Message Sources, Targeted Messages, and Physical Activity:

A Social Cognitive Theory View

by

Jennifer Lauren Marmo

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Graduate Supervisory Committee:

Anthony J. Roberto, Chair
Paul A. Mongeau
Barbara E. Ainsworth

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ABSTRACT

This study utilized targeted messages and expert and referent sources in an effort to promote physical activity behavior in college students. College students aged 18-25, excluding collegiate athletes, were randomized into three conditions using their current physical activity level. Two of the conditions received targeted messages highlighting three primary components of social cognitive theory – self-efficacy, outcome expectations, and goals – while the third condition received no messages. In addition, the experimental conditions received the messages from either an expert (i.e., a personal trainer) or a referent (i.e., a close friend). In this way, this experiment analyzed whether receiving social cognitive theory messages increased physical activity indicators compared to the control condition, as well as if the message source caused differences in the physical activity indicators. Moreover, participants completed Time 1 and Time 2 measures to determine if receiving messages or not caused changes over a one week time period. Seven physical activity indicators were assessed: self-efficacy, positive outcome expectations, negative outcome expectations, attitudes, response-efficacy, intentions, and physical activity behavior. Results revealed that both the personal trainer and close friend conditions had significantly higher scores than the control condition for intentions at Time 1 and Time 2, as well as physical activity behavior at Time 2. Moreover, the personal trainer condition had significantly higher positive outcome expectations compared to both the friend and control conditions. No other significant differences were found across conditions for Time 1 attitudes, response-efficacy, negative outcome expectations,

self-efficacy, and Time 2 attitudes, and self-efficacy. Overall, targeted messages were effective in increasing physical activity intentions and behavior regardless of the message source.

DEDICATION

In order for man to succeed in life, God provided him with two means, education and physical activity. Not separately, one for the soul and the other for the body, but for the two together. With these two means, man can attain perfection.

~ Plato

This dissertation is dedicated to my family and friends who have supported me throughout life and particularly graduate school. I appreciate their patience with my choice to spend less time with them as I devoted myself to my work. I appreciate their ability to listen as I vented and complained about the rigors of graduate school. I appreciate their acceptance of my decisions and continued encouragement to pursue academic excellence and my dreams. Without them, I could not have completed this endeavor.

In addition, I'd like to dedicate this dissertation to myself. I devoted (or, lost) many hours of my life to doctoral school. This dissertation, in particular though, helped me to regain my perspective and persistence toward physical activity and a healthy lifestyle. Moreover, it helped me learn a lot about myself: about my ability to be committed, passionate, disciplined, and strong. Although doctoral school contained some of the most challenging, and stressful, years of my life, I look forward to the adventures to come.

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Chapter 1

INTRODUCTION

The Importance of Physical Activity

The importance of physical activity cannot be overstated. According to Booth, Chakravarthy, Gordon, and Spangenburg (2002), "humans inherited genes that were evolved to support a physically active lifestyle" (p. 1). That is, humans are genetically programmed to live an active lifestyle as a survival mechanism. Unfortunately, lifestyles have shifted over time from active hunter-gather to inactive office-worker. For example, one in three adults is inactive with no forecast of improvement in the near future (Centers for Disease Control and Prevention [CDC], 2008). Moreover, over 300,000 premature deaths per year in the United States are attributable to unhealthy diet and physical inactivity (Mokdad, Marks, Stroup, & Gerberding, 2004). Physical activity and obesity are the *top* two health indicators according to *Healthy People 2010* (2010). More importantly, one in three persons will have Type 2 diabetes by 2050 if eating habits and physical activity trends don't change (Chan, 2010). Physical inactivity is an abnormality for a human genome programmed to expect physical activity and explains to some extent how physical inactivity leads to extreme disorders such as obesity, Type 2 diabetes, hypertension, and so on (Booth et al., 2002).

Physical activity is ranked number one as a health indictor because participation in regular physical activity can reduce the risks of being overweight, obesity, premature death, myocardial infarction, diabetes, hypertension, colon cancer, depression, and anxiety (CDC, 1999; for substantially more details see

U.S. Department of Health and Human Services [DHHS], 2008). Regular physical activity can also aid in weight control by increasing muscle strength, bone strength, lean muscle, and decreasing body fat. Additionally, physical activity promotes psychological well-being and better moods. Furthermore, regular physical activity maintains functional independence of adults and increases the quality of life for people of all ages (Buchner, 1997; LaCroix, Guralnik, Berkman, Wallace, & Satterfield, 1993; Nelson, Fiatarone, Morganti, Trice, Greenberg, & Evans, 1994). On average, physically active people outlive those who are inactive (Kaplan, Strawbridge, Cohen, & Hungerford, 1996; Kushi, Fee, Folsom, Mink, Anderson, & Sellers, 1997; Paffenbarger, Hyde, & Wing, 1993; Sherman, D'Agostino, Cobb, & Kannel, 1994). Regular physical activity, even at moderate levels, associates with lower death rates for adults of any age. According to Yap and Davis (2008), the current trend for obesity in the U.S., which has doubled in the last decade, makes it "the defining disease of our generation" (p. 55).

Physically inactive people are almost twice as likely to develop coronary heart disease (CHD) as persons who engage in regular physical activity. This difference is striking given that CHD is the leading cause of death and disability in the United States. Moreover, for people with joint or bone problems, physical activity improves muscle function, cardiovascular function, and physical performance (Stenstrom, 1994). Inactive persons, however, will see measureable health improvements by engaging in even small increases of physical activity. On a scale of one being not intense to ten being highest intensity, individuals

participating in intensity levels of a five or six will experience positive health benefits. Thus, physical activity does not need to be intense in order to provide measurable health benefits.

Physical Inactivity: The Problem

According to *Healthy People 2010* (2010), in 1997 only 15 percent of adults engaged in the recommended amount of physical activity while 40% reported they did not participate in any physical activity. Specifically, in 1997 23% of adults 18 years and older engaged in vigorous physical activity three or more days per week for 20 or more minutes, 18% performed activities that increased and maintained strength and endurance two or more days per week, and 30% participated in stretching exercises. Unfortunately, as of 2008, these numbers have not changed significantly (*Healthy People 2010*, 2010).

Physical activity decreases dramatically during high school years for both boys and girls. According to *Healthy People 2010* (2010), 65% of adolescents engaged in recommended amounts of physical activity. Once students reached high school, however, participation in at least 20 minutes of physical activity during school physical education class by grade declined beginning with 51% of freshman and ending with 28% of seniors (*Healthy People 2010*, 2010). Additionally, only 29% of students participated in a daily physical education class, which could educate students on the benefits and risks associated with physical activity. Although students can participate in physical activity outside of physical education class, these numbers demonstrate the lack of education and time for physical activity they receive in school. Furthermore, the number of

senior high public and private schools that required daily physical activity is roughly two percent and declining (*Healthy People 2010*, 2010).

Unfortunately, this decline in physical activity continues through the college years. For example, Stephens, Jacob, and White (1985) reported that the steepest declines in physical activity occurred from ages 15-25. Similarly, the 2009 Youth Risk Behavior Surveillance Survey (YRBSS) indicated that adolescents transitioning into college experienced declines in participation in exercise sufficient enough to simply make one sweat and breathe hard. Additionally, decreases occurred in the percentage of college students who participate in vigorous physical activity three or more days per week with these declines continuing to the age of 29 (the National Center for Health Statistics [NCHS], 2010). Specifically, Douglas, Collins, Warren, Kann, Golf, and Clayton (1997) found that only approximately 38 percent of college students engaged in vigorous physical activity (i.e., made them sweat and breathe hard) for at least 20 minutes on three or more days per week, and only approximately 20 percent engaged in moderate activity (e.g., walking and bicycling) at least 30 minutes on five or more days per week. Considerate research (e.g., Dowda, Ainsworth, Addy, Saunders, & Riner, 2003; Huang, Harris, Lee, Nazir, Born, & Kaur, 2003; Bray & Born, 2004; Petosa, Suminski, & Hortz, 2003; Racette, Deusinger, Strube, Highstein, & Deusinger, 2005; Suminski, Petosa, Utter, & Zhang, 2002) finds clear evidence of lower physical activity rates in college students compared to those in middle and high school.

Importantly, a national study of college students discovered that approximately 40-50% were inactive (i.e., engaging in high amounts of sitting or participating in light-intensity activities only such as walking) (Douglas et al., 1997; Keating, Guan, Pinero, & Bridges, 2005). Page's (1987) results revealed only about 35 percent of college students report having a regular physical activity schedule. Other research (e.g., Racette et al., 2005) suggested that only half the freshman and sophomore participants engaged in physical activity regularly and 30% did not engage in any physical activity on a regular basis. Collectively, this research demonstrates that approximately one-third of all college students consistently report inactivity. These statistics are astounding suggesting that a substantial proportion of college students live a sedentary, or inactive, lifestyle; college students are simply not engaging in physical activity as often as they should. This research, thus, begs our attention on how we can promote physical activity at the college level.

The Need for Physical Activity in College Students

Despite documented benefits, few individuals engage in regular physical activity and millions of Americans are failing to take advantage of physical activity. With more than 4,300 colleges and universities in the United States, enrolling more than 18.2 million students (National Center for Education Statistics [NCES], 2010), the lack of physical activity is a primary public health issue that needs to be addressed. Efforts need to target college student populations, particularly as American jobs continue to become increasingly sedentary (French, Story, & Jeffrey, 2001; Williams, 2009). As *Healthy People*

2010 (2010) stated, individuals who adopt a physically active lifestyle at a younger age are more likely to continue it into adulthood. According to Arnett (2000), college students are emerging adults (ages 18-25) who begin to shift their thinking to long-term concerns. Specifically, two defining characteristics of emerging adulthood is accepting responsibility for one's self and making independent decisions (Arnett, 1997, 1998). These qualities develop during the college years and are critical to a wide variety of personal, social, and societal outcomes, including physical activity. Moreover, the DHHS (2000) revealed that physical activity habits formed by late adolescence strongly correlate to those in early and later adulthood. Young adults who developed a foundation for physical activity and maintained that level of physical activity following graduation through the ages of 70-84, experienced a 49% decrease in mortality rates (Paffenbarger, Hyde, & Wing, 1986). A lifespan approach where individuals are active for life, as the DHHS (2008) argued, is the best way to be physically active. Thus, college students need to not only engage in physical activity but begin to build a foundation and desire to maintain physical activity levels throughout their lifetime.

Chapter 2

LITERATURE REVIEW: COLLEGE STUDENTS AND PHYSICAL ACTIVITY

Indeed there is need to examine physical activity promotion among college students. This literature review defines physical activity and its recommended amount, explores factors contributing to college student inactivity, highlights the particular benefits of physical activity for college students, reviews college student perceptions of importance, barriers, and motivators of physical activity, and finally presents approaches to promoting physical activity.

Conceptually Defining Physical Activity

Scholars, lay persons, and even governmental agencies generally agree about the definition of physical activity. Generally speaking, *physical activity* is defined as "any bodily movement produced by the contraction of skeletal muscles that increases energy expenditure above a basal level" (CDC, 2010). The extent of bodily movement, according to the DHHS (2008) can be divided into two categories. The first is baseline activity, which refers to the light-intensity activities of daily life. Baseline activity is synonymous with sedentary and inactive. Individuals who engage in only baseline activity have lifestyles characterized by high amounts of sitting and no or very little physical activity. The second level of bodily movement is known as health-enhancing physical activity. This activity when added to baseline activity produces health benefits. Thus, the function of physical activity is for individuals to move their bodies in ways that utilizes energy beyond that of simply being alive.

This broad definition complicates defining the scope of physical activity. For example, *physical fitness* is a multidimensional construct that it represents "a set of attributes that people have or achieve that relates to the ability to perform physical activity" (Ainsworth & Matthews, 2005, p. 305). More specifically, physical fitness is "a physiological state of cardiorespiratory endurance, muscle strength and endurance, flexibility, and body fat composition" (Yap & Davis, 2007, p. 373). Physical fitness encompasses the range of behaviors from agility, balance, exercise, flexibility, strength, power, and speed (*Healthy People 2010*, 2010). Thus, physical fitness is one outcome of physical activity. Likewise, *exercise*, similar to but not synonymous with physical activity, is only type of physical fitness. Exercise has been defined as "planned, structured, repetitive, and purposive bodily movement done to improve or maintain one or more components of physical fitness" (Caspersen, Powell, & Christenson, 1985, p. 120). Often college students use *exercise* and *working out* as terms to describe being physically active; these words, however, are only subcomponents to physical activity, which defines a larger entity of movement (Marmo, unpublished data). Individuals desiring to live healthy lifestyles need to do more than exercise or be physically fit; a "physiological state of cardiorespiratory endurance, muscle strength and endurance, flexibility, and body fat composition" comes from physical activity (Yap & Davis, 2007, p. 373).

To help clarify the definition of physical activity are the various terms used to define and explain physical activity. For example, some terms are based on different levels of physical activity exertion. *Light physical activity* occurs

when people do daily activities, such as cooking and cleaning. Light activity does not count toward physical activity as the body isn't working hard enough to increase the heart rate. *Moderate physical activity* use large muscle groups and are equivalent to brisk walking. Examples might include gardening, yard work, walking, bicycling, and occupational work (e.g., carrying boxes). *Vigorous physical activity* is rhythmic, repetitive physical activities that use large muscle groups at 70 percent or more of maximum heart rate (*Healthy People 2010*, 2010). Examples include jumping rope, dancing, lap swimming, cross-country skiing, and competitive sports. Both moderate and vigorous levels of exertion are considered aerobic physical activity, or endurance activity, because they improve cardiorespiratory fitness and occur when the large muscles of the body move in a rhythmic method for at least ten minutes at a time (CDC, 2011).

Other terms classify physical activity by level of choice. For example, *intentional physical activity* is physical activity that is engaged in deliberately; it involves a cognitive component such that one has chosen to participate in physical activity specifically for the benefits it provides (Yap & Davis, 2007). *Volitional physical activity* refers to activities done in structured or unstructured settings for a purpose (e.g., lifting heavy boxes for work) (Ainsworth & Matthews, 2005). On the other hand, *spontaneous physical activity* occurs briefly and results in energy expenditure (Ainsworth & Matthews, 2005). Examples of spontaneous physical activity include fidgeting or unintentional body movements.

Finally, some categorize physical activity by context. For example, *occupational physical activity* includes having to walk at work or lift or carry

boxes. *Leisure time physical activity* involves free or spare time wherein activities are selected based on enjoyment, relaxation, intrinsic motivation, and self-expression (Henderson, Bialeschki, Shaw, & Freysinger, 1996). Leisure time physical activity can range from vigorous to light and moderate; it can also shift from planned to mundane activities throughout a day (King et al., 1992).

Clearly, physical activity encompasses a wide range of movements. It can include formal exercise to daily activities including, work, chores, sports, mundane events, and leisure-time (Yap & Davis, 2008). Physical activity can range from a "strolling gait to a full on sprint" (Prochaska, Sallis, Sarkin, & Calfas, 2000, p. 866). It can occur daily in one longer dose or several times a day for short periods. Some physical activity happens weekly, monthly, or yearly. Physical activity can range from light to rigorous activity. Indeed, as Yap and Davis (2007) stated, "Physical activity is a complex combination of behaviors" (p. 373). As such, physical activity is the general movement of the body with the function to expend energy and a scope including a wide range of activities.

Recommended Levels of Participation in Physical Activity

According to the most recent federal physical activity guidelines (DHHS, 2008), healthy adults aged 18-65 should engage in a minimum of 150 minutes of moderate-intensity activity per week. Adults desiring to engage in less, but more vigorous, physical activity should participate in 75 minutes a week. Ideally, adults should engage in a combination of moderate- and vigorous-intensity activity. Furthermore, activity should occur in episodes of at least 10 minutes in duration dispersed throughout the week. For more extensive benefits, adults

should increase activity to 5 hours a week of moderate-intensity or 2.5 hours of vigorous-intensity or an equivalent combination of both. Additional benefits are gained by engaging in physical activity beyond the suggested amounts. Although endurance activity via moderate- and vigorous-intensity activity is important, adults should also participate in muscle-strengthening activities at least 2 or more days per week.

The following table from the DHHS (2008) displays the appropriate amounts of physical activity for adults as well as the benefits.

Figure 1

Classification of Total Weekly Amounts of Moderate-Intensity Physical Activity (adapted from DHHS, 2008, p. 4)

Level of Physical Activity	Minutes per Week of Moderate-Intensity Activity	Health Benefits	Comment
Inactive	No activity beyond baseline	None	Inactivity is unhealthy
Low	Fewer than 150 minutes per week	Minimal	Some physical activity is preferred over sedentary behavior
Moderate	150 minutes to 300 minutes per week	Substantial	The greater the activity per week, the more substantial the benefits
High	More than 300 minutes per week	Additional	An upper limit of activity above which additional benefits do not occur is currently not identified

Physical Activity Benefits

Physical activity reduces the risks of being overweight, obesity, premature death, myocardial infarction, diabetes, hypertension, colon cancer, depression, and anxiety (CDC, 1999). Regular physical activity can also increase muscle

strength, bone strength, lean muscle, and decrease body fat, thus aiding in weight control. Additionally, it enhances psychological well-being, can improve mood, increases quality of life, and can extend an individual's life. College students specifically experience decreased anxiety and depression (Berger & Owen, 1983), reduced test anxiety (Topp, 1989), and improved self-esteem (Trujillo, 1983) as a result of physical activity.

