met the guideline according to the NHIS. A variation also occurred when total minutes per week of physical activity, not a specific number of days, was considered. In this instance, prevalence was over 20 percentage points higher than when frequency was used. Occupational activity can also change estimates. Therefore, it is imperative that researchers are clear what type of activity they are measuring, how they are measuring it, and how they are analyzing the data. The researchers recommend standardizing measures so that different populations, such as adolescents, adults, etc, can be compared.

Summary

As mentioned in the previous chapter, college student's levels of physical activity can carry over to their adult lives. In all of the studies reviewed above, it is apparent that college students are generally more sedentary than adolescents, and that few actually get the recommended amount of moderate or vigorous physical activity.

Correlates of Physical Activity

Currently, there is little literature available on college students and the predictors of physical activity in this population. The following section reviews the existing literature on college students. Many of the studies included below investigate several variables. For clarity, the studies are arranged by variable. Therefore, only the information relevant to each specific variable will be included under each variable heading. If studies are mentioned under more than one variable, the sample information and basic study design is repeated for each mention to assist in interpreting the results.

Self-regulation

Two studies were located that investigated the relationship between self-regulation and physical activity (Petosa et al., 2003; Rovniak, Anderson, Winett, & Stephens, 2002). Both found that the variable was a significant predictor; one predicted days of vigorous physical activity, and the other predicted stage of change. Both studies are reviewed below.

Rovniak et al (2002) completed a prospective study on college students (Rovniak et al., 2002). Using Social Cognitive Variables such as social support, self-regulation, self-efficacy, and outcome expectations, the researchers aimed to create a model that would predict physical activity at 8 weeks. Subjects were college age students (mean age of 19.56, SD = 1.39) that were registered for psychology courses at Virginia Tech, who were offered extra course credit for participating in the study. Self-regulation was measured using two scales developed for the study – goal-setting and exercise planning. On each 10-item scale, students rated their level of agreement to statements on a 5-point

Likert scale ("does not describe" to "describes completely"). Internal consistency for these two scales ranged from .87-.89, and test-retest reliability was in the same range (.87-.89). Physical activity was measured in three ways – stage of change, energy expenditure, and mode of activity. The test-retest reliability for the energy expenditure measure was .75. The other physical activity measures' reliabilities were not reported. The results of the study indicated that self-regulation had significant total effects on physical activity (β=.71). Self-regulation mediated the effect of self-efficacy, where the indirect effect was β=.57. The authors report that the total model, including self-regulation, accounted for 55% of the variance in physical activity, as measured by Stage of Change.

Petosa et al. (2003) investigated the role of Social Cognitive theory constructs in predicting vigorous physical activity in 350 college students(Petosa et al., 2003). Variables that were included in the study were: self-regulation, outcome expectancy value, exercise role identity, positive exercise experience, family and friend social support, and self-efficacy. Self-regulation was assessed using a 43-item instrument with acceptable validity and reliability (test-retest r=.92, Cronback's alpha = .88). Vigorous physical activity was measured through a seven day recall that had been validated through expert panel review, and was found to be reliable (test-retest reliability, r=.72 for supervised activity). The researchers used a hierarchical multiple regression analysis to assess predictive capacity of the constructs on vigorous physical activity. Results of the study showed that the total model, consisting of all of the Social Cognitive Theory variables, accounted for 27.2% of the variance in vigorous physical activity.

Social Support

Social support was investigated as a predictor of physical activity in four studies. Studies that separated social support into family and friend social support found that both seem to be an important predictor for physical activity. All four studies found that some form of support (total, family and/or friend) was related to physical activity. The four studies are reviewed below.

Rovniak et al (2002) completed a prospective study on college students (Rovniak et al., 2002). Using Social Cognitive Variables such as social support, self-regulation, self-efficacy, and outcome expectations, the researchers aimed to create a model that would predict physical activity at 8 weeks. Subjects were college age students (mean age of 19.56, SD = 1.39) that were registered for psychology courses at Virginia Tech, who were offered extra course credit for participating in the study. Social support was measured using a 5-item, 5-point Likert scale (ranging from "never" to "16 or more times"), where the internal consistency and stability were found to be sufficient (α=.91, r = .88, respectively). Physical activity was measured in three ways – stage of change, energy expenditure, and mode of activity. The test-retest reliability for the energy expenditure measure was .75. The other physical activity measures' reliabilities were not reported. Data analysis included latent variable structural equation modeling. Social support was mediated by self-efficacy, where the indirect effect was β=.28. Outcome expectations did not have a significant effect on physical activity or self-regulation. The authors report that the total model, including social support, accounted for 55% of the variance in physical activity, as measured by Stage of Change.

Wallace et al. (2000) examined the relationship between Social Cognitive Theory variables in predicting stage of change for exercise (Wallace, Buckworth, Kirby, & Sherman, 2000). The sample consisted of 937 college students with a mean age of 22 (SD=5.6 years), where roughly 60% were female. In the sample, males reported more hours of sedentary activity than females. The internal consistency for the stage of change measure was .71. Social support, both by family and friends, was measured using a 12-item, 5-point likert scale (none to very often). In the pilot test, the internal consistencies were shown to be .91 (family) and .84 (friends). One week test-retest reliabilities for the family and friends scales were .86 and .90, respectively. Multiple discriminant analysis was used, since stage of change was a nominal variable. Roughly 52% of the sample described themselves as being inactive, or in precontemplation or contemplation. Family social support was a significant discriminating variables for females. A Tukey's post-hoc analysis showed that family social support increased through the stages significantly. For males, friend social support was a significant discriminating functions for males. After completing a Tukey's post-hoc test for males, it was found that friend social support was of growing importance when comparing males in different stages.

Petosa et al. (2003) investigated the role of Social Cognitive theory constructs in predicting vigorous physical activity in 350 college students(Petosa et al., 2003). Variables that were included in the study were: self-regulation, outcome expectancy value, exercise role identity, positive exercise experience, family and friend social support, and self-efficacy. Social support was assessed through a previously developed instrument, assessing both family and friend support for physical activity. This measure has been previously validated and found to be reliable. Physical activity was measured

through a seven day recall that had been validated through expert panel review, and was found to be reliable (test-retest reliability, r=.72 for supervised activity). The researchers used a hierarchical multiple regression analysis to assess predictive capacity of the constructs on vigorous physical activity. Results of the study showed that the total model, consisting of all of the Social Cognitive Theory variables, accounted for 27.2% of the variance in vigorous physical activity.

Leslie et al. (1999) completed a study on the characteristics of sufficiently active versus insufficiently active college students in Australia(Leslie et al., 1999). The sample consisted of 2,729 college students. A survey containing instruments related to environment, exercise enjoyment, social support, self-efficacy, and a two-week physical activity recall was administered to students. Social support from family and friends was assessed through a modified instrument that addressed barriers to exercise. A five-point scale (0 = never, 4=very often). Categories included low (score ≤ 2) or high (>2) social support. Physical activity was assessed using a 2-week physical activity recall that assessed the following types of physical activity: physical activity as a mode of transportation, moderate activity, and vigorous activity. Duration of activity was converted to energy expenditure. Students were considered sufficiently active if they expended 800 kcals/week or more. Students were insufficiently active if they expended less than 800 kcals/week. Odds ratios for being insufficiently active were calculated through logistic regression. Males with low social support from family and friends were 48% and 45%, respectively, more likely to be insufficiently active. Females who had low social support from family and friends were 55% and 23%, respectively, more likely to be insufficiently active.

Self-efficacy

Five studies were found that investigated the role of self-efficacy in predicting physical activity. Four of the five found that self-efficacy was related to physical activity. All of the studies are reviewed below.

Rovniak et al (2002) completed a prospective study on college students (Rovniak et al., 2002). Using Social Cognitive Variables such as social support, self-regulation, self-efficacy, and outcome expectations, the researchers aimed to create a model that would predict physical activity at 8 weeks. Subjects were college age students (mean age of 19.56, SD = 1.39) that were registered for psychology courses at Virginia Tech, who were offered extra course credit for participating in the study. Self-efficacy was measured using a 12-item, 5-point Likert scale. Internal consistency and reliability were not reported for this scale. Physical activity was measured in three ways – stage of change, energy expenditure, and mode of activity. The test-retest reliability for the energy expenditure measure was .75. The other physical activity measures' reliabilities were not reported. The results indicated that self-efficacy had significant total effects on physical activity (β= .48). Self-efficacy, however, was mediated in a large part by self-regulation, where the indirect effect was β=.57. Social support was mediated by self-efficacy, where the indirect effect was β=.28. The authors report that the total model accounted for 55% of the variance in physical activity, as measured by Stage of Change.

Wallace et al. (2000) examined the relationship between Social Cognitive Theory variables in predicting stage of change for exercise (Wallace et al., 2000). The sample consisted of 937 college students with a mean age of 22 (SD=5.6 years), where roughly

60% were female. In the sample, males reported more hours of sedentary activity than females. The internal consistency for the stage of change measure was .71. Self-efficacy for exercise was assessed using 5-point Likert scale for barriers to physical activity. The internal consistency for the instrument in a pilot study was .74, and test-retest reliability was .94. Roughly 52% of the sample described themselves as being inactive, or in precontemplation or contemplation. Self-efficacy was a significant discriminating variable for females. A Tukey's post-hoc analysis showed that self-efficacy increased through the stages significantly. For males, self-efficacy was a significant discriminating function for males. After completing a Tukey's post-hoc test for males, it was found that self-efficacy was of growing importance comparing males in different stages.

Petosa et al. (2003) investigated the role of Social Cognitive theory constructs in predicting vigorous physical activity in 350 college students(Petosa et al., 2003). Variables that were included in the study were: self-regulation, outcome expectancy value, exercise role identity, positive exercise experience, family and friend social support, and self-efficacy. Self-efficacy for physical activity was assessed using a 14-item measure that has been previously validated and found to be reliable. Physical activity was measured through a seven day recall that had been validated through expert panel review, and was found to be reliable (test-retest reliability, r=.72 for supervised activity). The researchers used a hierarchical multiple regression analysis to assess predictive capacity of the constructs on vigorous physical activity. Results of the study showed that the total model, consisting of all of the Social Cognitive Theory variables, accounted for 27.2% of the variance in vigorous physical activity.

Coureya and McAuley (1994) investigated the determinants of the frequency, intensity, and duration of activity in 170 college students (Courneya & McAuley, 1994). Self-efficacy for physical activity was measured using three scales, one for frequency, one for duration, and one for intensity. The Cronbach alphas for the three scales were .89, .93, and .87, respectively. The frequency scale assessed the ability of students to be physically active at least three days per week. The duration scale assessed the ability of students to complete activity from 15 to 105 minutes. The intensity scale ranged from very, very light to very, very hard. Physical activity was assessed by asking students to list the frequency, duration, and intensity of their exercise. Frequency was assessed by asking students to list the number of exercise sessions that they completed in the past month. Duration was assessed by averaging the number of minutes per exercise session. Intensity of physical activity was assessed by using the average rate of perceived exertion. In a regression model, it was found that self-efficacy accounted for 15% of the variance in frequency of activity, 15% of the variance in duration, and 8% of the variance in intensity of physical activity.

Leslie et al. (1999) completed a study on the characteristics of sufficiently active versus insufficiently active college students in Australia(Leslie et al., 1999). The sample consisted of 2,729 college students. A survey containing instruments related to environment, exercise enjoyment, social support, self-efficacy, and a two-week physical activity recall was administered to students. Self-efficacy was assessed through a modified instrument that addressed barriers to exercise. A five-point scale ("sure I cannot" to "sure I can") was used. Results were categorized into average self-efficacy (score ≤ 3) or high self-efficacy (score > 3). Physical activity was assessed using a 2-

week physical activity recall that assessed the following types of physical activity: physical activity as a mode of transportation, moderate activity, and vigorous activity. Duration of activity was converted to energy expenditure. Students were considered sufficiently active if they expended 800 kcals/week or more. Students were insufficiently active if they expended less than 800 kcals/week. Odds ratios for being insufficiently active were calculated through logistic regression. Self-efficacy was not found to increase odds ratios of being either sufficiently or insufficiently active.

Outcome Expectations and Expectancies

Two studies were located that investigated the relationship of outcome expectations and expectancies on physical activity. One study found a significant relationship between the variable and physical activity (Petosa et al., 2003). The other did not find a significant relationship between the variable and physical activity (Rovniak et al., 2002). Both studies are reviewed below.

Petosa et al. (2003) investigated the role of Social Cognitive theory constructs in predicting vigorous physical activity in 350 college students(Petosa et al., 2003). Variables that were included in the study were: self-regulation, outcome expectancy value, exercise role identity, positive exercise experience, family and friend social support, and self-efficacy. Outcome expectancy value was assessed using a 19-item instrument with reported validity and reliability (test-retest reliability on the three subscales ranged from .66 to .89). Physical activity was measured through a seven day recall that had been validated through expert panel review, and was found to be reliable

(test-retest reliability, r=.72 for supervised activity). The researchers used a hierarchical multiple regression analysis to assess predictive capacity of the constructs on vigorous physical activity. Results of the study showed that the total model, consisting of all of the Social Cognitive Theory variables, accounted for 27.2% of the variance in vigorous physical activity.

Rovniak et al (2002) completed a prospective study on college students (Rovniak et al., 2002). Using Social Cognitive Variables such as social support, self-regulation, self-efficacy, and outcome expectations, the researchers aimed to create a model that would predict physical activity at 8 weeks. Subjects were college age students (mean age of 19.56, SD = 1.39) that were registered for psychology courses at Virginia Tech, who were offered extra course credit for participating in the study. Outcome expectations were measured using a modified version of two scales. These scales included measures of positive and negative outcomes of physical activity and enjoyment of physical activity. The internal consistency (α=.81-.88) and test-retest reliability (r=.81-.85) on the positive and negative outcomes scale were found to be sufficient. The enjoyment scale included 18 items, where students rated their level of liking ("I enjoy it" to "I hate it") on a 7-point Likert scale. Physical activity was measured in three ways – stage of change, energy expenditure, and mode of activity. The test-retest reliability for the energy expenditure measure was .75. The other physical activity measures' reliabilities were not reported. Outcome expectations did not have a significant effect on physical activity or self-regulation.

Exercise Role Identity

One study investigated the role of exercise role identity in predicting physical activity. Exercise Role identity was found to be a significant contributor to the overall model for vigorous physical activity. The study is reviewed below.

Petosa et al. (2003) investigated the role of Social Cognitive theory constructs in predicting vigorous physical activity in 350 college students(Petosa et al., 2003). Variables that were included in the study were: self-regulation, outcome expectancy value, exercise role identity, positive exercise experience, family and friend social support, and self-efficacy. Exercise role identity was assessed using nine items, where internal consistency (Cronbach's alpha = .94) and test-retest reliability (r=.93) were considered adequate. Physical activity was measured through a seven day recall that had been validated through expert panel review, and was found to be reliable (test-retest reliability, r=.72 for supervised activity). The researchers used a hierarchical multiple regression analysis to assess predictive capacity of the constructs on vigorous physical activity. Results of the study showed that the total model, consisting of all of the Social Cognitive Theory variables, accounted for 27.2% of the variance in vigorous physical activity.

Exercise Enjoyment/Positive Exercise Experience

Three studies investigated the role of exercise enjoyment or positive exercise experience in predicting physical activity. All three studies found that there was a positive relationship between the variables and physical activity. The three studies are reviewed below.

Petosa et al. (2003) investigated the role of Social Cognitive theory constructs in predicting vigorous physical activity in 350 college students(Petosa et al., 2003). Variables that were included in the study were: self-regulation, outcome expectancy value, exercise role identity, positive exercise experience, family and friend social support, and self-efficacy. Positive exercise experience was assessed using a subscale of a subjective exercise experience instrument. Internal consistencies for the subscale ranged from .85-.88). Physical activity was measured through a seven day recall that had been validated through expert panel review, and was found to be reliable (test-retest reliability, r=.72 for supervised activity). The researchers used a hierarchical multiple regression analysis to assess predictive capacity of the constructs on vigorous physical activity. Results of the study showed that the total model, consisting of all of the Social Cognitive Theory variables, accounted for 27.2% of the variance in vigorous physical activity.

Frederick et al. (1996) studied 118 students (80 women, 38 men) from Southern Utah University (Frederick, Morrison, & Manning, 1996). The researchers measured motivation to participate in physical activity, exercise enjoyment, adherence to exercise, and attitude toward exercise. Exercise enjoyment was measured using a 20-item scale, which included items regarding fulfillment, dependence, weight-related perceptions, and drive to exercise. The test-retest reliability of the instrument was reported as .68. Adherence to exercise was assessed using two questions asking students to report the number of days per week that they did their most common form of physical activity, and the number of hours per week in which they did their most common form of activity.

Exercise fulfillment (a subscale of positive exercise experience) was shown to be a significant predictor of hours per week of exercise (β=.65, $p<.05$) for men. For women, adherence to exercise was not predicted.

Leslie et al. (1999) completed a study on the characteristics of sufficiently active versus insufficiently active college students in Australia(Leslie et al., 1999). The sample consisted of 2,729 college students. A survey containing instruments related to environment, exercise enjoyment, social support, self-efficacy, and a two-week physical activity recall was administered to students. Enjoyment, measured by a 21-item instrument, was assessed using a 5-point scale (1=no enjoyment, 5=a lot of enjoyment). Categories included low (score ≤ 3) or high (score >3) enjoyment. Physical activity was assessed using a 2-week physical activity recall that assessed the following types of physical activity: physical activity as a mode of transportation, moderate activity, and vigorous activity. Duration of activity was converted to energy expenditure. Students were considered sufficiently active if they expended 800 kcals/week or more. Students were insufficiently active if they expended less than 800 kcals/week. Odds ratios for being insufficiently active were calculated through logistic regression. Males who had low enjoyment of physical activity were 25% more likely to be insufficiently active. Females who had low enjoyment were 18% more likely to be insufficiently active.

Motivation

One study investigated the relationship of motivation and physical activity. The study found that body-related motivation was related to physical activity. The study is reviewed below.

Frederick et al. (1996) studied 118 students (80 women, 38 men) from Southern Utah University (Frederick et al., 1996). The researchers measured motivation to participate in physical activity, exercise enjoyment, adherence to exercise, and attitude toward exercise. Motivation to participate compiled questions involving five motivations to exercise – interest or enjoyment, development of skill, improving fitness, appearance, and social interests. Of these five motivations, two were considered intrinsic motivations (development of skill and interest or enjoyment), while the other three were considered extrinsic motivations. Results of the study showed that body-related motivation, including fitness and appearance, was a significant predictor of days per week of exercise (β=.74, $p<.05$) for men. For women, adherence to exercise was not predicted.

Attitude

Two studies included attitude in their investigation of correlates of physical activity. One study found that there was no relationship between attitude and physical activity (Frederick et al., 1996). The other study found that there was a relationship between attitude and physical activity (Courneya & McAuley, 1994).

Frederick et al. (1996) studied 118 students (80 women, 38 men) from Southern Utah University (Frederick et al., 1996). The researchers measured motivation to participate in physical activity, exercise enjoyment, adherence to exercise, and attitude toward exercise. Attitude was measured by four questions regarding their perceived competence and satisfaction with physical activity. No reliability or validity data was given. Adherence to exercise was assessed using two questions asking students to report

the number of days per week that they did their most common form of physical activity, and the number of hours per week in which they did their most common form of activity. There was no significant relationship between attitude and adherence to physical activity.

Coureya and McAuley (1994) investigated the determinants of the frequency, intensity, and duration of activity in 170 college students (Courneya & McAuley, 1994). Attitude toward physical activity was measured in two ways. The first measure, regarding the importance of regular physical activity, utilized one question that was rated on an 11-point scale (considerably less important to considerably more important). The second measure asked students the importance of physical activity when compared to eight other behaviors. This was rated on the same scale as the first measure. The second measure had an internal consistency of .79.

Physical activity was assessed by asking students to list the frequency, duration, and intensity of their exercise. Frequency was assessed by asking students to list the number of exercise sessions that they completed in the past month. Duration was assessed by averaging the number of minutes per exercise session. Intensity of physical activity was assessed by averaging the rate of perceived exertion. In a regression model, attitude accounted for 5% of the variance in frequency and 2% of the variance in duration.

Benefits versus Barriers

One study used the Health Belief Model to investigate the relationship of benefits versus barriers to physical activity. The study, reviewed below, found a significant relationship between benefits and barriers.

Grubbs and Carter (2002) used the health promotion model to investigate perceived benefits and barriers to exercise among college students (Grubbs & Carter, 2002). One-hundred, forty-seven college students from a large southeastern university served as the sample. Perceived benefits and barriers were measured using a 43-item, 4-point Likert scale (strongly disagree to strongly agree). The reported internal consistency of the measure was .95, and test-retest reliability was .89. Current exercise habits were assessed by asking students if they exercised using large muscle groups for at least 20 minutes, on three or more days per week, where the intensity was at least 60% of their maximum heart rate. If students reported doing so, they were considered to be exercisers. Of the total sample, 68.8% of students reported exercising at this level, while 31.2% did not. The researchers found that students who were considered exercisers were more likely to score higher on the benefits scale and lower on the barriers scale.

Environment

One study was found that measured the relationship between perceived environment and physical activity in college students. The researchers found no relationship between the two variables. The study is reviewed below.

Leslie et al. (1999) completed a study on the characteristics of sufficiently active versus insufficiently active college students in Australia(Leslie et al., 1999). The sample consisted of 2,729 college students. A survey containing instruments related to

environment, exercise enjoyment, social support, self-efficacy, and a two-week physical activity recall was administered to students. Assessment of environment included querying students on facilities available. Results were categorized into aware of facilities or unaware of facilities. Physical activity was assessed using a 2-week physical activity recall that assessed the following types of physical activity: physical activity as a mode of transportation, moderate activity, and vigorous activity. Duration of activity was converted to energy expenditure. Students were considered sufficiently active if they expended 800 kcals/week or more. Students were insufficiently active if they expended less than 800 kcals/week. Perceived environment was not significantly different between the levels of activity.

Summary

Clearly, differences in measures of correlates of physical activity, and different measures of physical activity can produce different results. First, in each of the studies reviewed above, there were different predictor variables targeted. Even those studies that claim to measure the same variable, such as self-efficacy, might be measuring different aspects of self-efficacy. This could partially explain the inconsistency in the results. There is little in the way of literature regarding correlates of physical activity in college students. The abovementioned studies used theories and models such as Social Cognitive theory, Stage of Change, the Health Belief Model, or other variables taken from other theories (i.e., the constructs were taken from two or more theories, or no theory was mentioned). The literature regarding correlates of physical activity in adolescents and

children is much more vast than it is in college students. Clearly there is a need for continued study on the correlates of physical activity in college students.

Second, while all of the above studies are attempting to predict physical activity, they are not predicting the same thing. First, some of the studies use proxy measures of physical activity (Stage of Change), while others use days of physical activity, and others use minutes or physiological measures. Also, the type of physical activity that is measured is likely different from study to study. In other words, one study may include only vigorous physical activity, while another may include both moderate and vigorous physical activity. It is likely that these studies will result in different rates of physical activity, which would affect the prediction model. In other words, if the dependant variable is not the same, it is difficult to compare prediction models across studies. For example, the Rovniak study appears to be superior in the prediction of physical activity(Rovniak et al., 2002). However, they are not actually predicting physical activity – they are predicting stage of change.

What can be gleaned from the reviewed studies is that self-efficacy, social support, self-regulation, and exercise enjoyment appear to have more evidence of a relationship with physical activity. In other words, the majority of studies that used these variables found a relationship with physical activity. Outcome expectations and Expectancies and attitude were mixed – for each, one study found a relationship and another study did not. Only one study as found for exercise role-identity, benefits versus barriers, motivation and environment. Therefore, it is difficult to make a decision regarding the usefulness of these variables in relating to physical activity.

Again, it must be said that there are few studies in college students to begin to make a case for or against many of these variables. Only self-efficacy and social support were employed in four or more studies. Clearly, more descriptive literature on college students' correlates of physical activity is needed to make any definitive decisions regarding predictors of physical activity.

Interventions

There has only been one published physical activity intervention study in a college population. The theory and model employed to change physical activity in the intervention were Social Cognitive Theory and the Transtheoretical Model. The only significant predictor at one-year follow-up was processes of change. There was an increase in strength training in women. At two years, there was no difference in physical activity.

Kahn and colleagues (2002) reviewed the effectiveness of interventions in different settings in increasing physical activity (Kahn et al., 2002). Only those studies using college students are included in this section. Interventions in college-based health and physical activity courses typically include a knowledge component and application of skills component. In their review, Kahn et al. found that although there were significant changes in physical activity during two interventions, the two-year follow-up showed that physical activity levels returned to baseline levels. It was concluded the there was "insufficient evidence" to evaluate the effectiveness of this type of intervention, since there were only two studies that qualified for the review.

Calfas et al. (2000) presented the two-year results of Project GRAD (graduate ready for activity daily) (Calfas et al., 2000). The sample consisted of 338 students, of which 185 were male. At two years, 93% of the total sample (314 students) provided useable data. Students who volunteered to participate in the study were randomly assigned to either the intervention or a general health course. The intervention, based on both the Transtheoretical Model and Social Cognitive Theory, targeted variables such as self-efficacy, social support, perceived benefits, barriers, enjoyment of physical activity,

and use of the processes of change. The intervention, which included a lecture and a lab, lasted one semester. During the lecture, two faculty members led a discussion of the benefits of and recommendations for physical activity as well as the process of exercise management. The lab sessions were peer-led, and students were expected to participate in physical activity while applying the behavioral skill they learned in the lecture. Follow-up measures were collected both through mail and phone surveys.

Physical activity was measured using the 7-day Physical Activity Recall as well as with energy expenditure. Psychosocial measures that were assessed were social support, self-efficacy, benefits and barriers, enjoyment, and processes of change.

At one year, strength training activities were significantly different in the intervention group than in the control group for women. There was no significant difference in physical activity for either sex at two years. Women in the intervention group did show an increase in their processes of change from baseline to one year ($F_{3,142} = 3.74$, $p<.02$). This change was maintained at two years. For men, there were no significant changes in mediators at one or two-year follow-up.

Summary of Physical Activity Interventions in other Populations

More intervention studies have been conducted on adolescents and adults. In choosing a theory for the basis of a physical activity intervention, it is important to understand which theories have been used, and which have been most successful in changing physical activity. Therefore, the following section gives a brief review of physical activity intervention studies. Intervention studies that do not mention the use of a theory were excluded from the review. Interventions that were completed before 1985 were also excluded from the review.

Eight studies were located that used Social Cognitive Theory variables as part of an intervention to change physical activity (Gortmaker, 1999; Johnson, 1991; Kelder, 1993; Killen, 1988; McKenzie, 1996; Parcel, 1989; Perry, 1987; Walter, 1989). Of the eight studies, three increased physical activity (Killen et al. 1988; Johnson et al., 1991; Kelder et al., 1993). Two studies completed in physical education had a positive effect on physical education activity levels (Parcel et al., 1989; McKenzie et al., 1996). Three studies did not change physical activity (Perry et al., 1987; Walter et al., 1989; Gortmaker et al., 1999).

Four studies were found that focused on Stage of Change or stage-matched instruction (Cardinal & Sachs, 1996; Eaton et al., 1999; Marshall, Leslie, Bauman, Marcus, & Owen, 2003; Napolitano et al., 2003). Three of the studies found significant increases in physical activity (Cardinal et al., 1996; Eaton et al., 1999; Napolitano et al., 2003). One study did produce a change in physical activity (Marshall et al., 2003).

The results of the reviewed studies are mixed, with few studies showing an impact on physical activity (Killen et al. 1988; Johnson et al., 1991; Kelder et al., 1993, Cardinal et al., 1996; Eaton et al., 1999; Napolitano et al., 2003). Further, none of the studies that produced changes in physical activity reported change of mediating variables. Therefore, it is difficult to say if the theory or some other part of the intervention was responsible for the change in physical activity at the end of the intervention. Until more intervention studies are published that measure mediating variable change, it is impossible to make a definitive decision as to which of the above approaches is best in promoting physical activity behavior change. What can be said, however, is that maintenance of physical activity has not been successfully illustrated following an intervention. Many studies do not include follow-up measures – those that do show that behavior change is not maintained long-term. From this, it can be said that there is not currently one approach that has been shown to be superior in changing physical activity behavior nor maintaining a change in activity.

Because there are currently no superior theoretical intervention approaches, the theoretical approach that was selected for this pilot study was use Self Regulation and other Social Cognitive Theory variables to develop an intervention to attempt to change physical activity in college students.

Web-based Physical Activity Interventions

To date, no web-based physical activity interventions have been conducted on college students. Further, only two have been completed on any population. The two studies located that described web-based physical activity interventions are included in this section. Though one study found initial promising results regarding moderate physical activity (Napolitano et al., 2003), it appeared as thought the follow-up measure was not significant. Both of the studies point out either that subjects did not visit the websites regularly, or that subjects did not recall information on the websites. Both of these points are important, as they likely are responsible in part for the lack of significant changes in physical activity over one month.

Marshall et al. (2003) compared a print versus a web-based physical activity intervention (Marshall et al., 2003). Participants included staff members of an Australian University (n=655). Subjects were stratified by Stage of Change and randomly assigned to either the web-based or print groups. The print intervention consisted of a previously tested booklet that was based on the Transtheoretical Model. Letters for reinforcement and encouragement were sent to participants every two weeks. The web-based intervention was based on the print booklet, but included more interactive components. Emails, instead of letters, were sent out every two weeks for reinforcement and encouragement. Physical activity data was collected via the International Physical Activity Questionnaire (IPAQ). At follow-up, there was no significant difference between groups or within subjects in physical activity.

It is important to note that only 33% of the print group and 28% of the website group recalled at least half of the material. From a process evaluation perspective, it appears that an insufficient number of participants completed the intervention as planned. Therefore, it is difficult to assess the usefulness of the intervention.

Napolitano et al. (2003) reported the results of an online physical activity intervention. Subjects, consisting of hospital staff in the United States, were recruited if they were between the ages of 18 and 65, and if they currently were exercising under the current recommended levels of both moderate and vigorous physical activity. After screening procedures, 65 subjects were randomly assigned to an Internet or Internet-wait list (control) group. The online intervention consisted of stage-matched information and weekly email tips. Information on barriers, health related benefits of activity, safety, and planning activity were the focus. Each time the subjects logged on to the website, their Stage of Change was assessed. They then received stage-specific information to help them increase their physical activity levels. The control group was not permitted to visit the website until after the three-month study period.

Physical activity was assessed using questions from the Behavioral Risk Factor Surveillance System, which had established test-retest reliability (r=.61). At one-month, the online intervention group had higher levels of moderate physical activity and walking minutes than the control group. At three months, only walking minutes were significantly higher in the intervention group than the control group. However, the researchers point out that many of the subjects did not return to the website after the first data collection period, as the subjects said the information did not change.

Construct Change

As mentioned by Baranowski (1998), the physical activity intervention research is woefully inadequate in presenting process evaluations including construct validations of the treatment (Baranowski, 1998). A construct validation of a treatment involves developing an intervention around constructs, then assessing whether or not those constructs changed from pretest to post-test. Therefore, it is difficult to say which variables, let alone the doses of the variables, are important in physical activity behavior change. A literature search was conducted on process evaluations and construct validations of the treatment. This review was not limited to physical activity alone – other health behavior interventions were included if a process evaluation was conducted. The review also included studies with different populations (other than college students).