College students in particular reap many benefits from engaging in physical activity. Research (e.g., Arent, Landers, & Etnier, 2000; CDC, 1999; Phillips, Kiernan, & King, 2001; Sallis et al., 1999b) consistently reveals that college students' high stress levels can be decreased through regular physical activity. Similarly, Johnson-Kozlow, Sallis, and Calfas (2004) found that college students reported an abundance of stressors with the most common being poor finances and lack of sleep. Interventions demonstrated that high-stress individuals received substantially more benefit than low-stress individuals in decreasing stress from engaging in physical activity. These findings align with previous research indicating that physical activity can reduce physiological and psychological stress symptoms (Arent et al., 2000; CDC, 1999; Phillips et al., 2001). Sallis et al. (1999b) found that physical activity is used more by men than women as a stress-coping mechanism; however, women also reported decreased stress as physical activity increased. Collectively, this research suggests that physical activity decreases college students' stress levels.

Moreover, neurobiologists are finding that physical activity stimulates neuron growth enhancing learning and successful brain functioning (Cotman & Berchtold, 2002). Specifically, physical activity

> improves learning on three levels: first, it optimizes your mind-set to improve alertness, attention, and motivation; second, it prepares and encourages nerve cells to bind to one another, which is the cellular basis for logging in new information; and third, it spurs the development of new nerve cells from stem cells in the hippocampus (Ratey, 2008, p. 53).

Physical activity improves learning and protects against cognitive decline (Cotman & Engesser-Cesar, 2002). Likewise, Themanson, Pontifex, and Hillman (2008) found that physical activity in young adults (aged 18-25) is positively associated with cognitive flexibility. That is, young adults with higher physical activity levels are more likely to be able to identify and correct mistakes during difficult cognitive tasks. Additionally, physical activity improves memory (Cotman, Berchtold, & Christie, 2007). This stimulation from physical activity is critical to college students in an educational environment.

Indeed, physical activity is important for physical and physiological reasons. However, it is clear that physical activity also provides tremendous psychological and educational benefits for college students.

Explaining Decreases in College Students' Physical Activity

College students are particularly prone to weight gain compared to same-age individuals who do not attend college (Mokdad, Serdula, Dietz, Bowman, Marks, & Koplan, 1999). Part of this weight increase can be simply attributed to

college students not participating in adequate physical activity. Numerous studies revealed significant decreases in physical activity during the transition to young adulthood (Bray & Born, 2004), during the first year of college (Bray & Born, 2004; Serlachius, Harner, & Wardle, 2007), and throughout college (Huang et al., 2003). Calfas, Sallis, Lovato, and Campbell (1994) found that both moderate- and vigorous-intensity physical activity declined from high school to college. In addition, these researchers asked college student participants whether or not they would be willing to spend time learning how to become more physically active; approximately 34% indicated they were unwilling to do this. Although this percentage included students who might already be physically active, it also revealed that students are not necessarily interested in increasing their physical activity behaviors.

Declines in physical activity can be attributed to many factors. First, many new environmental factors are at play when students transition to college (e.g., leaving home, cooking and cleaning, developing new friendships, managing time, balancing a job, social life, organizational involvement, and managing romantic relationships). As Calfas et al. (1994) stated, these factors play a significant role in physical (in)activity and thus individuals "may need to change their goals, overcome different barriers, and use different resources to become or remain active" (p. 323).

The environmental change can also increase college students' stress levels. Students arrive to college stressed and those levels only increased during college (Kitzrow, 2003). Schwartz (2006) found that student stress is on the rise, and that

student medication use to manage stress increased fivefold. Stress levels significantly affect college life. The American College Health Association (ACHA, 2007) found that approximately 34% of students reported that stress interferes with academic performance, including missing classes, receiving lower grades, or dropping courses. Likewise, Pritchard and Wilson (2003) found that stress affects decisions to remain in school, increased attrition, and issues with academic performance. High levels of stress are also related to sleeping difficulties, psychiatric disorders, substance abuse, and high-risk behaviors (Broman, 2005; Dusselier, Dunn, Wang, Shelley, & Whalen, 2005).

Additional physiological changes also occur during the college years as young ladies and gentlemen become women and men. With these changes body image becomes a critical focus for college students (Zabinski, Calfas, Gehrman, Wilfley, & Sallis, 2001). For many, a perception of being overweight is the ultimate failure (Lewis, Cash, Jacobi, & Bubb-Lewis, 1997). From 1972 to 1996 women's dissatisfaction with their physical appearance increased from 23% to 56% (Thompson, Heinberg, Altabe, & Tantleff-Dunn, 1999). More importantly, over 60% of female college students reported some form of eating disturbances (Mintz & Betz, 1988), which is strongly associated with a negative body image and sociocultural beliefs regarding female thinness. Many women experience body dissatisfaction, desire to be thinner, and overestimate their current size while men are equally divided between those who want to lose, and those who want to gain, weight (Grogan, 2008). Similarly, 42% of men reported body dissatisfaction (Thompson et al., 1999) with 85% reporting dissatisfaction with

their weight (Drewnowski & Yee, 1987). Many heterosexual men reported dissatisfaction with body image (Pope, Phillips, & Olivardia, 2000), but their levels of concern are far less serious than women (Cash, Morrow, Hrabosky, & Perry, 2004) and gay men (Morrison, Morrison, & Sager, 2004).

Body image is a primary concern during the collegiate years for both males and females and can motivate students to be active. Moreover, body image can cause the reverse effect preventing students from engaging in physical activity. This occurs if students are overly concerned about how they look and will not step into a gym or activity class out of fear that other more "perfect" bodies will judge them.

The "freshmen fifteen" is a third common issue when attending college. College students access a wide array of food including buffets, fast food, and late night dining. Without a parent telling them to eat healthy, students might make poor food choices. For example, Racette et al. (2005) found that notable weight gains (approximately 9 pounds) occurred among college students between the beginning of the freshman year and end of sophomore year. This weight gain takes the form of increased fat (Butler, Black, Blue, & Gretebeck, 2004; Hajhosseini, Holmes, Mohamadi, Goudarzi, McProud, & Hollenbeck, 2006; Hoffman, Policastro, Quick, & Lee, 2006), and could continue to increase throughout the duration of college (Lloyd-Richardson, Baily, Fava, Wing, & the Tobacco Etiology Research Network, 2009). These weight gains shift students from normal weight to being considered overweight (Hoffman et al., 2006; Lloyd-Richardson et al., 2009; Racette et al., 2005). More importantly, according to the

ACHA (2006), only approximately 7% of college students reported eating the recommended five or more servings of fruits and vegetables each day.

Body image might contribute to eating behaviors; however, weight gain and poor nutrition are also byproducts of college student choices that often do not include healthy meals and physical activity. As Johnson, Nichols, Sallis, Calfas, and Hovell (1998) found, college students' physical activity had a significantly negative association with fatty food intake. A lack of physical activity contributes to the weight increase.

Technology also contributes to a lack of physical activity during college. Children learn at a very young age to spend time watching television, playing video games, surfing the internet, or utilizing cell phones. Anderson, Crespo, and Bartlett (1998) found that one-quarter of U.S. children spend four or more hours per day watching television. In addition, according to *Healthy People 2010* (2010) in 2007, 65% of high school students viewed television for two hours or less on a school day with the NCHS (2010) finding that approximately 33% of students watched television three or more hours per average school day. Additionally, the NCHS found that 25% of students played video games, computer games, or used the computer for something non-school related for three or more hours per day on an average school day. As students transition to college these trends continue. American adults report that television viewing is the least necessary part of their lives, yet they spend six times more time watching television than engaging in physical activity (Robinson & Godbey, 1997). Use of computers and cell phones contributes to decreases in energy expenditure and

physical activity because individuals simply need to email, text, or call instead of having to walk to communicate with a person (French et al., 2001).

Overall, technology, such as viewing television, playing video games, and using personal computers, increased the number of individuals who are overweight and obese (Anderson et al., 1998). Further, high levels of cell phone use are associated with lower levels of self-rated health (Koivusilta, Lintonen, & Rimpela, 2007), overweight and obesity (Lajunen, Keski-Rahkonen, Pulkkinen, Rose, Rissanen, & Kaprio, 2007), and participation in health-compromising behaviors, including smoking, drinking, and drug use (Koivusilta, Lintonen, & Rimpela, 2005). More importantly, students are largely being educated for sedentary occupations where much of their time is spent sitting (Fotheringham, Wonnacott, & Owen, 2000). Environments that promote inactivity, for example schools where students sit for long periods or organizations where employees spend eight hours a day at a desk on a computer, shape persistent and potentially long-term sedentary behavior patterns (Sallis & Owen, 1999; Sallis, Bauman, & Pratt, 1998; Owen, Leslie, Salmon, & Fotheringham, 2000).

College is a time for a vivacious social life, but also tends to include health-compromising behaviors. Adults aged 18 to 24 consistently report among the highest users of tobacco (American Lung Association, 2011; Arnett, 2000; National Institute of Drug Abuse, 2006). College students also reported high rates of alcohol use (Knight, Kirincich, Farmer, & Hood, 2002) and unsafe sex (Hingson, Heeren, Zakocs, Kopstein, & Wechsler, 2002). According to the ACHA-NCHA (2006), alcohol use ranked highest for college students, followed

by marijuana use, and cigarette smoking. Interestingly, Johnson et al. (1998) found that physical activity in college students does not correlate with other health-related behaviors, such as tobacco use, drinking and driving, and unsafe sex. However, participants in Marmo's (unpublished data) focus groups revealed that having a social life, drinking, and smoking were primary barriers to being physically active. Similarly, participants also reported that inactive friends drastically, negatively influenced their health-related and physical activity behaviors.

Accessibility to recreational facilities is also a factor in physical activity participation; as facility distance increased, use generally decreased (French et al., 2001; *Healthy People 2010*, 2010). Both male and female students in Leslie, Owen, and Sallis's (1999) study wanted more recreational facilities available to be active. Typically, college students can access an on-campus gym for free; however, students who live off-campus or even those who live on-campus but not near the gym are at a risk for lower physical activity behavior.

Similarly, in the United States transportation has drastically changed our society. Walking declined over the past decades. In 1995, over 75% of all trips less than one mile were made by automobile (U.S. Department of Transportation [DOT], 1994). Additionally, walking trips made by adults dropped to only 5.4% in 1995. Likewise, bicycling, another healthy form of transportation, also declined. College students may be particularly apt to walk and bicycle as a means of traveling on campus; however, these behaviors might occur only when a student is on campus and might not be representative of their typical physical

activity behaviors. In addition, students might not view walking or biking as a means of transportation as physical activity. Regardless, automobile use for commuting to campus and other short trips radically increased (French et al., 2001).

Clearly, many changes occur during the college years that contribute to college students' inactivity and when combined are a recipe for a sedentary lifestyle. Before a discussion regarding promoting college students' physical activity behavior occurs, it is necessary to first understand college students' perceptions of physical activity.

Perceptions of Physical Activity: Importance, Barriers, and Motivation

It is necessary to understand if college students consider physical activity to be important in order to determine how to promote that behavior. Using focus groups, Marmo (unpublished data) inductively derived several reasons why college students considered physical activity to be important. First, college students believed physical activity is important because of many health-damaging societal and environmental factors, such as fast food and sugar consumption, technology, inactive jobs, and pressures to look a particular way. Second, they considered it important for the creation and existence of relationships, such as romantic relationship initiation, relational maintenance, family role models, and friendship factors including competition, accountability, social comparison, and social life. Finally, students stated physical activity provides many benefits to the self including increased energy, stress release, longevity, good health, and building a foundation, to name a few. These findings revealed that college

students recognize that there are several reasons why physical activity is important. Marmo (forthcoming), however, found that although all participants believed physical activity is important (i.e., no one selected 4 or below on a 7-point scale on the importance of physical exercise), more than half of students did not engage in the recommended amounts of physical activity. Similar to Williams, Sallis, Calfas, and Burke's (1999) conclusions, Marmo's research revealed that college students know the importance, advantages, and benefits of physical activity, but this information does not necessarily translate into motivators to be active enough.

Researchers frequently explore barriers that individuals face regarding physical activity in order to find ways to overcome them. In doing so, researchers, however, often neglect to examine key motivating factors. For example, Calfas et al. (1994) attempted to understand what motivates college seniors to be physically active. Results indicated that benefits to physical activity included psychological/personal benefits, convenience, body image, strength, and social aspects. These researchers combined benefits and motivators, assuming that the reasons physical activity is beneficial are what motivates physical activity participation. Indeed, given Calfas et al.'s findings as well as Marmo's, the importance and benefits of physical activity to college students aren't necessarily what motivates them to engage in physical activity.

In an effort to understand what motivates and prevents students from being active, Marmo (unpublished data) applied self-determination theory (SDT), a psychological theory about motivation, to focus group data. According to Ryan

and Deci (2000) who proposed SDT, motivation lies along a continuum of amotivated to active, personal commitment. Some students admitted to simply being unmotivated. Barriers that inhibit motivation include time constraints, social life, drinking and smoking habits, inactive friends, high stress levels, fatigue, and climate. According to *Healthy People 2010* (2010), several barriers from Marmo's data (e.g., lack of time, low motivation, and certain climates or seasons) aligned with hindrances preventing adults from participating in physical activity. Moreover, Calfas et al. (1994) studied college seniors and found that common barriers to physical activity included aversiveness of activity, inconvenience, worries, and competing demands on time. Likewise, Williams et al. (1999) found that students identifying the most barriers to being physically active watched more television than those reporting fewer barriers. Although college students report a variety of barriers to physical activity, students in Marmo's (unpublished data) discussed being motivated to overcome only a few of them (e.g., poor eating habits, smoking, drinking, and lack of time).

On the continuum after amotivation, SDT states that extrinsic motivation exists followed by intrinsic motivation (Ryan & Deci, 2000). Extrinsic motivation occurs when individuals behave in a way to receive some outcome other than enjoying the behavior itself. Intrinsic motivation is when individuals perform a behavior for its inherent satisfaction. As individuals move on the continuum towards intrinsic motivation regarding a behavior they become more autonomous.

Marmo's (unpublished data) findings indicated that students are predominantly extrinsically motivated through external regulation and introjected regulation. External regulation occurs when individuals are motivated to engage in behavior due to desiring to receive external rewards or avoid external punishments, while introjected regulation occurs when individuals seek to receive internal rewards and avoid internal punishments. Students are active because they desire to avoid external punishments, such as pressures from friends, family members, significant others, physicians, and/or society, as well as internal punishments, such as feeling guilty or inadequate. Moreover, they desire to reap internal and external rewards such as pride or self-worth and compliments, respectively.

Although students noted more autonomous forms of extrinsic motivation (i.e., identified regulation and integrated regulation), as well as the most autonomous motivator (i.e., intrinsic motivation), all three were discussed less frequently than external and introjected regulation. According to Ryan and Deci (2000), the more autonomous the motivation for a behavior, the more likely a person is to sustain and enjoy the behavior over time. Researchers (e.g., Fortier, Sweet, O'Sullivan, & Williams, 2007; Milne, Wallman, Guilfoyle, Gordon, & Courneya, 2008; Wilson, Blanchard, Nehl, & Baker, 2006) who studied physical activity and motivation found that those who experience autonomous motivation exhibited higher levels of physical activity behavior. This means that the more students desire to be active and internalize the importance of physical activity for their lives, the more likely they are to maintain physical activity habits. Thus,

students need to not only recognize the importance of physical activity but be autonomously motivated in order to develop a strong foundation of long-term physical activity behavior.

As is evident, college students recognize the importance of physical activity, yet they still experience barriers and struggle with motivation. Thus, researchers seeking to increase college student physical should develop messages or interventions that are complex as they should increase motivation as well as overcome barriers. This sentiment has been echoed by other researchers (e.g., Calfas et al., 1994; Williams et al., 1999).

Approaches to Promoting Physical Activity

Researchers have explored several approaches to addressing physical activity behaviors. The section highlights three perspectives – targeted messages, interventions, and applying theory.

Targeted messages. Kreuter and Skinner (2000) proposed five levels of communication: generic, targeted, personalized, tailored, and interpersonal. These levels differ in the personalization of communication. For example, generic communication is the least tailored and encompasses a message that can inform all people (e.g., a billboard encouraging physical activity). Targeted communication attempts to narrow the message to include information pertinent to a particular subset of the population (e.g., an educational pamphlet on the importance of physical activity to women). Personalized communication simply attaches an individual name to draw attention to a generic message (e.g., sending the billboard message on a postcard to individuals) (Kreuter, Farrell, Olevitch, &

Brennan, 2000). Tailored communication focuses on an individual and his/her personal information and behavior change needs (e.g., calling women and asking them to complete a brief survey identifying their barriers to being active, and then providing materials on how to overcome those barriers). Interpersonal communication is the highest level of tailoring because it consists of one-on-one interaction from an health professional directly providing information based upon the individuals needs (e.g., a recommendation letter from the physician containing specific ways to become more active and less inactive). Using these levels researchers develop messages to improve physical activity.

Given that many individuals are unmotivated to increase their physical activity (Marcus, Rossi, Selby, Niaura, & Abrams, 1992), it is important and necessary to target particular groups (Marcus, Nigg, Riebe, & Forsyth, 2000). The targeted message approach is widely applied in health research (e.g., Kreuter & Wray, 2003; Rimal & Adkins, 2003). Targeted messages focus on one segment of a population, usually based upon one or more demographic characteristic shared by all members; it assumes homogeneity of the subset and does not address individual differences (Kreuter & Skinner, 2000). Thus, targeted messages presume that group members are similar enough to be able to communicate one message to all members.

Targeted message interventions are capable of wide reach; however, have been under fire of late as researchers find that tailored message interventions are more effective (e.g., Bock, Marcus, Pinto, & Forsyth, 2001; Fahrenwald, Atwood, Noble-Walker, Johnson, & Berg, 2004; Marcus et al., 1998; Spittaels, De

Bourdeaudhuij, & Vandelanotte, 2006). A recent meta-analysis concluded that tailored messages outperformed targeted messages but the overall effect size was small and influenced by at least seven moderating variables (Noar, Benac, and Harris, 2007). The rationale for both approaches, however, is similar – the more that is known about the intended message receiver, the more the message can be made relevant to him/her (Kreuter & Wray, 2003).

When targeted messages are a good fit for an individual (i.e., when they address at least 70% of the receiver's needs), they are equally effective as tailored messages (Kreuter & Wray, 2003). Targeted messages are advantageous when there is little variability within the target audience on key determinants of the message's intended outcome. Determinants include *facilitators* (factors that promote physical activity) and *barriers* (factors that discourage physical activity) (Nahas, Goldfine, & Collins, 2004). Key determinants of college student physical activity include *personal characteristics* (e.g., age, sex, education, etc.), *psychological and behavioral characteristics* (e.g., self-efficacy, intentions, enjoyment, motivation, barriers, and stage of change), *environmental* (e.g., social support, accessibility and costs of facility, climate, and safety), and *physical activity characteristics* (e.g., activity type, intensity, and effort) (Nahas et al., 2004).

Targeted messages can be successful in a varied target population, so long as message receivers believe the message is relevant to them. Additionally, targeted messages are more effective at addressing health problems for which awareness or understanding is low in the target population. Although college

students recognize the importance of physical activity (Marmo, forthcoming; Williams et al., 1999), there is a lack of understanding as to how paramount physical inactivity is in college and why there is a need to be active now. Moreover, given that college students seemed to be in relative agreement regarding determinants of physical activity behavior (Calfas et al., 1994; Marmo, unpublished data), targeted messages should be appropriate for addressing college students.

Despite the attack on targeted messages, use of targeted messages by physicians is effective at increasing physical activity (Goldstein et al., 1999, Marcus et al., 1997). Moreover, targeted messages disseminated via the Internet are successful at increasing physical activity behaviors (Napolitano et al., 2002). The Physical Activity Task Force Communications Working Group (2011) recognizes the importance of targeted messages at increasing behavior; targeted messages increase knowledge, intentions to be physically active, and behavior.

Physical activity interventions. Although interventions target elderly adults (for extensive reviews see Conn, Minor, Burks, Rantz, FAAN, & Pomeroy, 2003; Nelson et al., 2007), children (see van Sluijs, McMinn, & Griffin, 2007), and minority populations (see Osei-Assibey, Kyrou, Adi, Kumar, & Matyka, 2010; Whitt-Glover & Kumanyika, 2009), interventions for college students are equally necessary. Until recently, college students have not been a primary target population for activity researchers. Several physical activity interventions at the collegiate level do exist, although, they experienced limited success.

Project GRAD (Graduate Ready for Activity Daily) is a one primary research plan that targeted college seniors to increase their physical activity behaviors before graduation (Calfas et al., 1994). Based on the Transtheoretical model and Social Cognitive Theory, Project GRAD participants in the intervention group participated in a one semester class prior to graduation receiving a weekly faculty-led lecture and peer-led lab (Sallis, Calfas, Alcaraz, Gehrman, & Johnson, 1999a; Sallis et al., 1999b). One behavioral science and one exercise science faculty taught lectures about benefits and risks of physical activity, exercise principles, physical activity recommendations, and behavior change strategies. Peer facilitators led a weekly lab (of up to 15 students) that involved physical activity and personal application of physical activity management strategies and goals. Students in the control group attended a typical health science lecture course for two hours per week. Lectures focused on general topics from a doctoral-level instructor. Results indicated that, for women, the intervention had significant, but small effects on self-efficacy for making time, self-efficacy for resisting relapse, social support from friends, and behavioral processes of change. For these women, the strongest contributors to physical activity change were social support and self-efficacy for resisting relapse. For men, the intervention had significant, but small effects on behavioral processes of change, and increasing perceived barriers to physical activity. The strongest contributors for men included change in enjoyment, change in self-efficacy regarding relapse, and change in benefits.

In addition, Project GRAD followed participants for 18 months after graduation. Participants in the intervention received peer-based phone and mail follow-ups. Phone conversations reiterated problem solving for barriers, highlighted potential upcoming risks, and developing new physical activity goals. Newsletters and tip sheets were mailed emphasizing a behavior change method. During the 18-month follow-up, participants in the control group received a general wellness newsletter. The intervention was unsuccessful at promoting long-term physical activity; however, the intervention was more successful among women than men. Some significant intervention effects existed at the 1-year measurement, indicating that frequent contact needs to be continued as long as possible (Calfas et al., 2000).

Project ARTEC (Active Recreation on Tertiary Education Campuses) was a quasi-experimental design promoting physical activity on college campuses (Leslie, Fotheringham, Veitch, & Owen, 2000). Activity classes were free to students on campus (e.g., weight training, aerobics), as well as fitness assessments and vouchers for nearby facilities. Incentives were offered to students to participate in physical activity. At the conclusion of the 8-week program, significant increases in vigorous physical activity were found among participants on the intervention campus, such that vigorously physically active students increased from 21% to 41%. The proportion of students who were sedentary in both the control and intervention, however, remained the same.

Project TEAM (Teaching Exercise/Activity Maintenance) is another campus-based approach to physical activity promotion (Buckworth, 2001).

Participants in this college intervention completed a semester physical education class personalized based on the Transtheoretical Model. Results suggested that the change in physical activity was associated with their stage of change and readiness to be physically active. Higher levels of physical activity change occurred in participants who were previously doing some physical activity but not habitually.

Project IMPACT (Increasing and Maintaining Physical Activity by Connecting and Tracking participants) used a buddy-system intervention that encouraged participants to keep records (Cholewa & Irwin, 2008). This research is based on Tucker and Irwin's (2006) focus group study that found that college students believed using the buddy system would effectively increase physical activity behavior. Same-sex individuals were paired based on matching criterion, such as current level of physical activity, seriousness, and intensity level. Participants utilized an online logbook to record all physical activity frequency, duration, goals, and progress. The effectiveness of a buddy system, record-keeping device, or both was evaluated. Participants in both the record-keeping device and combination group significantly increased in physical activity after nine weeks. Thus, an online recording device for physical activity might be an important tool in activity promotion. The buddy system intervention on its own did not cause significant changes in physical activity. As the researchers argued, this is likely attributable to the fact that "buddies" did not know each other very well.

Boyle, Mattern, Lassiter, and Ritzler (2011) tested whether college students attempting to change their physical activity behavior on their own compared to those who had a peer educator were more successful. The peer educator, an exercise physiologist in training, provided both education, support, and a tailored exercise program. The study lasted one semester. Findings revealed that women in both the intervention and control groups decreased in total amount of physical activity over the semester. Women in the intervention group, however, had a significantly smaller reduction than women in the control group. No significant differences were noted for men.

These interventions offered a variety of approaches – health education class, peer educators, online tools, buddy system, and more physical activity opportunities on campus. Most of them were effective in the short-term; however, at 1- and 2-year follow-ups, no significant differences in physical activity behavior emerged (Calfas et al., 2000; Sallis et al., 1999a). Results also revealed that women were more susceptible to the intervention than men, though not necessarily in a good way. In addition, several findings (e.g., Project ARTEC and Project TEAM) indicated that college students' current physical activity level is a critical factor in designing the intervention. Indeed, more extensive research on effectively promoting physical activity is necessary. Moreover, as several of these interventions exposed, it is important for the intervention to be based on theoretical models that accurately explain and predict behavior change.

Applying social cognitive theory. Social cognitive theory (SCT) expands social learning theory by becoming a general model of behavior functioning

rather than a general model of behavior acquisition (Bandura, 2001). According to SCT, human functioning is influenced by a triadic, reciprocal process involving personal factors, environmental factors, and behavior. Counter to behaviorists, Bandura (1986) argued that behavior is highly self-regulatory. Although the environment plays a role, it is the ability to stimulate cognitive processes that gives humans the capability to predict outcome expectations before a behavior is performed. That is, external sources of influences play a continuous role in motivating behavior. For example, if the climate where one lives permits doing physical activity outside, one might be more motivated to be active compared to if the climate has below freezing temperatures with snow and ice.

Simultaneously, however, people possess the ability to control their thoughts, feelings, and actions. Thus, there is a constant interplay between the environment and the self. Continuing the climate example above, one might know that it is beneficial to go outdoors and be active, however, if that individual is not in the mood or doesn't feel like doing it the choice can be made to be inactive. Through this interaction of environment and self, guides for behavior are created, individuals become motivated to behave in particular ways, and then evaluate the behavioral choices just enacted. Thus, if an individual chooses to not be active outdoors even though the climate is ideal this could create a pattern of behavior. That individual may never be motivated to be active outdoors, and will evaluate that choice every time it is made.

Often the self-evaluations of behavior are significantly impacted by the reactions of important others to the behavior. If that individual who never goes

outdoors to be active views important others (i.e., friends or family) performing activity outdoors and those important others question the individual's inactivity, the individual may reevaluate the behavioral choice. Therefore, response consequences teach people when and how to behave. This process between environment and self engages cognitive processes and determines human behavior.

There are five core determinants of behaviors in SCT – knowledge, self-efficacy, cognized goals, outcome expectations, and environmental factors. *Knowledge* pertains to knowing the health risks and benefits of a behavior, in this case physical activity. Knowledge is the initial phase of change (Bandura, 2004). This concept is similar to *response-efficacy*, which is defined as knowledge in the effectiveness of a specific behavior, such as, "being physically active will prevent obesity." If people do not know how their lifestyle choices affect their health, they are unlikely to change behaviors they enjoy, even if they are destructive. In order to overcome such obstacles, additional self-related influences beyond knowledge are necessary.

Self-efficacy is confidence in one's ability to successfully perform a behavior (Bandura, 1982). Self-efficacy regulates motivation, affect, and behavior and is influenced by four factors (Bandura, 1998). The first is past performance. According to Pekmezi, Jennings, and Marcus (2009) past performance is the most important of the four and has the greatest impact on self-efficacy. For example, past successes and/or overcoming barriers increases a person's self-efficacy. Conversely, past failures are difficult to let go of and

decrease self-efficacy. Second, vicarious learning affects self-efficacy such that observing someone similar to one's self successfully perform a behavior increases our efficacy in comparable situations. According to Bandura (1998), models not only set standards, but show competent ways to perform behavior, transmit knowledge, skills, and strategies to effectively overcome environmental demands, and teach. The third factor is social persuasion. Verbal persuasion that convinces an individual that they can master an activity can increase effort and minimize self-doubt. Persuasion should also be used to set attainable standards as well as encourage individuals to measure success in terms of improvement. Finally, somatic and emotional states affect self-efficacy. Stress and tension are often interpreted as inefficacy. Similarly, fatigue and pain reveal inability or incapability and attenuate efficacy levels. Positive mood, however, can increase self-efficacy. Bandura and associates (e.g., Bandura, Adams, & Beyer, 1977; Bandura, Adams, Hardy, & Howells, 1980) demonstrated that confidence in one's ability to perform a behavior has a strong impact on performance of that behavior.

The third SCT component is cognized *goals*, or results a person desires. Goals provide self-incentives and guide health behavior (Bandura, 1986). They can be both proximal and distal. For example, a proximal goal might include being able to do ten push-ups or run a mile, whereas a distal goal might include gaining muscle mass or being able to run a marathon. Short-term goals are often referred to as *intentions* (Bandura, 2004). "Short-term goals help individuals succeed by enlisting effort and guiding action in the here and now," whereas long-term goals set the course for behavior change (Bandura, 2004, p. 145). Self-

efficacy strongly regulates goal setting such that, individuals with higher self-efficacy are likely to set higher, more challenging goals. Goals are significant to behavior change because, when met, they assist in attaining success. Therefore, meeting one's goals encourage individuals to maintain the behavior.

Outcome expectations, or what we predict will happen following the performance of a particular behavior, is the fourth factor in SCT. Outcome expectations are influenced by three factors. The first is physical effects, including pain versus pleasure. If a behavior performed incurs pain, the individual will be unlikely to want to perform that behavior again. Second, social forces influence outcome expectations. Social forces are developed by societal norms and determine behavioral standards. Violation of a standard incurs censure from persons observing the behavior. Third is evaluative self-sanctions. This occurs when behavioral standards are accepted and is a way individuals can monitor their behavior in regards to what others expect.

Positive outcome expectancies provide incentives for individuals, while negative outcome expectancies provide disincentives (Bandura, 1998). Similar conceptually to outcome expectations are *attitudes*, which are essentially a measure of the perceived outcomes of the behavior and the value placed on those outcomes (Bandura, 1998, 2004). Both outcome expectations (Bandura, 1998) and attitudes (Ajzen, 2002) influence intentions and behavior.

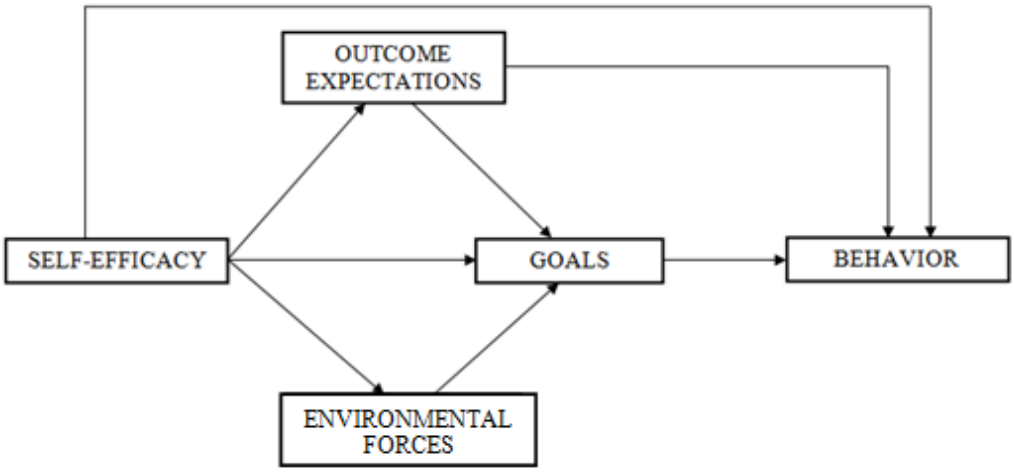
The final element of SCT is *environmental forces* that refer to facilitators and barriers to physical activity, including social and cultural factors as well as physical environmental factors. For example, social and cultural factors that

influence physical activity include family influence (Bauman, Sallis, Dzewaltowski, & Owen, 2002; Trost, Owen, Bauman, Sallis, & Brown, 2002), social support (Booth, Owen, Bauman, Clavisi, & Leslie, 2000; Courneya, Plotnikoff, Hotz, & Birkett, 2000; Duncan, Duncan, & Strycker, 2005; Wilcox, Castro, King, Housemann, & Brownson, 2000), and physician influence (Burton, Shapiro, & German, 1999; Clark, 1999). Physical environmental factors include facility accessibility and cost (Booth et al., 2000; Macdougall, Cooke, Owen, Willson, & Bauman, 1997), climate (Bauman, Smith, Stoker, Bellew, & Booth, 1991; King, Castro, Wilcox, Eyler, Sallis, & Brownson, 2000), safety (CDC, 1999; Ross, 2000), and location (Brown, Young, & Byles, 1999; Brownson, Eyler, King, Brown, Shyu, & Sallis, 2000), to name a few. Although researchers know these factors influence behavior, Fisher, Brownson, O'Toole, Shetty, Anwuri, and Glasgow (2005) and Hovell, Wahlgren, and Behrman (2002) stated that environmental factors were less studied in physical activity, particularly in interventions.

According to Bandura (2004), structural path models revealed that self-efficacy directly influences outcome expectations, intentions, environmental factors, and behavior; outcome expectations influence intentions and behavior; environmental factors influence intentions; and intentions influence behavior (see Figure 2). Thus, vital to behavior change and maintenance is self-efficacy and intentions. Knowledge is the precursor for change, and is therefore not included in the path model.