Physical Activity

A review of physical activity interventions that measured mediating variables found that family social support, knowledge, self-efficacy, self-monitoring/regulation, and outcome expectations are amenable to change during intervention. Unfortunately, there was no clear relationship between variable change and change in physical activity. The following section summarizes the studies that were located that measured mediating variables.

Marcoux et al., (1999) completed a process evaluation of the SPARK intervention for children (Marcoux et al., 1999). The process evaluation was conducted on the self-management portion of the program. The self-management program included goal-setting, reward, monitoring, planning, and problem solving skills. Students in the fourth

and fifth grades received the intervention. Their school was randomly assigned to the treatment or the control conditions. The self-management portion of the intervention was aimed at increasing the students' physical activity levels outside of school (as opposed to the physical education portion that attempted to increase students' physical activity levels during physical education).

The process evaluation showed that the majority of the lessons were delivered as planned by the physical education specialists. The percent of classroom teachers that delivered the lessons was lower. Lesson length was similar between the groups, and was similar to the projected time for each lesson.

In a regression analysis on participation in physical activity, it was found that 30% of the variance was accounted for by experimental condition, personal characteristics, and parental support in boys, and that 36.5% of the variance in participation in physical activity was accounted for by experimental condition and personal characteristics for girls.

The authors did not report on the change in the mediating variables from the beginning to the end of the intervention. Instead, the researchers chose to report the relationship of the mediating variables to participation in physical activity. Though the latter is important, it is also necessary to know if the mediating variables changed as a result of the intervention.

Perry et al., (1987) conducted a pilot test of the "Slice of Life" curriculum on both physical activity and on dietary behaviors(Perry, 1987). During the intervention, knowledge, value, locus of control, modeling, barriers, social support, self-monitoring, and reinforcement were used to change the behaviors. The girls in the intervention had

increased knowledge of healthy behaviors at post-test ($p<.05$), while boys did not. There was no significant change in physical activity for boys or girls. Theoretical variables were not measured.

Edmundson et al. (1996) report on the effects of CATCH, and intervention aimed at increasing physical activity and healthy eating habits, on determinants of the behaviors(Edmundson, Parcel, Feldman, & Elder, 1996). Ninety-six schools were randomly assigned to treatment groups. For the physical activity intervention, the determinants that were the focus of the program were support and self-efficacy. At the end of the intervention, there were no differences in support for physical activity. There was an initial increase in self-efficacy, but the difference was not significant at the end of the intervention. As reported by McKenzie et al. (1996), there was a significant change in moderate to vigorous physical activity at the end of the intervention.

Parcel et al. (1989) reported the impact of the "Go for Health" program on dietary and physical activity behaviors(Parcel, 1989). The intervention, based on behavioral capabilities, self-efficacy, and expectations was given to students in grades three and four. There was a significant time and treatment interaction for students in grade four for exercise self-efficacy. There were no effects for behavioral capabilities. There was, however a significant increase in aerobic activities in both the intervention and control groups from pre-test to follow-up.

Madsen et al. (1993) investigated the relationship of self-monitoring to risk factor change in children and adults(Madsen et al., 1993). Families were assigned to a control and intervention condition. The intervention, to modify diet and exercise, was based on Social Learning Theory, specifically self-monitoring. Each session included aerobic

exercise, information specifically for the children or adults, time for adults to set family goals related to diet and exercise, then a healthy snack session. The researchers found that several physiological markers were related to self-monitoring for dietary consumption. There were no significant physiological markers that correlated with self-monitoring of exercise in adults, but children's cholesterol ratios were significantly related to their self-monitored exercise changes.

Hallam and Petosa (1998) conducted a worksite intervention to increase exercise adherence in adults(Hallam & Petosa, 1998). Social Cognitive Theory variables, such as self efficacy, self-regulation, and outcome expectancy value were the focus of the intervention. Subjects were initially screened for their stage of change – those that were in contemplation, preparation or action were included in the study. Subjects in the treatment group attended four one-hour sessions that focused solely on increasing knowledge and skills for the constructs. The authors found that self-regulation and outcome expectancy values changed from pretest to post test in the intervention group. Specifically, the mean change for self-regulation was 23.95, and the mean change for outcome expectancy value was 16.14. The possible range on the self-regulation instrument was from 5 to 25, and the possible range on the outcome expectancy value instrument was 9-45.

This would seem to indicate that social cognitive theory variables are modifiable in interventions. The study did not measure physical activity change. Thus, it is unknown how much of a change is required in constructs to influence physical activity behavior.

Neumark-Sztainer et al. (2003) conducted an obesity prevention program for adolescent girls during physical education(Neumark-Sztainer, Story, Hanna, & Rex, 2003). "New Moves" is a curriculum based on Social Cognitive Theory to increase skills for physical activity and dietary behaviors in an attempt to prevent obesity. Four activity sessions were completed each week, and nutritional and social support sessions were also included. There were no post-test differences between groups on any of the measures, including physical activity, healthy food intake, benefits of physical activity and nutrition, enjoyment of physical activity, self-efficacy, and social support.

Dietary Habits

Many of the studies reviewed in this section were also included in the previous section. The interventions were aimed at changing both physical activity and diet. The mediating variables that were significantly changed in the following interventions were knowledge, behavioral capabilities, outcome expectations, and self-efficacy. The majority of the following studies did not produce a change in dietary behaviors. In the one study that did change dietary behavior, knowledge was the only significant mediating variable. The following section reviews intervention studies that measured mediating variables.

Perry et al. (1987), as described above, conducted a process evaluation of an intervention aimed at increasing physical activity and changing unhealthy eating patterns of adolescents. During the intervention, knowledge, value, locus of control, modeling, barriers, social support, self-monitoring, and reinforcement were used to change the

behaviors. Girls and boys in the intervention group increased their knowledge of healthy eating habits. Females in the intervention group increased their healthy eating habits significantly ($p<.05$).

Edmundson et al. (1996) report on the effects of CATCH, and intervention aimed at increasing physical activity and healthy eating habits, on determinants of the behaviors. Ninety-six schools were randomly assigned to treatment groups. For the dietary intervention, the determinants that were the focus of the program were dietary intention, usual food choices, dietary knowledge, reinforcement for food choices, and dietary self-efficacy. There was a significant change in dietary intervention, usual food choice, and dietary knowledge at post-test. There was also a significant change in reinforcement for food choice from friends, parents, and teachers. Dietary self-efficacy was not significant at post-test.

Parcel et al. (1989) reported the impact of the "Go for Health" program on dietary and physical activity behaviors. The intervention, based on behavioral capabilities, self-efficacy, and expectations was given to students in grades three and four. Diet behavioral capability, diet self-efficacy, and dietary expectations were all significantly different from pre-test to post-test. However, students did not increase their consumption of healthy foods during the intervention.

Miller et al. (2002) evaluated a nutrition intervention for older adults suffering from diabetes. The intervention, based on Social Cognitive Theory, included lessons on outcome expectations, observational learning, self-regulation, social support, and self-efficacy. Ten sessions, lasting 1-2 hours each were offered to participants. Outcome measures included self-efficacy, outcome expectations, knowledge, and relevant criteria

to make healthy selections. The intervention group had greater positive outcome expectations, self-efficacy measures, and knowledge at post-test than the control group. The intervention group also used more relevant criteria to select healthy foods at post-test.

Smoking

One smoking prevention intervention was found that measured mediating variable change. Langlois, Petosa, and Hallam, (1999) conducted an intervention for smoking prevention of six graders(Langlois, Petosa, & Hallam, 1999). Five treatment and five comparison schools were utilized. The intervention focused on behavioral capability, self-efficacy, and refusal expectations. The intervention was conducted twice per week, over three weeks. Each session lasted 30 minutes. Refusal self-efficacy, refusal expectations both were higher in the treatment than comparison group at the end of the intervention. Behavioral capabilities did not change.

The authors concluded that at least two 40 minutes sessions should be used to adequately address refusal skills to increase refusal self-efficacy. Though only 10-12 minutes was spent on positive outcomes of refusal, it seemed to produce a change in the intervention group. The same amount of time was spent on negative outcomes of refusal, yet no change occurred in the variable. Behavioral capability was the focus of 62 minutes of the intervention, yet produced no change in the variable.

HIV Prevention

One intervention was reviewed that measured mediating variable change. The National Institute of Mental Health Multisite HIV Prevention Trial Group published results of a multicenter intervention trial to influence safer sex behaviors among low-income, at risk adults(NIH, 2001). The intervention, based on Social Cognitive Theory, focused on increasing expectations of condom use, as well as increasing knowledge, skill, and self-efficacy. The participants were randomly assigned to levels of the treatment – a one-hour education session or a seven 90-120 minute sessions that met twice a week. The researchers found significant differences between self-efficacy, outcome expectation, condom use skills, and knowledge. However, it must be noted that the differences were small, likely due to the large sample size. For example, the difference at post-test between groups for self-efficacy was .3. The intervention group contained 1,518 people, while the control group contained 1,415. Thus, this differences is likely not meaningful.

Summary of Mediating Variable Change Across Behaviors

Across health behaviors, several variables seemed to be more likely to show a change during an intervention: knowledge, self-efficacy, outcome expectations, self-management, and social support. However, there is little consistency across the studies in regards to an impact on these variables. The inconsistency could be due to the interventions or the measures of the variables. For example, in the physical activity literature, studies employ multiple instruments to assess self-efficacy. With each of the instruments having a different scale, and potentially measuring different aspects of self-efficacy, it is difficult to compare results of the studies. Without consistency in

measurement, a dose-response relationship between amount of change in mediating variables and amount of change in behaviors may never be found. Thus, pilot studies, like the proposed study, are imperative in testing interventions preliminarily before larger scale studies are completed. The purpose of this study is to complete a construct validation of the treatment. If the treatment is not thought to be construct valid, then decisions will need to be made regarding modifications in the intervention or the instruments. However, if the subsequent alterations of the intervention are also conducting construct validations, then it might be possible to determine a relationship between mediating variables and behavior. If, after several alterations, constructs are still not found to change, then they might be taken out of the intervention and replaced with new variables for trial.

Web-based Education

Murphy and Gazi (2001) conducted a qualitative investigation of web-based instruction (Murphy, 2001). Seventeen graduate students completed a project-based, two-week section of a telecommunications course. Of the seventeen graduate students, 13 were female, 10 were masters students, and 8 were international students. None of the students had experienced a web-based course, and some of the students had limited telecommunications experience. The projects included discussions, role plays, simulations, evaluations, and panel discussions. Students felt the experience was relatively positive, citing that they were forced to communicate more with others (using telecommunications) for team projects. The facilitators of the two-week unit were busy, since they attempted to give more personal feedback to students than just posting

questions and responses. Facilitators also had to be adaptive to many problems that arose throughout the process. For example, several facilitators took over the job of one facilitator who had an emergency and had to leave campus. The participants did not know the difference. A few students cited technological problems and feelings of being overwhelmed.

Two important points seem to emerge from these findings. First, several facilitators were assigned for the two-week unit, while only 17 students were in the course. This would seem to indicate that running a web-based course is indeed time-intensive for the instructor. Typically, a course size of 17 is small, and only requires one instructor. The second point that arises is that facilitators attempted to make the course more personal for students (which most likely led to the large amount of time they spent on the course), yet students did not know the one facilitator left and others filled their place. Clearly the amount and type of personal interaction in a web-based format does not allow for the same interaction that could occur in the classroom.

McAvinia and Oliver (2002) described the use of web-based learning in teaching lifelong learning skills to students (McAvinia & Oliver, 2002). The authors argue that the web is cost-effective and that instructors can tailor the use of the web from course to course. For example, some courses can be primarily web-based, while others can use the web as a means for communicating and turning in assignments. It may also be that enrollments in web-based courses can be larger, since classroom size is not an issue.

The authors do point out the web-based technology does have some drawbacks. First, students may find difficulties in access or using features on the site. Also, some instructors fail to modify their lessons for use on the web. For example, a traditional

course may rely heavily on lecture and require students to take numerous notes. That same course transferred to the web without modification would be extremely "text-heavy," which may make it less appealing to students. Therefore, care must be taken to ensure that pedagogy is adjusted to make web-based learning effective.

Thirunarayanan and Perez-Prado (2001-2002) quantitatively compared traditional versus web-based learning in an English course (for students with English as a second language) (Thirunarayanan & Perez-Prado, 2001-2002). The online version of the course was delivered through Web CT. One instructor taught both sections of the course. Students in the online section met with the instructor three times during the semester, and were able to communicate with the instructor and other students via course email. The traditional section of the course did not allow students to communicate with the instructor through email. Course content and projects were similar for both groups. A pre-test and post-test were administered to both groups and were scored by the instructor and an assistant. The inter-rater reliability was 95% on the pre-test and 96% on the post-test. The researchers found that both groups scored similarly on the post-test, and concluded that both groups had similar levels of achievement.

Petrides (2002) described the use of a web-enhanced course to facilitate students learning (Petrides, 2002). Although students received a traditional lecture one night each week, communication with the instructor and other students was strongly encouraged via the course website. Generally, students were pleased with the use of the website, as it allowed for students to share ideas with each other outside of class. Several students also commented that interaction via the website were less daunting than sharing ideas in the classroom setting, and felt that the course was more participatory than most courses they

had taken in the past. As with some of the studies discussed above, some students expressed frustration with accessing computers, having slow modems, etc.

Summary

Two common themes emerge from the reviewed studies. First, students seem to enjoy the increased communication, both with the instructor and other students, which web-based courses allow through the use of chat, course email, and discussion groups. Students seem to prefer to communicate through the course website rather than speak out in class. Another commonality in the reviewed studies is that there will always be technological glitches or student frustration when using the web. Not all students will have the best technology at home, and may not have access to better technology. In the proposed study, students will either live on campus or near campus (commuters), so they will have access to students computing centers. Web-based courses are relatively new, and there is a need to quantitatively assess the efficacy of these courses at achieving course objectives as compared to their traditional counterparts. No studies were found that focused on fitness or health courses.

Summary of Chapter

Since rates of physical activity in college students are relatively low, and levels of college activity have been linked to levels of adult physical activity, this population is an important population in which to conduct physical activity interventions. Few studies have investigated correlates of physical activity in a college population. Of those that have, it seems that self-regulation, social support, exercise enjoyment, and self-efficacy are more consistently related to physical activity. Outcome expectations and expectancies, as well as attitude, benefits versus barriers, and motivation all are potentially promising variables to focus on in developing interventions for this populations.

There has only been one published physical activity intervention study in college students. This intervention did not promote long-term adherence to physical activity. Therefore, it was necessary to investigate which mediating variables, across behaviors, were more amenable to change, and to see if a change in the variables led to a change in the behavior. From this search, it was found that self-regulation, social support, self-efficacy, outcome expectations and expectancies, knowledge, and behavioral capability could be changed during an intervention.

Therefore, the variables chosen for the present study (self-efficacy, self-regulation, social support, and outcome expectations and expectancies) all have been shown to change during intervention. Thus, an intervention was designed around these four variables.

CHAPTER 3

INTRODUCTION

There are two main purposes of the study. The first is to complete a construct validation of a web-based physical activity intervention for college students to increase their knowledge and use of self-regulatory strategies. The second purpose is to pilot test the efficacy of the intervention in increasing students' physical activity both during and after the intervention as compared to the traditional section of the course and students enrolled in a general health course.

Self-Regulation

According to Bandura, self-regulation is a self-directed effort to attain a specific outcome (Bandura, 1986). This process involves three main sub processes – self-observation, judgmental processes, and self-reaction. The first, self-observation, involves monitoring a behavior. It is necessary people to be cognizant of a behavior if they plan to change it. It is also imperative for people to continue monitoring their behavior consistently if they wish to change it. Therefore, this study will employ self-monitoring to first make subjects aware of their baseline activity levels, and second, to have students monitor their behavior throughout the quarter.

The second sub process that Bandura discusses is the judgmental process. In this process, several things occur. First, people set personal standards. In the present study, the setting of personal standards is referred to as goal setting. Subjects are encouraged to set goals based on their behavior, not on the outcomes commonly associated with physical activity. For example, many people immediately set goals for weight loss, to "feel better", or other such goals. These goals are typically short-term, and the behavior discontinues once the goal is attained. Behavioral goals focus more on long-term adherence to physical activity. Second, people compare their behavior to others, standards, and/or prior personal behavior. This comparison may vary from person to person – one person may compare their progress or behavior with norms, another may compare their behavior with that of their friends or of their family, while another may compare their current level of behavior with their past level of behavior. This comparison can lead to reinforcement, which will be discussed later. A third part of the judgmental process is for a person to decide upon the value they place on outcomes. While some people may want to exercise to increase or maintain their quality of life, someone else may exercise specifically for the enjoyment for the activity. If people can discover what outcomes are important to them , they can look toward these outcomes as motivation to keep exercising. During the current study, lessons on goals setting and revision, comparison of their level of activity to others, and reasons to exercise are included.

The last sub-process of Self-regulation discussed by Bandura is self-reaction. During this process, people evaluate and reinforce their behavior. Personal evaluation of a behavior is important because people must reflect on their progress. If people do not

monitor their behavior, they do not know if they are meeting their goals. Evaluation throughout the process is important to maximize the level of enjoyment each person experiences. This is especially true in the case of physical activity – people sre not enjoying the exercises that they are doing, they are unlikely to continue exercising for long-term adherence.

An overriding theme in the current study is to promote personal enjoyment, specifically through tailoring. Petosa (1986) discusses the importance of personalizing goals and strategies for optimal adherence (Petosa, 1986). Although tailoring is mentioned as one lesson, it is truly captured in many of the lessons. The lessons are an attempt to get people to do an activity, report their results, and reflect on their experience. If a subject tries something and does not like it, they do not have to continue to do it. For example, one lesson has students try three new activities and immediately reflect on their enjoyment of the activities. If someone tries, say, an aerobics class and does not find enjoyment in it, it is likely not going to help them attain exercise adherence.

Zimmerman points out that self-efficacy is an important part of self-regulation (Zimmerman, 2000). According to Zimmerman, self-efficacy, or the belief that one has in their ability to engage in a behavior or learn a skill or concept, is central to the regulation of a behavior. If a person perceives that they cannot exercise regularly, they are unlikely to begin and adhere to a program. The current study looks to increase self-efficacy for exercise through optimizing enjoyment of exercise, goal setting, and reinforcements.

Social support can also play a role in self-regulation. Zimmerman discusses the importance of using "social resources" for increasing adherence to self-regulation. One lesson included in this study addresses several types of social support, and asks students to seek out these levels of support.

Setting/Subjects

Students registering for several courses at the Ohio State University will make-up the sample. Students registering for either the traditional lecture/lab 147 fitness course, the web-based 147 fitness course, or a general health course will make-up the three groups. Students will self-select, through course registration, which section of the course they wish to take. Therefore, the sample is a convenience sample, and neither subjects nor treatment will be randomly assigned to groups.

A Priori Power Calculations

In behavioral research studies, effect size is relatively low (Keppel, 1991). Cohen describes effect sizes as small, where omega squared = .01, medium, where omega squared = .06, or large, where omega squared = .15+(Cohen, 1969). To investigate what sample size is necessary to have adequate power to see a difference if there indeed is a difference between groups on self-regulation scores and physical activity, the following equations were used to assess how many subjects would be needed for a power = .80. Table 3.1 illustrates the power necessary to detect a change for all variables.

Power (Φ^2) = n (ω^2 / 1 - ω^2)

n = number of subjects per group
ω^2 = effect size

df_{denom} = (a) (n - 1)

The means used in table 3.1 for power calculations came from a study of college students (Petosa, et al., 2003). The study was prospective, and measured correlates of physical activity for students registered for health courses at the Ohio State University. The means from this study were used because the researchers in the study employed the same or similar instruments for each of the variables. The study was also conducted in a college population. From this table it appears as though 50 subjects are needed at follow-up for sufficient power to detect a difference of one day of physical activity between groups or within subjects between the three data collection period.

Instrument	Mean	Standard deviation	Change expected	**Number of subjects needed**
7 day Physical Activity Recall	1.47	1.48	1 day per week (2 days per week, power = 1)	**50**
Outcome Expectations and Expectancies	139.79	49.67	50 points	**25**
Self-regulation	92.88	21.73	40 points (increase 1 on each item)	**8**
Friend Social Support	29.34	11.31	12 (increase 1 on each item)	**22**
Family Social Support	21.75	9	12 (increase 1 on each item)	**14**
Self-efficacy	888.78	284.78	210 (15% on each item)	**41**

Table 3.1 A Priori Power Calculations for Study Instruments

Methods

The online group, experienced the 147 fitness course online using Web CT. Web CT is an online learning tool that has the ability to hold course email, discussion groups, chat, class assignments, quizzes, tests, and lecture material. Students used many of these items during the course. First, all lessons were readable (and printable) online. The lessons include background information on behavioral skills, as well as instructions on what assignments are due that week. Students could then download all the relevant assignments for the week at once, complete them during the week, and submit them on the assigned days. Students also submitted weekly activity logs, which were slightly modified from week to week, depending on lesson content.

Another capability of Web CT is that there can be a specific window in which students can access lessons and assignments, turn-in completed assignments, and complete quizzes. Each week, students were expected to read assigned chapters for the week. Students first had to pass a quiz to access the lesson for the week. The quizzes were structured so that students must keep taking the quiz until they correctly answer all questions. After taking the quiz for the first time, students who miss questions were given hints as to where to find the information in the textbook. They then retook the exam until they mastered it.

Once students passed the quiz, they could move on to accessing the lesson for the week. Students clicked on the lesson icon, and read the information on the screen. Each lesson included a definition of the lesson topic, reasons why the topic is important,

information regarding the topic, and information regarding the assignments for the week. Each lesson concluded with a checklist reminding students what assignments are due for the week.

Chat was also used for the course. Office hours were online, where an instructor was available in the chat room for students' questions or discussions.

The second group, Traditional, consisted of students that registered for the traditional 147 fitness course. The traditional 147 fitness course has two components – a lecture and a lab. The lecture meets one day per week for 48 minutes. In the lecture, students learn about general health and wellness, with an emphasis on fitness. In general, the topics covered in the lecture include: basic principles of fitness, cardiorespiratory endurance, muscular strength and endurance, flexibility, body composition, nutrition, weight management, cardiovascular health, and use of supplements.

The lab portion of the traditional 147 course allows students to choose between the following activities: jogging, weight training, cardiorespiratory exercise (in an exercise room with treadmills, elliptical machines, rowing machines, steppers, and stationary bikes), or aerobics (traditional or kickboxing). Students are required to attend three 48-minute lab sessions per week. They are expected to miss no more than three sessions without penalty.

The third group, Health, consisted of students registered for a general health-related course, cancer prevention. This group served as the reference group, since they were not learning about fitness in their course. This group was not required to complete physical activity as part of their course.

Criteria for inclusion

Since students in the traditional section of the course are penalized for attendance, there must be a regulation on what constitutes "participation" in the online section. For the purpose grading the course, students have to earn a certain percentage to get specific grades. The course is graded "A" through "E" (an "E" is equal to a failing grade). The grading scale is a typical 90-100 for an "A", 80-89 for a "B", etc.

For the purpose of the evaluation of the course in this study, students had to meet several criteria. First, students must submit at least 7 of the 9 activity logs. Since there are only 10 weeks in a quarter, this would be 80% of the activity logs. Students who do not turn in seven activity logs will be excluded from the analysis. Each week, students must complete a number of assignments. Each week covers a different topic (with the exception of tailoring). Therefore, it is imperative that students complete assignments every week. One hundred percent compliance, however, is difficult to achieve. In the interest of preserving subjects, students completing 80% of the assignments will be included in the analysis. This is roughly 10 of the twelve total assignments (not including activity logs each week).

There was a sufficient point penalty for students who did not complete activity logs. Each activity log was worth 33.33 points. Missing more than two dropped students a letter grade.

It is also possible to monitor how students use the course website. For example, it is possible to find out how often individual students log in, how they navigate the site, how long it takes them to complete the quiz, and how long they spent viewing lessons online. If it is found that specific students are not reading the lessons, they will be

excluded from the analysis. To alleviate this problem students will be informed during the first class meeting that the instructor has the ability to view how they navigate the site, and that this is how they will earn their participation grade. Emails were sent to students who are falling behind to remind them of the participation portion of their grade.

Intervention Design

The intervention was a pre-test, post-test, follow-up design with a three groups. Students self-selected their level of the intervention when they registered for the different sections of the course. Figure 1 was a timeline for collection of data. All three groups completed the instruments listed in the figure.

Pretest	Post-test	6 week follow-up
Self-regulation	Self-regulation	Self-regulation
Social support	Social support	Social support
Self-efficacy	Self-efficacy	Self-efficacy
Outcome expectations	Outcome expectations	Outcome expectations
Outcome expectancies	Outcome expectancies	Outcome expectancies
7-day activity recall	7-day activity recall	7-day activity recall
Fitness estimates	fitness estimates	Fitness estimates

Figure 3.1 Data Collection Timeline

On the next page, Figure 3.2 describes the relationship between the lessons, Self-regulatory constructs, and physical activity. The lessons are listed on the left. Their relationship to the constructs is shown by a series of arrows. The total number of weeks spent on each construct are listed under each construct name. This planning model assisted in planning how many lessons could be used in eight weeks to target each of the constructs. This figure will also allow for interpretation of a dose-response relationship for significant changes should they occur.

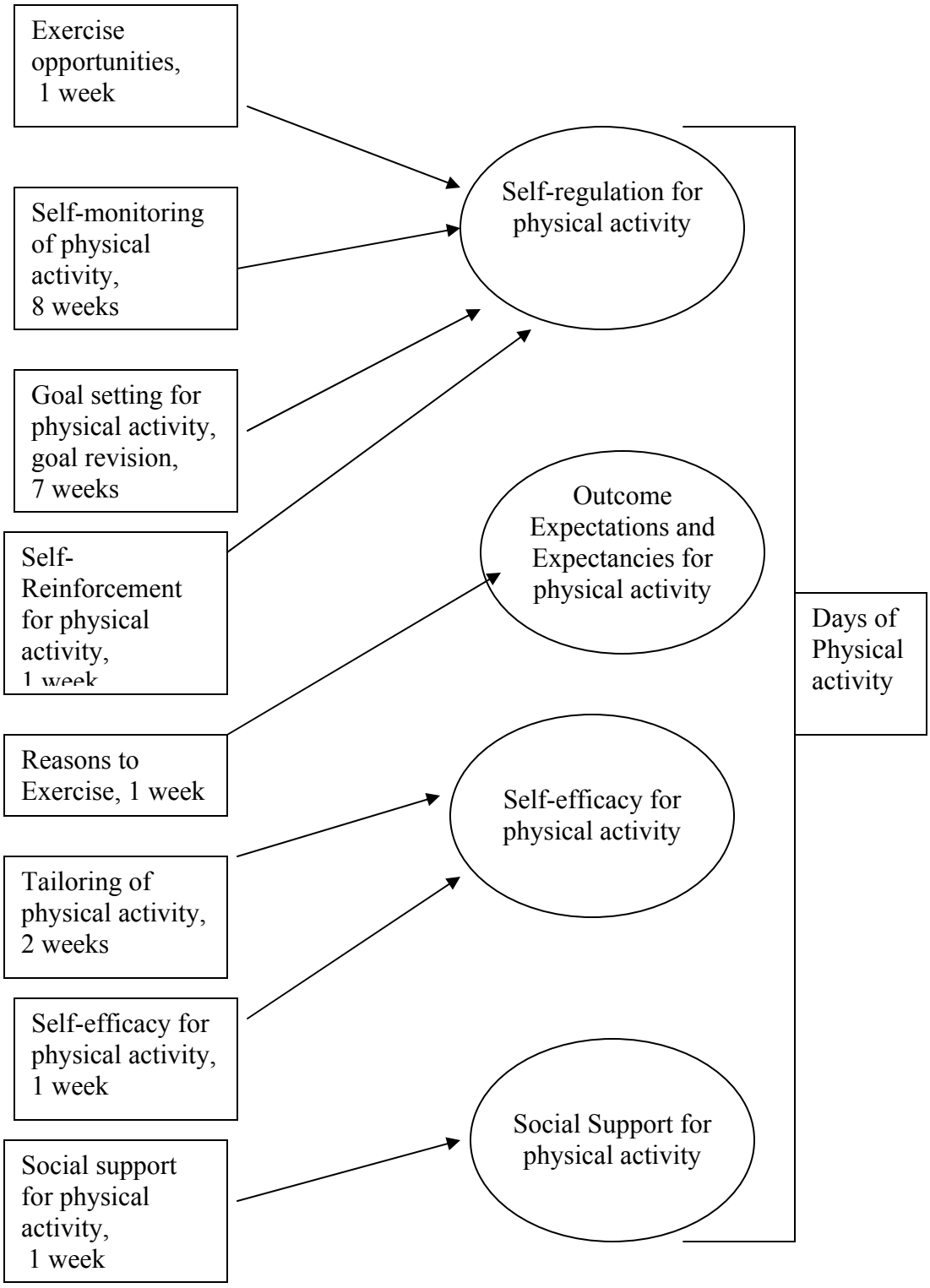

Figure 3.2 Instructional Planning Model for the Online Intervention

Lessons Targeting the Constructs

Self-regulation
Lessons
- Self-monitoring (1 week): tracking physical activity
- Goal setting (1 week): how to set behavioral goals
- Reinforcements (1 week): types of rewards, how to properly reward physical activity

Assignments
- Activity logs for 9 weeks
- Pedometers
- Weekly goals (8 weekly goals)
- Goal correction worksheet: rewriting poorly written goals

Self-efficacy
Lessons
- Tailoring (2 weeks): enjoyment, new activities, preferences
- Self-efficacy for overcoming barriers (1 week)

Assignments
- Exercise Preferences: evaluating what types of physical activity that they prefer
- Comfort zone worksheet: finding a comfortable intensity
- Assessing level of enjoyment on activity logs from week 4+ (7 weeks)
- Overcoming barriers worksheet: identifying and overcoming barriers
- Time management worksheet: finding time to be physically active

Social support
Lessons
- Social support (1 week): identifying different types of support

Assignments
- Social support activity: attaining different types of support, evaluating preferences
- Exercise opportunities: involves finding personal trainers, etc if they wish to use them

Outcome Expectations and Expectancies
Lessons
- Reasons to exercise (1 week): reasons people have for exercising
- Course overview lesson (1 week): people have different reasons for exercising

Assignments
- Reasons to exercise worksheet: ranking the most to least important reasons to exercise

Instruments

Self-efficacy for Physical Activity

Self-efficacy for physical activity is a perception of one's ability to overcome barriers to engage in regular physical activity (Glantz, Lewis, and Rimer, 1997). The self-efficacy scale used in the study has been previously published. Garcia and King completed a study of sedentary older adults and their adherence to exercise (Garcia & King, 1991). The scale was found to have a high internal consistency (Cronbach's α=.9). Test-retest reliability was also acceptable in the study (.67). The researchers found that self-efficacy was moderately correlated to adherence (r=.42 from 1-6 months, r=.44 from 7-12 months). Self-efficacy accounted for 17% of the variance in adherence to physical activity during months 7-12.

The 14-item instrument measures students' confidence that they could exercise in the face of common barriers. Students rated their confidence on a 1-100% scale (positively could not exercise to positively could exercise). Scoring the self-efficacy scale involved calculating the mean and standard deviation of the 14 items.

Social support for Physical Activity

Social Support for physical activity is perceived aid or assistance from family or friends to assist in promoting regular physical activity (Treiber et al., 1991). Treiber et al. (1991) validated a social support scale for exercise through two studies. The first study included middle-class males and females, while the second study included lower to middle class males and females. The social support scale, which was modified from an

earlier version, consisted of 12 items that relate to different types of social support. Subjects are asked to rank, on a 6 point Likert scale, how often the items occur with family and with friends. In both studies, the internal consistencies were high (ranging from .90 to .96 for family, and from .81 to .95 for friends in both of the studies).

Self-regulation for Physical Activity

Self-regulation for physical activity involves developing a set of skills, such as goal setting, reinforcement, and tailoring, to promote regular physical activity (Petosa, 1986). In an unpublished dissertation, a self-regulation scale was developed, validated, and had acceptable reliability (Petosa, 1995). In the dissertation, an expert panel established content validity for the self-regulation instrument. Internal consistency (α=.88) and test-retest reliability (r=.92) were found to be acceptable.

In this study, the 52-item instrument assesses self-regulatory skills that are thought to be related to participation in physical activity. The scale includes questions regarding self-monitoring, goal setting, outcomes of physical activity, reinforcements, and environmental aid. Students rate their use of techniques over the last month, from 1 (never) to 4 (often). The scale was summated, and means and standard deviations were calculated.

Outcome Expectations and Expectancies for Physical Activity

Outcome expectations of physical activity are the specific feelings and related effects one has from participating in regular physical activity. Outcome expectancies are the values a person places on the feelings or effects attained from participating in regular

physical activity (Dishman & Steinhardt, 1990). The outcome expectations and expectancies scale was developed by Winters (Dishman & Steinhardt, 1990; Winters, 2001). The outcome expectations and expectancies scale included several subscales - social outcomes, fitness outcomes, beauty-related outcomes, competition outcomes, relaxation outcomes, and thrill seeking outcomes. Internal consistencies for the subscales ranged from .86 to .95. Content validity was assessed through a facets analysis, where infit and outfit values were attained. These values show how well each item agrees with the expected value. The results of this analysis were acceptable to the author to achieve content validity.

The 40-item scale asks students how often they feel that exercise produces certain feelings or effects for them (expectations). Each item contains a pair of questions relating to outcomes of exercise and the value the person places on them. For example, some of the items discuss stress relief, making them feel stronger or healthier, etc. Once students rate how often they experience the items, they rate the value (expectancies) that they place on each item. For example, an item asks if exercise helps them reduce stress. The value of stress relief is assessed in the second question. A six-point scale was used for each question pair.

Physical Activity

Self-report physical activity was assessed using a seven-day physical activity recall (Petosa, 1995). Physical activity was assessed as both planned, moderate and vigorous physical activity that occurred in leisure-time. Planned physical activity is completed purposefully for health or fitness benefits. The instrument measured planned

physical activity, and asked subjects to separate their activities into moderate and vigorous activity. Subjects are asked to report the type of activity, the duration of activity, the days that they completed the activity on, and if the activity was planned or unplanned. Subjects do this for both moderate and vigorous activities that they completed in the past week. Examples of activities in each category are listed on the instrument. Moderate activity is described on the instrument as being "planned physical activity done to enhance health/fitness, which is continuous for 20 minutes or more, mildly elevates heart rate, mildly elevates breathing rate, and exercise in which one can hold a conversation while engaged in. Examples, such as low-impact exercise classes, brisk walking, and weight training, were offered.

Vigorous activity was described as planned physical activity that is done to enhance health/fitness, which is continuous for 20 minutes or more, elevates heart rate, increases breathing rate, and is activity in which it is difficult to hold a conversation while engaging in. Examples of vigorous activity that were included on the instrument were running, high-intensity aerobic classes, full-court sports, and swimming laps.

Blair et al. (1985) developed a seven-day physical activity recall of physical activity(Blair et al., 1985). The measure was found to be correlated to VO_2 (r=.33). Dishman and Steinhardt (1988) validated the measure in a college population(Dishman & Steinhardt, 1988). The seven-day recall was found to be highly correlated with seven-day physical activity diaries (r=.82-.87). Petosa (1995) modified the instrument to include more detailed information on frequency, duration, and activity. The modified

version of the instrument was shown to be correlated with seven-day diaries of physical activity (r=.72), and had acceptable test-retest reliabilities (r=.52-.72) for free-living and supervised activity, respectively (Petosa, 1995).

VO_2, body composition

Though not the main objective of the study, estimation of VO_2 and body mass index data were collected to compare the groups at pretest. It is not hypothesized that either of these measures will change as a result of the intervention.

Instead of having students complete a fitness assessment, students completed a non-exercise estimation of VO_2. This instrument asks students to list their height, weight, (for BMI calculations) gender, perceived ability to walk jog or run specific distance, and habitual physical activity. George, Stone, and Burkett (1997) validated this measure against a maximal treadmill test on active college students (R = .85, SEE = 3.44 ml/kg/min). They also found that self-report height and weight measures used in the instrument produced similar results to those that were produced by actual measurement of height and weight(George, Stone, & Burkett, 1997). Since bioimpedance measures are not particularly reliable, it was decided that BMI would be calculated through self-report height and weight. This is also necessary for the non-exercise VO_2 measure.

Lesson Outline

Each lesson involved a brief introduction to the topic for the week. The lesson format was as follows: definition of topic, explanation of why it is important, action plans, or activities, for the week, and a checklist of the assignments for the week. Students were continually asked to evaluate each lesson's subject in relation to their exercise program. The reason for this was to have students identify what portions of the program help them in attaining long-term adherence to exercise, and which do not help. Students could then continue to use the knowledge and skills that are most beneficial to them. There were 10 weeks in each quarter. The first and last classes met in a classroom. Copies of the worksheets and lessons are in Appendix A.

Week 1: ***Survey, fitness assessment, exercise opportunities***

Before the first course meeting, an email was sent out to students registered for the web-based section of the course. The email included a brief introduction, gave students the website for the course, and asked students to access the website before the first course meeting. Students were asked to view the first lesson before the first class meeting. The first lesson includes information regarding the rates of physical activity of adolescents, college students, and adults, what exercise adherence means, and how exercise is important in their lives.

During the first week, students met face-to-face with the instructor in a classroom. The instructor explained the syllabus, and explained the requirements for the course. Students completed the pre-test self-regulation survey during this time. For the second quarter of implementation, the first meeting was extended to include in depth instruction

on how to navigate the website. The room assigned for the first course meeting had a computer and projection capabilities. The instructors opened the website and showed students how to access quizzes, lectures, and assignments. Instructors also showed students how to access online office hours through chat, and how to submit assignments. Throughout the meeting, it was emphasized that accessing items through a specific order was necessary. Students were reminded that they had to pass the quiz for the week before they could access the lectures.

This change came about because the first quarter of the intervention found students had great difficulties navigating the website. Therefore, it was decided that a tutorial was needed for students during the first class meeting to help alleviate many of the problems students were having in the initial two weeks of the quarter.

Another requirement for week 1 is for students to find out about exercise opportunities that are in their area. Students are required to download the "Exercise Opportunities" worksheet, which asks students to find health clubs, fitness equipment stores, sport or recreation organizations, and parks in their area. At the end of the worksheet, students are asked to choose their preferred exercise opportunities. Since students were not required to come to campus to complete their activity, it was thought that they needed to find a place or places in which they could exercise.

Week 2: Self-monitoring, taking heart rate

Since students were required to turn in an activity log each week (from week two onward), the purpose of this lesson was to introduce students to the basics of self-monitoring their exercise. Students were given steps on how to fill out their activity log.

They were told to write each exercise that they complete in a week, the intensity of the exercise (either from a machine's readout or their heart rate), and the rate of perceived exertion (or how hard they perceive the exercise to be) for each day that they complete the exercise. Students were also required to wear a pedometer (which they purchased at the beginning of the quarter) for the week. They recorded the mileage and steps that they took during the week on their activity log.

The assignment for the week was to complete a worksheet where they practice taking their heart rate while doing different activities. Students were asked to take their heart rate while sitting, walking, and jogging or running. They were also asked to calculate their target heart rate range.

Week 3: Goal setting

The purpose of the goal setting lesson was to help students understand that there are different types of goals, and that some goals are more effective than others in helping them adhere to exercise. For example, many people set outcome goals (weight loss, etc) instead of behavioral goals. The goals that students were required to set for this course were behavioral goals. There was also a specific way that students created physical activity goals.

For each goal that they set during the course, students were required to include four parts: who, what, how much, and by when. The "who" portion of the goal includes the student and any others that they may have for support. The "what" portion of the goal includes the type of exercise that the student will complete. The "how much" portion of

the goal includes the duration of the exercise bouts that they will complete. Last, the "by when" portion of the goal makes students put a time limit for the attainment of the goal.

One assignment for the week was to set an acceptable physical activity goal, which was due at the beginning of the week. Submitted goals were reviewed by one of the instructors, and suggestions were made if goals were not complete. After this lesson, students were required to submit weekly goals.

Another assignment that students completed was a worksheet that included incorrectly written goals, and students had to rewrite the goals to make them correct. Students were required to complete a fitness log for the week, which they turned in at the end of the week.

Weeks 4 and 5: Tailoring

The main purpose of the tailoring lesson was to help students begin to think of exercise as a pleasant experience. This was targeted in three ways: having students try new activities, finding out what some of the student's exercise preferences are, and finding comfort zone intensities.

The first activity that students were required to complete was trying new types of exercise. Students were required to try at least three new activities for the week. They recorded this in their activity log for week 4, and wrote a brief reflection of their experience in trying each of the three new activities.

The second activity that students were required to complete was the exercise preferences worksheet. The questions on this worksheet looked at how students prefer to exercise. For example, students were asked if they prefer to exercise alone, with a friend,

or in a group. Students were also asked questions about what they focus on while exercising (music, television, how they feel, etc), if they like planned or spontaneous exercise, if they prefer weight training, cardiovascular exercise, or sport, and if they like competitive activities or noncompetitive activities, among others.

The last activity that students were required to complete was the comfort zone activity. In this activity, students were required to walk or jog slowly, walk or jog at a medium pace, and walk or run at a fast pace. Each session (slow, medium, fast) was done for at least 10 minutes. Students were required to take their heart rate and their rate of perceived exertion (how they felt) both during and after each intensity of activity. After completing each intensity, students decided which intensity was most comfortable for them. This was their comfort zone. Students were reminded, however, that their comfort zone could change as they became more fit. Students were also required to complete an activity log for week 5.

Week 6: Midterm Evaluation

During week six, students took the midterm examination. Once students opened the midterm, they had 48 minutes to complete the exam. Students were told not to use their books or notes. Students also completed an activity log for the week.

Week 7: Self-efficacy

The purpose of the self-efficacy lesson was to have students think about what types of barriers they have that keep them from being regular exercisers. Students then had to identify ways to overcome the barriers that they had identified.

The assignment for the week was for students to complete the overcoming barriers worksheet. In the worksheet, students were asked to list five barriers that may have had when they exercised in the past, and ways that they overcame these barriers. Students were also asked to list barriers that they encountered in the past week, and how it influenced their exercise behavior. The next item on the worksheet asked students to rank their barriers in order of severity. From this ranking, students listed their three greatest barriers, and three ways to overcome each barrier. At the end of the worksheet, students were required to set a physical activity goal that would help them overcome the greatest barrier to their physical activity program.

As with every week, students are required to complete an activity log for week 7. At the bottom of the log for the week, students identified their greatest barrier as well as the goal that they set on the barriers worksheet to overcome the barrier.

Week 8: Social Support

The purpose of the social support lesson was to help students understand that there are different types of support available to them to help them adhere to their exercise program. Students were told that types of support include: encouragement from a friend or family member, getting information from a fitness professional, exercising with a friend, etc.

The assignment for the week was to seek the following types of support: talking to a family member or friend about their exercise program and how they are progressing; asking a friend or family member to help them make time to exercise, encourage them, or exercise with them; and to find information that can help them with their fitness program.

The social support worksheet guided students through this process. Students were required to complete the activity log for week eight, which, along with the basic components, included requiring students to list whom they exercised with that week. Students also were asked to list which type of support they felt was most beneficial to them.

Week 9: Reinforcements and Reasons to Exercise

Reinforcements

During the reinforcement lesson, students learned different ways to reward themselves for reaching their goals. Students learned that there are internal and external rewards, and that there are proper and improper rewards for exercise.

The assignment for the week was for students to review their exercise goals, rewrite goals (if necessary), and assign reinforcements to each goal. Students were also asked to list previous goals that they had, and reinforcements that they used to try to attain those goals. They were asked to evaluate whether or not their reinforcements were effective in helping them reach their exercise goals. Students were asked how much of an effect reinforcements have on their exercise behavior. In other words, some students may not value reinforcement as much as others. Reinforcements would not be as beneficial to these students. Students were required to submit the activity log for week 9, which also has a reinforcement component on the bottom of the log sheet. Students identified if they used reinforcements that week, what the reinforcement was for, and what the reinforcement was.

Reasons to Exercise

This lesson involved introducing students to reasons people exercise. Students were told that people exercise for different reasons, and different outcomes motivate different people. Since many students may not think of all of the possible outcomes of physical activity, this lesson discusses broad categories of reasons as to why people exercise. The idea is that knowing why you exercise is an important step in adhering to exercise for years to come.

The assignment for the week was for students rank their reasons to exercise on the "Reasons to exercise rating sheet." Students were required to rank the reasons that they feel are most important to them as 1, numbering down to 7 as the least important. As with all other weeks, students submitted an activity log for the week.

Week 10: Course evaluation, survey, final exam

During the tenth week, students were required to attend a session in a classroom. The instructor gave students course evaluations that they were asked to fill out anonymously. Students filled out the second survey.

Also during the tenth week, students were required to complete the final exam. As with the midterm, the final exam was timed. Once students opened the exam, they had 48 minutes to complete the exam and submit it. Students were not permitted to use the book or their notes to complete the exam. During the tenth week, students were required to complete their last activity log.

Analysis

Process Evaluation

Implementation Fidelity

Student evaluations were analyzed using frequency measures, since a majority of the questions were nominal in nature. Each question is reported in Chapter 4, along with the percentages of students answering in a specific way. This will help in making decisions regarding future modifications of the course.

Construct Validation of the Treatment

In this part of the evaluation, the following research questions were addressed:

1. Are there differences between groups on theoretical variable scores across the three time periods? Analysis of this question was conducted using a Mixed between-within Repeated Measures Analysis of Variance (ANOVA), since the same subjects were tested on the same variables at multiple time periods. It was expected that there would be no differences between groups at pretest. However, it was expected that there would be a difference between groups at post-test on the construct variables. The following hypotheses were tested:

Self-regulation

H_0 = There is no difference between groups on self-regulation scores at pre-test.

H_0 = There is no difference between groups on self-regulation scores at post-test.

H_0 = There is no difference between groups on self-regulation scores at follow-up.

Family Social Support

H_0 = There is no difference between groups on family social support scores at pre-test.

H_0 = There is no difference between groups on family social support scores at post-test.

H_0 = There is no difference between groups on family social support scores at follow-up.

Friend Social Support

H_0 = There is no difference between groups on friend social support scores at pre-test.

H_0 = There is no difference between groups on friend social support scores at post-test.

H_0 = There is no difference between groups on friend social support scores at follow-up.

Self-efficacy

H_0 = There is no difference between groups on self-efficacy scores at pre-test.

H_0 = There is no difference between groups on self-efficacy scores at post-test.

H_0 = There is no difference between groups on self-efficacy scores at follow-up.

Outcome Expectations and Expectancies

H_0 = There is no difference between groups on outcome expectation/expectancy scores at pre-test.

H_0 = There is no difference between groups on outcome expectation/expectancy scores at post-test.

H_0 = There is no difference between groups on outcome expectation/expectancy scores at follow-up.

A priori alpha was set at .05. However, since multiple repeated measures ANOVAs were run, a Bonferroni correction was made to alpha to control for Type I error. Alpha was divided by the total number of Repeated Measures ANOVAs that were conducted. There were seven total ANOVAs run (including moderate and vigorous

physical activity). Therefore, .05/7 = .0071. Results were considered statistically significant if attained probability values were less than .0071. If group differences were found, Scheffe post-hoc comparisons were conducted. Differences in time were assessed using within-subjects contrasts.

Impact Evaluation

Physical Activity Behavior

The purpose of the study was to complete a construct validation of the treatment, and to pilot test the intervention. However, physical activity data was collected to get a preliminary test of how the intervention impacted behavior. Therefore, an impact evaluation was conducted to assess changes in moderate and vigorous physical activity. Moderate activity and vigorous activity were analyzed separately. The research question that was addressed was: Are their differences between groups in physical activity across the three time periods? A mixed between-within repeated measures ANOVA was used to test the following hypotheses:

Moderate Physical Activity

H_0 = There is no difference between groups on moderate physical activity scores at pre-test.

H_0 = There is no difference between groups on moderate physical activity scores at post-test.

H_0 = There is no difference between groups on moderate physical activity scores at follow-up.

Vigorous Physical Activity

H_0 = There is no difference between groups on vigorous physical activity scores at pre-test.

H_0 = There is no difference between groups on vigorous physical activity scores at post-test.

H_0 = There is no difference between groups on vigorous physical activity scores at follow-up.

Change in Physical Activity

Another important part of the impact evaluation was to assess whether changes in physical activity could be accounted for by changes in constructs. The research question for this section was:

1. Are there differences between groups in the amount of variance in change in physical activity that was accounted for by change in constructs? To analyze data to answer this question, a standard linear regression analysis was run. Stepwise regression and hierarchical regression were not employed, as they necessitate a much larger sample. For example, Kepple suggests 40 subjects per independent variable that is entered into a regression model(Keppel, 1991). It is thought that this study will involve 50 or fewer subjects per group by follow-up. Therefore, these methods of regression are not warranted. The hypotheses that were tested were:

H_0 = There is no difference between groups on the amount of variance that is accounted for in change in physical activity by change in constructs.

Subject Retention

In an attempt to retain as many subjects as possible at follow-up, the survey was available for students to take online. Since the second quarter students would be on summer break for the follow-up, it was thought that having the survey online would help with subject retention.

Several emails were sent to subjects who provided an email address at post-test. The first email was sent out five weeks after the post-test, asking students to take roughly 15 minutes to complete the survey one last time online. A link to the website was provided. Email addresses that were invalid were checked through Ohio State's website, and the message was sent again.

A second email was sent out six weeks after the post-test, reminding students to fill out the survey, and included the link to the website. Students who had completed the survey were removed from the list.

A third email was sent out at the end of week six, reminding students to fill out the survey. This was the last email that was sent out. The reason for this was two-fold. First, after the first quarter, some students lost patience with the emails and wrote the researcher back asking to be removed from the list. Also, weeks were passing. The follow-up assessments were needed in week six. If students had been permitted to complete the surveys at their leisure (anywhere from week 5 to week 9), they may have had different responses. To keep the data consistent, a two-week period was the only time students could complete the follow-up.

CHAPTER 4

RESULTS

Introduction

The purpose of the study was to complete a construct validation of a web-based physical activity intervention for college students to increase their knowledge and use of self-regulation strategies. A secondary purpose was to pilot test the efficacy of the intervention in increasing students' physical activity both during and after the intervention as compared to the traditional section of the course and students enrolled in a general health course.

The study consisted of a pre-test, post-test, and follow-up for three groups: the online group, the traditional group, and the health group. Self-regulation measures and physical activity information was collected at the three time periods. The online group received an intervention aimed at increasing their self-regulatory knowledge and skills, as well as increasing their general fitness knowledge. This group was required to complete three days per week of physical activity on their own time. The traditional group received the fitness knowledge portion of the intervention as well as some self-regulatory skills, such as self-monitoring and goal setting. This group was required to attend a

lecture one day per week, and a physical activity lab three times per week. The health group received no instruction on fitness, and did not have a physical activity requirement. Instead, the health course focused on cancer prevention.

This chapter is divided into several sections: Sample, descriptive statistics, process evaluation, and impact evaluation. In the sample section, the sample demographics, majors, and attrition rate are discussed. The descriptive statistics section presents the means and standard deviations of the self-regulation constructs as well as moderate and vigorous physical activity. In the process evaluation section, descriptive data is presented on the students' evaluations of the course, as well as the construct validation of the treatment. Last, the impact evaluation presents impact of the intervention on moderate and vigorous physical activity.

Sample

The sample consisted of 356 students at pretest enrolled in one of the following courses: Online physical activity course, traditional physical activity course, and health course (cancer). Students self-selected their enrollment in one or more of the courses over two quarters. If a student provided two sets of data, meaning they enrolled in one study course in one quarter and another in the second quarter, their second data set was removed from the study. This occurred in two cases.

At pretest, there were 103 males, and 219 females. Of the total sample, 250 where white, 42 were black, 11 were Asian, 9 were Hispanic, and 9 reported "other." One subject did not report his or her race. Of the pretest sample, 108 were seniors, 87 were juniors, 70 were sophomores, 38 were freshmen, 10 were graduate students, and 7 classified themselves as other. Two students did not report their rank.

Thirty-seven majors were represented in the sample at pretest. The most frequent majors reported at pretest were: Business/Marketing, Premed/Medical Fields, Engineering, Finance/Accounting, Communications, Education, and Exercise Science. Roughly ninety-three percent of the sample took the course as an elective, meaning it was not a required course. The mean age of the total pretest sample was roughly 21 years.

Subject Attrition

There was a high attrition rate between the three data collection period. At pretest, 356 students began the study. Of those 356, only 322 provided useable data. Those that were excluded at this point did not complete a significant part of an instrument. At post-test, 251 students provided complete data. Of those 251, only 233 students provided complete data. Seventy-one students did not complete the post-test, either because they dropped the course after taking the pre-test, or because they did not attend class on the day they post-test was given. In the health and traditional courses, the researchers were allowed to come into one class session. This likely was one of the last days of the quarter. If students did not show-up on the assigned class day, they did not have an opportunity to take the post-test. In other words, if students missed class on the assigned day, there were no more class sessions to meet with them to complete the survey. For post-test, 72% of the sample was retained. At follow-up, 90 subjects provided usable data. All subjects that completed the survey online provided complete data. One hundred, forty-three subjects that participated in post-test did not complete a follow-up. This is a 28% retention rate from pre-test, and a 39% retention rate from post-test.

Though demographic data was only collected at pretest, follow-up demographics are presented here. Only the subjects that were included at follow-up are included for hypothesis testing. Tables 4.1 and 4.2 display the mean ages of the three groups as well as percentages for gender, race, and rank for the three groups at follow-up. Percentages are presented instead of frequency counts so that a comparison can be made between the three groups.

Data collection point	**Age**			**Gender**		
Group	Online	Traditional	Health	Online	Traditional	Health
Follow-up	M = 22.2 SD = 3.7	M = 20.2 SD = 1.5	M = 21.3 SD = 5.9	85% F 15% M	96% F 4% M	64% F 36% M

F = Female, M = Male
Note: Missing values not included in table

Table 4.1 Sample Demographics – Means and Percentages of Age and Gender by Group at Follow-up

Data collection point	**Race***			**Rank***		
Group	Online	Tradit.	Health	Online	Tradit.	Health
Follow-up	85% W 7% B 7% A 0% H 2% O	82% W 9% B 0% A 5% H 5% O	96% W 5% B 0% A 0% H 0% O	57% Sr 17% J 10% So 7% F 4% G 4% O	18% Sr 27% J 36% So 18% F 0% G 0% O	32% Sr 23% J 23% So 23% F 0% G 0% O

W = White, B = Black, A = Asian, H = Hispanic, O = other
Sr = Senior, J = Junior, So = Sophomore, F = Freshman, G = graduate student, O = other
Note: Missing values not included in table
* Percentages are rounded, and thus may not equal 100% when totaled

Table 4.2 Sample Demographics: Percentages for Race and Rank by Group at Follow-up

The mean age for the three groups was similar. At follow-up, the groups consisted of a majority of females, and a majority of white students. The majority of students enrolled in the study throughout the data collection periods were upper-classmen (juniors or seniors).

Fitness and BMI

Fitness and Body Mass Index (BMI) data were also gathered in this study. Neither of these variables is meant to be a dependant variable in the study – in other words, it was not the purpose of the intervention to attempt to increase VO_2 or decrease BMI in ten weeks. However it was necessary to gather this data to describe the sample in terms of their current fitness levels and BMI to see if there was a difference at pre-test between the three groups. Table 4.3 displays the means and standard deviations for BMI. Table 4.4 displays the means and standard deviations for estimation of VO_2. For BMI, there was not a significant difference between groups at pre-test $F(2,85)=.163$, $p=.571$. There was also no significant difference between groups for estimation of VO_2, $F(2,84)=.102$, $p=.903$.

Data collection point	**BMI**		
	Online	Traditional	Health
Pre-test	M = 23.87 SD = 4.38	M = 23.33 SD = 3.32	M = 24.60 SD = 3.64
Post-test	M = 23.77 SD = 4.85	M = 23.43 SD = 3.44	M = 24.72 SD = 3.66
Follow-up	M = 24.13 SD = 4.86	M = 23.15 SD = 3.21	M = 24.24 SD = 4.17

Online group pretest n = 44, post-test n = 45, follow-up n = 46
Traditional group pretest n = 22, post-test n = 20, follow-up n = 22
Health group pretest n = 22, post-test n = 22, follow-up n = 22

Table 4.3 Means and Standard Deviations of BMI by Group at Pretest, Post-test, and Follow-up

All three groups appear to have similar BMI means at the three data collection periods. The sample sizes are different from the overall follow-up sample size because some students did not wish to list their weight. BMI could not be calculated for these subjects. According to the American College of Sports Medicine, students in the three groups would be classified as "normal" weight, though on the higher end of the normal range(ACSM, 2000). The limits for this classification are BMIs of 18.5 to 24.9.

Data collection point	**VO_2**		
	Online	Traditional	Health
Pre-test	M = 38.69 SD = 8.18	M = 39.12 SD = 6.00	M = 38.00 SD = 9.96
Post-test	M = 41.35 SD = 7.32	M = 41.61 SD = 5.14	M = 39.65 SD = 7.56
Follow-up	M = 39.53 SD = 8.15	M = 41.38 SD = 4.52	M = 40.15 SD = 7.93

Online group pretest n = 44, post-test n = 45, follow-up n = 46
Traditional group pretest n = 21, post-test n = 19, follow-up n = 22
Health group pretest n = 22, post-test n = 22, follow-up n = 22

Table 4.4 Means and Standard Deviations of Estimation of Maximum VO_2 at Pretest, Post-test, and Follow-up

Means of VO_2 estimates appear similar between groups at each data collection period. The error of the estimation (roughly 3.5 ml/kg*min) is close to the change in VO_2, and there is no evidence that estimated VO_2 changed significantly over the three data collection periods. This was expected, as the intervention lasted only ten weeks. This is likely not going to increase VO_2 estimates by a large enough amount to overcome the error of the estimate. Again, sample size varied. Some students did not complete

some portions of the instrument. Since the calculation for the estimate included BMI, those that did not list weight could not be calculated. Others did not complete another portion of the instrument.

The American College of Sports Medicine gives percentiles for males and females. Since the sample is mixed, it is difficult to classify the estimates. For example, a VO_2 of 40 is roughly in the 70^{th} percentile for women ages 20-29. For males, however, this value is only in about the 30^{th} percentile.

Comparison of Respondents and Non-respondents

To assess if there were differences between subjects that completed the three measures and subjects that dropped out of the study, means were calculated for both post-test and follow-up respondents and non-respondents. If means appeared to be different, then an independent samples t-test was run between those that completed the measure and those that did not.

An analysis of demographic data for post-test respondents and non-respondents was conducted. The age of the post-test respondents and non-respondents was similar for all groups and for both respondents and non-respondents (means ranged from 20.67 to 21.82). The online group had more males drop out of the study (51% male non-respondents versus 34.5% respondents) from pretest to post-test than the other groups (male non-respondents ranged from 28-31%). This likely occurred because many students first thought they could select weight training as a form of activity for the online course. This was not counted toward cardiorespiratory activity, which caused some students to drop the course and add a traditional section. Across all groups and all respondents and non-respondents, there were no differences for race or class rank between respondents and non-respondents.

An analysis of demographic data for follow-up respondents and non-respondents was also conducted. Ages for respondents and non-respondents across groups were similar (means ranged from 20.23 to 22.22). More males than females dropped out of the study in the online group (non-respondent males=48%, respondent males=15.2%). The other groups were similar in gender of respondents and non-respondents (above 60% for female respondents and non-respondents). Race was similar for respondents and non-

respondents in all of the groups. There was a difference in modal categories between respondents and non-respondents in the three groups for year in school. It appeared that younger students were more likely to drop out of the online group. In the traditional group, it appeared that younger students were more likely to be retained. There were a substantial number of seniors that took the online course. They would be less likely to drop the course, as they might have been filling credit hours with the online course. Younger students might have been less experienced with Web CT or web courses, and might have dropped the course for more traditional courses.

Pretest to Posttest Comparison

Table 4.5 lists the means and standard deviations for the online group between subjects who were retained and those who dropped out between the pretest and post-test. In reviewing the means between respondents and non-respondents in the online group at post-test, it appeared that there could be a difference between vigorous days of physical activity, self-efficacy and outcome expectations. An independent samples t-test found that there was no significant difference between respondents and non-respondents in the online group on self-efficacy ($t(141)=-.775$, $p=.440$), self-regulation ($t(141)=-.759$, $p=.449$), or outcome expectations and expectancies ($t(141)=-.848$, $p=.398$). However, there was a significant difference between post-test respondents and non-respondents on days of vigorous physical activity at pre-test ($t(141)=-2.025$, $p=.045$). The non-respondents reported more days of vigorous physical activity at pre-test than respondents. This could potentially cause the mean that was used for analysis to be lower than it might have been had the non-respondents not dropped out.

Variable	Respondents		Non-respondents	
	Mean	**Standard Deviation**	**Mean**	**Standard Deviation**
Self-regulation	121.33	29.15	126.14	32.05
Family Social Support	25.85	10.89	26.36	10.06
Friend Social Support	28.58	10.02	29.99	10.17
Self-efficacy	926.63	248.46	968.09	258.59
Outcome Expectations and Expectancies	698.56	221.09	738.18	207.03
Moderate Days of Physical Activity	2.74	2.06	2.19	1.96
Vigorous Days of Physical Activity	1.36	1.76	2.15	2.09

Respondents n=116, Non-respondents n=27

Table 4.5 Pretest Means and Standard Deviations for Variables Between Respondents and Non-respondents at Post-test for the Online Group

Table 4.6 presents the pretest means and standard deviations of post-test respondents and non-respondents in the traditional group. The means between respondents and non-respondents seemed different enough for self-efficacy and outcome expectations and expectancies to warrant an independent samples t-test. Self-efficacy ($t(91)=1.65$, $p=.104$) and outcome expectations and expectancies ($t(91)=-1.27$, $p=.209$) were not found to be significantly different between respondents and non-respondents in the traditional group.