Figure 2

Structural Path Model of Social Cognitive Theory (adapted from Bandura, 2004, p. 146)



Social cognitive theory and physical activity behavior. SCT is a dominant theory in physical activity research. Bauman et al. (2002) in their meta-analysis of physical activity research discovered that 70% of the variables in the studies they examined were taken from SCT. Specifically, self-efficacy is the primary variable that is utilized. SCT is critical to understanding behavior change, especially physical activity adoption and maintenance.

Self-efficacy is critical to physical activity. Without self-efficacy, individuals are unlikely to consider changing behavior, and more important, they are unlikely to maintain physical activity levels. As Pekmezi et al. (2009) reported, lower self-efficacy in physical activity equated to self-doubt, low motivation, less commitment, giving up quicker, setting lower standards, and recovering slowly from failure. Persons with higher self-efficacy, however, tried

new behaviors, persevered, and pushed through challenging times. Thus, self-efficacy influences behavior, such that persons low in self-efficacy will likely rarely attempt to change behavior. Williams et al. (2008) found that self-efficacy was also important to physical activity maintenance. Additionally, Rimal (2000, 2001) found that self-efficacy determined whether individuals assess health risks and benefits. Those with low-efficacy, even if they are knowledgeable and perceive themselves to be susceptible to physical inactivity, will take no action to become more physically active.

Goals have been studied less frequently in relation to physical activity interventions (Rovniak, Anderson, Winnett, & Stephens, 2002). Lewis et al. (2008) found that goals were one of two most useful factors in an internet-based physical activity intervention. Similarly, Dunn, Marcus, Kampert, Garcia, Kohl, and Blair (1999) found that structured interventions that specifically target goal setting and goal achievement not only increased physical activity behavior but also experienced fewer declines in physical activity once the intervention was finished. Likewise, Rovniak et al. (2002) found a significant positive correlation between goals and physical activity behavior. Thus, helping individuals set and attain realistic goals is effective in changing behavior.

Some researchers have argued that outcome expectations are less important to health behaviors (e.g., deVries, Kok, Dijkstra, 1992; Kok, deVries, Mudde, & Strecher, 1991; Lechner & deVries, 1995). Bandura (1998), however, argued that "people do not act like weathervanes" (p. 7). Rather, they adopt standards to behave in ways that help an individual achieve self-worth and self-

satisfaction. Thus, people commonly behave in ways that align with societal norms and gain them the most benefit. In reviewing physical activity literature, outcome expectations appear to be less studied in physical activity. Dzewaltowski (1989) found that participants' greater satisfaction and belief in the positive outcomes of physical activity the more they were physically active. Williams et al. (2008) included outcome expectations in their study predicting that expectations would be important to physical activity adoption, but not maintenance. Interestingly, they found that outcome expectations were not important to either maintenance or adoption. Thus, outcome expectations might be less important to physical activity; however, it could be because a comprehensive measure does not yet exist (Bandura, 1998) or because if self-efficacy is being studied simultaneously, outcome expectations might not explain significant additional variance (Bandura, 1997).

A variety of environmental forces exist; however, researchers minimally focus on these factors with regards to physical activity interventions. Williams et al. (2008) included social support and environmental access in their study of physical activity adoption and maintenance and found that only environmental access was a significant predictor/determinant to adoption. Giles-Corti and Donovan (2002) found that the environment was a critical factor in physical activity, especially considering individual (e.g., self-efficacy, attitudes, social norms, and barriers to activity) and social environmental (e.g., how often do close friends, family, and significant others participate in physical activity) determinants. Recently, Winett, Williams, and Davy (2009) urged researchers to

include and examine a variety of environmental forces including social support, schedules, nutrition, access costs of fitness centers, comfort in a fitness gym, and guidance by others. Environmental forces play an important role and thus should be considered in physical activity research studies; however, because there are a wide array of factors that need to be considered at the collegiate level, this study does not explore them.

Magoc, Tomaka, and Bridges-Arzaga (2011) recently tested whether a web-based SCT-driven intervention providing learning lessons and modules would increase physical activity compared to a web-based control group that received minimal physical activity information. Participants were sedentary and insufficiently active college students. Findings revealed that the experimental group independently increased in the amount of their moderate or vigorous physical activity, while the control group revealed no changes. Thus, SCT is a useful theory upon which to design an intervention.

SCT provides a strong foundation on which to build interventions (King et al., 1992). As Boyle et al. (2011) argued, SCT-based interventions hold promise for increasing college students' physical activity behaviors. More research needs to be conducted applying theory to targeted messages and physical activity interventions. By focusing on the specific elements of social cognitive theory, researchers can promote behaviors as they highlight key factors that affect individuals engaging in said behavior.

Chapter 3

CURRENT STUDY

The 2008 physical activity guidelines recommend several ways for individuals to take action and increase physical activity levels (DHHS, 2008). Several of the suggestions for adults (aged 18-65 years) include personalizing the benefits by engaging in activities that are enjoyable, improve personal appearance, quality of sleep, and reduce feelings of low energy. Additionally, adults can set and attain personal goals. The recommendations also offer community (e.g., community-wide campaigns, PE classes, and programs) and community-level (e.g., parks and recreation, law enforcement, urban planning, transportation, education, architecture, employers and private organizations, health care, and public health) ideas for physical activity promotion. Efforts to promote physical activity in college students have utilized both the community (e.g., Project ARTEC) and community-level (e.g., Project GRAD and Project TEAM) approaches with limited success. Innovative approaches to reaching college students must be considered.

Predictions of Message Effectiveness

Whether messages targeting physical activity influence college students' behavior remain indeterminate. *Healthy People 2010* (2010) identify postsecondary institutions as ideal settings for health promotion efforts. One such way this can be done is by promoting physical activity behaviors through the use of targeted messages and honing in on theories that demonstrate effectiveness in health behavior change. Marmo's (unpublished data) focus groups revealed that

college students were in relative agreement regarding physical activity facilitators and barriers. This indicates that targeted messages could be effective in promoting physical activity. Moreover, Marmo (forthcoming) asked college students in focus groups to think of messages that they believed would be effective in motivating them to be physically active. When rereading the data, Marmo found that the messages were best understood if thematically-analyzed into the four concepts of social cognitive theory. Messages were coded into categories representing self-efficacy (past experience, vicarious learning, verbal persuasion, somatic and emotional states), environment, outcome expectations, and goals. Thus, the major components of SCT were perceived by college students to influence their physical activity behavior. SCT was particularly useful to explaining messages college students believed increased their physical activity behavior. Physical activity is a complex process "reflective of multiple personal, interpersonal, and environmental variables" (Nahas et al., 2004, p. 42).

Accordingly, this study will examine if theoretically driven messages affect physical activity indicators, such as attitudes and self-efficacy, and physical activity behavior itself. In the study reported here, messages were delivered only once; however, participants were assessed immediately following message reception (i.e., Time 1), and one week later (i.e., Time 2). In this way, short-term physical activity indicators were assessed as well as knowing if the messages sustain any changes over a one week time period. Moreover, two conditions received the SCT messages while a third condition received no messages. The following hypotheses are offered:

H1: At Time 1, participants receiving messages (i.e., personal trainer and friend conditions) will have more favorable attitudes toward physical activity compared to those in the control condition.

H2: At Time 1, participants receiving messages (i.e., personal trainer and friend conditions) will have higher self-efficacy regarding physical activity compared to those in the control condition.

H3: At Time 1, participants receiving messages (i.e., personal trainer and friend conditions) will have higher response-efficacy regarding physical activity compared to those in the control condition.

H4a: At Time 1, participants receiving messages (i.e., personal trainer and friend conditions) will have more positive outcome expectations regarding physical activity compared to those in the control condition.

H4b: At Time 1, participants receiving messages (i.e., personal trainer and friend conditions) will have lower negative outcome expectations regarding physical activity compared to those in the control condition.

H5: At Time 1, participants receiving messages (i.e., personal trainer and friend conditions) will have higher physical activity intentions compared to those in the control condition.

H6: At Time 2, participants receiving messages (i.e., personal trainer and friend conditions) will have more favorable attitudes toward physical activity compared to those in the control condition.

H7: At Time 2, participants receiving messages (i.e., personal trainer and friend conditions) will have higher self-efficacy toward physical activity compared to those in the control condition.

H8: At Time 2, participants receiving messages (i.e., personal trainer and friend conditions) will have higher physical activity intentions compared to those in the control condition.

H9: At Time 2, participants receiving messages (i.e., personal trainer and friend conditions) will have higher levels of physical activity behavior compared to those in the control condition.

Message Source

Although the DHHS recommendations offer many physical activity promotion ideas, they are missing a potentially key component. There is no mention of relationships and the importance of other people in supporting physical activity. Two notable exceptions include: the suggestion for adults to help a spouse lose weight as a means to personalize the benefits of physical activity and communities offering interventions such as organizing a buddy system or walking group. Both of these recommendations, though hidden under fancy headlines and numerous bullet points, emphasize the use of relationships to physical activity.

This trend to de-emphasize relationships is echoed in research. As discussed above, Kreuter and Skinner (2000) proposed five levels of communication: generic, targeted, personalized, tailored, and interpersonal. Noticeably missing is the relational level. Targeted messages delivered by

friends, family, or significant others likely motivate individuals to be physically active compared to messages delivered via billboard, commercials, or even physicians. Researchers call for future research to examine social factors (King et al., 1992) and important relationships (Winett et al., 2009). Interpersonal relationships are important as they affect individual health and well-being (Berkman & Glass, 2000). As Keating et al. (2005) state in their meta-analysis of college student physical activity behaviors, multi-level approaches (i.e., personal, psychosocial, and environmental) are necessary for the college student population. The social environment is recognized as an important influence in health behavior research (Emmons, 2000; DHHS, 1996). The social environment influences behavior by "shaping norms, enforcing patterns of social control, providing or not providing environmental opportunities to engage in particular behaviors, reducing or producing stress, and placing constraints on individual choice'' (Institute of Medicine, 2003). Attempting to change physical activity behavior without considering the social environment is unlikely to produce behavior change (McNeill, Kreuter, & Subramanian, 2006).

Therefore, this study explores the impact of the message source on physical activity outcomes. Previous interventions utilized peer educators, a buddy system where the participants did not know one another, and health classes taught by behavior and exercise science faculty. Although receiving messages might increase physical activity intentions and behavior, the impact of the message source has yet to be examined. Specifically, this experiment tests

whether messages delivered by a friend are more effective than messages delivered by a personal trainer.

French and Raven (1958) stated that interpersonal power is the basis of interpersonal influence. Interpersonal influence is the ability to persuade another. French and Raven developed a taxonomy of interpersonal power – reward, coercive, legitimate, referent, and expert power. The types of social power examined in this study are expert and referent as it compares a personal trainer to a friend. Expert power exists because individuals believe the other knows "better" than they do; it is assumed that the expert is correct. Experts do not need to present a persuasive argument to encourage change; it is the simple fact that they are the expert and therefore what they say regarding their subject of expertise must be true. Referent power comes from the term *reference group,* which describes groups with which individuals identify and feel psychologically-involved. Groups define and provide norms and values (Kelley, 1952; Turner, 1991). By definition, referent power is having power over another based on the fact that there is identification between people in a dyad or group. Identification occurs when two individuals share similarities, benevolence, respect, and acceptance. Although friends are relationally closer and likely hold more persuasive power than strangers do, personal trainers would likely hold greater credibility in terms of the goals of the study and information provided.

Power and physical activity. Physical activity research for older adults highlights the importance of expert power (i.e., use of physicians) to increasing physical activity behavior (e.g., Carroll, Lewis, Marcus, Lehman, Shaffer, &

Sciamanna, 2010; Spink & Wilson, 2010). This type of power, however, leads to externalized motivation as individuals participate in a behavior in order to avoid feelings of guilt or disappointment (cf, Deci, 1975; Kelman, 1958). This change in behavior occurs over the short-term, but is less likely to be sustainable over time because the choice to perform the behavior was attributed to external forces and has not created personal responsibility for the individual (Rodin & Janis, 1979; Shaw & Condelli, 1986).

Fischer and Bryant (2008) examined expert power comparing personal trainers working with students over the course of a semester to a control group who received no assistance in physical activity. Students in the control group regressed more over the semester compared with those in the personal trainer group. Moreover, those in the personal trainer group demonstrated a significantly, positive pattern of physical activity behavior. Similarly, Jones, Sinclair, and Courneya (2003) had experts deliver positively or negatively framed messages from either a credible or non-credible source. Participants receiving positively framed messages from a credible source reported higher exercise intentions and behaviors. Other interventions studying college students (e.g., Boyle et al., 2011; Jung & Heald, 2009; Project GRAD; Project TEAM) utilized a health education expert to deliver tailored information. These interventions were successful in producing short-term increases in physical activity behavior. All of these studies compared expert power to a control group. Indeed, people are more likely to do something because an expert tells them to (Abrams & Hogg, 1990).

Referent power, on the other hand, as Rodin and Janis (1979) argue, is currently the least used type of power in health care. Referent power, however, is critical to promoting internalized motivation (Rodin & Janis, 1979), personal empowerment (Ryn, 1997), and thus sustainable, rather than short-term, behaviors. Research (e.g., Allen, 1975; Janis, 1982, 1983; Walker & Heyns, 1982; Wallerstein, 1992) reveals that individuals behave more consistently with norms when they are communicated by important others due to internalization of the norm. Relationships establish social norms that enable or constrain health behaviors (Berkman, 2000; Heaney & Israel, 1997). Janis and colleagues (Janis, 1982, 1983; Tedeschi & Lindskold, 1976) found that referent power was effective in changing weight loss and smoking cessation goals. Moreover, referent power increased individual participant self-esteem and sense of control (Janis, 1982, 1983). These findings are consistent across a variety of outcomes as well as for both short-term and long-term changes (Ryn, 1997).

Project IMPACT examined a buddy system; however, participants did not initially know the person and thus the experiment was unsuccessful. In an effort to address closer relationships, Ullrich-French, Smith, and Cox (2011) studied the relationship between best friends, motivation, and physical activity behavior. They found that best friend attachment predicted high levels of relatedness, which increased autonomous motivation. Thus, best friends helped one another internalize feelings regarding physical activity, and are a good source of referent power. Although relatedness was not associated with physical activity behavior (Ullrich et al., 2011), self-determined motivation is positively correlated with

higher levels of physical activity (Fortier et al., 2007; Milne et al., 2008; Wilson et al., 2006). Lacaille, Nichols Dauner, Krambeer, and Pedersen (2011) conducted focus groups with college students and both male and female participants agreed that close friends increased physical activity motivation and participation, as well as held them accountable to their goals.

Moreover, Bandura (1998) argued for the importance of support to health-related behaviors. Social support from a spouse, family, and/or friends is positively correlated with increases in physical activity (Eyler, Brownson, Donatelle, King, Bwon, & Sallis, 1999; Sallis, Hovell, & Hofstetter, 1992; Sternfeld, Ainsworth, & Quesenberry, 1999). In particular, researchers (e.g., Okun, Karoly, & Lutz, 2002; Prochaska, Rodgers, & Sallis, 2002) found that for college students, close friends are more powerful motivators than family in regards to physical activity behaviors. Similarly, Leslie et al. (1999) found that a lack of support from close friends for college students predicted physical inactivity. Specifically, Okun, Ruehlman, Karoly, Lutz, Fairholme, and Schaub (2003) found that social support predicted moderate and vigorous leisure-time physical activity. Overall, higher levels of social support predict physical activity initiation (Verheijden, Bakx, van Weel, Koelen, & van Stavem, 2005) and adherence (Courneya & McAuley, 2005; Felton & Parsons, 1994; Kahn et al., 2002; Treiber, Baranowski, Braden, Strong, Levy, & Knox, 1991; Wing & Jeffrey, 1999), such that friends who feel supported and believed their friends regarded physical activity as important are more likely to be active.

Although social support is only one component of a close friendship, its effects on physical activity behaviors are substantial. Specifically, social support moderates the effect between self-efficacy and physical activity, thereby fostering health-promoting behaviors (Cutrona & Troutman, 1986; Duncan & McAuley, 1993; Major, Mueller, & Hildebradt, 1985; Rovniak et al., 2002). Moreover, studies on physical activity that include a social support measure repeatedly reveal a positive relationship between support and activity levels (Booth et al., 2000; Courneya et al., 2000; Duncan et al., 2005; Wilcox et al., 2000). Thus, referent power should promote and sustain physical activity.

As expert and referent power have not yet been examined simultaneously in regard to physical activity, this study compares different message sources, as well as assesses the relational level lacking from Kreuter and Skinner's (2000) levels of communication. Moreover, participants will be assessed at Time 1, immediately following message reception, and Time 2, one week following receiving the messages. As past research suggests, expert power might lead to immediate change that may not be maintained over time as individuals are behaving as a means to comply with the expert. Referent power, however, might yield more long-term changes as individuals do the behavior for their own inherent good. Given that Marmo's (unpublished data) findings revealed that college students are predominantly extrinsically motivated, referent power might be an effective way to shift students into more internalized motivation regulation and promote sustainable physical activity behaviors. Moreover, as college is a time where students are influenced by their close friends' decisions and behaviors,

it is possible that a close friend could be more effective in changing behavior than a personal trainer. Accordingly, in alignment with the proposed hypotheses above, the following research questions examine whether messages relying on referent power (friend) are more or less effective than messages relying on expert power (personal trainer).