Variable	Respondents		Non-respondents	
	Mean	**Standard Deviation**	**Mean**	**Standard Deviation**
Self-regulation	117.06	27.15	124.19	41.04
Family Social Support	23.21	9.00	24.52	13.49
Friend Social Support	29.72	9.23	34.00	10.81
Self-efficacy	978.82	242.68	877.619	266.53
Outcome Expectations and Expectancies	727.62	218.56	796.05	215.92
Moderate Days of Physical Activity	3.08	2.12	2.52	1.81
Vigorous Days of Physical Activity	1.37	1.98	1.05	1.43

Respondents n=72, Non-respondents n=21

Table 4.6 Pretest Means and Standard Deviations for Variables Between Respondents and Non-respondents at Post-test for the Traditional Group

Table 4.7 displays the pretest means and standard deviations for variables between the post-test respondents and non-respondents. The means for self-regulation and outcome expectations and expectancies were different enough to warrant an independent samples t-test. Self-regulation ($t(84)=-1.26$, $p=.210$) and outcome expectations and expectancies ($t(84)=-2.15$, $p=.055$) were not statistically significant between the respondents and the non-respondents.

Variable	Respondents		Non-respondents	
	Mean	**Standard Deviation**	**Mean**	**Standard Deviation**
Self-regulation	105.72	37.14	117.28	36.61
Family Social Support	21.89	8.44	23.05	9.20
Friend Social Support	26.35	9.72	28.36	10.88
Self-efficacy	840.39	308.70	843.86	299.03
Outcome Expectations and Expectancies	607.73	189.77	694.89	153.79
Moderate Days of Physical Activity	2.36	2.08	2.18	2.28
Vigorous Days of Physical Activity	.59	1.15	1.18	2.11

Respondents n=64, Non-respondents n=22

Table 4.7 Pretest Means and Standard Deviations for Variables Between Respondents and Non-respondents at Post-test for the Health Group

Post-test to Follow-up Comparison

The majority of loss of subjects occurred between post-test and follow-up. Therefore, it is necessary to discover if there are differences between respondents and non-respondents. Table 4.8 presents the post-test means and standard deviations of the respondents and non-respondents in the online group at follow-up. The only means that appeared different were for self-efficacy. An independent samples t-test found there was no significant difference between respondents and non-respondents ($t(106)=1.774$, $p=.079$).

Variable	Respondents		Non-respondents	
	Mean	**Standard Deviation**	**Mean**	**Standard Deviation**
Self-regulation	172.62	24.94	170.65	26.93
Family Social Support	29.00	11.97	26.60	11.25
Friend Social Support	30.35	11.73	33.53	11.09
Self-efficacy	1010.13	191.90	938.20	219.71
Outcome Expectations and Expectancies	712.39	227.29	730.59	218.60
Moderate Days of Physical Activity	3.04	1.75	2.89	1.68
Vigorous Days of Physical Activity	2.13	1.53	2.27	1.63

Respondents n=46, Non-respondents n=62

Table 4.8 Post-test Means and Standard Deviations for Variables Between Respondents and Non-respondents at Follow-up for the Online Group

Table 4.9 displays the post-test means and standard deviations for the respondents and non-respondents in the traditional group. Since the means for self-efficacy looked to be slightly different, an independent samples t-test was run. There was not a significant difference between means ($t(62)=.762$, $p=.449$) for the respondents and non-respondents (for follow-up measures) in the traditional group at post-test.

Variable	Respondents		Non-respondents	
	Mean	**Standard Deviation**	**Mean**	**Standard Deviation**
Self-regulation	149.95	26.40	158.60	24.77
Family Social Support	23.91	9.45	23.21	10.12
Friend Social Support	31.27	11.10	31.05	9.46
Self-efficacy	1014.55	168.01	965.52	275.32
Outcome Expectations and Expectancies	735.32	207.43	757.24	227.25
Moderate Days of Physical Activity	3.27	2.29	3.67	1.90
Vigorous Days of Physical Activity	2.62	2.01	2.24	1.76

Respondents n=22, Non-respondents n=42

Table 4.9 Post-test Means and Standard Deviations for Variables Between Respondents and Non-respondents at Follow-up for the Traditional Group

Table 4.10 displays the post-test means and standard deviations for variables between respondents and non-respondents in the health group. Moderate physical activity, self-efficacy, and outcome expectations and expectancies appeared to be potentially different between respondents and non-respondents. Independent samples t-tests were run to detect if the differences were significant. Moderate physical activity ($t(59)=1.45$, $p=.153$) and self-efficacy ($t(59)=-.65$, $p=.515$) were not statistically different. However, outcome expectations and expectancies were different between respondents and non-respondents ($t(59)=2.55$, $p=.013$). Follow-up respondents had significantly higher outcome expectation and expectancy scores than non-respondents at post-test.

Variable	Respondents		Non-respondents	
	Mean	**Standard Deviation**	**Mean**	**Standard Deviation**
Self-regulation	123.65	34.98	123.00	42.88
Family Social Support	22.27	7.34	23.38	10.46
Friend Social Support	27.27	10.99	28.21	11.49
Self-efficacy	813.95	340.69	870.82	317.42
Outcome Expectations and Expectancies	738.68	217.13	590.13	219.16
Moderate Days of Physical Activity	2.82	2.48	1.97	1.98
Vigorous Days of Physical Activity	.86	1.52	1.15	1.68

Respondents n=22, Non-respondents n=39

Table 4.10 Post-test Means and Standard Deviations for Variables Between Respondents and Non-respondents at Follow-up for the Health Group

Summary

There were very few differences between respondents and non-respondents in the three groups for post-test and follow-up on demographics and study variables. Though there was a substantial loss to follow-up of subjects, respondents and non-respondents in each group were similar in mean scores for each of the study variables. In the online group, there was a difference between the post-test respondents and non-respondents for pre-test days of vigorous physical activity. This would mean that the post-test mean score for vigorous physical activity could be lower than it would have been if the non-respondents had not dropped out of the study. This result could potentially affect the detection of group differences in physical activity at post-test. The post-test respondents in the health group had lower pretest outcome expectation and expectancy scores than non-respondents. This would suggest that those subjects retained for analysis at post-test had deflated values for this variable. Thus, the post-test mean that was used for analysis is likely an underestimation of the true mean for the traditional group. Both of these issues will be considered in interpretation of the results in the next chapter.

Descriptive Statistics

In the following section, means and standard deviations for each of the study variables are presented. Frequency distributions of days of moderate and vigorous physical activity are also presented. The sample included in this analysis only includes students who provided complete data for pre-test, post-test, and follow-up. The reason for this is to provide consistency between descriptive statistics and hypothesis testing.

Frequency of Participation in Physical Activity by Group

Though means and standard deviations of physical activity are presented next, it is important to understand how many subjects in the groups could be considered to be meeting current physical activity guidelines. As mentioned in chapter two, the current vigorous physical activity guideline is three days per week. For moderate activity, the recommendation is most if not all days of the week. For the purpose of this analysis, "most" equates to at least five days per week.

Table 4.11 presents the percentages of students engaging in moderate activity at pre-test, post-test, and follow-up. The number of students in the online and traditional groups that reported zero days of moderate activity decreased from pre-test to post-test, but than increased at follow-up. In the health group, the percent of students reporting zero days of moderate activity seems to drop from post-test to follow-up.

According to the table, there percentage of students in the online group who exercised moderately five days per week or more increased from pre-test to post-test, but dropped at follow-up. The percentage of students in the traditional group exercising at this level remained relatively stable across the measures, increasing slightly from pre-test to post-test. In the health group, the percentage of students exercising moderately five or more days per week decreased from post-test to follow-up, but then returned to baseline levels at follow-up. Throughout the measures, the traditional group had more students exercising at recommended levels than the other two groups.

Group	Days per week	Percent of Students Reporting Moderate Days		
		Pre-test	**Post-test**	**Follow-up**
Online	0	22.4	9.6	18.8
	1-2	27.3	27.0	41.7
	3-4	28.7	46.1	25.0
	5-6	18.2	13.1	10.5
	7	3.5	4.3	4.2
Traditional	0	18.3	11.1	13.6
	1-2	22.6	15.3	9.0
	3-4	32.2	36.1	40.9
	5-6	22.6	31.9	27.3
	7	4.3	5.6	9.1
Health	0	31.4	31.7	22.7
	1-2	24.5	25.4	31.8
	3-4	25.6	30.2	27.3
	5-6	13.9	4.8	13.6
	7	4.7	7.9	4.5

Table 4.11 Percentages of Students Reporting Ranges of Moderate Physical Activity

Table 4.12 displays the percentage of students reporting days of vigorous activity by group over the three data collection periods. The general trend in percent of students reporting zero days of vigorous activity decreased from pretest to post-test in the online group and traditional group. At post-test, the number of students in the online group reporting zero days of vigorous physical activity decreased dramatically, from 43% at pre-test to about 16% at post-test. Unfortunately, this number jumped back up to a higher than baseline level of 54% at follow-up. The percent of students in the health group who reported zero days per week of vigorous physical activity decreased through the data collection periods.

Group	Days per week	Percent of Students Reporting Vigorous Days		
		Pretest	**Post-test**	**Follow-up**
Online	0	43.0	15.7	54.2
	1-2	33.1	40.9	22.9
	3-4	16.9	34.7	14.6
	5+	7.0	8.7	8.4
Traditional	0	57.6	33.8	40.9
	1-2	16.3	19.7	18.1
	3-4	17.4	36.6	27.2
	5+	8.7	9.8	13.6
Health	0	70.9	56.3	44.0
	1-2	13.9	29.7	40
	3-4	12.8	7.8	12
	5+	2.4	6.3	4

Table 4.11 Percentage of Students Reporting Days of Vigorous Physical Activity

As mentioned earlier, the recommendation for vigorous physical activity is currently three days per week. A greater percentage of students in the online group reported three to four days per week of vigorous activity at post-test than at pre-test. This was also the case with the traditional group. In both the online and traditional groups there were fewer students meeting the recommendations at follow-up than at post-test. In the health group, the percentage of students that reported three to four days per week of vigorous activity decreased from pre-test to post-test, but returned to baseline level at follow-up.

Summary

The data show that both the online and traditional courses promoted physical activity from pre-test to post-test. Though a majority of the subjects in each group were not meeting the recommended days per week of activity, it does seem that the intervention had an affect on those subjects that were sedentary (zero days per week). This was more evident in vigorous activity than moderate activity.

Moderate Physical Activity

The means and standard deviations of days of moderate physical activity across the three groups at all three data collection periods are presented in table 4.13. The minimum number of days that could be reported was zero, and the maximum was seven. A day of moderate physical activity was counted if the bout lasted at least 20 minutes. Work-related physical activity was not included.

Data collection point	**Days of Moderate Physical Activity**		
	Online	Traditional	Health
Pre-test	M = 2.65 SD = 1.93	M = 2.82 SD = 1.99	M = 2.55 SD = 2.09
Post-test	M = 3.04 SD = 1.75	M = 3.27 SD = 2.29	M = 2.82 SD = 2.48
Follow-up	M = 2.39 SD = 1.84	M = 3.41 SD = 2.02	M = 2.59 SD = 2.17

Online group n=46, Traditional group n=22, Health group n=22

Table 4.13 Means and Standard Deviations of Days of Moderate Physical Activity at Pretest, Post-test, and Follow-up

An important note regarding the physical activity scores is that the issue of planned versus unplanned activity was not included in the analysis. The reason for this was that, at follow-up, this part of the instrument was not completed by a large majority of respondents. The default that was set for the planned versus unplanned component was set at "unplanned." Only two students changed this to "planned activity." However, it did appear that some of the students that reported "unplanned" activity had a pattern (Monday, Wednesday, Friday, etc) Therefore, using this to qualify physical activity at

follow-up would overwhelmingly skew the data, and would decrease the number of days of physical activity drastically at follow-up. This means that the follow-up scores introduced error into the measurement process. It would be incorrect to attempt to compare follow-up scores to scores from other data collection points, where planned activity was assessed. Therefore, the idea of planned physical activity had to be removed from the other data points so that a comparison could be made between data collection points.

Overall, it appears that the traditional physical activity course group reported more days of moderate activity than the other two groups. This group is required to attend a physical activity lab three days per week, so it might be expected that they would report roughly three days per week of activity. The online group was required to complete at least three days of physical activity also, but there was no scheduled class time for them to complete their activity. Instead, they would report their activity in weekly activity logs. The health group had no requirement for physical activity.

Vigorous Physical Activity

The means and standard deviations for days of vigorous physical activity for all groups at all data collection periods are presented in table 4.14. The minimum amount of physical activity that could be reported was zero days in one week. The maximum was seven days in one week. A day of vigorous physical activity was included if the duration of the bout reported on that day lasted at least 20 minutes.

Data collection point	**Days of Vigorous Physical Activity**		
	Online	Traditional	Health
Pre-test	M = 1.2 SD = 1.76	M = 1.77 SD = 2.32	M = 0.59 SD = 1.10
Post-test	M = 2.13 SD = 1.53	M = 2.64 SD = 1.97	M = .86 SD = 1.52
Follow-up	M = 1.2 SD = 1.63	M = 1.86 SD = 1.96	M = 1.18 SD = 1.47

Online group n = 46, Traditional group n = 22, Health group n = 22

Table 4.14 Means and Standard Deviations of Days of Vigorous Physical Activity at Pretest, Post-test, and Follow-up

The online and traditional groups increased their mean days of vigorous physical activity from pre-test to post-test, then decreased from post-test to follow-up. The health group appears to slightly increase their days of vigorous physical activity throughout the three data collection periods.

Self-regulation

Means and standard deviations for the Self-Regulation instrument are presented in Table 4.15. The minimum possible score on the self-regulation instrument was 52. The maximum possible score was 260.

Data collection point	**Self-Regulation Scores**		
	Online	Traditional	Health
Pre-test	M = 119.74 SD = 31.11	M = 118.56 SD = 20.65	M = 105.52 SD = 36.05
Post-test	M = 172.62 SD = 24.93	M = 149.95 SD = 26.40	M = 123.65 SD = 34.98
Follow-up	M = 130.87 SD = 33.71	M = 124.36 SD = 29.08	M = 118.91 SD = 27.57

Online group n = 46, Traditional group n = 22, Health group n = 22

Table 4.15 Means and Standard Deviations of Self-Regulation Scores at Pretest, Post-test, and Follow-up

The overall trend for the three groups was for scores on the self-regulation instrument to increase from pretest to post-test. Scores also appeared to decrease from post-test to follow-up in the three groups.

To illustrate what the scores mean, a score of 104 on the instrument is roughly answering "2," or "rarely" for all of the items. A score of 156 on the instrument is like answering "3" or "sometimes." on the instrument. The online group increased their score from 119 to 172, which is roughly 1 point on each instrument. The other groups increased their scores to a lesser extent.

Social Support – Family

The means and standard deviations for family social support are presented in table 4.16. The minimum possible score for family social support is 12. The maximum score on the instrument is 60.

Data collection point	**Family Social Support**		
	Online	Traditional	Health
Pre-test	M = 26.37 SD = 10.57	M = 25.09 SD = 8.91	M = 21.86 SD = 7.57
Post-test	M = 29.00 SD = 11.97	M = 23.91 SD = 9.45	M = 22.27 SD = 7.34
Follow-up	M = 22.59 SD = 10.64	M = 20.18 SD = 8.06	M = 22.00 SD = 7.91

Online group n = 46, Traditional group n = 22, Health group n = 22

Table 4.16 Means and Standard Deviations For Family Social Support at Pretest, Post-test, and Follow-up

The online group appears to report increased scores at post-test from pretest, but then reports decreased family social support from post-test to follow-up. The health group follows this trend, but to a lesser extent. The traditional group appears to show a slight decline in family social support over the three time periods.

To illustrate what the scores mean, a score of 24 on the instrument is like answering "2," or "rarely" on each item. The change in scores from pre-test to post-test is negligible, since it appears that the online group only increased by three points, or by increasing their score by one point on three items.

Social Support – Friends

Means and standard deviations for friend social support are presented in table 4.17. The minimum possible score for friend social support is 12. The maximum score is 60.

Data collection point	**Friend Social Support**		
	Online	Traditional	Health
Pre-test	M = 28.26 SD = 10.75	M = 32.41 SD = 11.33	M = 26.64 SD = 9.78
Post-test	M = 30.35 SD = 11.73	M = 31.27 SD = 11.10	M = 27.27 SD = 10.99
Follow-up	M = 24.70 SD = 11.05	M = 26.91 SD = 10.37	M = 28.00 SD = 13.31

Online group n = 46, Traditional group n = 22, Health group n = 22

Table 4.17 Means and Standard Deviations For Friend Social Support at Pretest, Post-test, and Follow-up

The online group increased from pretest to post-test, but then decreased from post-test to follow-up. The traditional group decreased across the three time periods. The health group increased slightly across the three time periods.

To illustrate what the scores mean, a score of 24 on the instrument is like answering "2," or "rarely" on each item. A score of "3," or "a few times," on each item would total 36. None of the groups appeared to increase or decrease more than 5 points, or an increase or decrease of 1 point on five items.

Self-Efficacy for Physical Activity

The means and standard deviations for scores on the self-efficacy instrument for the three groups across the three data collection points are presented in table 4.18. The minimum possible score on the self-efficacy instrument is zero. The maximum score is 1400.

Data collection point	**Self-Efficacy for Physical Activity**		
	Online	Traditional	Health
Pre-test	M = 920.52 SD = 258.34	M = 976.36 SD = 236.29	M = 815.45 SD = 348.11
Post-test	M = 1010.13 SD = 191.90	M = 1014.55 SD = 168.01	M = 813.95 SD = 340.69
Follow-up	M = 875.70 SD = 299.36	M = 984.77 SD = 251.37	M = 773.55 SD = 297.30

Online group n = 46, Traditional group, n = 22, Health group, n = 22

Table 4.18 Means and Standard Deviations For Self-Efficacy for Physical Activity at Pretest, Post-test, and Follow-up

Self-efficacy appears to be higher in the online and traditional groups than in the health group at all data collection periods. It may be that people who enroll in either type of physical activity course have a higher self-efficacy for physical activity than students that do not enroll in physical activity courses. The online and traditional groups' self-efficacy scores increased from pre-test to post-test, but then decreased from post-test to follow-up.

To illustrate what the scores mean, a score of 700 means that students answered that they are 50% confident they could exercise under the listed conditions for each item. A score of 1050 means that students answered they are 75% confident that they could exercise in the listed conditions for each item. Though self-efficacy scores change throughout the data collection periods, one must keep in mind that each item can vary from 0% to 100%. Therefore, a change in 100 for a group might only mean a 10% change on ten items, or a 50% change on two items, etc.

Outcome Expectations and Expectancies

Means and standard deviations for outcome expectations and expectancies are provided in table 4.19. For this instrument, outcome expectation scores and outcome expectancy scores are multiplied for each participant. The multiplied scores are then summated. It was from these summated scores that the means and standard deviations were calculated. The minimum possible score on this instrument is 40. The maximum total score is 1440.

Data collection point	**Outcome Expectations and Expectancies**		
	Online	Traditional	Health
Pre-test	M = 670.85 SD = 199.48	M = 743.97 SD = 182.81	M = 641.40 SD = 194.71
Post-test	M = 712.39 SD = 227.29	M = 735.32 SD = 207.43	M = 738.68 SD = 217.13
Follow-up	M = 541.59 SD = 252.49	M = 614.5 SD = 186.03	M = 613.22 SD = 249.51

Online group n = 46, Traditional Group n = 22, Health group n = 22

Table 4.19 Means and Standard Deviations For Outcome Expectations and Expectancies at Pretest, Post-test, and Follow-up

The online and health groups appear to increase in outcome expectation and expectancy scores from pre-test to post-test, and then decrease in scores from post-test to follow-up. The traditional group appears to decrease across the three time periods.

An illustration of the scores on this instrument is much more difficult, since the scale is multiplicative. In a simplified example, if students answered "2," or "rarely happens," for the expectation, and "2," or "rarely" for the expectancy value on each item, their score would be 160. If students answered "4," or "often happens" for the

expectation, and "4," or "often" for the expectancy value for each item, their score would be 640. Again, since the scale is multiplicative, there are numerous combinations of scores.

Subscale Analysis

On the outcome expectations and expectancies instrument, there are six subscales: relaxation outcomes, health or fitness related outcomes, beauty-related outcomes, thrill-seeking outcomes, competition, and social outcomes. The relaxation subscale and the health subscales included five questions. The beauty-related subscale included nine questions. The thrill-seeking subscale included six questions. There were five questions for the competition subscale, and ten for the social outcomes subscale. Table 4.20 presents the means and standard deviations for each of the subscales at pre-test, post-test, and follow-up.

Scores for the relaxation outcomes subscale increased from pre-test to post-test but then decreased to follow-up for all three groups. The same general trend was shown for health-related outcomes. For beauty-related outcomes, it appears as though the health group increased to pos-test, but then decreased to follow-up. The online and traditional groups had a seemingly large drop from post-test to follow-up. For thrill-seeking outcomes, all groups appear to increase from pre-test to post-test, and to decrease at follow-up. For competition-related outcomes, the online group decreased across the three data collection periods. The traditional and health groups increased to post-test, but decreased to follow-up. The means on this scale also seem quite low when compared

with the means of the other scales. For social outcomes, the online and health groups increase from pre-test to post-test, and decrease from post-test to follow-up. The traditional group decreases across the three time periods.

Summary

It appears as though there were specific outcome categories that were more important to students than others. For example, it appears as though competition outcomes were less important or less of a focus for students in all groups. Though the subscales included five questions, it would seem that the mean scores on the subscale are still low. To contextualize the results, a score of three on the outcome and expectancy for five questions would equal 45. A score of four on each question would equal 80. For the competition scale, the mean scores ranged from roughly 38 to 67. On the other hand, the health outcome scale also contained five questions, but the means ranged from 115-152. Clearly, health related outcomes were more important to students in all groups than competition-related outcomes.

		Online		Traditional		Health	
Data collection point	**Subscale**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Pre	Relaxation	116.78	29.26	129.23	32.75	108.09	31.78
	Health	134.04	33.66	145.68	23.41	123.41	35.55
	Beauty	112.59	54.17	114.91	62.49	95.58	45.16
	Thrills	97.76	30.24	110.77	29.43	86.64	31.99
	Competition	53.48	42.38	56.00	44.04	52.59	39.37
	Social	156.20	72.83	187.38	64.12	175.09	61.30
Post	Relaxation	125.91	29.62	137.23	35.12	121.05	38.06
	Health	141.17	30.00	152.82	26.87	127.23	40.61
	Beauty	113.93	58.70	108.50	66.26	120.27	51.69
	Thrills	118.78	47.14	116.59	42.00	107.68	42.49
	Competition	49.37	39.29	59.18	46.16	67.09	51.38
	Social	163.22	76.49	161.00	65.33	195.36	77.76
Follow-up	Relaxation	102.87	41.59	113.00	39.89	104.64	30.29
	Health	116.07	45.65	138.32	36.16	115.55	41.27
	Beauty	88.35	57.84	76.86	52.68	91.41	55.21
	Thrills	88.46	50.73	102.77	37.62	89.82	49.14
	Competition	38.20	34.89	40.73	34.25	55.41	47.74
	Social	107.65	68.61	142.82	61.94	156.41	82.47

Table 4.20 Means and Standard Deviations for the Outcome Expectations and Expectancy Subscales at Pre-test, Post-test, and Follow-up by Group

Summary of Descriptive Statistics

The mean scores for the theoretical variables were similar to means found in studies completed using similar instruments in a similar population (Petosa et al., 2003). Social support means were similar to means found by Petosa and colleagues. Self-efficacy means for the current study were higher than expected in groups one and two at pretest. It could be that students with higher self-efficacies for overcoming barriers to exercise were more likely to enroll in one of the types of physical activity courses. Self-regulation and Outcome Expectations and Expectancies cannot be compared, because different measures were used.

Process Evaluation

A process evaluation was conducted to assess whether or not the intervention was delivered as planned. Through Web CT, it is possible to force students to open assignments, quizzes, and lecture materials in a certain order. The way the course was set-up, students had to read the text chapter before logging on to the course website. Whether or not they read the chapter was assessed through a quiz. Students had to take and pass the quiz before they could access the lecture. After students passed the quiz, they were then permitted to open the lecture. Students were instructed to read the lecture, and then access the corresponding assignments. The only place students could access the assignments was through the lecture. Students then completed the assignments for the week and turned them in by the end of the week.

Another way implementation was controlled was that students could only access the quizzes, lectures, and assignments for one week. If they did not access these items for the week, they would not have another opportunity to do so. The course was designed in this manner so students could not skip weeks and make the work up. The idea was that students focused on one specific behavioral skill per week.

Web CT also has a function that allows the instructor to view how many "hits' students have to the website. After the first quarter, this information was analyzed, and found to be unreliable. Some students who had turned all assignments in every week on time were below the number of hits that were estimated to be the minimum number of log-ins that would be needed to complete the course. Therefore, this information was not included as part of the process evaluation.

As expected, emails from students having problems with the function of the website decreased over the course of the quarter. For the first quarter of the study, the introductory meeting was held in a room with no data projection capability. Thus, the instructors explained the sequence of tasks for students to complete orally. This created much confusion during the first three weeks of the study. To improve the study for the second quarter, a room was reserved that contained data projection capabilities. During the first meeting the second quarter, instructors explained the sequence of tasks for the students to complete both orally and visually. Instructors led the students step-by-step through the process. This alleviated many of the technical difficulties students had the first three weeks. It also appeared that the majority of students had more experience with Web CT during the second quarter, which may have helped them work their way through the course.

Student Evaluations of the Course

At the end of the quarter, students completed anonymous evaluations for the course. Students were instructed to answer the questions honestly, and were told that their responses would in no way affect their grade. Student evaluations were not viewed until grades for the quarter had been turned in. The evaluation form consisted of nominal data. Only the online course students completed course evaluations, as the questionnaire was specific to the online section. There were 127 students who completed evaluations. The total number of students that omitted answers is noted for each question.

Question 1: Why did you take this class?

For this question, students were instructed to select all statements that applied to them. All 127 students provided answers to this question. Of the total sample, 14 students reported that the course was a requirement for their major. The other 113 students were not required to take the course. Fifty-six students reported that they took the course to fill credit hours. Seventy-six students responded that they wanted to take an activity course. Forty-eight students reported taking the course because it fit into their schedule. Fifty-six students reported taking the course because they were interested in the course.

Question 2: Are you a student at Ohio State, staff member, faculty member, or student enrolled in distance education not in Columbus.

Students were asked to select one answer from the above list. Of the total sample (n=127), 120 subjects reported they were students at The Ohio State University. The remaining seven students were staff (3), faculty (1), or distance education students (3).

Question 3

For this question, students were asked to rate the usefulness of different components of the course on a three-point scale as very useful, somewhat useful, or not useful. The results are presented in table 4.21.

Lesson	Worksheet	Very Useful	Somewhat Useful	Not Useful
Introductory Lesson	Lesson	24%	58%	8%
	Exercise History	28%	55%	17%
	Exercise Opportunities	36%	45%	14%
Self-monitoring	Lesson	48%	35%	10%
	Pulse	50%	37%	12%
Goal-setting	Lesson	51%	38%	6%
	Goal correction	37%	42%	20%
Tailoring	Lesson	30%	54%	9%
	New Activities	34%	54%	13%
	Exercise Preferences	49%	39%	11%
	Comfort Zones	50%	38%	8%
Self-efficacy	Lesson	43%	45%	7%
	Overcoming barriers	50%	42%	8%
	Time-management	57%	36%	6%
Social Support	Lesson	30%	50%	17%
	worksheet	28%	56%	15%
Reinforcements	Lesson	40%	45%	13%
	worksheet	37%	46%	16%
Reasons to Exercise	Lesson	50%	38%	9%
	worksheet	48%	42%	10%

*Students not providing a response are not included

Table 4.21 Percent of Students in the Online Group Rating Lessons and Worksheets as Very Useful, Somewhat Useful, and Not Useful

Activity Logs

Though students were required to submit activity logs every week, this question asked students about their overall impression of the activity logs throughout the quarter. One student did not provide a response to this question. Fifty-eight percent of students felt the activity logs were very useful, 32% felt the logs were somewhat useful, and 9% felt the logs were not useful.

Summary

It appears from the data above that some lessons were more useful to students than others. The goal-setting lesson was the only lesson rated as "very useful" by over 50% of students. The following worksheets were rated as "very useful" by over 50% of students: pulse worksheet, comfort zones worksheet, overcoming barriers worksheet, and the time-management worksheet. However, the self-monitoring lesson, self-efficacy lesson, and reasons to exercise lesson were rated as "very useful" by over 40% of students. The worksheets that also were rated high (over 40% of students reporting they were "very useful") were: exercise preferences and reasons to exercise. It did not appear that students overwhelmingly felt that any of the lessons or worksheets were "not useful."

Question 4: Did this course help you begin an exercise program or help you maintain your current exercise program?

Four students did not provide an answer to this question. Of the remaining 126 students, 47% reported that this course helped them begin an exercise program. The remaining 50% reported that this course helped them maintain their current exercise program.

Question 5: Do you think the course will help you maintain your exercise program once the course is over?

One student did not respond to this question. Of the remaining students, 92% felt that the course would help them maintain their exercise program, while 7% felt that the course would not help them maintain their exercise program.

Question 6: Have you taken an online course before? If yes, how many have you taken?

Of the total sample, 63% of students said that they have not taken an online course before, while 37% reported they had taken an online course before. Of the students that reported having taken an online course before, 38% said they had taken one online course, 34% said they had taken two online courses, 21% said they had taken three online classes, and 2% reported having taken four, six, or nine classes each.

Question 7: After taking this course, would you take another online course?

One student did not provide a response. Of the remaining sample, 95% of students said they would take another online course. Only 4% said they would not take another online course.

Question 8: Did you exaggerate your physical activities on your log so that you would meet the course criteria?

For this question, students were asked to choose one of the following answers: yes, a few times during the quarter; yes at least one time per week; yes, more than one time per week; or no, I recorded the amount of exercise I actually did.

Of the total sample, 52% said they exaggerated their physical activity a few times during the quarter. Thirty-four percent said they recorded the activity they actually completed. The remaining students said they exaggerated their physical activity at least one time per week (6%) or more than one time per week (9%).

Question 9: Did you use the pedometer on the assigned weeks?

Possible responses to this question were: yes, I wore it each day during the assigned week; usually, but sometimes I forgot; no, I did not wear the pedometer.

Of the total sample, 65% reported they usually wore their pedometer, but sometimes forgot. Twenty-five percent of students reported wearing their pedometer during the assigned week, and 10% reported not wearing a pedometer.

Question 10: How did you complete the midterm?

Possible answers were: I completed it without the use of a book or notes; I occasionally referred to my book, but completed most of it without the book; or I used the book while taking the final.

Of the total sample, 48% of students said they occasionally referred to their book when taking the midterm. Thirty-two percent said they used the book while taking the midterm, and 21% said they did not use their book when taking the midterm.

Clearly, taking exams online has drawbacks. Though the exam was timed, students still had time to look-up some answers in their textbooks. The only way to combat students cheating on online exams is to have students meet in a computer lab to take exams.

Question 11: How did you complete the final?

Students had the same answer choices as above: without the book or notes, occasionally referenced the book, or used the book. Seventeen students did not answer this question. It is likely that there were so many non-respondents because students had not completed the final when they completed the evaluation. Because of this, students answered the question in regards to their intent.

Thirty-nine percent of respondents said they planned to occasionally refer to their book during the final exam. Twenty-five percent said they planned to use the book during the exam. Twenty-three percent said they did not plan to use their book at all during the final exam.

Question 12: Did you feel that you got a timely response to your concerns via email?

Student responses included: yes, no, or not applicable. One student did not respond to this question. Of those that responded, 88% said they had gotten a timely response to their concerns via email. Six percent each said that they did not get a timely response or they did not email concerns (not applicable).

Question 13: Did the instructors answer your concerns to your satisfaction?

Students could select either yes, no, or not applicable. Two students did not provide responses to this question. Of the remaining sample, 86% said their concerns were answered to their satisfaction. Five percent said that their questions were not answered to their satisfaction, and eight percent said they did not have concerns (not applicable).

Question 14: Overall, how satisfied were you with the course?

Students could select one of the following answer choices: very satisfied, satisfied, dissatisfied, or very dissatisfied. One student did not answer the question. Of the remaining sample, 47% said they were very satisfied with the course, and 46% said they were satisfied with the course. Eight percent said they were dissatisfied with the course, and no students said they were dissatisfied with the course.

Four questions were included on the evaluations that were open-ended questions. Though not all students provided responses, the following are the most common categories of responses to the questions.

Question 15: What was your favorite part of the course?

The top three responses to this question were: students liked recording their workouts or tracking their progress; students liked doing the work or working out at their own pace, and that having physical activity as a requirement made them exercise. Several students also mentioned they liked the book, pedometers, goal setting activities, and the quizzes. The remainder of responses dealt with specific lessons or worksheets. Though goal setting was an individual lesson, it is mentioned above because roughly seven students mentioned this as their favorite part of the course, as compared to one or two students for the remaining lessons and worksheets.

Question 16: What was your biggest problem with the course?

The overwhelming response to this question was computer problems. This category included computer errors, internet access problems, and incompatible software. It was stated in the syllabus that students must have access to Word and Excel to complete the assignments. If students used other programs, or a Macintosh computer, the instructors were unable to open the assignments.

Another common response to this question was redundant work. Some students felt the worksheets were redundant or were "busy work," while other students did not like turning in logs every week.

Some students also had pedometer problems. Some students did not like to wear the pedometers, had their pedometers break, or forgot to wear them.

Other students did not like the structure of the course. Some students did not like the deadlines of the homework, the time restriction on the midterm and final, or that they could only access lectures and assignments for one week.

Other responses included: lack of time on the student's part to complete assignments, no place to workout, the course took more time than expected, unclear instruction on worksheets, that the course required cardiovascular exercise, there were too many points for the course, they did not like to send weekly goal emails, and they felt alone.

Question 17: What part of the course do you feel will be most useful to you?

The overwhelming response to this question was activity logs. Students said they got into a habit completing the activity logs, and planned to continue using the logs after the course ends. The other two favorite responses were time-management and goal setting. Students said that these two activities will help them maintain their exercise program.

Other responses included: lectures, self-discovery of activity level and health, overcoming barriers, the textbook, the pulse/target heart rate activity, understanding their reasons to exercise, and pedometers. As for the previous question, one or two students mentioned other lessons and worksheets. However, goal-setting, reasons to exercise, overcoming barriers, and the pulse activity were mentioned by numerous students.

Question 18: What suggestions do you have to improve the course?

Many students wrote that they wanted more face-to-face meetings. Students mentioned meetings for lecture, working out, and for fitness testing. Many of the students who wrote they wanted more face-to-face meetings also wrote of concerns of other students cheating.

Some students requested examples of exercise programs for them to follow. Other students asked for the course to be modified for students that were already active. Students that mentioned problems with pedometers usually suggested getting rid of the pedometers or making them optional.

Some students reported that they often forgot to turn assignments in by the deadline. Because of this, they suggested that instructors send a "reminder email" out a few days before the assignments are due.

Some students wanted the course to occur completely online. They wanted to be able to take the surveys and complete the evaluation online instead of having the first and last course meetings face-to-face.

A few students suggested placing all of the worksheets and logs in quiz format so software compatibility is not a problem. Other students wanted to see more of the book information included in the lectures or worksheets.

Summary of Student Evaluations

Overall, the students seemed to react favorably to the course. There were very few students who said they would not take another online course after this one. One interesting note is that some students wished there were more class meetings. Other students were concerned about others cheating, and said that we should do some fitness tests to assess whether or not people were exercising as they reported.

This idea of cheating on physical activity during the quarter was discussed prior to the study. However, it would have been difficult to get students in the health course and the traditional course to come in on their own time to complete fitness assessments. It was also thought that doing so would increase attrition rates at post-test and follow-up, as students would be even less likely to come in two more times for fitness assessments. Instead of bringing students in for a fitness assessment, a non-exercise estimation of maximal oxygen consumption was added to the survey. The instructors and other faculty felt there were some problems with using fitness measures as part of the grading process. First, students' fitness levels may not increase enough to show a difference in ten weeks. Also, since the focus was on comfortable intensities, it was thought that some students might choose moderate activities. This intensity of activity might not be likely to change fitness to a degree that could be detected through fitness testing. Last, students that were already exercising and may have a high level of fitness would not change their fitness to the degree that an untrained person might over the course of the ten weeks.

The addition of the non-exercise estimation of oxygen consumption to the survey was also meant to give students the impression that fitness improvement was important. From student comments, it appears that they did not get this impression.

Knowledge

Student knowledge of the textbook material was assessed using a midterm and a final exam. Both the online group and the traditional physical activity course group took the same midterm and final exam. Construct knowledge was assessed using five questions that were added onto the final. All students completing the midterm and final are used in this analysis. Means and standard deviations are presented in Table 4.22.

Test	Group	N	Mean	Standard Deviation
Midterm	Online	169	87.04	12.10
	Traditional	408	82.34	11.89
Final	Online	169	89.44	10.47
	Traditional	408	84.68	11.89
Constructs	Online	169	4.23	.85
	Traditional	397	3.51	1.08

Table 4.22 Means and Standard Deviations of Midterm and Final Test Grades By Group

The values for the midterm and final expressed in the table are out of 100. The Constructs were assessed by five questions. Since three independent samples T test were conducted, a Bonferroni correction was made, changing alpha from .05 to .0167. Independent samples T tests were used because there were only two groups, and the two groups had three different measures (not a repeated measure). Therefore, it was necessary to test each one separately.

For the midterm and final, equal variances were assumed. For the construct questions, equal variances were not assumed between groups, but all measures were significant at p<.001. The results of the T tests are presented in Table 4.23.

	t	df	p value	Mean Difference	Standard Error Difference
Midterm	4.31	575	.000	4.71	1.09
Final	4.53	575	.000	4.76	1.05
Construct	8.42	397.98	.000	.72	.09

*Equal variances not assumed

Table 4.23 Independent Samples T-Tests for Midterm Exam, Final Exam, Construct Knowledge Score

The online group and the traditional physical activity course group were significantly different on all measures. For the midterm, the groups were significantly different, t (575)= 4.305, p<.001. On the final, the two groups were significantly different as well, t(575) = 4.529, p<.001. The two groups also scored significantly different on the construct assessment, t(8.424) = 8.424, p<.001.

One must be cautious in saying the online course produced better results on the midterm and final. As mentioned in an earlier section, a vast majority referred to their book occasionally or used the book for the entire exam. Therefore, the difference in scores is likely a function of using the book and not the course itself.

The construct knowledge scores were different between the two groups. The lectures that contained the information to answer the questions were not available during the final exam. Therefore, this difference is likely due to the content of the course.

Instructor and Student Time Commitment

Both instructors and students were surprised by the amount of time they spent with this course. One instructor compared the amount of hours she spent per week with the online class versus a lecture course. The results are presented in Figure 4.1 below.

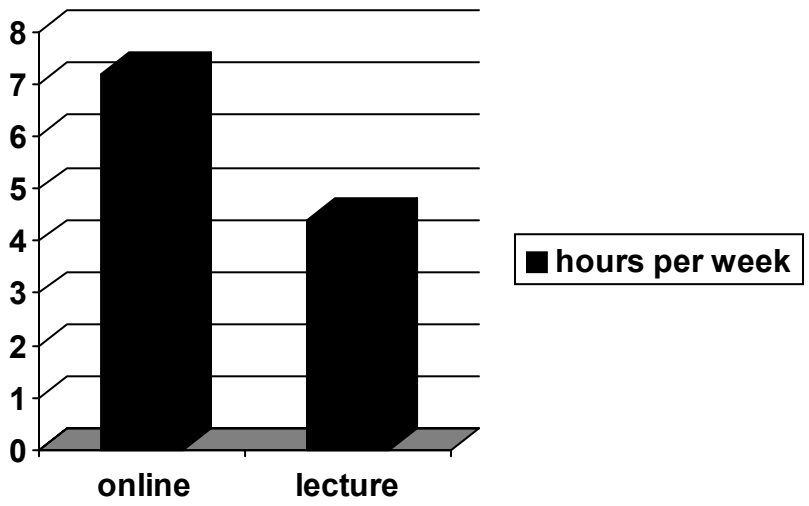

Figure 4.1 Average Hours Per Week Spent by Instructor for Online and Lecture Courses

For the online course, the average hours per week includes time necessary for grading, course maintenance, and answering emails. For the lecture course, the average hours per week includes time spent preparing for class, time for class meetings, grading, and entering grades.

Even when taking course-meeting times into consideration, clearly there is a difference in the amount of instructor time spent between the two types of classes. An important note is that this average time assumes that the course has already been taught once prior to the quarter. In other words, the instructor does not have the additional time requirement for developing the course website or creating lectures for the lecture course. This would add a substantial amount of time onto both averages.

Change in Constructs

A second part of the process evaluation is to test whether or not there is a difference in theoretical variables between groups at the three time periods. The technique used to analyze the data was a mixed between-within subjects ANOVA. This is an extension of the repeated measures ANOVA. In a repeated-measures ANOVA, one group is tested multiple times. However, in this study, three groups of subjects (independent of each another) were tested at three different times. Thus, a mixed between (groups) - within (time) subjects ANOVA was the correct test to use. The independent variables for this analysis are time and group. The dependent variables are the variable scores.

Only subjects providing complete data at all three data collection points are included in the following analyses. The number of subjects providing complete data in each group are as follows: Online group, n = 46; Traditional group, n = 22; Health group, n = 22.

A Bonferroni correction to the alpha level was necessary because multiple tests were performed. The original alpha, set at .05, was divided by the number of between-within subjects ANOVAs that were performed. Since seven of these tests were performed (moderate physical activity, vigorous physical activity, self-regulation, social support family, social support friends, self-efficacy, and outcome expectations and expectancies), the alpha level was changed to .0071 (.05/7). It was this new level of alpha that will be used to determine statistical significance.

Assumptions

The following are assumptions of a repeated measures ANOVA: level of measurement of dependant variable must be interval or ratio, random sampling should be used, observations are independent, there is a normal distribution of scores for the dependant variable, homogeneity of variance, and homogeneity of covariance(Keppel, 1991; Pallant, 2001; Stevens, 1986).

Level of measurement of the dependant variables are continuous, and are at least of interval level (theoretical variables in the process evaluation and physical activity in the impact evaluation). Random sampling was not used. This is a common occurrence in behavioral studies, as random assignment is not always possible (Stevens, 1986).

Observations between groups are independent. Groups consisted of students in different courses. There were only a few students who provided more than one set of data. The first data set was used, and the second was thrown out. This occurred in two cases, and occurred over two quarters. There were no students who took more than one of the involved courses in the same quarter.

Violation of the normal distribution assumption is typically not an issue with large enough sample sizes (Gravetter & Wallnau, 2000). An ANOVA is typically a relatively robust statistical test, and should not be greatly affected by violation of this assumption (Gravetter & Wallnau, 2000; Pallant, 2001; Stevens, 1986).

Homogeneity of variance is assessed through the Levene test. If this test is significant at alpha = .0071, then one might make alpha more conservative for interpreting the significance between groups. However, since alpha is already conservative, (.0071), and sample size is small, this would greatly increase the risk of a type II error.

Homogeneity of covariance is assessed in Box's Test of Equality of Covariance. If this test is significant (alpha = .0071), then a more conservative statistic (Hotelling's Trace), or the most conservative (Roy's Largest Root) will be checked to see if the attained probability values agree with Pillai's Trace.

To assess significant time effects, Pillai's Trace was used. This statistic is used instead of the more common Wilks' Lambda because it is more robust, meaning it is useful if sample size is small, groups are unequal, or if there is a violation of assumptions. For some variables, there were unequal variances between the three groups. There was also a different number of subjects in the online group than in traditional and health groups. Therefore, Pillali's trace is the logical choice.

Sphericity, or the assumption that the variance of population difference scores for any two conditions are the same as any other two conditions (Pallant, 2001), is also a concern when running a mixed between-within analysis of variance. To test this assumption, Machley's test of sphericity is used. If this test is significant, then one can refer to the multivariate statistics rather than the univariate statistics.

Missing Data

The issue of missing data was addressed through mean replacement. If 80% of the items on an instrument or subscale were complete, then mean replacements were entered for missing data values. If more than 20% of the data values were missing, then subjects were excluded from the final analysis. In the majority of cases, missing data occurred because students missed an entire page or subscale of an instrument. These subjects were removed from the study.

Of the original sample (356 students), 34 students were excluded from the study for providing incomplete data sets. These students missed an entire page of the survey, or missed the majority of an instrument. Of these 34 excluded subjects, 17 were from the online group, 13 were from the traditional group, and 4 were from the health group.

The remainder of students provided at least 80% of each instrument or subscale of each instrument. For both the pretest and posttest, only 25 data sets required mean replacement for one to three items. Missing data points were replaced by inputting the calculated mean of the subscale or instrument.

Mean replacement decreases variability, thus increasing the chance of finding a significant result. However, this study employed strict control for committing a Type I error, especially when considering the small sample size. Therefore, the Bonferroni adjustment that was made to alpha, alpha = .0071, should help decrease the change of committing a type I error.

Self-Regulation

A mixed between-within subjects ANOVA was conducted to compare mean scores on the self-regulation instrument at pretest, post-test, and follow-up between the three groups.

Box's Test of Equality of Covariance Matrices revealed that Box's M (31.028) p=.004 was less than the alpha stated above (alpha = .0071). This means that covariance was not equal between the measures. This may tend to increase the type 1 error rate. Typically, one might change alpha level to be more conservative from .05 to .01 to interpret the results. However, alpha has already been corrected using Bonferroni's correction. Making alpha any smaller may lead to a substantial increase in type II errors, especially since the sample size is small. According to the multivariate analysis, there was a significant effect for time, Pillai's Trace = .506, F (2, 86) = 44.105, p<.001, partial eta squared = .506. The effect size, partial eta squared was relatively high, when considering .6 is typically considered a large effect. This same finding was supported in the test of within-subjects effects. Since sphericity was assumed (Mauchly's test of sphericity was not significant, p = .301), the time effect was also found to be significant F(2, 174) = 52.011, p < .001, partial eta squared = .374.

Tests of within-subjects contrasts revealed that there was a significant difference between post-test and follow-up F(1,87) = 49.786, p <.001, partial eta squared = .364. There was also a significant difference between pre-test and post-test F(1, 87) = 85.523, p < .001, partial eta squared = .496. Post-hoc tests are summarized in table 4.24. With alpha set at .0071, there was a significant difference between groups one and three (p=.004).

Group	Comparison Group	Mean Difference	Standard Error	Significance
Online	Traditional	10.12	6.23	.273
	Health	25.05	6.23	.001
Traditional	Online	-10.12	6.23	.273
	Health	14.93	7.25	.126

Table 4.24 Scheffe Post-Hoc Comparisons Between Groups on Self-regulation Scores

Interactions

According to the multivariate test, there was a significant interaction between group and time, Pillai's Trace = .235, $F(4, 174) = 5.789$, $p<.001$, partial eta squared = .117. The significant interaction was also shown in the test of within-subjects effects, $F(4, 174) = 7.249$, $p<.001$, partial eta squared = .143. The interaction is displayed in Figure 4.2.

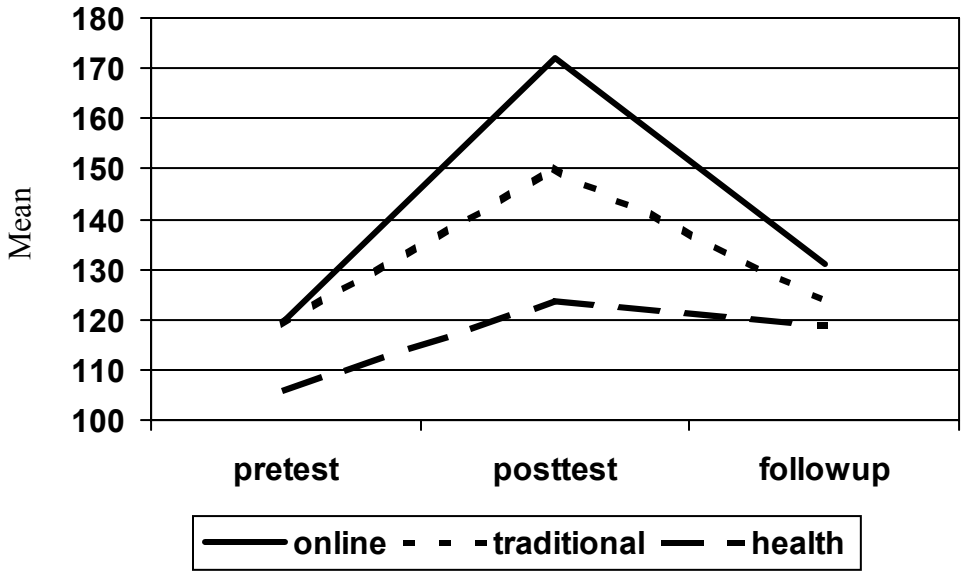

Figure 4.2 Interaction Between Group and Time Mean Scores

This graph shows the interaction between group and time. This means that the three groups scores did not follow a similar pattern across time, and that self-regulation scores over the three time periods did not change in a similar fashion between groups.

Figure 4.2 shows that all groups tended to show the same trend – increasing from pre-test to post-test, then decreasing from post-test to follow-up. However, the degree to which the groups changed was different. For example, the online group seemed to increase dramatically from pre-test to post-test. Though the traditional and health groups also increased from pre-test to post-test, their scores did not increase as dramatically.

This interaction would lead one to believe that, though all groups increased their scores from pretest to post test, it would seem that the online group increased their scores to a greater degree than the other groups.

To discover where the interaction occurred, a post-hoc One-Way ANOVA was run. The One-Way ANOVA results revealed that there was a significant difference at post-test between groups, $F(2, 87) = 23.222$, $p<.001$. Table 4.25 displays these results.

Time		Sum of Squares	df	Mean Square	F	Sig.
Pretest	Between Groups	3202.80	2	1601.40	1.75	.181
	Within Groups	79813.94	87	917.40		
	Total	83016.74	89			
Posttest	Between Groups	36464.88	2	18232.44	23.22	.000
	Within Groups	68307.25	87	785.14		
	Total	104772.13	89			
Follow-up	Between Groups	2244.50	2	1122.25	1.15	.321
	Within Groups	84860.13	87	975.40		
	Total	87104.62	89			

Table 4.25 One-Way ANOVA Results for Self-regulation at Pretest, Post-test, and Follow-up

Since a significant interaction was found, a Scheffe post-hoc test was run. The results are found in table 4.26. At post-test, alpha = .0071, the online and health groups were significantly different than each other ($p<.001$) on post-test self-regulation scores.

Group	Comparison Group	Mean Difference	Standard Error	Significance
Online	Traditional	22.67	7.26	.010
Online	Health	48.97	7.26	.000
Traditional	Health	26.31	8.45	.010

Table 4.26 Scheffe Post Hoc Test on Post-test Self Regulation Scores

Summary

Since an interaction occurred, it was important to discover where the differences occurred so that the results could be interpreted meaningfully. The one-way ANOVA results show the significant difference occurred between groups at post-test, and that the online group was significantly different at post-test on self-regulation scores than the health group. There was sufficient power to detect time (power=1) and group (power=.953) differences, as well as the interaction (power=.995).

Family Social Support

A mixed between-within subjects repeated measures ANOVA was conducted to compare mean scores for family social support at pre-test, post-test, and follow-up between the three groups.

Box's test was significant ($p<.001$), meaning there was not equal covariance between groups across all measures. This is important if differences are found between groups or times.

According to Pillai's Trace, there was a significant effect for time, Pillai's Trace = .133, $F(2, 174) = 6.615$, $p = .002$, partial eta squared = .133. This was also supported in the within-subjects test, where $F(2, 174) = 6.983$, $p = .001$, partial eta squared = .074. Mauchly's test for Spericity was not significant. There was no difference in the test of between-subjects effects (group) $F(2, 174) = 1.970$, $p = .146$, partial eta squared = .043.

Significant contrasts for time included pretest and follow-up ($F(1,87)=8.28$, $p=.005$, partial eta squared = .087) as well as post-test and follow-up ($F(1,87)=11.825$, $p=.001$, partial eta squared=.12). There was not a significant interaction between time and group for family social support.

Summary

Though a time effect was found, there was not a significant group effect. This means that all subjects were different between pre-test and follow-up, and post-test and follow-up. One important note is that, although there were no significant differences between groups, one must realize that the n for the online group (n=46) is double that of

the other two groups (n=22 in each group). The online group's mean scores on the instrument were higher at pretest and post-test than the other groups. Therefore, when looking at means across time periods, it appears that the online group would seem to account for much of the time effect. In other words, the traditional group actually declined in scores from pretest to post-test, and the health group appeared to change little across time periods. Therefore, the online group may have had an influence on this change.

Power for detecting group differences was low (.398) which may have been a function of a small sample size. A priori power tests indicated a need for 14 subjects per group to detect a difference of 12 on the instrument. The difference in means for this sample was less than twelve. To be able to detect a smaller change, a larger sample would need to be attained.

Friend Social Support

A mixed between-within subjects repeated measures ANOVA was conducted to compare mean scores on the friend social support instrument at pretest, post-test, and follow-up.

Box's test of equality of covariance was not significant (p = .031) at alpha = .0071. Pillai's Trace was not significant for time, Pillai's Trace = .096, F(2, 86) = 4.54, p = .013, partial eta squared = .096. The test of within subjects effects also produced no significant result F(2, 174) = 4.929, p = .008, partial eta squared = .054. The test of between-subjects effects produced no significant result for group F(2, 87) = .595, p = .554, partial eta squared = .013. There was no significant interaction between time and group

Summary

For friend social support, there was no significant difference between groups or between time periods. Observed power was sufficient (.802) to detect a time difference if one had occurred. Power to detect a difference between groups was low (.146).

Self-efficacy

A mixed between-within subjects ANOVA was conducted to compare mean scores on the self-efficacy instrument at pre-test, post-test, and follow-up between the three groups.

Box's test of Equality of Covariance was significant, Box's M = 30.369, F(12, 17808.29) = 2.384, p = .005. It is important to consider this if significant differences are found between groups or between time periods.

There was no significant time effect for the multivariate analysis, Pillai's trace = .089, F (2, 86) = 4.221, p= .018, partial eta squared = .089. This was echoed in the test of within-subjects effects for time F(2, 174) = 3.443, p=.034, partial eta squared = .038. There was also no significant group effect F(2, 87) = 4.102, p = .02, partial eta squared = .086. There was no significant interaction between group and time for self-efficacy.

Summary

For self-efficacy, there was no significant effect for time or for group. Power for the time effect was less than .8. Power for the group effect was close to .8. Therefore, had a difference existed between groups, it should have been detected.

Outcome Expectations and Expectancies

A mixed between within repeated measures ANOVA was conducted to compare means on the outcome expectations and expectancies instrument at pre-test, post-test, and follow-up between the groups.

Box's test of equality of covariance was significant, Box's M = 28.597, F (12, 17808.29) = 2.245, p = .008.

There was a significant time effect for outcome expectations and expectancies, according to the multivariate analysis, Pillai's trace = .292, F(2, 86) = 17.736, p<.001, partial eta squared = .292.

Mauchly's test of Sphericity was not significant (p=.002). This typically leads one to be more conservative when interpreting results. Because of this violation, Greenhouse-Geisser was used to test within-subjects effects. The value, F(1.760, 153.081) = 20.506, p<.001, partial eta squared = .191 was significant at the .0071 level.

Contrasts were completed to discover where the time differences occurred. There was a statistically significant difference between scores on pre-test and post-test, F(1, 87) = 14.800, p<.001, partial eta squared = .145. There was also significant difference between post-test and follow-up, F (1, 87) = 35.359, p<.001, partial eta squared = .289.

There was no significant difference between groups, F(2, 87) = .691, p = .504, partial eta squared = .016. There was also no significant interaction between group and time.

Summary

There was a time effect for outcome expectations and expectancies for all subjects between pre-test and post-test and between post-test and follow-up. There was no difference in this variable between groups. Power to detect a group difference was low (.163).

Outcome Expectations and Expectancies Subscale Analysis

Since there were six distinct categories of outcome expectations and expectancies, it is important to know which categories of expectations were the most important in the time effect. It is also important to see if there were time and group differences between for the subscales.

For the relaxation related outcomes, there was a significant time effect ($F(1.69, 147.06) = 16.85$, $p<.001$, partial eta squared = .162, power = .99). Within-subjects contrasts showed that the difference occurred between pre-test and post-test ($F(1, 87)=12.54$, $p=.001$, partial eta squared = .126, power = .94), and between post-test and follow-up ($F(1,87)=31.48$, $p<.001$, partial eta squared = .266, power = 1). There was not a significant group effect ($F(2,87)=1.73$, partial eta squared = .038, power = .35.

For the health related outcomes, there was a significant time effect ($F(1.79, 155.88)=8.78$, $p<.001$, partial eta squared = .092, power = .955). Within-subjects contrasts showed that there was a difference between post-test and follow-up ($F(1,87)=15.91$, partial eta squared = .155, power = .98). There was not a significant group effect ($F(2, 87)=3.82$, $p=.026$, partial eta squared = .081, power = .68).

There was a significant time effect for the competition subscale ($F(2, 174)=6.96$, $p=.001$, partial eta squared = .074, power = .92). Contrasts showed that there was a difference between post-test and follow-up ($F(1,87)=12.73$, $p=.001$, partial eta squared = .128, power = .94). There was not a significant group effect for the subscale ($F(2,87)=.719$, $p=.490$, partial eta squared = .016, power = .168).

There was a significant time effect for the beauty-related outcomes subscale ($F(2, 174)=15.02$, $p<.001$, partial eta squared = .147, power = 1). Contrasts showed that the difference occurred between pre-test and follow-up ($F(1,87)=14.45$, $p<.001$, partial eta squared = .142, power = .96), and between post-test and follow-up ($F(1,87)=28.77$, $p<.001$, partial eta squared = .249, power=1). There was no significant group effect ($F(2,87)=.077$, $p=.926$, partial eta squared = .002, power=.061).

For the thrill-seeking subscale, there was a significant time effect ($F(2,174)=10.75$, $p<.001$, partial eta squared = .11, power=.99). The differences were found between pre-test and post-test ($F(1,87)=15.44$, $p<.001$, partial eta squared = .151, power = .97), and between post-test and follow-up ($F(1,87)=16.82$, $p<.001$, partial eta squared = .162, power=.982). There was not a significant group effect for the subscale ($F(2,87)=1.13$, $p=.328$, partial eta squared = .025, power=.243).

For the social outcomes subscale, there was a significant time effect ($F(2,174)=17.32$, $p<.001$, partial eta squared=.166, power=1). The differences occurred between pre-test and follow-up ($F(1,87)=22.99$, $p<.001$, partial eta squared=.209, power=.99), and between post-test and follow-up ($F(1,87)=27.11$, $p<.001$, partial eta squared=.238, power=.99). There was not a significant group effect for this subscale ($F(2,87)=2.53$, $p=.085$, partial eta squared=.055, power=.495).

Summary of Subscale Analysis

There were time effects for all of the subscales, but no group effects. This matches the result on the entire outcome expectations and expectancies instrument. For the majority of the subscales, the time differences occurred between pre-test and follow-up or post-test and follow-up. This is likely because of the drop in means at follow-up for many of the subscales. The only subscales that showed differences between pre-test and post-test were thrill seeking and relaxation-related outcomes. The implications of these findings are presented in the conclusions section of the next chapter.

Impact Evaluation

An impact evaluation was conducted to see if physical activity behavior changed between groups over the three time periods. Results are separated into days of moderate and vigorous physical activity.

Though the instrument includes a column where students label their activity as either "planned" or "unplanned," the type of activity used in this analysis was not separated into these two categories. At follow-up, subjects completed the questionnaire online. Though the online questionnaire yielded more complete data sets for each of the constructs, it seemed to be less reliable for reporting of planned and unplanned physical activity. The default for the online survey was set to unplanned. When reviewing the results, all but two subjects reported their activity as unplanned. Some of the subjects that had reported their activity as unplanned seemed to have a regular schedule of activity for the week, i.e., running Tuesday and Thursday, and weight training Monday, Wednesday, and Friday.

The researcher did not feel that all of the activity would be correctly labeled as unplanned. This is especially true when comparisons between the other data collection periods were made. If, at all data collection periods, only planned physical activity was included, then the groups at follow-up would seem exceptionally sedentary. Therefore, the decision to drop the "planned" or "unplanned" criteria was made, and all activity that was reported was included in the analysis.

Moderate Physical Activity

A mixed between-within subjects repeated measures ANOVA was used to assess differences in days of physical activity between groups across the three time periods.

According to the multivariate test, there was no significant time effect for days of moderate physical activity, Pillai's Trace = .028, F(2, 86) = 1.141, p=.324, partial eta squared = .026. This was also supported by the test of within-subjects effects, F(2, 174) = .987, p = .375, partial eta squared = .011. There was no significant interaction between group and time, F(4, 174) = .599, p = .664, partial eta squared = .014. There was also no significant group effect, F(2, 87) = .933, p = .397, partial eta squared = .021.

Summary

There was no significant time effect or group effect for days of moderate physical activity between groups. Power was low to detect a difference had one existed for time (.210) and group (.201).

Vigorous Physical Activity

A mixed between-within subjects repeated measures ANOVA was used to compare means for days of vigorous physical activity across the three time periods.

Box's test of equality of Covariance was not significant, $F(12, 17808.29) = 1.885$, $p = .031$. The multivariate analysis showed a significant time effect, Pillai's Trace = .123, $F(2, 86) = 6.013$, $p = .004$, partial eta squared = .123. This result was supported in the test of within-subjects effects, $F(2, 174) = 6.435$, $p = .002$, partial eta squared = .069.

To assess where the differences occurred for time, contrasts were completed. The only significant difference between tests occurred between pre-test and post-test, $F(1, 87) = 11.434$, $p = .001$, partial eta squared = .116. There was no significant time-group interaction. There also were no significant differences between groups, $F(2, 87) = 4.299$, $p = .017$, partial eta squared = .090.

Summary

There was a significant time effect for days of vigorous physical activity between pre-test and post-test. There was no significant group effect. Power to detect a difference between groups was .735, which is close to the recommended .8 value.

Change in Physical Activity

One of the research questions for this study was to see if the change in constructs accounted for the change in physical activity. Since vigorous physical activity, not moderate physical activity, was found to be significantly different from pretest to post-test measurement, it was used as the dependant variable in the regression analysis.

Change scores were computed from pre-test to post-test, post-test to follow-up, and from pre-test to follow-up. Since the only significant difference in days of vigorous physical activity was found at post-test, change scores from pre-test to post-test were regressed on change in vigorous physical activity from pre-test to post-test.