RQ1: At Time 1, will there be differences in attitudes toward physical activity between participants who received messages from a friend, participants who received messages from a personal trainer, and the control condition?

RQ2: At Time 1, will there be differences in self-efficacy toward physical activity between participants who received messages from a friend, participants who received messages from a personal trainer, and the control condition?

RQ3: At Time 1, will there be differences in response-efficacy toward physical activity between participants who received messages from a friend, participants who received messages from a personal trainer, and the control condition?

RQ4a: At Time 1, will there be differences in positive outcome expectations regarding physical activity between participants who received messages from a friend, participants who received messages from a personal trainer, and the control condition?

RQ4b: At Time 1, will there be differences in negative outcome expectations regarding physical activity between participants who

received messages from a friend, participants who received messages from a personal trainer, and the control condition?

RQ5: At Time 1, will there be differences in physical activity intentions between participants who received messages from a friend, participants who received messages from a personal trainer, and the control condition?

RQ6: At Time 2, will there be differences in attitudes toward physical activity between participants who received messages from a friend, participants who received messages from a personal trainer, and the control condition?

RQ7: At Time 2, will there be differences in self-efficacy toward physical activity between participants who received messages from a friend, participants who received messages from a personal trainer, and the control condition?

RQ8: At Time 2, will there be differences in physical activity intentions between participants who received messages from a friend, participants who received messages from a personal trainer, and the control condition?

RQ9: At Time 2, will there be differences in physical activity behavior between participants who received messages from a friend, participants who received messages from a personal trainer, and the control condition?

Chapter 4

PILOT STUDY METHODS AND RESULTS

A pilot study tested the feasibility of several measures for use in the main study. First, the targeted messages developed qualitatively (Marmo, forthcoming) warranted empirical support as the use of focus groups made it difficult to quantify participants' perception of message effectiveness. For example, the researcher noted that participants generally offered agreement when a message was mentioned; however, individuals were not required to quantify their thoughts on each message. Second, a modified version of the Stanford Brief Activity Scale (SBAS; Taylor-Piliae et al., 2006) was evaluated. To ensure the protection and well-being of participants, all procedures were conducted in compliance with and approval from the university's Institutional Review Board (see Appendix A).

Participants

Participants were recruited from communication courses at a large Southwest University. Initially 735 students completed the survey; respondents who took less than five minutes to complete the survey or who did not complete the survey in its entirety were dropped to maintain the integrity of the dataset. In addition, respondents who were not aged 18 to 25 or college athletes (i.e., competed in a University-affiliated sport or club team – but not intramural participants) were excluded from this study. Because the focus of the main study is on the average undergraduate college student's physical activity behavior, both participants' age and competitive sport participation were eliminated. Thus, 536 participants were retained (250 men and 286 women) ranging in age from 18 to

25 years (*M* = 20.44, *SD* = 1.70). Participants described themselves as Caucasian (69.2%), Hispanic (12.5%), Asian/Pacific Islander (7.1%), African American (3.5%), Native American (0.7%), and "other" (7.0%). Participants were freshmen (26.3%), sophomore (26.7%), junior (24.3%), senior (18.1%), and fifth year (4.5%).

Measures

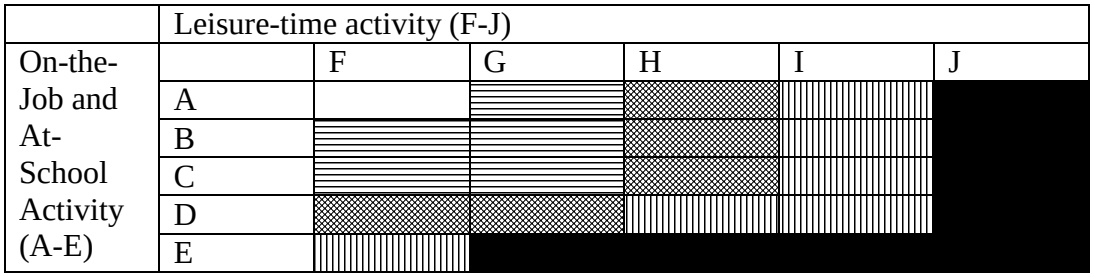
Targeted messages. Messages emerging from Marmo's (forthcoming) focus group data were assessed (see Appendix B for all messages). College students in the focus groups presented messages they believed were successful at motivating them to be active. These messages were then thematically analyzed into four social cognitive theory concepts – self-efficacy, outcome expectations, goals, and environmental factors. Because college students reported extreme diversity in environmental factors, this concept was not included in the current study. Using 7-point scales, participants responded to a total of 39 messages to indicate their perceptions of messages' effectiveness in promoting their own physical activity. Mean scores for each message were ranked on the extent to which they believed each message was effective (1 = not at all effective to 7 = highly effective). Example messages include, "Physical activity will be beneficial in the end," "My clothes don't fit like they should; I need to get to the gym," "I want to look good for an event, I need to be active," and "There's no good reason for me to quit or not do physical activity."

Stanford brief activity survey. The Stanford Brief Activity Survey (SBAS) is a self-report measure of global physical activity behavior (Taylor-

Piliae et al., 2006) (see Appendix C). The SBAS consistently yields valid and reliable results (Taylor-Piliae et al., 2006; Taylor-Piliae et al., 2010). The original SBAS assessed on-the-job activity and leisure-time activity. To calculate college student physical activity behavior, the on-the-job activity portion was modified to include time at school and on-the-job job activity. The modification of this measure accounted for the amount of time students spend at school and not necessarily at a job. Participants reported their physical activity by selecting one of five responses for both on-the-job/at-school activity and leisure-time activity. Crossing these two categories yielded a measure of five levels (inactive, light-intensity, moderate-intensity, hard-intensity, and very hard-intensity) of physical activity behavior (see Figure 3 below). For example, one option is "I spent most of the day sitting or standing. When I was at work or school, I did such things as writing, typing, talking on the phone, assembling parts, or operating a machine that takes very little exertion or strength. I did not lift or carry anything for more than a few minutes each day."

Figure 3

Stanford Brief Activity Survey (adapted from Taylor-Piliae et al., 2006, p. 606)



Note: Illustration of SBAS scoring: inactive = solid white, light-intensity activity = horizontal lines, moderate-intensity activity = trellis pattern, hard-intensity activity = vertical lines, and very hard-intensity activity = solid black. Refer to Appendix C for explanations of A-E and F-J.

International Physical Activity Questionnaire. The International Physical Activity Questionnaire (IPAQ) is a self-report measure that assesses physical activity behavior (see Appendix D). This measure has undergone extensive testing and research that indicates that it is both reliable and valid (Booth, 2000). The short version was utilized with participants identifying the frequency and duration of their vigorous activity, moderate activity, walking, and inactivity for the previous seven days (IPAQ, 2011). A physical activity score, i.e., a MET-minute, was calculated for each participant by multiplying the number of minutes per week spent engaging in intense exercise by its metabolic equivalent of task (MET) value (Godin & Shephard, 1985). Essentially, a MET is the basic unit of metabolism; i.e., energy cost consumption during specific physical activities as multiples of resting metabolic rate (RMR). By convention, 1 MET is considered the resting (e.g., quiet sitting) metabolic rate (Byrne, Hills, Hunter, Weinsier, & Schutz, 2005). The intensity of physical activity increases the metabolism and is classified via corresponding METs. Specifically, vigorous activities (e.g., heavy lifting, digging, aerobics, or fast bicycling) correspond to 8.0 METs, moderate activities (e.g., carrying light loads, bicycling at a regular pace, or doubles tennis) to 4.0 METs, and walking activities to 3.3 METs (IPAQ, 2011). For example,

> vigorous MET-minutes/week = 8.0 * vigorous-intensity minutes * vigorous-intensity days.

By summing the three intensity-level scores (excluding inactivity), a continuous physical activity variable for each participant is created.

Procedure

Data were collected via an online survey with students receiving a small amount of extra credit for their participation in this study. Participants responded to questions regarding their physical activity behaviors and the messages they believed motivate them to be active.

Data Analysis

To determine the messages that students perceived to be the most effective at promoting their own physical activity, a means table was constructed. Mean evaluations for each message were compared with the top two messages from each SCT concept – self-efficacy, outcome expectations, and goals – being selected for the experimental study. To determine if the modifications to the SBAS were valid, a correlation was run on the modified SBAS and IPAQ scores.

Results

Targeted messages. To examine which messages students believed were most effective in motivating them to be physically active, messages were compared in a means table. The two messages with the highest means from each of the three SCT concepts – self-efficacy, outcome expectations, and goal-oriented messages – were selected for use in the full study. The top self-efficacy messages included, "Physical activity is not going to kill me; I can do it" (M = 5.84, SD = 1.33) and "Physical activity is not that bad; I should try it" (M = 5.78, SD = 1.31). Outcome expectancy messages included, "Physical activity will be beneficial to me in the end" (M = 6.16, SD = 1.18) and "I'll feel better about myself after being active" (M = 5.95, SD = 1.19). Goals messages included, "Set

goals to be more active; I can get in better shape" (*M* = 5.72, *SD* = 1.21) and "By doing physical activity, I am meeting my goal of getting stronger" (*M* = 5.67, *SD* = 1.21). See Table 1 for means of each message by message type.

Table 1

Means Table for Pilot Study: Each Message by Message Type and Mean Totals

Item	1.	2.	3.
Physical activity will be beneficial in the end.			**6.16**
I'll feel better about myself after being active.			**5.95**
I will be happy with myself after I do physical activity.			5.90
It is valuable for you to be physically active.			5.89
Physical activity is not going to kill me; I can do it.	**5.85**		
I am working out because I will feel good.			5.79
Physical activity is not that bad; it will get easier the more I do it.	**5.78**		
I can get in better shape - be more active.		**5.73**	
By doing this activity, I am getting stronger.		**5.67**	
I owe it to my body to give it one hour of activity.	5.63		
Push; I can do this activity.	5.62		
I'm trying to get to this overall goal, if I'm not active I won't get there.		5.59	
Get up and go; be active! I can do it!	5.58		
Bear through this physical activity.	5.57		
I look good and feel good now all because of the physical activity.			5.57
Changes don't occur overnight when you are active, remember your goals.		5.55	
If s/he can be active, I can do it.	5.50		
Don't be weak in this activity.	5.45		
If I can do this activity, imagine what else I can do.	5.41		
There's no good reason for me to quit or not do physical activity.	5.40		

I'm doing this to stay active.		5.39	
I want to look good for this guy or girl.		5.37	
I have discipline to do this activity.	5.35		
I'm already being active, I might as well finish.	5.22		
Look at those people who are being physically active, so should I.	5.19		
My goal is not beneficial unless I am active.		5.18	
I can get guys/girls with this body.		5.10	
By doing this activity I am losing weight.		4.95	
I have nothing better to do, might as well be active.	4.90		
I need to burn the calories I already ate or the calories I want to be eating.		4.81	
My clothes don't fit like they should; I need to get to the gym.		4.68	
The people around me are working hard in their physical activities.	4.67		
If I do physical activity X many times this week, I can do Z event (e.g., party, wear bathing suit, go out).		4.55	
I was in such better shape a few years ago.	4.37		
If I do physical activity X many times this week, I can eat X.		4.18	
If I do physical activity X many times this week, I can drink Y.		4.12	
I was not in shape before being active; I don't want to go back to that.	4.11		
TOTAL MEAN	4.48	3.46	4.53

Modified SBAS. The modified SBAS included the addition of "at-school" to the on-the-job category, was tested. Participants reported being inactive (3.0%), light (39.3%), moderate (24.3%), hard (22.6%), and very hard (9.9%). As a means to run a validity check on the modified SBAS, participant scores on the modified SBAS were compared to responses to the IPAQ. To determine if a correlation existed between the modified SBAS and the IPAQ a Spearman's Correlation Coefficient (rho) was computed, $r_s(534) = .34$, $p < .001$.

Thus, the modified SBAS was acceptable for use as there was a significant, positive correlation between the two self-report measures of physical activity behavior.

Conclusions

First, the pilot study provided the messages that students perceived to be most effective in promoting their physical activity behaviors. These messages will be used in the experiment to determine if students receiving these messages will have higher physical activity intentions and behavior. Second, the modification of the SBAS resulted in an acceptable measure that can be used in the experiment to randomize participants based on their current level of physical activity.

Chapter 5

MAIN STUDY METHOD

Participants completed an online screening questionnaire to determine if they were eligible for participation in the study. Those selected for the study were randomly assigned to one of three conditions (i.e., one of the two experimental conditions – personal trainer or friend – or the no message control condition). Once selected, participants came to the laboratory to engage in the experiment and complete the Time 1 survey. One week later, participants completed the Time 2 survey online. All study procedures received approval from the University's Institutional Review Board to ensure the protection of participants (see Appendices E-G).

Participants

Participants were recruited from communication courses at a large Southwest University. Initially 452 students completed the online screening questionnaire. Respondents (n = 140) who were not aged 18-25, were a collegiate athlete (e.g., they participated in a University-sanctioned sport), or who participated in the procedural pilot study were excluded from this study. Respondents who met the criteria (n = 312) were invited to participate in the study by signing up for a time to come to the lab. Of those invited, 65 did not respond to the invitation, 17 signed up but skipped their lab time, and 108 were provided an alternate assignment as they were not needed in the experiment. The remaining 122 participants completed the study. Ten participants were excluded from the study because the message sender violated the predetermined message

instructions or did not take the message delivery seriously (i.e., three from the personal training condition and seven from the friend condition); and four participants were excluded from the study because they completed the Time 2 follow-up after the final deadline passed. Thus, the final sample consisted of 108 participants (54 men and 54 women) ranging in age from 18 to 25 years (M = 21.21, SD = 1.47). Participants described themselves as Caucasian (65.8%), Hispanic (13.7%), Asian/Pacific Islander (7.3%), African American (5.6%), Native American (1.0%), and "other" (6.6%). Participants were freshmen (10.2%), sophomore (17.6%), junior (26.9%), and senior (43.4%).

Experimental Design

Independent variable. This study utilized a one-way experimental design. The independent variable was message source. The same six targeted messages were delivered to participants in the experimental conditions, while the control group received no messages to determine if participants receiving messages increased in physical activity indicators.

***Message source manipulation*.** Participants in the experimental conditions received the targeted messages from one of two sources to assess if message source affects the effectiveness of the messages. Specifically, messages were delivered by one of two same-sex sources: a personal trainer or a friend. Male participants interacted with a male personal trainer, while female participants interacted with a female personal trainer. One male and one female personal trainer were hired and prepared by the researcher to deliver the social cognitive theory messages.

The same-sex dyadic composition was also required in the friend group. Friends were trained on the spot regarding their role in the study. The friend and participant were separated upon arrival at the laboratory so the close friend could be trained. The friend received written and oral instructions from the experimenter advising him/her to engage in a three to five minute conversation with the participant about physical activity. The instructions also indicated that the friend needed to deliver the six target messages, and *only* those messages, during the conversation. Friends were informed that they could not say anything other than the target messages and that each message must be delivered at least once. Friends were given a clipboard containing the target messages for the conversation. They were told that they must be discreet about the messages and to try to make message delivery as natural as possible (i.e., not to read directly from the clipboard). Once the friend agreed to the role, s/he signed a consent form. The friend was then allowed several minutes to review the directions and messages.

Same-sex dyads were utilized as research on power has found that men are less persuaded by a woman than by a man (Ridgeway, 1981). The message source presented the six messages to participants in the course of a brief conversation. Participants in the control condition received no messages.

Targeted messages. The two messages with the highest means from each of three social cognitive categories (self-efficacy, outcome expectations, and goal-oriented; six messages total) in the pilot study were compiled for this study (see Appendix E). Because the messages were delivered by either a personal trainer or

a friend compared to the pilot study where participants rated the message, the pronoun in each sentence was changed from first person to second person for both message source conditions. For example, efficacy messages targeted students' abilities to be active and were changed from "Physical activity is not going to kill me; I can do it" to "Physical activity is not going to kill you; you can do it." Outcome expectation messages highlighted the results immediately attained following physical activity, for example, "You'll feel better about yourself after being active." Goal-oriented messages focused on goal-setting or reminding them of current goals, for example "Set goals to be more active; you can get in better shape."

Instrumentation

The random assignment criteria (i.e., physical activity behavior) and dependent measures (i.e., attitudes, self-efficacy, response-efficacy, outcome expectations, intentions, and physical activity behavior) are described below. All measures for both time and source conditions appear in Appendices I-M.

Random assignment criteria. To ensure that levels of physical activity varied equally across each condition, participants were randomly assigned to conditions based on their levels of physical activity. An equal number of participants at each physical activity level based on the SBAS were randomly assigned into each group.