To run a regression analysis, there are several different views on required sample size. Stevens (1996) recommends having at least 15 subjects per independent variable. If this holds true, then this analysis would require at least 75 subjects. Stepwise regression requires many more subjects per independent variable.

Two regression analyses were completed. The first regression analysis was conducted after splitting the subjects into groups. The idea here is to assess whether the theoretical constructs accounted for variance in vigorous activity to a differing degree in the three groups. Though this causes the regression analysis to be completed on a small number of subjects, it is nonetheless necessary to answer the question of group differences. Running regression on a small sample tends to make the model less able to be generalized to the population. Since this is a pilot test, this study was not conducted to generalize to the general population.

The second regression analysis that was run included the entire sample. Since there was a time effect but no group effect, it would seem that this would be the way to analyze the data. The analysis answers a different question than the one above. The above regression analysis gives a model for each group. This second analysis provides information about the total sample.

In both instances, standard multiple regression was run. All of the independent variables were entered as a block, and backward elimination was conducted if p values were greater than .1. Stepwise and hierarchical regressions were ruled out for both analyses. Since stepwise regression typically calls for 40 subjects per independent variable, this type of analysis was not possible on either the entire sample or the analysis on the three groups.

Group Regression Analysis

Means and standard deviations of change scores from pretest to post-test are presented in table 4.27. Mean change scores for the online group, on all variables, appear greater than the other two groups.

Correlations between change scores for the constructs and days of vigorous physical activity are presented in table 4.28. Correlations are one way to check collinearity. Highly correlated independent variables can limit the amount of variance accounted for in the model. The above correlations are low to moderate.

Group	Variable	Mean	Standard Deviation
Online	Vigorous Physical Activity	.93	1.73
	Self-regulation	52.88	32.78
	Family Social Support	2.63	10.02
	Friend Social Support	2.09	8.97
	Self-efficacy	89.61	217.00
	Outcome Exp. and Exp.	41.54	144.37
Traditional	Vigorous Physical Activity	.86	2.44
	Self-regulation	31.40	37.32
	Family Social Support	-1.18	9.01
	Friend Social Support	-1.14	12.23
	Self-efficacy	38.18	184.90
	Outcome Exp. and Exp.	-8.65	190.76
Health	Vigorous Physical Activity	.27	1.20
	Self-regulation	18.12	28.53
	Family Social Support	.41	4.00
	Friend Social Support	.64	5.28
	Self-efficacy	-1.50	228.61
	Outcome Exp. and Exp.	97.29	153.16

Table 4.27 Means and Standard Deviations of Pretest-Post-test Change Scores by Group

Group		VPA	SR	FASS	FRSS	SE	OEE
Online	VPA	1.000	.319	.216	-.067	.038	-.022
	SR	.319*	1.000	.396*	.037	.509*	.296*
	FASS	.216	.396*	1.000	-.075	.343*	.314*
	FRSS	-.067	.037	-.075	1.000	.039	.169
	SE	.038	.509*	.343*	.039	1.000	.323*
	OEE	-.022	.296*	.314*	.169	.323*	1.000
Traditional	VPA	1.000	.481*	.285	.364*	.273	.345
	SR	.481*	1.000	.503*	.603*	.548*	.412*
	FASS	.285	.503*	1.000	.608*	.039	.503*
	FRSS	.364*	.603*	.608*	1.000	.557*	.442*
	SE	.273	.548*	.039	.557*	1.000	.080
	OEE	.345	.412*	.503*	.442*	.080	1.000
Health	VPA	1.000	.168	.045	.076	-.043	.247
	SR	.168	1.000	.048	.590*	.613*	.506*
	FASS	.045	.048	1.000	.165	-.014	-.148
	FRSS	.076	.590*	.165	1.000	.409*	.407*
	SE	-.043	.613*	-.014	.409*	1.000	.237
	OEE	.247	.506*	-.148	.407*	.237	1.000

* significant at alpha = .05.
VPA = vigorous physical activity, SR = self-regulation, FASS = Family social support, FRSS = friend social support, SE = self-efficacy, OEE = outcome expectations and expectancies.

Table 4.28 Correlations Between Pretest-Post-test Change Scores by Group

Table 4.29 presents the results of the regression analyses for the three groups. The results of the regression analyses above show that Self-regulation was the only variable to significantly contribute to a model for the online and traditional groups. In the online group, change in self-regulation accounted for 10.2% of the variance in change in vigorous physical activity. In the traditional physical activity group, change in self-regulation accounted for 23.2% of the variance in change in vigorous physical activity. None of the variables accounted for variance in vigorous physical activity in the health group. Tolerance and VIF Values for the variables are at acceptable levels. Values closer to 0 indicate a problem with collinearity. All values for the regression models above were .4 or above.

Group	MO	R	R^2	Adjusted R^2	Standard Error of Estimate
Online	OEE, FRSS, SR, FASS, SE	.393	.155	.049	1.6877
	OEE, SR, FASS, SE	.39	.153	.071	1.6686
	SR, FASS, SE	.372	.138	.077	1.6628
	SR, SE	.350	.123	.082	1.6585
	SR	.319	.102	.081	1.6590
Traditional	OEE, SE, FASS, SR, FRSS	.511	.262	.031	2.3978
	OEE, FASS, SR, FRSS	.511	.262	.088	2.3263
	OEE, SR, FRSS	.510	.260	.137	2.2625
	OEE, SR	.508	.258	.180	2.2061
	SR	.481	.232	.193	2.1876
Health	OEE, FASS, SE, FRSS, SR	.313	.098	-.184	1.3081
	OEE, FASS, SE, SR	.308	.095	-.118	1.2714
	OEE, SE. SR	.301	.091	-.061	1.2383
	OEE, SE	.268	.072	-.026	1.2178
	OEE	.247	.061	.014	1.1939
	none	.000	.000	.000	1.2024

OEE = Outcome Expectations and Expectancies, FRSS =Friend Social Support, FASS = Family Social Support, SE = Self-efficacy, SR = Self-regulation

Table 4.29 Model Summaries for Regression Analyses by Group

ANOVAs for the regression models for the three groups are presented in table 4.30. Since the health group did not have a significant model, and ANOVA is not necessary for this group. Only results for final regression models for the online and traditional groups are presented below. Since self-regulation was the only remaining variable after backwards elimination, it is the only significant predictor of vigorous physical activity. The purpose of the ANOVA is to test whether the model is significantly different from zero.

Group		Sum of Squares	df	Mean Square	F	Sig.
Online	Regression	13.69	1	13.69	4.97	.031
	Residual	121.11	44	2.75		
	Total	134.80	45			
Traditional	Regression	28.88	1	28.87	6.03	.023
	Residual	95.71	20	4.79		
	Total	124.59	21			

Table 4.30 One-Way ANOVAs for Final Regression Models (Self-regulation) on Change in Days of Vigorous Physical Activity from Pre-test to Post-test for the Online and Traditional Groups

The models, including Self-regulation, for the online and traditional groups are significant at the .05 level. This means that R^2 values are significantly different than zero. Since only one variable entered the regression model, collinearity is not an issue.

Entire Sample Regression Analysis

Means and standard deviations of change scores from pretest to post-test are presented in table 4.31. Correlations between change scores for the constructs and days of vigorous physical activity are presented in table 4.32.

	Mean Change Score	**Standard Deviation**
Vigorous PA	.76	1.83
Self-regulation	39.13	35.85
Family social support	1.16	8.74
Friend social support	.944	9.18
Self-efficacy	54.77	213.74
Outcome expectations and expectancies	42.90	161.40

Table 4.31 Means and Standard Deviations of Pre-test-Post-test Change Scores for Entire Sample

	Vigorous PA	Self-regulation	Family Social Support	Friend Social Support	Self-Efficacy	Outcome EE
Vigorous PA	1.000	.373*	.225*	.133	.110	.128
Self-regulation	.373*	1.000	.401*	.319*	.553*	.299*
Family Social Support	.225*	.401*	1.000	.191	.233*	.306*
Friend Social Support	.133	.319*	.191	1.000	.248*	.306*
Self-efficacy	.110	.553*	.233*	.248*	1.000	.208*
Outcome EE	.128	.299*	.306*	.306*	.208*	1.000

* significant at alpha = .05.

Table 4.32 Correlations of Pretest-Post Test Change Scores for Entire Sample

Correlations can be used as one assessment of collinearity. Highly intercorrelated independent variables can confound the regression model. If two or more variables that are highly correlated are entered into a model, this can limit the size of R, and will make it difficult to determine which of the predictors are most important. It appears that the intercorrelations of the independent variables are all low to moderate, ranging from r=.191 to r=.553.

All variables were entered into regression as a block, and systematically removed if p>.100. The model summary is presented in Table 4.33. Table 4.34 displays the ANOVA tables for the five regression models.

Model	R	R^2	Adj. R^2	Std. Error of the Estimate
OEE, SE, FASS, FRSS, SR	.400	.160	.110	1.72
SE, FASS, FRSS, SR	.400	.160	.120	1.71
SE, FASS, SR	.399	.159	.130	1.70
SE, SR	.390	.152	.133	1.70
SR	.373	.139	.129	1.70

OEE = Outcome Expectations and Expectancies, SE = Self=efficacy, FASS = Family Social Support, FR = Friend Social Support, SR = Self-regulation

Table 4.33 Model Summary for Regression of Change Scores on Change in Vigorous Physical Activity Days, Entire Sample

Model		Sum of Squares	df	Mean Square	F	Sig.
OEE, SE, FASS, FRSS, SR	Regression	47.39	5	9.48	3.19	.011
	Residual	249.23	84	2.97		
	Total	296.62	89			
SE, FASS, FRSS, SR	Regression	47.39	4	11.85	4.04	.005
	Residual	249.23	85	2.93		
	Total	296.62	89			
SE, FASS, SR	Regression	47.28	3	15.76	5.434	.002
	Residual	249.35	86	2.90		
	Total	296.62	89			
SE, SR	Regression	45.18	2	22.59	7.82	.001
	Residual	251.44	87	2.89		
	Total	296.62	89			
SR	Regression	41.22	1	41.22	14.20	.000
	Residual	255.40	88	2.90		
	Total	296.62	89			

OEE = Outcome Expectations and Expectancies, SE = Self-efficacy, FASS = Family Social Support, FRSS = Friend Social Support, SR = Self-regulation

Table 4.34 ANOVAs for the Regression Models on Change in Days of Vigorous Activity from Pre-test to Post-test, Entire Sample

All of the models are significant at the .05 level. Therefore, it is necessary to discover which variables are contributing significantly to the model. T-tests for the models showed that self-regulation was the only significant predictor in any of the models, with model five having the highest t-test value ($t=3.77$, $p<.001$). Though the other models were statistically significant from zero, they did not include other variables that contributed significantly to the model. Therefore, model five is the correct model, and this model, including only change in self-regulation, accounts for 13.9% of the variance in change in days of vigorous physical activity.

Summary

Regardless of the regression analyses, change in self-regulation was the only significant predictor in change in vigorous physical activity. Interestingly, however, higher mean scores on change in self-regulation do not necessarily account for more variance in change in vigorous physical activity. This was found in comparing the regression analyses between groups. Group one had higher mean change scores on self-regulation and on vigorous physical activity. However, the model for group one explained less variance in change in vigorous activity than the model for group two did. This could be due to measurement error in the dependant variable (physical activity). Since self-regulatory activity is planned activity, and planned activity was not extracted for analysis, it could be that the traditional group had higher levels of unplanned activity. Had these activities been excluded, their regression model might have been lower.

CHAPTER 5

CONCLUSIONS AND DISCUSSION

Introduction

This chapter will include three sections: Conclusions, Limitations, and Recommendations for future research. In the conclusions section, a summary of the purpose of the study, description of the sample, methods, and results are presented along with an interpretation of the results. Limitations are also discussed in this chapter. Recommendations for further research in this area are included as well.

Conclusions

The two purposes of the study were to complete a construct validation of the treatment and to pilot test the efficacy of the intervention in increasing students' physical activity levels during and after the intervention. Students self-selected their level of treatment when they registered for the courses. Of the original sample (n=322), only 39% were retained for all data collection periods.

The online group received an intervention that included fitness and behavioral skill knowledge and practice using behavioral skills that are hypothesized to be linked to physical activity via the web. Students tracked their physical activity on weekly activity

logs. Students did not have a regularly scheduled physical activity class session, but were expected to complete at least three days of cardiorespiratory exercise when it was convenient for them. Students in this group were expected to complete activities each week that were hypothesized to increase the student's behavioral skills in the area for the week (i.e., identification of and ways to overcome barriers, time management activities for self-efficacy).

The traditional physical activity group received instruction on fitness principles and some self-regulatory skills. Students in the traditional course were required to complete an activity log throughout the quarter, and also received instruction on how to set goals. They also had a required lab section that included meeting for exercise three days per week. Lecture met once per week.

The health course (Avoiding Cancer) had no physical activity component. Students met with the instructor once, twice, or three times per week (depending on the section) for lecture.

Subject Attrition and Outcomes of the Study

Since many subjects dropped out of the study either between pre-test and post-test, or between post-test and follow-up, it was important to find out if the respondents and non-respondents were different in their scores on the study variables. An analysis found that the respondents and non-respondents were similar on all variables on pre-test except for outcome expectations and expectancies. Interestingly, post-test respondents in the health group had lower mean scores than non-respondents at pretest. This could mean that the mean used for analysis could be an underestimation of the sample mean, as

the non-respondents had higher means at pretest. Had they been retained, the mean score used for analysis could have been higher. This might have led to less of a difference between groups at post-test. The analysis found that there was not a significant group effect for outcome expectations and expectancies. Since there were no group differences, this would have not affected the outcome.

Data collection in the traditional and health courses occurred during class time during the first and last weeks of the quarter. Some of the courses only met one day per week. In other instances, the instructors asked for the researchers to collect data on specific days. If students were absent on these days, they did not complete a post-test survey. It is recommended that future similar studies have at least two days of data collection scheduled with instructors to allow for maximum subject retention.

The majority of subjects were lost between post-test and follow-up. Again, respondents and non-respondents were similar on all variables but outcome expectations and expectancies. Post-test respondents in the health group had higher outcome expectations and expectancy scores than non-respondents. This could inflate the group mean at follow-up, as those with lower scores dropped out of the study. Time effects were found between pre-test and follow-up and post-test and follow-up. The entire sample decreased in mean score from post-test to follow-up. So, even with an inflated mean score for the health group, there still was a dramatic decline in scores at follow-up. Had the non-respondents been retained, then the score would likely be lower. Since follow-up scores were already significantly lower than pretest and post-test scores, it this finding does not affect the results. In other words, lowering the follow-up score does not make the finding any more significant.

Process Evaluation

Evaluation of Online Instruction of the Course

Though the course was set-up to minimize error in implementation of the intervention, it did not control for every aspect of implementation. Students had to navigate the course in a specific order, but there was no way to tell if they were actually reading the lectures that were posted on web ct. Also, instructors for the course only had time to check whether or not the assignments were complete or not. A grade was not given in regards to the quality of their work. This was a time issue for the instructors, as it typically took instructors at least one hour per assignment to open it, scan it for completeness, and input a grade for all students. There were at least two assignments per week, and sometimes more. This is an important point, as some of the non-significant results may have been due to students' lack of reading the lectures or the grading procedures for homework. In other words, if students were not reading the lectures, they were not getting the necessary information on the behavioral skills. If they were not putting effort into the assignments, then they were not practicing the behavioral skills. If they were not getting the knowledge or practicing the behavioral skills, then they would likely not change their scores for the theoretical variables from pre-test to post-test.

The fitness knowledge test scores could not be compared between the online group and the traditional physical activity group, since a large number of the online group reported some use of their books during the exams. Therefore, the higher scores in the online group are likely due to the use of their books. From these findings, it is recommended that exams in online courses be taken on-campus in a supervised setting.

The construct knowledge assessment only included five questions. The reason for this was because students only had 48 minutes to complete the final examination. If there had been too many questions, students may not have been able to finish the exam in time. Also, if it was too long, students in the traditional course may not have completed the page including these questions. Since the last page of the exam, with questions about theoretical construct knowledge, was not part of their grade (they were informed of this before completing the exam), they may not have completed it had it been longer. However, scores on these five questions were significantly higher for the online group when compared to the traditional physical activity group. This means the online group's knowledge of the behavioral skills was significantly higher than the traditional group's knowledge.

Student feedback after the course was generally positive. Although students did report technological problems during the course, the majority of them reported they would take another online course. Students also felt that the course helped them become physically active or helped them maintain their level of activity. Self-regulation was a favorite part of the course for many students, with students feeling generally positive about tracking their physical activity behavior.

Time commitment for instructors was an issue. Instructors spent at least two hours per week grading assignments, roughly 1.5 hours per week answering emails, and roughly 30 minutes per week changing materials over and maintaining the website. The online course actually demanded more of the instructors' time than the other courses they were teaching.

This is an important finding of this process evaluation. Students and instructors alike may falsely believe that online courses are easier and take less time than their traditional counterparts. Both students and instructors for this course were surprised by the amount of time demanded by the course. As mentioned earlier, instructors only had time to scan assignments for completeness. If instructors had more time or if there were fewer students in the course, individual feedback on the quality of the assignments would have been possible. This may have improved the ability of the intervention to increase subject's scores on the theoretical variables.

Universities may want to take this into consideration when developing and offering online courses. Though it may seem that online courses can have unlimited enrollments leading to economic gains for the institution, there is a severe limit to the quality of the instruction that can be given to the course. Limited enrollments or assignment of multiple instructors to a course could help increase the quality of education achieved through online courses.

Summary

Though online courses had the capacity to increase enrollments at universities, caution must be taken in capping enrollments for online courses. The time requirement for instructors and students is much larger than it is for traditional lecture courses. Instructors spent much more time with the online course than traditional lecture courses. Some students complained about the amount of work that went along with the online course. They might have incorrectly thought that an online course was similar to the format of a traditional course. Students might have thought that there would be lectures

they could read online, and that they would only be required to take a midterm and final exam. When they discovered how "active" their participation had to be in the course, they were a bit surprised. Fortunately, many students appreciated the lessons and worksheets, responding that the lessons and worksheets were "very useful" to them.

Cheating becomes an issue on exams when a course is placed online. To alleviate this, exams either need to be monitored in a computer lab, or exams should be open-book or open-note. As compared to a traditional course, taking into account the courses were not identical, the online course was as good as the traditional course in promoting physical activity.

Construct Validation

When completing a construct validation, one is attempting to discover if an intervention that was based on theoretical constructs actually changed the constructs from pre-test to post-test. Group mean scored for variables were compared across groups via a form of repeated measures ANOVA.

For self-regulation, family and friend social support, and outcome expectations and expectancies, there was sufficient power (>.8) to statistically test the constructs for time effects. Self-regulation was the only variable that had sufficient power to detect group effects. There was insufficient power to test self-efficacy for time or group effects. Further study is warranted to statistically test the variables that had insufficient power to detect differences. Because a Bonferroni correction was made to control for type I error due to use of multiple analyses, alpha was lowered to a very strict level. This strict level of alpha created a situation in which there was less power to detect differences, which

also had a hand in decreasing the power to detect differences in the study. The following section will discuss the implications of the statistical results, practical significance of the results, and power.

Power, Effect Size, and Practical Significance

Power is an important idea to discuss when interpreting the statistical findings of this study. Since small sample size was a concern, it is necessary to discuss the power of the statistical tests in detecting a difference between means.

Statistical power is dependant on several items: sample size, alpha level, and effect size, as well as other things, such as the sensitivity of the measures(Murphy & Myors, 1998). If there is a large number of subjects, it is likely to find many statistically significant differences, regardless of magnitude. On the other hand, it is also possible that large differences will not be statistically significant if there is a small number of subjects. Alpha level also affects power. If alpha is set to a strict level, such as .01 or .001 instead of .05 or .1, then power is typically lower, and the chance of making a Type II error increases. Last, if effect sizes are larger, it is easier to achieve statistically significant differences between measures. When all of these are taken into account, it is necessary to discuss the practical implications of the findings. In the following section, which is organized by variable, the concepts of power, effect size, and practical significance are discussed.

Self-Regulation

The results of the repeated measures ANOVA for self-regulation found that the online and health groups were statistically different at post test. Power to detect time and group differences was sufficient (1 for time, .953 for group). The probability value was smaller than the value set by the strict control for a type I error, which typically increases the chances of committing a type II error. Therefore, it is likely the result did not happen by chance. The effect sizes were small to moderate (partial eta squared =.158 for group, .374 for time). This, along with the fact that there was a small sample size, illustrates that intervention was construct valid in modifying self-regulation. Self-regulatory scores changed one point on each item – this change is considered practically important.

A case can be made for a dose-response relationship for change in self-regulation by intervention method. In the traditional course, some self-regulatory skills and knowledge are taught. During the quarter, the traditional course required students to keep an activity log, and submit the log at the end of the quarter. It is not known the extent of regular monitoring of behavior among students in this group. In other words, it is not known if students tracked their activity daily, weekly, or completed the log at the end of the quarter before turning it in. Nonetheless, there was a monitoring requirement for the traditional group. This group was also instructed on the proper way to set goals according to the SMART method (specific, measurable, action-oriented, realistic, timely). They were also required to record one to three goals in their activity logs for the quarter. Last, students in the traditional group had the option of deciding upon rewards for meeting their goals. This is a form of reinforcement, though it must be mentioned that

not all instructors required students to decide upon reinforcements. Students that did choose reinforcements did not always choose appropriate reinforcements (rewarding oneself with an unhealthy behavior, such as going out for fast food, for physical activity goal attainment).

These three self-regulatory items were sufficient in increasing self-regulation from pretest to post-test. This increase was to a greater degree than the increase in the health group, which had no self-regulation component.

The online course required weekly monitoring of activity. Along with a lesson on the correct way to monitor activity, students were required to submit logs every week. Clearly, students in the online group were required to complete more regular monitoring of their activity. Specifically, students were required to monitor their activity each week for eight weeks. Students in the online section were also required to set weekly goals after the third week of the quarter. Students read a lesson that included information on properly setting behavioral goals, and were then required to email a weekly goal to the instructor at the beginning of each subsequent week. The online intervention also included a lesson on reinforcements, including a reinforcement worksheet that had students identify rewards that were most meaningful to them.

With all three of these components, the online intervention increased students' self-regulation scores from pretest to post-test to a greater degree than the traditional intervention. Therefore, it is established that the online intervention was the most successful in changing self-regulation.

Family Social Support

The results of the repeated measures ANOVA for family social support found that there was a time effect, but no group effect. The power to detect a time effect was sufficient (.923), but power to detect a group effect was only .398. The effect sizes for both time (partial eta squared = .074) and group (partial eta squared = .043) were small. When looking at the means of the scores on the family social support instrument across groups, it appears as though the means are not much different across the time periods or between groups. In other words, the changes of three to seven points on a scale with a range of 48 is quite small. Practically, there was little change across time or group. The range of differences between means equated to a difference in scores of one on three to seven items. This does not even represent a difference of one on each item.

Though there was a change from pretest to follow-up and a change from post-test to follow-up, there was not a significant change from pre-test to post-test. Thus, either the intervention was insufficient in changing the subjects' levels of family social support, or there was not sufficient power to test the construct change. It is also possible that there was insufficient focus in the intervention on social support to change the variable to a greater degree. Only one lesson was developed for students to understand and attain social support. This concept is likely more complex of an issue that would warrant more time in the intervention.

Friend Social Support

The repeated measures ANOVA for friend social support found that there were no time or group effects with alpha at .0071. Power was sufficient to detect a difference. The p value for a significant time effect was .008. For group, the power was low (.146). The effect sizes for both time (partial eta squared = .054) and for group (partial eta squared = .013) were very small. With a p value of .008, it is important to discuss the practical significance of the finding.

One might argue that .008 is close enough to the alpha level (.0071) that it might be considered practically significant, especially since sample size was small. However, when comparing means, the change in means was between two and six points. Again, as it was for family social support, the range for the instrument is 48 (12-60). This difference represents a difference of one for less than 6 scores out of the 12 on the instrument. Practically, this change seems small in relation to the overall range of the instrument. As was mentioned in the family social support section, it is either that the intervention was not sufficient enough to change the construct, or that there was not enough power to detect a difference. Only one lesson was developed to change social support – both for family and for friend social support. Thus, it is likely that social support is a more complex issue that should be addressed in more than one lesson, especially if there are different levels of support that are trying to be changed.

Self-efficacy

The repeated measures ANOVA found that there were no time or group effects for self-efficacy. Power to detect a time effect was inadequate (.640). Power to detect a group effect (.713) was lower than .8. Had the correction for avoiding Type I error not been done, there would have been significant time and group effects for the variable. The p value for time was .018, and the p value for group was .02. Effect size was small for both time (partial eta squared = .038) and group (partial eta squared = .086).

Since the above effects are potentially practically significant, it is important to analyze where the differences occurred. The group effect occurred between the traditional and health groups, and the time effect occurred between post-test and follow-up. For a construct validation, the change should occur between pretest and post-test. This was not the case with self-efficacy.

It is also important to clarify what the changes in means signifies in terms of the instrument. The change in means between data collection points was less than 100 for each group. The range on the instrument was 1400. A change of 10 on each item would result in a change of 140. Therefore, it seems that the change is less than ten on each item. Three lessons and four worksheets were devoted to this variable. With insufficient power to detect a group difference, it is difficult make a conclusion about the intervention's efficacy in changing self-efficacy.

What is concerning, however, is that the self-efficacy scores in the intervention group dropped to below pretest values at follow-up. Though this may seem counterintuitive, it seems to follow the same trend as other studies (Hallam, 1998), AND WINTERS). Subjects might have higher levels of self-efficacy for physical activity before they actually make the commitment to be physically active. Once they discover that it is difficult to commit to a program, their self-efficacy might decrease.

The change that was witnessed from pretest to post-test in the intervention group appears to be greater than that achieved in the traditional group. Another important point about the sample was that self-efficacy scores were higher at post-test in the two groups where physical activity was a requirement. It may be that people with higher self-efficacy for physical activity are more likely to sign-up for a physical activity course. If subjects come into a study with high levels of the variables, it would logically be more difficult to change the variable. Therefore, it might be that self-efficacy was more resistant to change, as subjects started the study with a higher level than is typically found in a college population (Petosa et al, 2003). Because of this, it is difficult to make a conclusive decision regarding the intervention's ability to change this construct. Further study is warranted to discover if the intervention can change self-efficacy significantly in a population with lower initial self-efficacy scores.

Outcome Expectations and Expectancies

The repeated measures ANOVA found a significant time effect but no significant group effect for outcome expectations and expectancies. The significant time effects occurred between pretest and follow-up and post-test and follow-up. There was no significant effect from pre-test to post-test. Power to detect a time difference was high (1), while power to detect a group difference was low (.163). Effect sizes were small for time (.191) and for group (.016). Considering that the differences of mean scores on the instrument was less than 200, and the possible range on the instrument was 1400, one might say this could be a large change. However, there was little change from pre to post test – in fact, the greatest changes occurred between post-test and follow-up, where the group means dropped dramatically. Since a construct validation attempts to change scores from pretest to post-test, it would appear that the intervention was insufficient in changing outcome expectations and expectancy scores. Only one lesson was used to attempt to change variable scores. It is likely that more instructional time needs to be spent on this variable.

A subscale analysis was conducted to see if there were differences between groups across the time periods. There were only two subscales that showed differences in means from pretest to post-test: thrill-seeking and relaxation. There were no lessons specifically on the subscale categories. Instead, the intervention focused on informing students of the different categories, and having students rank their preferred outcomes. Therefore, it is unlikely that the specific subscale means changed because of the content of the intervention.

Impact Evaluation

Moderate Physical Activity

Frequencies

At pretest, more students in the traditional group (38.7%) reported four or more days per week of moderate physical activity than the online (34.3%) and health groups (30.2%). The health group had the highest percentage of students reporting zero days of moderate physical activity (31.4%) when compared to the online (22%) and traditional (18.3%) groups.

At post-test, the traditional group had more students reporting four or more days of moderate physical activity (45.5%) than the online (38.3%) and health (28.6%) groups. More interestingly, however, is the dramatic decrease in the percentage of students reporting zero days of moderate physical activity at post-test. The online (9.6%) and traditional (11.1%) groups had substantially fewer students reporting zero days than the health group (31.7%)

At follow-up, the traditional (40.9%) and health (50%) groups had substantially more students at four or more days per week of moderate activity than the online group (16.8%). The online (18.8%) and traditional groups (13.6%) also increased in the proportion of students reporting zero days of moderate activity.

From the data presented above, it would appear that that traditional intervention was better at promoting moderate physical activity than the online and health groups. However, caution must be taken when interpreting these results. Since the "planned versus unplanned" component of the physical activity recall was removed from the study, it could be that the traditional group's physical activity could be more incidental. The

online intervention promoted planned physical activity at a comfortable intensity – this could be either moderate or vigorous activity. Therefore, it could be that these frequencies would be different if only planned activity was analyzed, the idea being that the traditional group's level of moderate activity would decrease if unplanned activity was removed from the analysis.

The inferential data analysis showed that there was no significant time or group effect for physical activity. Power to detect a difference was low for both time (.210) and group (.207). The effect sizes were very small (.011, .021). To contextualize the differences, and why the effect sizes were small, it is necessary to understand the differences in the means. With days of physical activity, the range is 7 (seven days per week). The a priori power test showed that fifty subjects would be needed to detect a change in one day per week. Not only did the study include a smaller sample size (less than 50 subjects per group), but the change in moderate physical activity across time and group was less than one day per week.

However, this non-significant result might be due to measurement error. Since the "planned" aspect of the instrument had to be removed because of the error in the follow-up measurement online, it could be that much of the reported moderate physical activity was incidental. If moderate physical activity is going to be changed in an intervention where self-regulation is the focus, it is important that this intensity of activity be planned. In other words, self-regulation requires people to be aware of their behavior so they can monitor their behavior, set goals for changing their behavior, and to reinforce

their attainment of goals. To do all of these things, the behavior would have to be planned. Since planned moderate activity was unable to be assessed, it is difficult to make a definitive decision regarding the intervention's ability to change moderate activity.

Vigorous Physical Activity

Frequencies

At pre-test, 23.9% of students in the online group, 26.1% of students in the traditional group, and 15.2% of students in the health group reported three or more days of vigorous physical activity. A substantial proportion of the online (43%), traditional (57.6%), and health (70.9%) reported zero days of vigorous physical activity.

At post-test, 43.4% of students in the online group, 46.4% of the traditional group, and 14.1% of the health groups reported three or more days of vigorous physical activity. The percentage of students reporting zero days of vigorous activity decreased in the three groups (online – 15.7%, traditional – 33.8%, and health – 56.3%).

At follow-up, 23% of the online group, 40.8% of the traditional group, and 16% of the health group reported three or more days of vigorous physical activity. The number of students reporting zero days of vigorous activity increased from post-test. The proportion of students in the online group (54.2%) reporting zero days of vigorous activity was higher than the traditional (40.9%) and the health (44% groups).

Inferential data analysis showed that there was a time effect for vigorous physical activity, but no group effect. The significant time effect occurred between pretest and post-test. Though the group effect was not significant at alpha = .0071, it would have

been significant had the strict corrections for Type I error not have been made (p=.017). Power to detect a time effect was sufficient (.9), and power to detect a group effect (.735) was close to the .8 value. The group difference, however, occurred between the traditional and health groups. The online group was not significantly different than the other two.

Again, planned versus unplanned physical activity was not included in the analysis. Students that were not exercising regularly might report incidental bouts of physical activity. For example, some students were only active one or two days per week for a pick-up game of basketball. Again, since this is incidental physical activity, it is likely done for enjoyment or other reasons as opposed to health benefits of physical activity. In the online group, students set weekly goals for physical activity. Thus, the activity they completed during the week was planned activity. Had this occurred, self-regulation likely would have accounted for more variance in vigorous physical activity. Had planned vigorous activity been assessed instead of total physical activity, it may be possible that the online group would have a higher mean change in vigorous physical activity than the other groups. Therefore, the online group should have reported a larger amount of planned activity at post-test.

Group comparisons for physical activity

Though there may not have been significant group differences between the online and traditional groups, one must consider the fact that the traditional group was required to attend exercise sessions three times per week. The online group was required to complete three days of activity per week also, but did not meet with an instructor, have to

sign in and out of class, etc. The scores in vigorous activity increased from pretest to post-test in both the online and traditional groups. This is expected in the traditional group, as they are required to come in to class three days per week. The fact that the online group increased their level of physical activity seems more important. Though the online group was required to complete activity, there was no supervision of their activity except for monitoring of activity logs. Therefore, it is possible that the intervention might be responsible for the change in vigorous physical activity in the online group. Since there was no difference between groups, it appears as though the online intervention produced similar results at post-test as the traditional group.

Change in Vigorous Physical Activity

The purpose of running a regression analysis was to test whether or not a change in theoretical variables accounted for variance in change in vigorous physical activity. Since moderate activity was found to not be significant for time and group, running a regression was not necessary.

Though there was not a sufficient number of subjects in each of the three groups to run regression for each group, it was nonetheless completed. The reason for this was to see if an greater change in constructs led to a greater change in vigorous physical activity to a differing degree between groups. This was one of the main purposes of the study.

However, one might argue that there was no group effect for vigorous physical activity, but there was a time effect for all groups. If this is the case, then it would make sense to include all subjects in one group for the regression model. The time effect that

was found was for the entire sample, not individual groups. Therefore, regressing change in theoretical variables from pre-test to post-test (where the significant time effect was found) on change in vigorous physical activity for the entire sample would make sense.

Regression was run both ways – to assess the significant models for each of the groups, and to assess the significant model for the entire sample.

The regression models for each group produced vastly different results. Self-regulation for the online group, which had a greater change in self-regulation scores from pre-test to post-test than the other two groups, accounted for only 10% of the variance in vigorous physical activity. Self-regulation for the traditional group accounted for 23% of the variance in vigorous physical activity. None of the theoretical variables entered a regression model significantly in the health group.

This result seems counterintuitive. If there was a greater change in self-regulation, the only variable that significantly entered the regression model, in the online group, it would seem that the variable would account for more variance in vigorous physical activity than in the traditional group. This was not the case. Therefore, something else is accounting for the majority of the variance in vigorous physical activity.

A second regression analysis was conducted on the entire sample to see if the theoretical variables accounted for variance in vigorous physical activity. Again, this was run because there were no significant group effects for vigorous physical activity. In this analysis, it was found that 13.9% of the variance in change in vigorous physical activity was accounted for by change in self-regulation scores.

Currently, there are very few studies in the literature that investigate predictors of physical activity in college students. Those that exist use different ways of measuring the dependant variable, physical activity. Some use Stage of Change, while others use days per week or bouts of physical activity. Measurement of the dependant variable likely has much to do with the wide range of results. For example, the Rovniak study found a model that predicted 55% of the variance in Stage of Change(Rovniak et al., 2002). Petosa et al. (2003) found a model that accounted for 27% of the variance in vigorous physical activity. Since the dependant variable is not the same, these results cannot be meaningfully compared.

The current study uses change scores of days of vigorous physical activity as the dependant variable. So, one might think that, since days of vigorous physical activity was used, it would allow comparison between this study and the Petosa et al (2003) study. However, in this study change scores from pre-test to post-test were used. Therefore, meaningful comparisons cannot be made between models.

Limitations

One of the most important limitations of the study was sample size. Although data was collected over two quarters to attempt to retain 50 subjects (as found through an a priori power test) in each group, attrition was still a problem. In the online group, only 32% of the original sample was retained for follow-up. Roughly 24% of subjects were retained in the traditional group, and 25.5% were retained in the health group. Since the sample size was low for each group in the final analysis, power was insufficient in many cases to test construct change.

Sample selection was also a concern in this study. Students selected their level of the treatment by registering for the different courses. It may have been that students who were already active or interested in becoming active would register for activity courses. This might explain why the online and traditional groups had more students participating in the recommended levels of moderate and vigorous physical activity at pre-test and post-test than the health group. The health group had more students report no days of physical activity than the other two groups. To equalize the groups, and to strengthen the study design, random assignment of subjects to groups would be ideal. With the three groups employed in this study (online, traditional, and health), it would only be possible to randomly assign students to the online or traditional groups. It would not make sense to randomly assign a student to the health course when they thought they were registering for some form of activity course. A new course would have to be created to allow for random assignment to occur. This way, students would consent ahead of time to be randomly assigned to the treatment groups.

Another limitation was the structure of the online course. Though implementation was controlled to a degree, it did not control for perhaps the most important parts of the intervention: reading the lectures and completing assignments. Students were forced to open the lectures to access the assignments. However, there was no way to assess whether or not students were reading the lectures. Also, it was unclear if assignments were correctly completed by students, or if students filled in answers just to get credit. Since the course was offered online, student's behavior was not monitored. Another potential reason for lack of change in variables from pre-test to post-test in the online group may have been that the students were either not reading the behavioral skill lectures or not practicing the skills to complete the worksheets. Since this is an implementation issue, it is difficult to say whether the intervention itself was at fault for the lack of change, meaning the lessons were insufficient or the number of activities was insufficient, or if the failure occurred due to problematic student consumption of the intervention. Therefore, it is difficult to assess whether the lack of significant change in many variables was due to the intervention itself or the media in which it was delivered (online course versus a traditional course). This was realized prior to the intervention, but was logistically unable to be overcome.

The current traditional physical activity course includes multiple sections, all of which teach the same material. Instructors were assigned to the lecture courses before the study began, and the researcher was unable to teach the content in the lecture sections. Plus, the lectures serve several labs, of which only two sections were included in the study. Only cardiorespiratory-types of labs were included – which excluded the weight training labs. Therefore, several of the lectures would have been changed to

attempt to include a sufficient number of subjects that were enrolled in the two cardiorespiratory activities (diet and exercise and kickboxing aerobics). This was beyond the scope of this study, since the study was meant to pilot test the intervention. The abovementioned points would be necessary to include in a follow-up study.

Measurement of planned physical activity was flawed. The intent of the study was to assess planned physical activity, or moderate and vigorous activity that was completed for health or fitness benefits. Since the follow-up data did not reliably include the planned or unplanned component, this portion of the physical activity recall had to be eliminated. Therefore, both incidental and planned activities were included in the analysis. It is likely that inclusion of only planned physical activity would produce different results. Had only planned activity been included, there may have been differences between groups, as the online group had to complete weekly physical activity goals each week. The physical activity in this group might likely have included more planned activities than the other groups. Therefore, before any future physical activity data is collected online, the physical activity recall survey must be fixed.

The format of the follow-up survey was an additional limitation. The follow-up survey was completed by students online, while the first two surveys were pencil and paper surveys. The validity and reliability of the surveys when placed online was not assessed, and it introduced error in the measurement of the dependant variable.

Time available for the intervention was a limitation. The quarter system at Ohio State allows for ten weeks of instruction. Two of the ten weeks were taken-up by exams. This means that the remaining eight weeks were available for lesson content. With four constructs as the focus of the intervention, it was difficult to decide which constructs

would hold more weight in the lessons. The decision was made to emphasize self-regulation, and three lessons were developed to target self-regulation. Since two of the main goals of the intervention were to have students self-monitor their physical activity and participate in weekly goal setting, these lessons were placed at the beginning of the quarter.

Self-efficacy was weighted heavier than the other constructs (except self-regulation), so two lessons over three weeks covered the topic. This pushed social support and outcome expectations to the end of the quarter. As mentioned in the previous section, social support is likely a complex variable and would require more than one lesson for a change to occur. It also might be possible that including a "buddy" component earlier in the intervention could help change this variable. The same can be said with outcome expectations and expectancies. It might make more sense to have students identify their outcome expectations earlier on in the intervention, so that they can focus on them during the quarter. It might also be useful to revisit the construct later in the intervention to see if their preferences have changed. In other words, when people become bored with physical activity, they might be less likely to value outcomes such as health or relaxation. They might attempt to focus on thrill seeking, competition, or beauty-related outcomes for a change of pace and activities.

Recommended Modifications to the Intervention

This intervention was designed to target inactive or irregularly active people. Active students in the course commented that the course was "obviously" targeted at people who do not exercise regularly. If a person is already regularly active, then there is

little room for improvement. This might also be the case for the construct variables. If a person is already active, and already has high self-efficacy, for example, then it is difficult to increase an already elevated level of self-efficacy. Therefore, it would be useful to see if the intervention would have better results on previously inactive students. The intervention could also be modified for active students. Interested students could be screened before the intervention for level of activity and assigned to the appropriate activity-level intervention. This might be a more effective way of targeting both active and inactive individuals.

Time is always a factor in completing interventions in classrooms. In this case, the number of weeks limited the amount of lessons and activities that could be included. It was clear that there was sufficient time spent on self-regulation. In reviewing the model on page 68, it is apparent that many of the lessons focused on this construct. Since a dose-response relationship between lessons and other constructs was not found, further study is warranted allowing for more focus on the other constructs. Moving this intervention to a college employing semesters would allow for more time to target other constructs.

The intervention was insufficient in targeting social support. An improvement might be to include social support in the beginning of the intervention. This way, subjects could, for example, recruit a friend to exercise with them. Continued friend social support during the intervention might be more effective in changing social support scores.

Outcome expectations and expectancies could also move toward the beginning of the intervention. Doing this would allow students to focus early on their valued

outcomes. This could also be revisited later in the intervention, as a way to alleviate boredom. Students might become less motivated by health related outcomes when they become bored with their activities. They could review the reasons to exercise, and might decide to focus on thrills or beauty-related outcomes to alleviate their boredom.

Recommendations

One of the purposes of this study was meant to pilot test the efficacy of an intervention in changing theoretical constructs and subsequently physical activity. Recommendations for future research in this area include:

1. Replication of this study should be completed on more subjects to see if a larger sample produces similar results.
2. More descriptive studies need to be conducted to determine predictors for physical activity in college students.
3. Establish validity and reliability for instruments when placed online.
4. Complete a follow-up intervention to test online instruction versus traditional instruction. One limitation of the present study was that it is unclear whether the intervention failed to produce change, or whether the failure was due to the media in which the intervention was offered. In other words, the online group had little supervision of how they consumed the course. To test whether or not the intervention is valuable in changing theoretical variables and behavior, it is necessary to complete a follow-up intervention that delivers the same exact content to the online group and a traditional group. As mentioned earlier, this was beyond the scope of this pilot study.

5. Test the intervention in a group of active versus previously inactive students. It may be that theoretical variables have more of an impact on physical activity when a person is just beginning a program. Exercise adherers might have different reasons for continued engagement in physical activity.
6. Test the intervention in males versus females. The current sample was too small to do any analysis on subgroups.

Online physical activity interventions are relatively new. More research needs to be done in this area to see if physical activity change is possible through online sources. Though it seems counterintuitive to promote physical activity through a sedentary means (internet), it is possible to reach many people this way. Currently, a community physical activity intervention is being developed that will use many parts of this intervention.

As recommended earlier, more studies need to be completed on college students. College students are an important group to target, as their activity patterns in adulthood may be influenced by their patterns as college students. If the decline in physical activity over the lifespan is going to be slowed, it is important to focus on all age groups for the promotion of physical activity.

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APPENDIX A

LESSON PLANS AND WORKSHEETS

Course Overview

Physical activity has many health benefits. By exercising regularly, you can help prevent coronary heart disease, obesity, diabetes, and some cancers. Although regular exercise is not the only factor related to these diseases, it is one thing that you can control. You may not be able to change your age, gender, race, or genetics, but you can make the decision to exercise regularly.

Many people think that exercise has to be vigorous for health benefits to occur. This most certainly is not the case. Moderate activity, such as walking, bike riding, etc, can also help you stay healthy. The difference is that sessions of moderate activities should last longer (at least 30 minutes) than sessions of vigorous activities (15 to 20 minutes).

To give you an idea of the importance of this class, two charts are presented below. The first chart shows rates of physical activity among adolescents and young adults. The second chart shows rates of physical activity in adults.

[insert charts from CDC regarding rates of PA from ages 12 to 21, and BRFSS data for adults]

What can we see when looking at these two charts?

First, we can see that rates of physical activity drop substantially through adolescence and young adulthood. We can also see that the majority of adults are either not activity regularly, or not active at all.

Why is this relevant to you?

Think back through your elementary school, junior high, and high school years. When were you most active? Are you currently as active as you were in 6th grade? 9th grade? After you graduate from college, you will at some point get a job that will require much more of your time than is required by your school responsibilities. You may find a partner, have a family, etc. How confident are you that you can continue being active after college?

Recommendations

The recommendation for physical activity that will be a focus of this course is that all adults should accumulate at least 30 minutes of moderate-intensity activity on most, if not all, days of the week.

Purpose of the course

The purpose of this course is to introduce you to the idea of adherence. Many people think of adherence to exercise as being regularly active for six months or so. In reality, exercise adherence really involves making physical activity a part of your lifestyle – so much, in fact, that you will be active for not months, but for years and decades.

Action Plan – Assignment #1

The purpose of this portion of the lab is to get you familiar with exercise opportunities at school, in your community, or where you work. In the following exercise, you will be required to find phone numbers, costs, etc. to find out what opportunities are best for you.

Accessing the assignment:

Go to the assignment icon on the course website. Click on "Exercise Opportunities". Download the assignment. You will need Microsoft Word to work on the assignment. Complete the assignment and upload to the assignment dropbox. Complete this and upload it to the dropbox *no later than 11:00 pm Sunday evening.*

WEEK 1 CHECKLIST:

Complete the Exercise Opportunities worksheet, and submit no later than 11:00 pm Sunday evening.

Exercise History

Typical Physical Activity

1. Considering a 7-day period (one week), how many times on the average do you do the following kinds of exercise for more than 15 minutes during your free time?

a. **STRENUOUS EXERCISE (heart beats rapidly)**
(i.e., running, jogging, hockey, football, soccer, squash, basketball, cross country skiing, judo, roller skating, vigorous swimming, vigorous long distance bicycling)

b. **MODERATE EXERCISE (not exhausting)**
(i.e., fast walking, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, alpine skiing, popular and folk dancing)

c. **MILD EXERCISE (minimal effort)**
(i.e., yoga, archery, fishing from river bank, bowling, horseshoes, golf, snow-mobiling, easy walking)

2. Consider a 7-day period (one week): During your leisure-time, how often do you engage in any regular activity long enough to work up a sweat (heart beats rapidly)? (Mark and X in the blank next to the word that most accurately describes your level of participation in activity that makes you sweat)

_____Often _____Sometimes _____Never

3. How many years did you participate in youth sport programs?

Ages 4-9 _____ years. Ages 10-13 _____ years. Ages 14-18 _____years

4. How many years did you participate in any school sport during middle school? _____ years

5. How many years did you participate in any school sport during high school?
_____ years

6. How many days per week did your mother typically exercise when you were between 5 and 18 years old?
_____ days per week

7. How many days per week did you father typically exercise when you were between 5 and 18 years old?
_____ days per week

8. When you were growing up, how often did your mother encourage you to exercise or engage in sports? (Mark an "X" in **one** blank)
_____Never _____sometimes _____often _____always

9. When you were growing up, how often did your father encourage you to exercise or engage in sports? (Mark an "X" in **one** blank)
_____Never _____sometimes _____often _____always

10. How many days a week do you intend to exercise when you are 40 years old?
_____ days per week

Exercise Opportunities

Find your Exercise Opportunities
Use the phonebook, the internet, and other sources of information to find out more about exercise opportunities. The following websites may help you in your search:
www.switchboard.com - this site allows to you to search yellow page categories. You can browse the categories or do a search in an area of interest. You can even search by distance, which will tell you how far the item is from your zip code!

www.joincombo.org/ - for outdoor cycling enthusiasts. The site gives trail information and information about bike clubs and events.

www.rrca.org/clubs/data/oh.htm - for runners

www.dnr.state.oh.us/odnr/parks/ - for those that like to exercise outdoors. This site has links and information about parks and recreational facilities.

www.columbusrecparks.com/sports/index.html - Sport and recreational opportunities in Columbus.

www.nfpt.com/trainers/state.htm?curstate=oh - short list of certified personal trainers in Ohio

Part 1 – Health Club or Fitness Facility
Find the following information on a fitness facility or health club in your area. Complete the following table:

Name of Facility	
Phone Number	
Address	
Hours of Operation	
Programs offered of interest	
Costs	

Part 2 – Fitness Equipment Store
Find the following information on a fitness equipment store in your area. Complete the following table:

Name of Store	
Phone Number	
Address	
Hours of Operation	
Types of equipment for sale of interest to you	
Cost of equipment of interest to you	

Part 3 – Sport or Recreation organization

Find the following information on a sport or recreation organization in your area. Complete the following table:

Name of Organization	
Phone Number	
Type of programs offered	
Meeting times and locations	
Costs	

Part 4 – Parks

Find the following information on a park in your area. Complete the following table:

Name of park	
Type of facilities available	
Location and Distance	

Part 5 – Preferred Exercise Opportunities

Identify your preferred exercise opportunity(s) that you found above. List the reason why you chose the opportunity(s).

Preferred Exercise Opportunities	*Reason*

Self-monitoring

Definition – keeping track of your exercise and skills (that you will acquire in this course) in a structured way

During the quarter, you will be required to exercise as many days per week as possible. You will be required to write down your activity in your activity log each week, and turn in your weekly log every week. You will also be required to use several activity monitoring devices throughout the quarter.

Why it is important

- When trying to begin a long-term exercise program, it is important to know your baseline level of activity.
- To address the progressive overload principle, it is important to keep track of FITT for activities, so that the program can be modified logically.
- Self-monitoring has been shown to help people become long-term exercisers
- Self-monitoring is the foundation for this section of the course. You will be required to track your exercise sessions in every lab.
-

<u>Activity Log and Pedometers</u>

The purpose of filling out an activity log is to keep track of your exercise. This is important for several reasons. First, you can keep track of your baseline exercise. By doing this, you can see what your current exercise level is. Second, after finding out what your current level is, you can develop an exercise program based on your goals (which we will set in the next lesson). Last, once you begin an exercise program, it is important to keep track of your progress.

Go to the assignment icon on the course web page and download the activity log for week 2.In the log for this week, and every other week of the quarter, you will find blanks for the following items:

Activity (Type) - write the specific activity (i.e. walking, running, biking, hiking, elliptical machine, swimming, etc)

a. Intensity – write how hard the activity was. If on a machine, you can use a numerical "resistance" level as a measure of intensity. If you are doing free-living activity, monitor your heart rate (learning how to take your pulse is your homework for the week). Also record perceived exertion from 1 (easy) to 10 (extremely difficult). Refer to the Rate of Perceived Exertion in your book to familiarize yourself with RPE, and what each number stands for in words.
b. Time – how long the activity was performed, or duration

c. Frequency – do this for each day that you complete an activity (how many days per week)

*Notice that the items are FITT, in a different order!

II. Pedometers
   a. Wear a pedometer for one week.
   b. Record miles and steps on the bottom of the activity log for week 2.

Action Plan – Assignment #1

1. Record your exercise sessions in your activity log for week one. When you fill in your log (this week and in future weeks), be sure to include: the type of activity, the intensity of activity, the time, and the frequency of your exercise sessions.

2. Your activity log has room for several activities in the left column. List all of the activities that you did in the past week. List the intensity, time, and RPE for each of the activities under the days that you did them. For example – if you walked on Monday and Friday, you would write "walk" in the left column, and record your intensity, time, and RPE in the Monday and in the Friday columns.
   3. Record your miles and steps for the week from your pedometer on the bottom of the log in the space provided.

Turn in your completed log for the week between Saturday at noon and Sunday at 11:00 pm. This is the only time you can submit you can submit your log.

Action Plan – Assignment 2

You will practice taking your pulse while sitting, walking, and jogging. Go to the assignment dropbox and download "Pulse activity".

- To take your pulse, find your pulse at either your wrist or the side of your neck.

(see WEBSITE for details)

CHECKLIST FOR WEEK 1

1. Activity Log and Pedometer recordings, due sometime between noon on Saturday and 11 pm on Sunday.

2. Pulse Activity worksheet, due anytime during the week, no later than 11 pm Sunday evening.

Pulse Activity

Taking Your Heart Rate

There are two places that you can locate quickly to take your pulse – your neck or your wrist. (See WWW for pictures) Using your pointer and middle finger (not your thumb), locate your pulse. Begin counting with zero, and have someone time you for six seconds. After six seconds, take your counts and add a zero to the end (6 seconds X 10 = 60 seconds, or 1 minute). For example, if you count 12 beats in six seconds, you would add a zero, making it 120. This is your heart rate in one minute.

Take your heart rate during the three following activities. Record your heart rate in the space provided.

Sitting quietly

Sit quietly for 5 minutes. Record your heart rate (in one minute):

Walking

Walk for at least 10 minutes. Record your heart rate (in one minute):

Jogging/Running

Jog or run for at least 10 minutes. Record you heart rate (in one minute):

Target Heart Rate

It is also helpful to know what your target heart rate zone is, so that you can monitor whether you are working hard enough or are working too hard. Your target heart rate zone is between 60% and 90% of your maximum heart rate. Your maximum heart rate is 220 minus your age. You can see that this range will change as you get older. The following steps will help you calculate your target heart rate.

Step 1: Maximum Heart Rate

220 – age = Maximum heart rate

220 - ____=_____

Step 2: Low target heart rate

Maximum heart rate ∗ .60 (60%) = Low target heart rate

_____ ∗ .60 = _____

Step 3: High Target heart rate

Maximum heart rate ∗ .90 (90%) = High target heart rate

_____ ∗ .60 = _____

Target Heart Rate range: _____ (low target heart rate) to _____ (high target heart rate)

Goal-Setting

Definition – a deliberate process for achieving a target behavior.

Why it is important

- By setting correct, clearly defined goals, you can observe and experience the achievement of those goals. Each goal attained is called a mastery experience.
- By having mastery experiences over time leads to the achievement of a long-term goal and greater feeling of control over the behavior over time. You can see forward progress in what might previously have seemed a long pointless grind.
- By setting goals, you will also raise your self-confidence, as you recognize your ability and competence in achieving the goals that you have set.
- The process of achieving goals and seeing this achievement gives you confidence that you will be able to achieve higher and more difficult goals.

What is Goal-Setting? - Goal setting is a formal process for personal behavioral planning. By setting long-term goals you decide what you want to achieve over the long run, and then step-by-step move towards the achievement of this long-term goal, through the manipulation of short-term goals.

The process of setting proximal goals and targets allows you to choose where you want to go in your development of health and fitness. By knowing precisely what you want to achieve, you know what you have to concentrate on to do it. You also start to identify things that inhibit your ability to reach these goals.

Goal setting is used in may behavior change programs to achieve desired behavioral goals. It gives you long-term vision and short-term motivation. During the quarter, you will be required to set exercise goals weekly. You will be required to submit weekly exercise goals online; you will submit these goals every Monday.

Goals are set on a number of different levels:

1. First you decide what you want to do with your life and what large-scale goals you want to achieve.
2. Break these down into the smaller and smaller targets that you must hit so that you reach your lifetime goals.
3. Finally, once you have your plan, you start working towards achieving it.

Creating Good Goals

Over the quarter you will be expected to develop and achieve goals weekly. This process requires that you understand the main parts of a goal, and how they are written. First thing is to set a long-term goal. The long term goal for all members of the class will be: ***Each class member will increase their physical activity to as many days as is possible in week for the entire quarter.***

In order to achieve this we need to have each of you develop short- term weekly goals. Meeting all of your short-term goals should help you achieve this goal.

There are 4 components to writing a goal:

1. Who? – Who will be acting upon the goal?
2. What? – What will you be doing?
3. How Much? - How much of it will you be doing?
4. By When? - What is the time limit for the goal?

Look at the goal we provided above, does it contain the 4 components?
Each class member will increase his or her physical activity to as many days as is possible in week for the entire quarter.

Physical activity goals must be specific. Here are some guidelines to help you in creating your goals:

1. A goal must be observable. You cannot set a goal to feel better next week, since that is not observable. Because we are speaking of behaviors you must have and observable behavior you are targeting. In our case this is easy as we are talking about physical activity.

2. A goal must be quantified, thus the how much. Do we do the behavior hourly every day or just twice a week for 10 minutes? In either case the quantity has to be specified otherwise we can never know if we achieved the goal.

3. Goals need to be realistic as well. I need to make sure I do not start with a goal of running 6 miles if I have never run before. Goals should be challenging yet reachable.

Goal-Setting Exercise

The purpose of creating an exercise goal is to set a goal and see if you can attain that goal. This is important for two reasons. First, you can evaluate your success or failure at meeting the goal. Second, you can identify things that are preventing you from achieving your goal. When establishing goals you're your workouts it is important to keep track of your progress and adjust the goals accordingly.

Go to the Goal-Setting icon on the course web page and Submit a goal for this week.

Success on the goal-setting exercise will depend on your ability to create a goal that meets the following criteria: The 4 components to a goal:

1. Who? – Who will be acting upon the goal?
2. What? – What will you be doing?
3. How Much? - How much of it will you be doing?
4. By When? - What is the proximal time horizon for the goal?

As well as following the guidelines of:

1. A goal must be an observable behavior, you must see it.

2. A goal must be quantified, thus the how much.

3. **Goals need to be realistic as well**

OR SMART!!

Students will create and submit a goal related to their physical activity. A different goal will be submitted each week.

Goal Correction Exercise

The purpose of this assignment is to get you familiar with evaluating goals. You should use the criteria given to you above to evaluate the goals in the goal correction sheet. Find the errors in the goals and make corrections to them to make them good goal statements.

Go to the Goal correction icon on the course web page and correct the goals found there.

CHECKLIST FOR WEEK 3

1. Submit goal to website by noon Monday.
2. Turn in goal correction worksheet by noon Thursday.
3. Activity Log due sometime between noon on Saturday and 11 pm on Sunday.

Goal Correction Worksheet

1. Jane will run two miles by Sunday.

Correct: _____

2. Joe will lift weights this week.

Correct: _____

3. Bill will run for twenty minutes on Tuesday and Wednesday and will do spinning for 60 minutes on Saturday.

Correct: _____

4. Kevin will do cardiovascular exercise twice this week.

Correct: _____

5. Joyce will jog three times a week for 15 minutes per bout.

Correct: _____

6. Jaimy will bicycle for 6 hours this month.

Correct: _____

7. Michelle will play softball on Saturday and Sunday

Correct: _____

8. I will run twice a week.

Correct: _____

9. Emily will walk from the farthest parking spot to the office twice a week.

Correct: _____

10. Stephanie will lift twice this week and run once this week.

Correct: _____

Tailoring (2 week lesson)

Definition – structuring your exercise program around your goals and your level of enjoyment so that you can exercise regularly

Why it is important

- There are many types of activities that you may not have tried that you may find that you enjoy.
- There may be a specific intensity that you feel more comfortable exercising in when beginning your program.
- If you enjoy the type and intensity of exercise, then you are more likely to continue to exercise.

New Activities

Some people do not exercise because they have not found any activities that they like. Trying new activities not only allows you to experiment with new types of activities, but it also gives you more options for your fitness plan to help alleviate boredom.

Action Plan – Assignment 1

Each time you exercise this week, try a new type of activity. Example activities that you may not have tried are: specialty aerobic classes, such as pilates, kickboxing, funk; playing a pick-up game of basketball, hiking, etc. Try at least three new activities this week.

You will record your new activities for the week on the activity log for this week (week 4). Turn in your activity for week 4 between Saturday at noon and Sunday at 11:00 pm.

Exercise Preferences

You have probably tried several different types of exercise, and formed an opinion about that type of exercise. What you have to remember is that exercise does not have to be really hard or very boring.

Action Plan – Assignment 2

Download the "Exercise Preferences" worksheet from the assignment dropbox. Read the directions on the worksheet and fill in your answers. Upload the assignment to the dropbox **no later than Sunday at 11:00 pm.**

Comfort Zones

Many people do not exercise because they think that it is too hard. Others begin exercising at too high of an intensity, and quickly dropout.

There may be a specific intensity that you find to be more enjoyable, or comfortable, exercising at when you begin your exercise program. This is called you "comfort zone". Your comfort zone is an intensity that you find challenging, yet still enjoyable. In other words, you would be able to continue at this intensity for at least 20 minutes.

As your fitness level increases, you will find that your beginning comfort zone will become too easy. You will have to continually re-examine your comfort zone so that you can get both optimal fitness gains and optimal enjoyment.

Action Plan – Assignment #3

For your exercise sessions this week, you will do one day of walking or jogging. Your assignment is to complete three different intensities of either activity. For example: Walk slowly, walk at a medium pace, walk at a fast pace, or jog slowly, jog at a medium pace, or run quickly. You will exercise at each intensity for at least 10 minutes. Record your heart rate, how you felt during each intensity of each activity. Use the "comfort zone" form provided in the "assignments" folder on the website. Turn this in **no later than Sunday at 11:00 pm.**

WEEK 4 CHECKLIST

1. Turn in your activity log, where you record your new activities for the week, between noon on Saturday and 11:00 pm on Sunday.

WEEK 5 CHECKLIST

Complete the exercise preferences worksheet, and upload it to the assignment dropbox no later than 11:00 pm on Sunday.

1. Complete the "comfort zone" worksheet, and upload it to the assignment dropbox no later than 11:00 pm on Sunday.

2. Complete the activity log for week 5, and submit it between noon on Saturday and 11:00 pm on Sunday.

New Activities

Activity #1
Name of activity:

Intensity attempted:

Did you enjoy the activity? Why or why not?

Will this activity help you to become a regular exerciser? Why or why not?

Activity #2
Name of activity:

Intensity attempted:

Did you enjoy the activity? Why or why not?

Will this activity help you to become a regular exerciser? Why or why not?

Activity #3
Name of activity:

Intensity attempted:

Did you enjoy the activity? Why or why not?

Will this activity help you to become a regular exerciser? Why or why not?

Exercise Preferences

Listed below are questions designed to help you identify your exercise preferences. Your preferences should make exercise more enjoyable. Please type a "Y" in each box that applies to you.

1. I prefer to exercise:

Alone	
With 1 partner	
In a small group (less than 6 people)	
Large group (6 or more people)	

2. If I had to select ONE preference that I enjoyed the most when I exercised, it would be to:

Listen to music	
Watch television	
Talk to exercise partner	
"zone-out", meditate, relax my mind	
Focus on how exercise feels	
Other (list)	

3. Which do you prefer – planned exercise (ex. Run 5 miles on Monday, Wednesday, Friday at 7:00) or spontaneous exercise (whenever you feel like it)?