Physical activity level. The pilot study revealed the modification of the SBAS acceptable, thus it was utilized. This measure asked students to report on their physical activity behavior during their time at school and at a job, if they

have one, as well as during their leisure-time. Participants selected one of five options for both on-the-job/at-school time and leisure-time roughly ranging from inactive to highly active. Crossing these two categories (school/job by leisure-time) yielded a global measure of physical activity behavior (see Figure 3 in Chapter 4). Although the SBAS provided five categories of physical activity (inactive, light, moderate, hard, and very hard), the pilot study revealed that few participants were in the inactive (2.9%) and very hard (9.9%) categories. Thus, the decision was made to merge the inactive and light categories as well as the hard and very hard categories yielding three levels of physical activity – low, moderate, and high.

Dependent measures. Seven dependent variables were utilized in this experiment. Response-efficacy, positive outcome expectations, and negative outcome expectations were assessed only at Time 1. Attitudes, self-efficacy, and intentions were assessed at both Time 1 and Time 2, while physical activity behavior was evaluated only at Time 2.

Attitudes. Five items developed by Ajzen and Fishbein (1980) were used for attitudes. An attitude score was developed by averaging scores from five semantic differential scales ("physical activity is…" bad/good, undesirable/desirable, unfavorable/favorable, unimportant/important, insensible/sensible). Participants rated their attitudes toward physical activity attitudes on a 7-point interval scale coded such that higher scores indicate more favorable evaluations. Assessments were reliable both at Time 1 ($\alpha = .78$) and Time 2 ($\alpha = .86$).

Self-efficacy. Self-efficacy beliefs were assessed with three Likert-type items, each accompanied by a 7-interval response scale (1 = strongly disagree, 7 = strongly agree) (Witte, Berkowitz, Cameron, & McKeon, 1998). Items were coded such that higher scores indicate greater levels of self-efficacy. Items included "I am able to be physically active," "I am confident I can be physically active," "It is easy to be physically active." Time 1 yielded a reliability of .78 with Time 2 revealing a reliability of .86.

Response-efficacy. Response-efficacy was measured with four Likert-type items, each with a 7-interval response scale (1 = strongly disagree, 7 = being strongly agree) (Witte et al., 1998). Items were, "Physical activity is valuable to a healthy life," "Physical activity prevents health conditions, such as diabetes, obesity, high cholesterol, high blood pressure, and other illness," "Physical activity prolongs my life," and "Physical activity helps with weight management." Items were scored such that high scores reflect high response efficacy. Time 1 yielded a reliability of .93.

Outcome expectations. Rovniak et al.'s (2002) Outcomes of Exercise measure, a modified version of the Benefits of Physical Activity Scale (BPA), measured outcome expectancies. A total of 27-items assessed outcome expectations -- 14-items assessed positive outcome expectations(e.g., "If I participate in physical activity regularly then I will improve my self-esteem"), and 13-items assessed negative-outcome expectations (e.g., "It will take away from the time I have to spend with my friends"). Participants rated each outcome on a 1 (not at all likely) to 5 (extremely likely) scale. Higher mean scores indicated the

outcomes were extremely likely. Evaluation occurred at Time 1 for positive outcomes (α = .85) and Time 1 for negative outcomes (α = .81).

Intentions. Dzewaltowski, Noble, and Shaw (1990) assessed intentions using a four-item measure that yielded high reliability. Participants rated the extent to which they disagreed or agreed with each statement on a 7-point Likert-type scale, with 1 strongly disagree and 7 strongly agree. Items were coded such that higher scores indicated greater intentions. Statements include, "I will try to be participate in physical activity," and "I intend to participate in physical activity," "I have decided to participate in physical activity," and "I am determined to participate in physical activity." Evaluation occurred Time 1 (α = .95) and Time 2 (α = .95).

Physical activity behavior. The International Physical Activity Questionnaire (IPAQ) is a self-report measure that evaluates physical activity behavior. This study used the scale's short version at Time 2 where participants identified the frequency and duration of their vigorous activity, moderate activity, walking, and inactivity for the previous seven days (IPAQ, 2011). For a description of the calculation of physical activity as a continuous variable see the *IPAQ* description in the pilot study measures section. Because this measure can range from 0 to 81,000 (i.e., if a person were to do vigorous activity for 24 hours a day 7 days a week), this variable might not be normally distributed. In assessing skew and kurtosis, findings revealed that the distribution was positively skewed (2.55) and extremely leptokurtic (10.66). A square root transformation was performed on this variable, with results suggesting that the transformation

made the variable more normally distributed (skew = .70, kurtosis = 1.34). The square root transformation was utilized in all subsequent analyses.

In addition, each component (vigorous, moderate, and walking activity, as well as inactivity) can be analyzed individually. By using the amount of time per week participants responded (i.e., vigorous days per week * vigorous minutes per week), a single measure for each participant is calculated. Similar to the overall measure, these individual components are likely to be not normally distributed (i.e., vigorous activity skew = 2.49, kurtosis = 8.73; moderate activity skew = 3.14, kurtosis = 13.01; walking activity = 2.68, kurtosis = 8.50). A square root transformation was performed all three components revealing normally distributed data (vigorous activity skew = .45, kurtosis = .25; moderate activity = .89, kurtosis = 1.49; walking activity = 1.04, kurtosis = 1.59). The square root transformation was utilized in all subsequent analyses. The inactivity component revealed normal distribution (skew = .63, kurtosis = .31) and therefore was not transformed.

Overall means, standard deviations, and reliability coefficients for all dependent measures appear in Table 2 below.

Table 2

Overall Means, Standard Deviations, and Reliability Coefficients for Experimental Study Variables

	Time 1			Time 2		
Study Variables	*M*	*SD*	*α*	*M*	*SD*	*α*
Attitudes	6.36	.66	.78	6.47	.76	.86
Self-Efficacy	6.20	.89	.78	6.07	1.14	.86
Response-Efficacy	6.63	.80	.93	--	--	--
Positive Outcome Expectations	4.25	.52	.85	--	--	--
Negative Outcome Expectations	2.18	.57	.81	--	--	--
Intentions	6.24	.99	.95	6.21	1.00	.95
Physical Activity Behavior[a]	--	--	--	61.69	28.18	--
Vigorous Activity	--	--	--	12.25	8.76	--
Moderate Activity	--	--	--	14.77	10.55	--
Walking Activity	--	--	--	19.13	11.25	--
Inactivity	--	--	--	378.93	198.84	--

[a]Calculated as a MET-minute and reported using the transformed numbers

Descriptive Measures

Stage of change. Prochaska and DiClemente (1984) proposed the Transtheoretical Model (TTM), which states that individuals move through five

stages when considering change regarding a particular behavior. Those stages include precontemplation (no intention to change), contemplation (seriously considering change), preparation (making small changes), action (actively engaging in the behavior), and maintenance (continuation of successful behavior performance)[1]. Participants selected the stage of change they believed they were in regarding physical activity behavior (Schumann, Estabrooks, Nigg, & Hill, 2003). Marcus et al. (1992) validated this version of participants' stage of change while Courneya (1995) determined this version to be reliable. This instrument defined regular physical activity as "any physical exertion intended to improve or maintain physical fitness and health, performed at least 30 minutes of moderate physical activity five days per week or at least 45 minutes of vigorous physical activity three days per week." Five statements were provided each of which represents one stage of change. The participant was asked to mark the statement that best represented his/her current physical activity behavior: precontemplation "I am inactive and not thinking about becoming more active," contemplation "I am inactive, but am thinking about becoming more active," preparation "I am doing some physical activity but not on a regular basis," action "I do enough physical activity but I have only done so within the last 6 months," and maintenance "I make physical activity a habit by engaging in regular activity and I've done so for longer than 6 months."

[1] Given that the stage of change and physical activity level are strongly related conceptually (i.e., those who are more active are likely in a higher stage of change) and empirically (Pilot Study: $r = .63$, $p < .001$; Experimental Study: $r = .61$, $p < .001$), stage of change was not utilized in any analyses for this study. This association, however, supports grouping the physical activity level into three categories as opposed to five since the correlation remains high for both the pilot study, which evaluated five levels, and the experiment, which utilized three levels.

Physical activity view. Participants were asked to describe their current view of their own physical activity behavior. Participants selected one of three options, "I currently do enough physical activity," "I need to be doing more physical activity," and "I'm not sure." This measure was included to help understand college students' perceptions of their own physical activity.

Body mass index (BMI). Participants reported their height and weight in order to calculate BMI, a measure of body fatness (CDC, 2011). A BMI below 18.5 indicates a person is underweight; 18.5 – 24.9 reveals a normal weight range; 25.0 – 29.0 indicates overweight; and 30.0 and above is morbidly obese. Persons who are overweight or obese are at higher risk for chronic conditions, such as diabetes, high cholesterol, and high blood pressure.

Covariate

The randomization of participants in the experiment was conducted using physical activity level measured by the SBAS. To control for this design, physical activity level was included in the analyses as a covariate. For a description of the measure see *physical activity level* above.

Manipulation Verification

All participants in message conditions completed source closeness and credibility scales. The check was used to ensure that participants receiving messages from a friend brought a close friend to the study. In addition, the check was utilized to ensure that participants receiving messages from a personal trainer believed the trainer to be credible.

Closeness measure. Aron, Aron, and Smollan (1992) established the Inclusion of Other in the Self (IOS) measure to assess closeness. Venn-like diagrams represent varying degrees of closeness contingent on the overlap of the two circles (one labeled "self" and the other labeled "other"). Participants selected from seven circles the circle that best represents the level of closeness they believe indicates their relationship. Aron et al. (1992) conducted extensive research on this scale to ensure its validity.

Credibility measure. McCroskey and Teven's (1999) source credibility scale was used to assess credibility. This seven-point, 18-item, semantic-differential is composed of three dimensions – competence, goodwill, and trustworthiness. Each dimension demonstrated reliability for the personal trainers: competence ($\alpha = .78$), goodwill ($\alpha = .85$), and trustworthiness ($\alpha = .90$). The personal trainer credibility measure yielded an overall alpha of .81. Each dimension demonstrated reliability for the close friends: competence ($\alpha = .81$), goodwill ($\alpha = .79$), and trustworthiness ($\alpha = .87$). The close friend credibility measure yielded an overall alpha of .77.

Procedure

Participants were recruited from communication courses at a large southwestern university. Students interested in participating in the study completed an online screening questionnaire that focused on inclusion criteria (i.e., age, not part of the procedural pilot study, and not an athlete participating in a university-sponsored sport or club team). In addition, participants responded to basic demographic questions (e.g., age, year in school, ethnicity, height, and

weight). Participants who met the study criteria were directed to schedule a time to participate in the study using an online calendar. All participants were also informed that this experiment required them to bring a close friend to the study during their scheduled appointment.

In the screening questionnaire participants indicated their typical physical activity levels during school and work time as well as leisure-time on the modified SBAS. This allowed for categorization of physical activity levels for all participants. Using participant responses to the modified SBAS, the researcher randomly assigned participants to one of three conditions (a control condition and two experimental conditions). More specifically, each condition had an equal amount (n = 12) of low, moderate, and high physical activity levels. In addition, quota assignment was utilized to fill each of the three message source conditions (i.e., friend, trainer, or none) with 36 total participants – 18 males and 18 females. Thus, each condition had 6 females with low physical activity, 6 females with moderate activity, 6 females with high activity, 6 males with low activity, 6 males with moderate activity, and 6 males with high activity. Participants in the experimental conditions received messages from a personal trainer or from a friend; participants in the control condition received no messages. Dependent variables were self-report measures of behavior, intentions, attitudes, self-efficacy, outcome expectation beliefs, and response-efficacy regarding physical activity.

When participants arrived at the lab, they received experimental materials from the experimenter. All participants were required to bring a close friend to

the study. Although participants in the control and personal trainer groups did not need a close friend for the actual study, this procedure was required for all participants to maintain consistent procedures across all three conditions. Because the friend brought by participants assigned to the control and personal trainer conditions was not pertinent to this study, the participant and friend were separated upon arrival. The close friend was placed in a separate room where s/he signed a consent form and then completed an alternate assignment.

Control condition. Once separated from their friend, control group participants were informed their human subjects' rights and signed a consent form. During the appointment, participants were asked to complete the Time 1 questionnaire. Participants and their friend were then brought into the same room where they were both debriefed on the study.

Personal trainer condition. Participants assigned to the personal trainer group were separated from their friend, signed the consent form, and then were introduced to a certified, experienced personal trainer. The trainer and participant were informed that they were to engage students in a conversation about physical activity. The participant was advised to speak about topics such as, current physical activity behaviors, frequency, and physical activity routines or rituals. In addition, participants were told that if for some reason they got stuck during the conversation, the experimenter would offer a prompt to assist in continuing the conversation. Prior to the conversation, the experimenter delivered a brief biography about the personal trainer to the participant. The biography included the source's credentials as a personal trainer (e.g., professional certifications,

years of experience, college degree and alma mater, and other relevant skills or experience), with both trainers having roughly the same credentials. The personal trainer engaged in a brief three to five minute discussion with the participant regarding his/her physical activity behaviors. During this discussion, the trainer delivered six predetermined messages to the participant, which was tracked by the experimenter. The experimenter also noted if the personal trainer said or did anything else during the conversation that could affect the study. The experimenter monitored the conversation to ensure that all six messages were presented. Following the discussion, participants completed the Time 1 questionnaire. The personal trainers did not engage in any interaction beyond the brief discussion. Participants and their friends were then brought into the same room where they were debriefed.

Friend condition. As in the control and personal trainer groups, the friend and participant were separated upon arrival to the laboratory. The friend was trained in a separate room (for more details see *message source manipulation* above). During the training time, the participant was informed their rights and signed the consent form. Once the friend felt prepared for the role, the friend came into the lab where the experimenter and the participant waited. Both the participant and friend were told they would engage in a conversation about physical activity behaviors. Specifically, the participant was told to discuss topics pertaining to his/her own physical activity behaviors. They were also informed that if for some reason they got stuck during the conversation, the experimenter would offer a prompt to assist in continuing the conversation. During the

discussion the experimenter tracked the messages that were delivered by the friend, as well as noted any other messages presented by the friend that could affect the study. To assist in tracking messages, the experimenter had a list of target messages and checked each one off as they were delivered. Following the discussion, both the participant and the friend completed a questionnaire. Participants and friends were then debriefed on the true purposes of the study.

Time 2. During the debriefing, all participants were told to not discuss this study with anyone else, especially the close friend they brought to the study. They were also informed that in one week the researcher would send a brief follow-up online questionnaire (Time 2). Participants were told that they must complete the online follow-up within 24 hours of receiving the email. One week following the experimental session, all participants received an email containing a link to the Time 2 online survey. Participants received extra credit for completing both the Time 1 and Time 2 study.

Data Analysis

To assess all hypotheses and research questions, ANCOVAs were run on each dependent variable (i.e., attitudes, self-efficacy, response-efficacy, positive outcome expectations, negative outcome expectations, and intentions at Time 1, as well as attitudes, self-efficacy, intentions, and physical activity behavior at Time 2) with physical activity level as the covariate and condition (i.e., friend, trainer, or control) as the independent variable.

Chapter 6

MAIN STUDY RESULTS

Before data analysis was conducted, the manipulation verifications were analyzed using the closeness and credibility measures. In addition, assumptions were checked to ensure the covariate could be utilized. Finally, all hypotheses and research questions were assessed using ANCOVA.

Participants' Physical Activity Characteristics

Participants indicated their current view of their own physical activity, describing themselves as doing enough physical activity (48.1%) and needing to be more physically active (51.9%), with no students selecting "I don't know." Students reported their TTM stage: precontemplation (0%), contemplation (18.5%), preparation (45.4%), active (20.4%), and maintenance (15.7%). Participants BMI ranged from 14.23 (severely underweight) to 41.38 (morbidly obese) (M = 23.20, SD = 4.06). In addition, students reported on average, how many hours per day they were inactive (excluding sleeping) selecting from 0-2 hours (8.3%), 3-5 hours (41.7%), 6-7 hours (34.3%), 8-10 hours (13.9%), and 11 or more hours (1.9%).

Manipulation Verification

The IOS scale was used to ensure that participants brought a close friend to the study. In addition, it was expected that participants receiving messages from a close friend would have higher closeness levels than those receiving messages from a personal trainer they just met. Levene's was not acceptable, F (1,70) = 12.52, p = .001, indicating that there was greater variation in responses

for one group compared to the other; however, t-test revealed that participants receiving messages from a close friend (M = 5.85, SD = 1.92) reported much higher closeness levels than participants receiving messages from a personal trainer (M = 3.63, SD = 1.03), t (51.77) = -6.07, $p < .001$, $\eta_p^2 = 0.35$.

In addition, credibility of the trainer and close friend were assessed for each dimension. T-test for competence revealed that Levene's was acceptable, F (1,70) = 1.10, p = .30. Personal trainers (M = 6.43, SD = 0.60) were more competent than close friends (M = 6.09, SD = 0.70), t (70) = 2.21, $p < .05$, η_p^2 = 0.07. T-test for goodwill revealed that Levene's was acceptable, F (1,70) = 1.11, p = .30. Close friends (M = 6.17, SD = 0.77) had more goodwill than personal trainers (M = 5.28, SD = 1.00), t (70) = -4.07, $p < .001$, $\eta_p^2 = 0.19$. T-test for trustworthiness revealed that Levene's was not acceptable, F (1,70) = 7.81, p = .01. This suggests that participants in one group had higher variation compared to the other group. Close friends (M = 6.61, SD = 0.61) were more trustworthy than personal trainers (M = 6.01, SD = .91), t (70) = -3.25, $p < .01$, $\eta_p^2 = 0.13$. These findings demonstrate that participants believed the personal trainer to be more competent than the close friend, but they believed the friend had more goodwill and was more trustworthy than the trainer.