Planned exercise	
Spontaneous exercise	

4. When I exercise, I prefer:

Resistance training (lifting weights)	
Endurance training	
Active sports or games (basketball, soccer)	

5. When I exercise, I prefer:

Mild pace (breathing just a bit above resting)	
Moderate pace (breathing rapidly, cannot maintain a conversation)	
Hard pace (breathing rapidly, cannot maintain a conversation)	
Very hard pace (all out, as fast as you can)	

6. When I do aerobic exercise, I prefer:

Stationary equipment (treadmill, cycle, etc)	
Active sports	
Walking/running	
Aerobic class with leader (aerobic dance, step, tae bo, etc)	

7. When I exercise, I prefer:

Competition with others	
Noncompetitive activities	

8. How can you use your exercise preferences to help you become a regular exerciser?

Comfort Zone Worksheet

In this activity, you will complete three different intensities of an activity, each **for at least 10 minutes**. You may walk, jog, or bike. When you choose the three intensities, think of going first at a slow pace, then a medium pace, then finally, a fast pace. It is important to understand that each pace is what you feel is slow, medium, and fast, not what you think everyone else thinks is a slow, medium and fast pace. In other words, I may find that I jog at a pace that I feel is fast, but someone who has been running for years may find to be slow or medium. Type the information in the tables below.

Activity you chose:

INTENSITY #1: SLOW PACE

What was your heart rate?	
How did you feel during the 10 minutes that you attempted this intensity? (Was it easy or hard, did you feel tired, energized, etc)	
How did you feel immediately after the exercise? (Tired, energized, etc)	
Do you think that you could continue at this pace for at least 30 minutes?	

INTENSITY #2: MEDIUM PACE

What was your heart rate?	
How did you feel during the 10 minutes that you attempted this intensity? (Was it easy or hard, did you feel tired, energized, etc)	
How did you feel immediately after the exercise? (Tired, energized, etc)	
Do you think that you could continue at this pace for at least 30 minutes?	

INTENSITY #3: FAST PACE

What was your heart rate?	
How did you feel during the 10 minutes that you attempted this intensity? (Was it easy or hard, did you feel tired, energized, etc)	
How did you feel immediately after the exercise? (Tired, energized, etc)	
Do you think that you could continue at this pace for at least 30 minutes?	

Review your answers to the questions above.

1. During which intensities were you in your target heart rate zone?

2. Which intensity did you feel most comfortable in?

3. After which intensity did you feel most comfortable?

4. Which intensity(s) do you think that you could do for at least 30 minutes?

5. What is your preferred intensity?

THIS IS YOUR COMFORT ZONE!

You will have to reassess your comfort zone when you begin to see improvements in fitness. You may find that the slow pace is your preferred pace at the beginning, but that it has become too easy. If you keep reassessing your comfort zones, you are less likely to overexert yourself. One reason people stop exercising is because they begin at too difficult of a pace, and exercise is no longer enjoyable. Your comfort zone intensity should be enjoyable.

Self-Efficacy

Definition: An individual's belief in their ability to perform a specific task. Specifically, self-efficacy is the level of confidence you have in your ability to participate and adhere to regular exercise.

Throughout the quarter you have been participating in regular exercise and learning various behavior change techniques. These behavior change techniques, if practiced diligently and correctly, will help you adhere to a regular physical activity program after the end of the quarter and throughout life. Self-efficacy is a characteristic that has been shown to be associated with increased adherence exercise rates.

Why is self-efficacy important?

- People with high levels of self-efficacy for exercise are more likely to be regularly active
- Self-efficacy is task specific. For example, you may have high self-efficacy for playing basketball, but low self-efficacy for participating in a regular exercise program.
- Increasing your self-efficacy for exercise will increase your likelihood for adhering to your exercise program
- High levels self-efficacy is associated with your ability to identify and overcome barriers for exercise.
- Increasing self-efficacy for exercise can be done by
    - Repetition of successfully performing a specific task (mastery experiences)
    - Increasing exercise by incremental steps (goal setting)

Overcoming barriers to exercise

Identifying Barriers

Many things in life make participation in a regular exercise program difficult. Barriers are those things that may make it hard to exercise regularly. Some examples of barriers are: I couldn't get a ride to practice, it is too expensive, or I had too much schoolwork to do.

There are many barriers that people have to overcome when exercising. These barriers can be associated with school or other requirements, other social factors, to activity will help you adhere to your physical activity program. Identifying barriers to exercise is the first step in maintaining a regular exercise program.

Overcoming Barriers:
Once you have identified barriers to exercise, the next step is to step up a strategy for overcoming them. Think of things that you have done in the past to help with activity. Also think of things that you could currently do to help with increasing adherence to physical activity.

Go to the assignment icon on the course homepage download the Overcoming barriers worksheet and activity log for week 5

Action Plan - Self-Efficacy Assignment

1. Record your exercise sessions in the log as you did for each of the previous weeks in addition with each exercise session record if you had experienced any barriers to activity. If so, how did you overcome them.
2. At the end of the week complete the bottom part of the activity log which has you identify your greatest barrier. After identification of the barrier. Devise a plan to overcome it.
3. Turn in Overcoming Barriers worksheet to the assignment drop box.

CHECKLIST FOR SELF-EFFICACY LESSON

1. Complete Overcoming Barriers Worksheet

Submit Activity Log with Daily Barriers between noon on Saturday and 11pm on Sunday. This is the only time you can submit your activity log for the week.

Overcoming Barriers

There are many factors that influence whether or not you are active. Barriers to exercise are one of these factors. A barrier is anything that hinders your ability to perform exercise on a regular basis. For example, *I couldn't get a ride to practice, it was raining outside, my gym membership was too expensive to renew, or my schoolwork is too time consuming.*

This assignment is designed to help you determine what your primary barriers are to regular exercise and ways to overcome them.

IDENTIFYING BARRIERS

1) Think back to the assignment that you completed when you had to describe your previous exercise behavior *(grade school, high school)*.

- **What were the barriers that made it difficult to exercise?**
- **How did you overcome them?**

Fill out the table below

Barriers	How you overcame them
1)	
2)	
3)	
4)	
5)	

List only as many as you can remember

2) Recall your exercise patterns from last week. Think about the barriers that you came across.

- **Did you run out of time?**
- **Was the weather bad and you like to exercise outside?**
- **Did you have other obligations that were more important?**

3) How did they affect your activity?

- **Did you not exercise?**
- **Did you modify your schedule to include exercise?**
- **Did you do nothing and skip your exercise session?**

Fill out the table below

Barriers	How did you modify your exercise?
1)	
2)	
3)	
4)	
5)	

OVERCOMING BARRIERS
Now that you have identified both previous and current barriers for exercise the next step is to devise a plan to overcome these barriers.

1) Rank you barriers to physical activity in order of severity.

1	
2	
3	
4	
5	

Fill out as many barriers as you can identify

2) Pick your three greatest barriers to physical activity.

3) List three possible ways to overcome each of the barriers.

- **For example, if you have difficulty refusing a social outing, even if you haven't completed your exercise goal for the day. A possible way to overcome this barrier is to include exercise in your social plans.**
- **Remember that these techniques for overcoming barriers must be achievable for you.**

Barrier 1	1)
	2)
	3)
Barrier 2	1)
	2)
	3)

Barrier 3	1)
	2)
	3)

Devise A Plan

1) Consider the barrier that you feel is the most likely to give you the most trouble adhering to your exercise program. Devise a plan to overcome the barrier.

A) Select Barrier:

B) Create a Plan.

- Set specific goals to help you overcome your barrier of choice.
- Remember goals should be written in a way that describes: who, what, how much, and by when.

Social Support

Definition - aid or encouragement for exercise that can come from a family member, friend, or instructor.

Why it is important

- having a support system helps you adhere to a long-term exercise program having an exercise buddy helps motivate you to exercise, and can help alleviate boredom while you exercise

Social support

Support for exercise can come in many forms. Some examples are: encouragement, help in making time for you to exercise, exercising with you, providing information, advice, suggestions, or feedback.

Action Plan - Assignment

This week, you will try to attain different types of support.

1. Find information that can help you with your fitness program
2. Talk to a friend or family member about your exercise program, and how you are progressing.
3. Ask a friend or family member to help you make time to exercise, to encourage you to exercise, and/or to exercise with you.

Download the "Social support" worksheet from the assignment dropbox. Complete and submit *no later than 11:00 pm on Sunday*.

WEEK 7 CHECKLIST

1. Submit your social support worksheet no later than 11:00 pm Sunday evening.
2. Submit your activity log for week 7 between Saturday at noon and Sunday at 11:00 pm.

Social Support Worksheet

Informational Support

1. Find information from an instructor, a family member, or friend that will help you with your exercise program. List the type of information that you found, and list who you got the information from.

Information	
Person (or people) who supplied the information	

Direct Support

2. Ask a family member or friend to help you make time to exercise, or to give you encouragement while you continue your exercise program. List the person who helped or encouraged you, and what they did to support your exercise program.

Person	
What they did	

3. Ask a family member or friend to exercise with you on a regular basis. List who agreed to exercise with you, how often they will exercise with you, and what types of exercises you will do.

Person	
How often they will exercise with you	
Types of exercises	

Evaluation of Support

1. Which type of support did you find most useful?

2. Which type of support did you not find useful?

3. Were you able to attain all of the above types of support? Explain.

4. How can you use your preferred method of social support to help you reach your behavioral goal?

Reinforcements

Definition: Reinforcements are outcomes that occur after participating in a specific behavior. Reinforcements are the things that occur immediately after exercise.

Reinforcements for exercise the things that happen to you after exercise, such as a feeling of accomplishment or a rush of energy. Reinforcements can be either positive or negative. Positive reinforcements give you something positive after completing your exercise. They are called rewards. An example of a reward would be a receiving a positive comment (Nice job!!) after a hard workout. Negative reinforcements remove something negative after completing exercise. Negative reinforcements increase the likelihood of participating in exercise by removing something negative, such as losing weight.

Why are reinforcements important?

- Reinforcements are an important part of self-regulating behavior. By receiving reinforcements for exercise you increase the likelihood for repeating the activity.
    - If you feel a sense of accomplishment after every time you exercise, you are more likely to continue to exercise regularly.
- Using reinforcements especially rewards, while setting goals for exercise will help you stay motivated for completing exercise goals.
    - For example, you can reward yourself with a CD after successfully completing your exercise goals for the month.
- Reinforcements should be strategically planned to help reach your exercise goals.
    - For example, rewarding yourself with a hamburger after every exercise session will not produce the same results as rewarding yourself with something meaningful after successfully completing your goals for a month.

Using Reinforcements

Using reinforcements for exercise is a very helpful tool, especially when setting goals. Remember reinforcements can be both positive and negative. They can also be internal or external. Internal reinforcements are your perceptions of the value of the reinforcement. For example, if the sense of accomplishment you feel after completing an exercise session is a valuable feeling for you. An external reinforcement is reinforcement with a particular value, such as buy a new shirt if you achieve your exercise goals.

The first step in using reinforcements is choosing and identifying them appropriately. Reinforcements should provide you with the incentive to participate in exercise again. When choosing or identifying reinforcements be careful of the **over-justification effect**. This is any external constraint that is imposed on a behavior that may reverse the level of internal motivation for exercise. For example, a person who usually enjoys jogging decides to participate in a study that pays $10 for each time they run. The monetary reward can possibly make jogging less rewarding intrinsically.

Go to the assignment icon on the course homepage. Download the Identifying Reinforcement Worksheet

CHECKLIST FOR REINFORCEMENT LESSON

1. Turn in the Identifying Reinforcement worksheet to the assignment drop box.
2. Submit Activity Log for the week between noon on Saturday and 11pm on Sunday.

Reinforcement Worksheet

Reinforcements for exercise the things that happen to you after exercise, such as a feeling of accomplishment or a rush of energy. Positive reinforcements give you something positive after completing your exercise. They are called rewards.

- A reward would be a receiving a positive comment (Nice job!!) after a hard workout.

Negative reinforcements remove something negative after completing exercise.

- A negative reinforcement could be losing weight after participating in a long-term exercise program.

Reinforcements can also be internal or external. Internal reinforcements are your perceptions of the value of the reinforcement.

- Internal Reinforcements
  - The sense of accomplishment you feel after completing an exercise session is a valuable feeling for you.
- An external reinforcement is reinforcement with a particular value.
  - Buy a new shirt if you achieve your exercise goals.

Fill in your exercise goal for the week

Identify a reinforcement for successfully competing your goal.

Is the reinforcement positive or negative?

Is the reinforcement internal or external?

Fill in your exercise goal for the quarter

Identify a reinforcement for successfully competing your goal.

Is the reinforcement positive or negative?

Is the reinforcement internal or external?

Evaluate your reinforcements

Do you think that reinforcements that you have chosen will help keep you motivated to continue in your exercise program? Why?

Which type of reinforcements do you think will help you maintain your exercise goals, internal or external? Why?

Rewrite your exercise goal for the week using the type of reinforcement that will most benefit adherence to your exercise program.

Rewrite your exercise goal for the quarter using the type of reinforcement that will most benefit adherence to your exercise program.

Reasons to Exercise

There are many reasons to exercise and not everyone who exercises does it for the same reasons. This unit is to help you think of ways you can exercise on a daily basis and find enjoyment in it.

Why it is important

- By knowing and exploring the many reasons to exercise you can find the mode of exercise that works best for increasing your enjoyment of exercise.
- By choosing the reasons that you find most important you can increase your adherence to your exercise program.
- Exploring the 7 reasons to exercise will give you a feeling for what is enjoyable or not in regard to your exercise program.

So far this quarter you have been working on lessons, taking quizes, setting exercise goals, and ultimately exercising. Part of maintaining exercise is determining the reasons you exercise or enjoy exercising. This help you select activities and set goals that meet your likes and dislikes. This should increase your adherence to your exercise program. Those who adhere to exercise for years typically know exactly why they enjoy exercise and the types of exercise that are the most enjoyable to them. In general, there are 7 categories of reasons to exercise.

The seven reasons people exercise include:

1. Social Support- An opportunity to get together with existing friends and exercise with them, making exercise a social experience.
2. Social Growth- An opportunity to meet new friends through exercise, many people meet new friends at the gym or on club teams.
3. Thrills- An opportunity to loose control of your body, or have an exciting experience. An example of this is people who like extreme sports, such as snow boarding, skateboarding a half pipe.
4. Fitness – An opportunity to improve in your fitness level. This can include increases in aerobic capacity, muscular strength, flexibility etc.
5. Competition- An opportunity to beat another person in a sporting competition.
6. Relaxation- An opportunity to escape from daily pressures or daily stresses.

7. Beautiful Movement- An opportunity to experience movement in order to create emotion or communicate feelings. An example would be dancing.

Remember we all have our own interests and goals for exercise. The key is to find out why you may want to engage in exercise and then focus on those one or two reasons that suit you best.

Action Plan – Assignment #1

3. Fill out reasons to exercise rating sheet on Monday. This week we want you to focus on these seven reason's for exercise while you complete your exercise goals. On Friday we want you to go back to the reasons to exercise rating sheet and reevaluate your reasons for exercise.
4. You should keep the primary reasons you exercise in mind when creating your exercise goals in the future.

Reasons To Exercise

As we discussed there are many reasons why exercise can fun. The key here is to determine what reasons you find most appealing. Please rank the reasons to exercise according to your preference. Place a 1 next the most important reason to exercise. Then place a 2 next to the next most important. Continue until you have ranked all 7.

____ Social Support- An opportunity to get together with existing friends and exercise with them, making exercise a social experience.

____ Social Growth- An opportunity to meet new friends through exercise, many people meet new friends at the gym or on club teams.

____ Thrills- An opportunity to loose control of your body, or have an exciting experience. People who like extreme sports like extreme snow boarding.

____ Fitness – An opportunity to improve in your physical capability. This can include increases in aerobic capacity, muscular strength, flexibility etc.

____ Competition- An opportunity to beat another person in a sporting competition.

____ Relaxation- An opportunity to escape from daily pressures or daily stresses.

____ Beautiful Movement- An opportunity to experience movement in order to create emotion or communicate feelings. An example would be dancing.

APPENDIX B

INSTRUMENTS

Seven Day Physical Activity Recall
Moderate Activity

During the LAST 7 DAYS, how much TIME did you spend doing MODERATE exercise?
1. In the DAY column, mark an "0" for no exercise, "X" each day you engaged in MODERATE exercise.
2. In the TOTAL MINUTES column, write in the amount of time you did MODERATE exercise that day.
3. In the ACTIVITY column, list the MODERATE exercise you did (e.g. walking).
4. In the PLANNED ACTIVITY column, specify whether the activity is part of a regular, planned exercise program. Mark "P" if activity was planned. Mark "U" if the activity was unplanned.
MODERATE EXERCISE: is planned physical activity done to enhance health/fitness which,
1. is continuous for 20 minutes or more
2. mildly elevates heart rate
3. mildly elevates breathing rate
4. can hold a conversation while exercising

Examples:
low-impact exercise/strength classes
brisk walking, cycling less than 3 miles,
recreational team sports (volleyball, soccer, etc.)
calisthenics (sit-ups, push-ups. etc.)
golfing without cart, hiking, Half-court basketball

DAY	Minutes	Activity	Planned Activity?
Sun_____	_____	_____	_____
Mon_____	_____	_____	_____
Tues_____	_____	_____	_____
Wed_____	_____	_____	_____
Thur____	_____	_____	_____
Fri_____	_____	_____	_____
Sat_____	_____	_____	_____

Seven Day Physical Activity Recall

Vigorous Activity

During the LAST 7 DAYS, how much TIME did you spend doing Vigorous exercise?

1. In the DAY column, mark an "0" for no exercise, "X" each day you engaged in VIGOROUS exercise.

2. In the TOTAL MINUTES column, write in the amount of time you did VIGOROUS exercise that day.

3. In the ACTIVITY column, list the VIGOROUS exercise you did (e.g. walking).

4. In the PLANNED ACTIVITY column, specify whether the activity is part of a regular, planned exercise program. Mark "P" if activity was planned. Mark "U" if the activity was unplanned.

VIGOROUS EXERCISE: is planned physical activity done to enhance health/fitness which,

1. is continuous for 20 minutes or more
2. elevates heart rate
3. breathing, rapidly, deeply
4. can NOT hold a conversation while exercising

Examples:

running or jogging
high-intensity aerobic classes
competitive full-field sports (soccer)
competitive full-court basketball
cycling (10 mph more than 3 miles)
swimming laps

DAY	Minutes	Activity	Planned Activity?
Sun_____	_____	_____	_____
Mon_____	_____	_____	_____
Tues_____	_____	_____	_____
Wed_____	_____	_____	_____
Thur____	_____	_____	_____
Fri_____	_____	_____	_____
Sat_____	_____	_____	_____

Self Regulation

Part I. Items 1-40.

People use various techniques to help them exercise on a regular basis. Recalling your exercise activities performed in the last four (4) weeks, please answer the following questions regarding techniques you may have used to help you exercise. If you did not exercise during this time period, select "never".

In the scale provided next to each item, circle the number that best represents how often you used the specified technique in the past four (4) weeks.

		never	rarely	some-times	often	very often
1.	I mentally kept track of my exercise activities.	1	2	3	4	5
2.	I mentally noted specific things which helped me exercise.	1	2	3	4	5
3.	I recorded my exercise activities in a written record.	1	2	3	4	5
4.	I recorded my exercise activities in a written record including duration or intensity of exercise performed.	1	2	3	4	5
5.	I kept a written record of specific methods used to enhance my ability to perform exercise.	1	2	3	4	5
6.	I established short term goals (daily or weekly) related to how often I exercise.	1	2	3	4	5
7.	I established long term goals (monthly or longer) related to how often I exercise.	1	2	3	4	5
8.	I established goals for exercise time or distance (e.g. swim 20 minutes, run three miles).	1	2	3	4	5
9.	I established exercise goals that focused on my health (e.g. improved fitness).	1	2	3	4	5
10.	I established exercise goals that focused on my appearance (e.g. lose weight, tone body).	1	2	3	4	5
11.	I established a written commitment with others to exercise.	1	2	3	4	5
12.	I established an oral commitment with other to exercise regularly.	1	2	3	4	5
13.	I mentally set exercise goals.	1	2	3	4	5
14.	I wrote down my exercise goals.	1	2	3	4	5
15.	I exercise with someone to help me exercise regularly.	1	2	3	4	5
16.	I exercised with a pet to help me exercise regularly.	1	2	3	4	5
17.	I talked to someone while I exercised to help me exercise regularly.	1	2	3	4	5
18.	I received verbal praise from someone for	1	2	3	4	5

	exercising.					
19.	I received a reward from someone for exercising.	1	2	3	4	5
20.	I asked someone to remind me to exercise.	1	2	3	4	5
21.	I asked someone to assume some of my responsibilities so I could exercise.	1	2	3	4	5
22.	I asked someone for advice or demonstration of exercise activities.	1	2	3	4	5
23.	I asked an exercise expert/health professional for advice or demonstration of exercise activities.	1	2	3	4	5
24.	I rewarded myself for exercising (e.g. snack, watch TV, movies, buy gift, etc.)	1	2	3	4	5
25.	I rewarded myself for reaching health goals related to exercise. (e.g. improved fitness).	1	2	3	4	5
26.	I rewarded myself for reaching appearance goals related to exercise (e.g. lose weight, tone body).	1	2	3	4	5
27.	I punished myself for not exercising (e.g. withhold reward if I don't exercise).	1	2	3	4	5
28.	When I exercised, I focused on how good I felt.	1	2	3	4	5
29.	After I exercised, I focused on how good I felt.	1	2	3	4	5
30.	I reminded myself of positive health benefits of exercise (e.g. lose weight, tone body).	1	2	3	4	5
31.	I reminded myself of negative health consequences of not exercising (e.g. heart disease).	1	2	3	4	5
32.	I remind myself of negative appearance consequences of not exercising (e.g. weight gain)	1	2	3	4	5
33.	I mentally schedule time periods to exercise	1	2	3	4	5
34.	I wrote down specific time periods to exercise.	1	2	3	4	5
35.	I rearranged my schedule of other activities to ensure I had time to exercise.	1	2	3	4	5
36.	If I had conflicts with my scheduled time periods for exercise, I chose exercise.	1	2	3	4	5
37.	I mentally noted barriers which influenced my ability to exercise.	1	2	3	4	5
38.	I mentally planned ways to overcome barriers to my exercise activities	1	2	3	4	5
39.	I wrote down barriers which influenced	1	2	3	4	5

	my ability to exercise.					
40.	I wrote down ways to overcome barriers to my exercise activities.	1	2	3	4	5
41.	I asked others to identify barriers to my exercise activities.	1	2	3	4	5
42.	I purposely plan ways to exercise when I am on trips away from home.	1	2	3	4	5
43.	I purposely planned ways to exercise during bad weather.	1	2	3	4	5
44.	I place exercise equipment in a prominent place to remind me to exercise	1	2	3	4	5
45.	I placed posters or pictures in a prominent place to motivate myself to exercise	1	2	3	4	5
46.	I wrote a note to remind myself to exercise	1	2	3	4	5
47.	I listened to music while I exercised	1	2	3	4	5
48.	I watched television while I exercised	1	2	3	4	5
49.	I read while I exercised	1	2	3	4	5
50.	I used home exercised facility to help me to exercise regularly	1	2	3	4	5
51.	I used a local exercise facility/club to help me to exercise regularly	1	2	3	4	5
52.	On trips away from home, I purposely stay at places which have access to exercise facilities	1	2	3	4	5

Social Support

Name _____

Please rate each question **twice**. Under **FAMILY**, rate how often anyone living in your household has said or done what is described during the last 3 months. Under **FRIENDS,** rate how often friends, co-workers, or acquaintances have said or done what is described during the last three months.

None Rarely A few times Often Very often
1 2 3 4 5

	Family	**Friends**
67. Exercised with me.	_____	_____
68. Gave me encouragement to stick with my exercise program.	_____	_____
69. Changed their schedule so we could exercise together.	_____	_____
70. Offered to exercise with me.	_____	_____
71. Gave me helpful reminders to exercise.	_____	_____
72. Planned for exercise on recreational outings.	_____	_____
73. Discussed exercise with me.	_____	_____
74. Talked about how much they like to exercise	_____	_____
75. Helped plan activities around my exercise	_____	_____
76. Asked me for ideas on how **they** can get more exercise.	_____	_____
77. Took over chores so I had more time to exercise.	_____	_____
78. Made positive comments about my physical appearance.	_____	_____

Self-Efficacy
How confident are you that you could exercise under each of the following conditions?

0%==10%==20%==30%==40%==50%==60%==70%==80%==90%==100%
Positively could NOT Exercise Positively COULD exercise.

Confidence Rating 0-100%

53 I could exercise when I am tired. _____
54. I could exercise during or following a personal crisis. _____
55. I could exercise when feeling depressed. _____
56. I could exercise when feeling anxious. _____
57. I could exercise during bad weather. _____
58. I could exercise when sore from the last work-out. _____
59. I could exercise when on vacation. _____
60. I could exercise when there are competing interests (e.g. watching television) _____
61. I could exercise when I have a lot of work to do. _____
62. I could exercise when I don't receive support from my family/ friends. _____
63. I could exercise when I have no one to exercise with. _____
64. I could exercise when my schedule is hectic. _____
65. I could exercise when exercising is not enjoyable. _____
66. I could exercise when I haven't reached my exercise goals. _____

Reasons to Exercise

Never Happens	Rarely Happens	Occasionally Happens	Often Happens	Usually Happens	Always Happens
1	**2**	**3**	**4**	**5**	**6**

Physical exercise will,

1. relieve my stress 1 2 3 4 5 6

Stress reduction is important to me.
Never Rarely Occasionally Often Usually Always

2. make me more relaxed 1 2 3 4 5 6

I like to stay relaxed.
Never Rarely Occasionally Often Usually Always

3. get rid of my frustrations. 1 2 3 4 5 6

It feels good to release my frustrations.
Never Rarely Occasionally Often Usually Always

4. make me happy. 1 2 3 4 5 6

Staying happy is very important to me.
Never Rarely Occasionally Often Usually Always

5. get me to calm down. 1 2 3 4 5 6

When I feel out of control I calming myself is helpful.
Never Rarely Occasionally Often Usually Always

6. make me feel healthier. 1 2 3 4 5 6

I feel good when I feel healthy.
Never Rarely Occasionally Often Usually Always

7. keep me in good condition. 1 2 3 4 5 6

I like to stay in good physical condition.
Never Rarely Occasionally Often Usually Always

8. make me leaner. 1 2 3 4 5 6

It is important to me to work on being lean.

Never Rarely Occasionally Often Usually Always

9. improve my endurance. 1 2 3 4 5 6

I like to feel as though my body can accomplish a lot of work.

Never Rarely Occasionally Often Usually Always

10. make me stronger. 1 2 3 4 5 6

Having muscular strength feels good to me.

Never Rarely Occasionally Often Usually Always

11. provide me an opportunity to demonstrate my feelings. 1 2 3 4 5 6

Having an opportunity to express my feelings for me is a valuable experience.

Never Rarely Occasionally Often Usually Always

12. provide me an opportunity to convey a sensation to others 1 2 3 4 5 6

To convey a strong sensation to people around me is a thrill.

Never Rarely Occasionally Often Usually Always

13. provide me an opportunity to demonstrate my creativity. 1 2 3 4 5 6

I like to demonstrate my creative nature.

Never Rarely Occasionally Often Usually Always

14. give me an opportunity to use body language. 1 2 3 4 5 6

I enjoy expressing myself through the use of body language.

Never Rarely Occasionally Often Usually Always

15. give me an opportunity to show my emotions. 1 2 3 4 5 6

It is important for me to be able to show the emotions I experience.

Never Rarely Occasionally Often Usually Always

16. help me to nurture the development of precise movement. 1 2 3 4 5 6

I enjoy developing my ability to create precise movement.

Never Rarely Occasionally Often Usually Always

17. give me opportunity to experience precise movement. 1 2 3 4 5 6

Experiencing precise movement is important to me.

Never Rarely Occasionally Often Usually Always

18. help me attain physical mastery without thought. 1 2 3 4 5 6

It feels good to master physical movement without having to think.

Never Rarely Occasionally Often Usually Always

19. help me to explore the purity of movement. 1 2 3 4 5 6

Experiencing the purity of motion is enjoyable.

Never Rarely Occasionally Often Usually Always

20. help me to feel exhilarated. 1 2 3 4 5 6

I like to experience physical exhilaration.

Never Rarely Occasionally Often Usually Always

21. give me an opportunity to make bold decisions. 1 2 3 4 5 6

It is important for me to make bold decisions.

Never Rarely Occasionally Often Usually Always

22. give me opportunity to explore my physical abilities. 1 2 3 4 5 6

Exploring your physical abilities is important.
Never Rarely Occasionally Often Usually Always

23. help me to have an adventure. 1 2 3 4 5 6

Being adventurous is fun.
Never Rarely Occasionally Often Usually Always

24. give me opportunity to test my physical limitations. 1 2 3 4 5 6

I like testing my physical limitations.
Never Rarely Occasionally Often Usually Always

25. help me to extend my boundaries. 1 2 3 4 5 6

I think it is important to expand my current boundaries.
Never Rarely Occasionally Often Usually Always

26. give me an opportunity to challenge another person to a contest. 1 2 3 4 5 6

I enjoy engaging in physical contests.
Never Rarely Occasionally Often Usually Always

27. enable me to compare my physical accomplishments against others. 1 2 3 4 5 6

It is valuable to compare physical accomplishments.
Never Rarely Occasionally Often Usually Always

28. help me to find out who is the best athlete. 1 2 3 4 5 6

It is important to determine who the best athlete is.
Never Rarely Occasionally Often Usually Always

29. give me an opportunity to beat another person in athletic contest. 1 2 3 4 5 6

Winning is important to me.
Never Rarely Occasionally Often Usually Always

30. give me an opportunity to keep a record of athletic victories. 1 2 3 4 5 6

It is important to accumulate a lot of victories.
Never Rarely Occasionally Often Usually Always

31. help me to be with my friends. 1 2 3 4 5 6

I enjoy spending time with my friends.
Never Rarely Occasionally Often Usually Always

32. allow me to stay connected with the lives of my friends. 1 2 3 4 5 6

Being a part of my friends' lives is important to me.
Never Rarely Occasionally Often Usually Always

33. allow me to become closer to my friends. 1 2 3 4 5 6

Remaining close with my friends is important.
Never Rarely Occasionally Often Usually Always

34. allow me to share experiences with my friends. 1 2 3 4 5 6

I value sharing moments with my friends.
Never Rarely Occasionally Often Usually Always

35. give me the opportunity to develop a bond with my friends. 1 2 3 4 5 6

The bonds of friendship are meaningful to me.
Never Rarely Occasionally Often Usually Always

36. Help me meet new people. 1 2 3 4 5 6

Meeting new people is enjoyable.
Never Rarely Occasionally Often Usually Always

37. allow me to find new friends. 1 2 3 4 5 6

Developing new friendships is valuable to me.

Never Rarely Occasionally Often Usually Always

38. enable me to join new groups. 1 2 3 4 5 6

I like to join new groups.

Never Rarely Occasionally Often Usually Always

39. give me the opportunity to get a date. 1 2 3 4 5 6

Dating is something I enjoy.

Never Rarely Occasionally Often Usually Always

40. give me the opportunity to break social boundaries. 1 2 3 4 5 6

It is good to break social boundaries.

Never Rarely Occasionally Often Usually Always