Covariate

Before conducting any analyses, assumptions were checked regarding physical activity level as a covariate. First, a covariate must be significantly correlated with the dependent variables. The correlations between the covariate and the dependent variables are all significant (rs ranged from 0.16 – 0.46, ps <

.05), with the exception of positive outcome expectations ($r = .11$, $p = .13$). See Table 3 for all correlations.

Table 3

Intercorrelations for Experimental Study Variables

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Respondents (n = 108)															
1. PA Level (Cov.)	-														
2. T1 Attitudes	.21*	-													
3. T1 SE	.30**	.27**	-												
4. T1 RE	.16*	.34***	.52***	-											
5. T1 POE	.11	.52***	.16*	.32***	-										
6. T1 NOE	-.25**	-.31***	-.28**	-.11	-.16	-									
7. T1 Intentions	.36***	.55***	.55***	.65***	.54***	-.36***	-								
8. T2 Attitudes	.35***	.47***	.27**	.30**	.30**	-.35***	.43***	-							
9. T2 SE	.45***	.27**	.36***	.16*	.32***	-.19*	.33***	.26**	-						
10. T2 Intentions	.35***	.54***	.54***	.65***	.51***	-.36***	.98***	.42***	.33***	-					
11. T2 PAB	.46***	.29**	.16*	.13	.18*	-.25**	.33***	.22*	.34***	.33***	-				
12. T2 Vigorous	.52***	.23**	.17*	.07	.19*	-.24**	.38***	.18*	.41***	.38***	.77***	-			
13. T2 Moderate	.42***	.20*	.21*	.14	.13	-.18*	.28**	.18*	.25**	.28**	.74***	.49***	-		
14. T2 Walking	.10	.18*	-.01	.11	.09	-.14	.07	.12	.10	.09	.65***	.17*	.31**	-	
15. T2 Inactivity	-.11	-.16*	.10	-.07	-.08	.10	-.11	-.12	.05	-.09	-.05	-.14	-.05	.02	-

Notes: SE = Self-Efficacy, RE = Response-Efficacy, POE = Positive Outcome Expectations, NOE = Negative Outcome Expectations, PAB = Physical Activity Behavior. Correlations based on one-tailed probability estimates. $*p < .05$; $**p < .01$; $***p < .001$

Moreover, to include a variable as a covariate, it must be independent of the treatment effect and exhibit homogeneity of regression slopes. A one-way ANOVA with experimental condition as the independent variable and physical activity level (covariate) as the dependent variable reveals that the independent variable and covariate are independent, F (2,107) = .00, p = 1.00. Homogeneity of regression slopes (Field, 2009) was assessed using a customized ANCOVA model. If the covariate interacts with the independent variable in the customized model, the assumption of homogeneity of regression slopes has been violated. The interaction term for all the dependent variables revealed that the assumption is met ($p > .05$). See Table 4 for homogeneity of regression slopes details. All assumptions for using physical activity level as a covariate were met, thus it was included in analyses for all of the variables except for positive outcome expectations and physical activity behavior. Given that physical activity behavior (and its subsequent components) and physical activity level are conceptually and operationally similar, physical activity level is not necessary as a covariate.

Table 4

Homogeneity of Regression Slopes of the Covariate and Dependent Variables for Experimental Study

	Experimental Condition x Stage of Change				
Dependent Variables	df_1	df_2	F	p	η_p^2
T1 Attitudes	2	108	1.51	.23	.03
T1 Self-Efficacy	2	108	0.56	.57	.01
T1 Response-Efficacy	2	108	0.74	.48	.01
T1 Positive Outcome Expectations	2	108	0.33	.72	.01
T1 Negative Outcome Expectations	2	108	1.12	.33	.02
T1 Intentions	2	108	0.47	.63	.01
T2 Attitudes	2	108	0.95	.39	.02
T2 Self-Efficacy	2	108	0.50	.61	.01
T2 Intentions	2	108	0.19	.83	.00
T2 Physical Activity Behavior	2	108	0.11	.89	.00
T2 Vigorous Activity	2	108	.27	.90	.01
T2 Moderate Activity	2	108	.49	.75	.02
T2 Walking Activity	2	108	1.56	.19	.06
T2 Inactivity	2	108	1.12	.29	.01

Hypotheses and Research Questions

Table 5 below reports adjusted means and standard errors of all dependent variables by the three conditions. Correlations between all dependent variables are included in Table 3 (above). In addition, some of the analyses were not significant at the $p < .05$ level, despite the fact that some effect sizes were meaningful and LSD post hoc analyses revealed significant differences. Therefore, to capture all potentially important results, the significance level was set at .10.

Time 1. Hypothesis 1 predicted differences between participants receiving messages and the control condition regarding favorable attitudes toward physical activity at Time 1. Research question 1 asked which conditions would differ in attitudes at Time 1. An ANCOVA was conducted with experimental condition as the independent variable, attitudes as the dependent variable, and physical activity level as the covariate. The physical activity level produced a significant main effect in the ANCOVA, F (1,108) = 4.80, $p < .05$, $\eta_p^2 = .04$, and therefore was retained in the model as a covariate. Levene's test for attitudes was acceptable, F (2,105) = .41, $p = .60$.

Results for ANCOVA on attitudes did not find a significant difference due to source condition, F (2,108) = 0.32, $p = .73$, $\eta_p^2 = .01$, observed power = .10, between the friend condition (adjusted $M = 6.43$, $SD = 0.11$), the personal trainer condition (adjusted $M = 6.35$, $SE = 0.11$), and the control condition (adjusted $M = 6.31$, $SE = 0.11$). Hypothesis 1 predicted specifically that the control condition would report less favorable attitudes toward physical activity than the

Table 5

Adjusted Means and Standard Errors for Experimental Study Variables by Experimental Condition

	Control		Personal Trainer		Friend	
Dependent Variables	*M*	*SE*	*M*	*SE*	*M*	*SE*
T1 Attitudes	6.31	.11	6.35	.11	6.43	.11
T1 Self-Efficacy	6.19	.14	6.23	.14	6.19	.14
T1 Response-Efficacy	6.41	.13	6.74	.13	6.75	.13
T1 Positive Outcome Expectations	4.10	.09	4.41	.09	4.26	.09
T1 Negative Outcome Expectations	2.17	.09	2.11	.09	2.26	.09
T1 Intentions	5.94	.15	6.40	.15	6.38	.15
T2 Attitudes	6.52	.12	6.50	.12	6.37	.12
T2 Self-Efficacy	5.81	.17	6.19	.17	6.21	.17
T2 Intentions	5.94	.15	6.40	.15	6.36	.15
T2 Physical Activity Behavior[a]	51.76	4.04	62.97	4.04	70.34	4.04
T2 Vigorous Activity	9.64	1.25	12.47	1.25	14.63	1.25
T2 Moderate Activity	12.16	1.58	13.94	1.58	18.21	1.58
T2 Walking Activity	16.84	1.85	21.56	1.85	18.99	1.85
T2 Inactivity	385.50	32.87	419.58	32.87	330.69	32.87

[a]Calculated as a MET-minute and reported using the transformed numbers

friend and personal trainer conditions. Therefore, a planned contrast was run using -2, 1, and 1 as the contrast coefficients for control, friend, and personal trainer, respectively. The contrast coefficients did not significantly match the pattern of means, t (105) = .61, p = .27. Therefore, H1 is not supported and in response to RQ1 there are no differences between the three conditions in respect to physical activity attitudes.

Hypothesis 2 predicted that at Time 1 the participants receiving messages would have higher self-efficacy regarding physical activity than those in the control condition. Research question 2 asked if there would be differences between the three conditions at Time 1. An ANCOVA with experimental condition as the independent variable, self-efficacy as the dependent variable, and physical activity level as the covariate indicated that physical activity level produced a significant main effect, F (1,108) = 10.48, $p < .01$, $\eta_p^2 = .10$, and therefore was retained in the model as a covariate. Levene's test for self-efficacy was acceptable, F (2,105) = .18, p = .84.

Results for ANCOVA on self-efficacy did not indicate a significant difference due to source condition, F (2,108) = .02, p = .983, $\eta_p^2 = .00$, observed power = .05, between the personal trainer condition (adjusted M = 6.23, SE = 0.14), the friend condition (adjusted M = 6.19, SE = 0.14), and the control condition (adjusted M = 6.19, SE = 0.14). Hypothesis 2 predicted specifically that the control condition would report lower self-efficacy levels toward physical activity than the friend and personal trainer conditions. Therefore, a planned contrast was run using -2, 1, and 1 as the contrast coefficients for control, friend,

and personal trainer, respectively. The contrast coefficients did not significantly match the pattern of means, t (105) = .10, p = .46. Therefore, H2 is not supported and in response to RQ2 there are no differences between the three conditions regarding physical activity self-efficacy.

Hypothesis 3 predicted that at Time 1 participants receiving messages will have higher response-efficacy compared to those in the control condition. RQ3 asked if at Time 1 there were differences between the three conditions. To assess these differences an ANCOVA was conducted with experimental condition as the independent variable, response-efficacy as the dependent variable, and physical activity level as the covariate. The physical activity level produced a significant main effect in the ANCOVA, F (1,108) = 3.00, p = .09, η_p^2 = .03, and was therefore retained in the model. Levene's test for response-efficacy was significant, F (2,105) = 3.98, p = .02; however, since ANCOVA is robust to violations of the assumption of homogeneity of variance, only p-values below .01 deserve caution.

Results for ANCOVA on response-efficacy did not indicate a significant difference due to source condition, F (2,108) = 2.22, p = .11, η_p^2 = .04, observed power = .44, between the friend condition (adjusted M = 6.75, SE = 0.13), the personal trainer condition (adjusted M = 6.74, SE = 0.13), and the control condition (adjusted M = 6.41, SE = 0.13). Hypothesis 3 predicted specifically that the control condition would report lower response-efficacy levels toward physical activity than the friend and personal trainer conditions. Therefore, a planned contrast was run using -2, 1, and 1 as the contrast coefficients for control, friend,

and personal trainer, respectively. The contrast coefficients significantly matched the pattern of means, t (40.18) = 1.62, $p < .05$. Therefore, H3 is not supported because there are no significant differences between groups even though the prediction was in the correct direction; in response to RQ3, there are no differences between the three conditions.

Hypothesis 4a predicted differences between participants receiving messages and the control condition regarding positive outcome expectations at Time 1. Research question 4a asked if there would be differences in positive outcome expectations between the three conditions at Time 1. To assess these differences an ANCOVA was conducted with experimental condition as the independent variable, positive outcomes as the dependent variable, and physical activity level as the covariate. The physical activity level did not produce a significant main effect in the ANCOVA, F (1,108) = 1.36, $p = .25$, $\eta_p^2 = .01$. In addition, because physical activity level and positive outcome expectations did not meet a key assumption of a covariate (i.e., they were not correlated), physical activity level was therefore not retained in the model and an one-way ANOVA was run instead. Levene's test for positive outcome expectations was acceptable, F (2,105) = 1.26, $p = .29$.

Results for ANOVA[2] on positive outcome expectations found a significant difference due to source condition, F (2,107) = 3.38, $p < .05$, $\eta_p^2 = .06$.

[2] Analysis was also run using the ANCOVA to ensure that the findings were consistent even though the covariate of physical activity did not meet the assumptions. Results revealed that the ANCOVA yielded the same outcome as the ANOVA, F (1,108) = 3.39, $p < .05$, $\eta_p^2 = .06$. An LSD pairwise comparisons was run with the significant differences between the personal trainer and control condition; no other group differences were found.

Specifically, post-hoc LSD tests indicated that the only significant difference was between the personal trainer condition (adjusted $M = 4.41$, $SE = 0.09$) and the control condition (adjusted $M = 4.10$, $SE = 0.09$). The friend condition (adjusted $M = 4.26$, $SE = 0.09$) did not differ significantly from the other two conditions. Hypothesis 4a predicted specifically that the control condition would report lower positive outcome expectancies toward physical activity than the friend and personal trainer conditions. Therefore, a planned contrast was run using -2, 1, and 1 as the contrast coefficients for control, friend, and personal trainer, respectively. The contrast coefficients significantly matched the pattern of means, t (105) = 2.27, $p < .05$. Therefore, H4a is partially supported with the personal trainer condition differing from the control condition on positive outcome expectations. In response to RQ4a, differences were not found between the experimental conditions or the friend condition and control condition but between the personal trainer condition and the control condition.

Hypothesis 4b predicted differences between participants receiving messages and the control condition regarding negative outcome expectations at Time 1. Research question 4b asked if there would be differences in negative outcome expectations between the three conditions at Time 1. To assess these differences an ANCOVA was conducted with experimental condition as the independent variable, negative outcomes as the dependent variable, and physical activity level as the covariate. The physical activity level produced a significant main effect in the ANCOVA, F (1,108) = 6.78, $p < .05$, $\eta_p^2 = .06$, and therefore

was retained in the model as a covariate. Levene's test for negative outcome expectations was acceptable, F (2,105) = 3.17, p = .05.

Results for ANCOVA on negative outcome expectations did not find a significant difference due to source condition, F (2,108) = .65, p = .52, η_p^2 = .01, observed power = .16, between the personal trainer condition (adjusted M = 2.11, SE = 0.09), the control condition (adjusted M = 2.17, SE = 0.09), and the friend condition (adjusted M = 2.26, SE = 0.09). Hypothesis 4b predicted specifically that the control condition would report higher negative outcome expectancies toward physical activity than the friend and personal trainer conditions. Therefore, a planned contrast was run using -2, 1, and 1 as the contrast coefficients for control, friend, and personal trainer, respectively. The contrast coefficients significantly matched the pattern of means, t (105) = .18, p = .43. Therefore, H4b is not supported and in response to RQ4b there are no differences between the three conditions on negative outcome expectations.

Hypothesis 5 predicted that at Time 1 participants receiving messages would have higher physical activity intentions than those in the control condition. Research question 5 asked if there would be differences Time 1 in intentions between the three conditions. To assess these differences, an ANCOVA was conducted with experimental condition as the independent variable, intentions as the dependent variable, and physical activity level as the covariate. The physical activity level produced a significant main effect in the ANCOVA, F (1,108) = 16.66, p < .001, η_p^2 = .14, and therefore was retained in the model as a covariate. Levene's test for intentions was acceptable, F (2,105) = 2.35, p = .10.

Results for ANCOVA on intentions found a significant difference due to source condition, F (2,108) = 2.91, $p < .06$, $\eta_p^2 = .05$. Specifically, post-hoc LSD tests indicated that the significant differences were between the personal trainer condition (adjusted $M = 6.40$, $SE = 0.15$) and the control condition (adjusted $M = 5.94$, $SE = 0.15$), as well as the friend condition (adjusted $M = 6.38$, $SE = 0.15$), and the control condition. Hypothesis 5 predicted specifically that the control condition would report lower intentions toward physical activity than the friend and personal trainer conditions. Therefore, a planned contrast was run using -2, 1, and 1 as the contrast coefficients for control, friend, and personal trainer, respectively. The contrast coefficients significantly matched the pattern of means, t (105) = 2.25, $p < .05$. Therefore, H5 is supported; participants receiving messages differed from those who did not on physical activity intentions. In response to RQ5, differences were not found between the experimental conditions but between both experimental conditions and the control condition.

Time 2. Hypothesis 6 predicted that at Time 2 participants receiving messages would have more favorable attitudes toward physical activity than those in the control condition. Research question 6 asked if there would be differences in Time 2 in attitudes between the three conditions. An ANCOVA was conducted with experimental condition as the independent variable, attitudes as the dependent variable, and physical activity level as the covariate. The physical activity level produced a significant main effect in the ANCOVA, F (1,108) = 14.80, $p < .001$, $\eta_p^2 = .13$, and therefore was retained in the model as a covariate. Levene's test for attitudes was acceptable, F (2,105) = 0.58, $p = .56$.

Results for ANCOVA on attitudes did not find a significant difference due to source condition, F (2,108) = 0.46, p = .63, η_p^2 = .01, observed power = .12, between the control condition (adjusted M = 6.52, SE = 0.12), the personal trainer condition (adjusted M = 6.50, SE = 0.12), and the friend condition (adjusted M = 6.37, SE = 0.12). Hypothesis 6 predicted specifically that the control condition would report less favorable attitudes toward physical activity than the friend and personal trainer conditions. Therefore, a planned contrast was run using -2, 1, and 1 as the contrast coefficients for control, friend, and personal trainer, respectively. The contrast coefficients did not match the pattern of means, t (105) = -.55, p = .29. Therefore, H6 is not supported and in response to RQ6 there are no differences between the three conditions on physical activity attitudes.

Hypothesis 7 predicted that at Time 2 participants receiving messages would have higher physical activity self-efficacy than those in the control condition. Research question 7 asked if there would be differences in Time 2 in self-efficacy between the three conditions. An ANCOVA was conducted with experimental condition as the independent variable, self-efficacy as the dependent variable, and physical activity level as the covariate. The physical activity level produced a significant main effect in the ANCOVA, F (1,108) = 27.23, p < .001, η_p^2 = .21, and therefore was retained in the model as a covariate. Levene's test for self-efficacy was acceptable, F (2,105) = 1.16, p = .32.

Results for ANCOVA on self-efficacy did not find a significant difference due to source condition, F (2,108) = 1.81, p = .17, η_p^2 = .03, observed power = .37, between the friend condition (adjusted M = 6.21, SE = 0.17), the personal

trainer condition (adjusted $M = 6.19$, $SE = 0.17$), and the control condition (adjusted $M = 5.81$, $SE = 0.17$). Hypothesis 7 predicted specifically that the control condition would report lower self-efficacy levels toward physical activity than the friend and personal trainer conditions. Therefore, a planned contrast was performed using -2, 1, and 1 as the contrast coefficients for control, friend, and personal trainer, respectively. The contrast coefficients significantly matched the pattern of means, $t\ (105) = 1.70$, $p < .05$. Therefore, H7 is not supported because there are no significant differences between groups even though the prediction was in the correct direction; in response to RQ8, no differences between the conditions were found.

Hypothesis 8 predicted that at Time 2 participants receiving messages would have higher physical activity intentions than those in the control condition. Research question 8 asked if there would be differences in Time 2 in intentions between the three conditions. An ANCOVA was conducted with experimental condition as the independent variable, intentions as the dependent variable, and physical activity level as the covariate. The physical activity level produced a significant main effect in the ANCOVA, $F\ (1,108) = 16.66$, $p < .001$, $\eta_p^2 = .14$, and therefore was retained in the model as a covariate. Levene's test for intentions was acceptable, $F\ (2,105) = 2.35$, $p = .10$.

Results for ANCOVA on intentions found a significant difference due to source condition, $F\ (2,108) = 2.91$, $p < .06$, $\eta_p^2 = .05$. Specifically, post-hoc LSD tests indicated that the significant differences were between the personal trainer condition (adjusted $M = 6.40$, $SE = 0.15$) and the control condition (adjusted $M =$

5.94, *SE* = 0.15), as well as between the friend condition (adjusted *M* = 6.36, *SE* = 0.15) and the control condition. Hypothesis 8 predicted specifically that the control condition would report lower intentions toward physical activity than the friend and personal trainer conditions, which would not differ. Therefore, a planned contrast was performed using -2, 1, and 1 as the contrast coefficients for control, friend, and personal trainer, respectively. The contrast coefficients significantly matched the pattern of means, t (105) = 2.59, $p < .01$. Therefore, H8 is supported; participants receiving messages differed from those who did not with respect to intentions. In response to RQ8, differences were not found between the experimental conditions but between both experimental conditions and the control condition.

Hypothesis 9 predicted that at Time 2 participants receiving messages would have higher self-report physical activity behavior than those in the control condition. Research question 9 asked if there would be differences in Time 2 in physical activity behavior between the three conditions. An ANOVA was conducted with experimental condition as the independent variable and physical activity behavior as the dependent variable[3]. The square root transformed self-report physical activity behavior variable was utilized. Levene's test for physical activity behavior was acceptable, F (2,105) = 2.43, $p = .09$.

[3] Physical activity level was not included in the model as a covariate as it is too similar to the dependent variable, physical activity behavior. An ANCOVA using condition as the independent variable, physical activity level as the covariate, and physical activity behavior as the dependent variable, however, was run to determine if the results differed from the ANOVA. Results revealed significant differences due to condition, F (2,108) = 5.37, $p < .01$, $\eta_p^2 = .09$, identical to that of the ANOVA and therefore, the simpler ANOVA results were reported.

Results for the ANOVA on physical activity behavior found a significant difference due to source condition, F (2,107) = 4.20, $p < .05$, $\eta_p^2 = .07$. Specifically, LSD post-hoc tests indicated significant differences were observed between the control condition (M = 51.76, SD = 22.93) and both the friend condition (M = 70.34, SD = 33.18) and the personal trainer condition (M = 62.97, SD = 24.92). The friend and personal trainer conditions did not differ from one another. This pattern is consistent with the -2, 1, and 1 contrast coefficients developed from H9. The planned contrast based on these coefficients significantly related to physical activity scores, t (105) = 2.67, $p < .01$. Therefore, H9 is supported; participants receiving messages differed from those who did not with respect to physical activity behavior. In response to RQ9, differences were not found between the experimental conditions but between both experimental conditions and the control condition.

Physical activity behavior deconstructed. The physical activity behavior measure is comprised of four components – vigorous activity, moderate activity, walking activity, and physical inactivity. Given that differences were found between the experimental conditions and the control condition for overall physical activity behavior (H9), differences among the four components were explored in alignment with the proposed hypotheses and research questions.

Hypothesis 9a predicted that at Time 2 participants receiving messages would have higher self-report vigorous physical activity behavior than those in the control condition. Research question 9a asked if there would be differences Time 2 in vigorous physical activity behavior between the three conditions. An

ANOVA was conducted with experimental condition as the independent variable and vigorous physical activity behavior as the dependent variable. The square root transformed self-report vigorous physical activity behavior variable was utilized. Levene's test for vigorous physical activity behavior was acceptable, F (2,105) = 1.60, p = .21.

Results for ANOVA on vigorous physical activity behavior found a significant effect for message condition, F (2,107) = 3.04, $p < .05$, $\eta_p^2 = .06$. Specifically, post-hoc LSD tests indicated that the only significant difference was between the friend condition (M = 14.63, SD = 10.44) and the control condition (M = 9.64, SD = 7.09). The personal trainer condition (M = 12.47, SD = 7.91) did not differ significantly from the other two groups. Hypothesis 9a predicted specifically that the control condition would report lower levels of vigorous physical activity than the friend and personal trainer conditions (and the latter two conditions would not differ). Therefore, a planned contrast was performed using -2, 1, and 1 as the contrast coefficients for control, friend, and personal trainer, respectively. The contrast coefficients significantly matched the pattern of means, t (105) = 2.22, $p < .05$. Therefore, H9a is partially supported; participants receiving messages from friends differed from those who did not with respect to vigorous physical activity behavior. In response to RQ9a, differences were not found between the experimental conditions but between the friend condition and the control condition.

Hypothesis 9b predicted that at Time 2 participants receiving messages would have higher self-report moderate physical activity behavior than those in

the control condition. Research question 9b asked if there would be differences Time 2 in moderate physical activity behavior between the three conditions. An ANOVA was conducted with experimental condition as the independent variable and moderate physical activity behavior as the dependent variable. The square root transformed self-report moderate physical activity behavior variable was utilized. Levene's test for moderate physical activity behavior was acceptable, F (2,105) = .2.57, p = .08.

Results for the ANOVA on moderate physical activity behavior found a significant effect for condition, F (2,107) = 3.26, $p < .05$, $\eta_p^2 = .06$. Specifically, post-hoc LSD tests indicated that the friend condition (M = 18.21, SD = 12.52) differed from both the personal trainer condition (M = 13.94, SD = 8.17) and the control condition (M = 12.16, SD = 9.83). The trainer and control conditions, however, did not differ from one another. H9b predicted that the control condition would report lower levels of moderate physical activity than the friend and personal trainer conditions. Therefore, a planned contrast was performed using -2, 1, and 1 as the contrast coefficients for control, friend, and personal trainer, respectively. The contrasts significantly reflected the pattern of means, t (105) = 1.86, $p < .05$. Therefore, H9b is partially supported; participants receiving messages from friends differed from those who did not with respect to moderate physical activity behavior. The personal trainer condition did not differ from the control condition. In response to RQ9b, differences were found between the experimental conditions as well as between the friend and control conditions.

Hypothesis 9c predicted that at Time 2 participants receiving messages would have higher self-report walking physical activity behavior than those in the control condition. Research question 9c asked if there would be differences Time 2 in walking physical activity behavior between the three conditions. An ANOVA was conducted with experimental condition as the independent variable and walking physical activity behavior as the dependent variable. The square root transformed self-report walking physical activity behavior variable was utilized. Levene's test for walking physical activity behavior was acceptable, F (2,105) = .47, p = .63.

Results for ANOVA on walking physical activity behavior did not find a significant difference, F (2,107) = 1.61, p = .21, η_p^2 = .03, observed power = .33, between the personal trainer condition (M = 21.56, SD = 11.83), the friend condition (M = 18.99, SD = 12.42), and the control condition (M = 16.84, SD = 9.01). Because H9c predicted that the control condition would report lower levels of walking physical activity than the friend and personal trainer conditions, a planned contrast was run. Using -2, 1, and 1 as the contrast coefficients for control, friend, and personal trainer, respectively, the planned contrast revealed a significant relationship between conditions, t (105) = 1.50, p < .06. Therefore, H9a is supported, but in response to RQ9c, differences were not found between the experimental conditions.

Hypothesis 9d predicted that at Time 2 participants receiving messages would have lower levels of physical inactivity than those in the control condition. Research question 9d asked if there would be differences Time 2 in physical

inactivity behavior between the three conditions. An ANOVA was conducted with experimental condition as the independent variable and physical inactivity behavior as the dependent variable. Levene's test for physical inactivity was acceptable, F (2,105) = 1.37, p = .26.

Results for ANOVA on physical inactivity found a significant difference, F (2,107) = 2.91, p < .06, η_p^2 = .05, between the personal trainer condition (M = 419.58, SD = 20.11), the friend condition (M = 330.69, SD = 17.05), and the control condition (M = 386.50, SD = 18.87). Because it was expected that the control condition would report higher levels of physical inactivity than the friend and personal trainer conditions, a planned contrast was run. Using 2, -1, and -1 as the contrast coefficients for control, friend, and personal trainer, respectively, the planned contrast did not find a significant relationship between conditions, t (105) = .58, p = .39. An LSD pairwise comparisons test found significant differences between the friend and personal trainer conditions only. Therefore, H9d is supported, and in response to RQ9d, differences were found between the experimental conditions only.

Repeated Measures Analyses

Repeated measures analyses were run on the three dependent variables included in both Time 1 and Time 2 data collections. A mixed-model design was utilized with time as the within-subjects variable (measured twice), one between-subjects variable (experimental condition), and physical activity level as the covariate. This was done to conclude if time was a significant factor in the

variation among attitudes, self-efficacy, and intentions. All adjusted means and standard errors on time for each dependent variable are in Table 6.

Table 6

Repeated Measures Adjusted Means and Standard Errors Experimental Study Variables

	Time 1		Time 2	
Study Variables	*M*	*SE*	*M*	*SE*
Attitudes	6.36	.06	6.47	.07
Self-Efficacy	6.21	.08	6.07	.10
Intentions	6.24	.09	6.20	.09

A repeated measures ANCOVA was conducted with experimental condition as the independent variable, attitudes as the dependent variable, and physical activity level as the covariate. Mauchly's test of sphericity assesses homogeneity of variance for the within-subjects variable. Mauchly's was acceptable, $\varepsilon = 1$. In addition, Levene's tests homogeneity of variance for the between-subjects variable was acceptable for attitudes at both Time 1, F (2, 105) = .51, p = .50, and Time 2, F (2, 105) = .58, p = .56.

Results for the repeated measures ANCOVA on attitudes did not find a significant effect for time, F (1, 104) = 1.25, p = .27, η_p^2 = .01, observed power = .20. Attitudes at Time 1 (adjusted M = 6.36, SE = .06) and attitudes at Time 2 (adjusted M = 6.47, SE = .07) did not differ. In addition, results revealed a non-

significant time by experimental condition interaction effect, F (2, 104) = 1.36, p = .26, η_p^2 = .03, observed power = .29.

A repeated measures ANCOVA was conducted with experimental condition as the independent variable, self-efficacy as the dependent variable, and physical activity level as the covariate. Mauchly's test of sphericity was acceptable, ε = 1. In addition, Levene's tests was acceptable for self-efficacy at both Time 1, F (2, 105) = .18, p = .84, and Time 2, F (2, 105) = 1.16, p = .32.

Results for the repeated measures ANCOVA on self-efficacy found a significant effect for time, F (1, 104) = 5.91, p < .02, η_p^2 = .05, between self-efficacy at Time 1 (adjusted M = 6.21, SE = .08) and self-efficacy at Time 2 (adjusted M = 6.07, SE = .10). In addition, results revealed a non-significant effect for the time by experimental condition interaction, F (2, 104) = 1.23, p = .30, η_p^2 = .02, observed power = .26.

A repeated measures ANCOVA was conducted with experimental condition as the independent variable, intentions as the dependent variable, and physical activity level as the covariate. Mauchly's test of sphericity was acceptable, ε = 1. In addition, Levene's was acceptable for intentions at both Time 1, F (2, 105) = 2.35, p = .10, and Time 2, F (2, 105) = 2.20, p = .12. Results for the repeated measures ANCOVA on intentions did not find a significant effect for time, F (1, 104) = .25, p = .62, η_p^2 = .00, observed power = .08. Intentions at Time 1 (adjusted M = 6.24, SE = .09) did not differ from intentions at Time 2 (adjusted M = 6.20, SE = .09). In addition, results revealed a non-significant

effect for the time by experimental condition interaction, F (2, 104) = 1.83, p = .17, η_p^2 = .03, observed power = .38.

Chapter 7

MAIN STUDY DISCUSSION

The current experiment utilized targeted messages based on social cognitive theory in an effort to promote physical activity behaviors through face-to-face communication. Participants were randomly assigned to conditions in a way that balanced current physical activity levels across conditions. Participants in the experimental conditions received messages targeting self-efficacy, outcome expectations, and goals either from a personal trainer (expert power) or a friend (referent power). Participants in the control condition received no messages. Overall, findings revealed that, compared to the control condition, participants receiving messages had higher physical activity intentions at both Time 1 (immediately following message reception) and Time 2 (one week later), as well as higher levels of overall physical activity behavior at Time 2. Additionally, at Time 1 only participants who received messages from the personal trainer held higher positive physical activity outcome expectations compared to those who received messages from a friend and the control condition. No differences appeared at Time 1 for negative outcome expectations, or for attitudes, self-efficacy, or response-efficacy. Similarly, at Time 2 no differences were found for attitudes or self-efficacy.

Time 1

At time 1, participants receiving messages reported significantly different scores than participants who did not receive messages on two variables. Participant mean scores regarding positive outcome expectations (H4a/RQ4a)

were high (means exceeded 4.10 on a 1-5 scale). Specifically, significant differences in positive outcome expectations were seen between only the personal trainer and the control conditions. Participants might be more likely to believe a personal trainer due to the visual (i.e., in his/her physique), communicative ability, and expertise. Given that the trainer is an expert on the subject, s/he has been educated in and is living the positive outcomes of physical activity. This expertise may be the factor that influenced participants' positive outcome expectations. Analogously, it is possible that friends did not change participants' feelings regarding positive outcomes if the participant knew the friend did not believe in the positive outcomes. Regardless of the identification and relational connection between the participant and friend, referent power was less successful at increasing positive outcome expectations. Thus, it appears that messages need to be delivered from an expert who is knows and is truly living the benefits of physical activity as students are more likely to believe in the positive outcomes.

At Time 1, Physical activity intentions (H5/RQ5) differed between those who received messages and those who did not; no differences were found between the personal trainer and the friend conditions. Mean scores suggested a much higher intention to be physically active for those who communicated about physical activity with a trainer or friend (i.e., strong agreement regarding intentions) compared to those who did not (i.e., agreement regarding intentions).

These results are consistent with Jones et al. (2003) and Jung and Heald's (2009) who found that receiving messages from an expert increased physical activity intentions. Similarly, Ullrich-French et al. (2011) and Lacaille et al.

(2011) concluded that close friends increased physical activity motivation and intentions. Therefore, communicating about physical activity and receiving messages regarding self-efficacy, outcome expectations, and goals regardless of whether an expert or referent is communicating the message increases intentions to be active.

No differences were found between conditions regarding physical activity attitudes (H1/RQ1). Mean scores across the groups revealed that participants already hold favorable attitudes toward physical activity (i.e., means exceeded 6.30 on a 1-7 scale). Thus, a ceiling effect may have reduced the ability to identify differences between groups. These findings align with Jung and Heald's (2009) findings where messages delivered in their study did not affect student attitudes towards physical activity.

Findings concerning self-efficacy, or one's belief that s/he is capable of being physically active (H2/RQ2) (Bandura, 1982), revealed no differences between conditions with mean scores at and above 6.1 on a 7-point scale. This too, supports a ceiling effect for self-efficacy, suggesting that students believed they were capable of being active. That is, students already held high levels of self-efficacy; messages could not significantly increase these ratings. Calfas et al. (1994) were able to significantly increase self-efficacy scores for women, but not men through their tailored intervention; as this study did not examine sex differences it is possible efficacy scores changed by sex, however, verification of this effect awaits future research. Self-efficacy is a significant predictor of physical activity behavior (for a substantial review see Bauman et al., 2002), yet

this study was unable to significantly increase self-efficacy levels given that they were already high.

In reviewing participant self-efficacy scores by item, it is worthy of noting that participants held higher mean scores (i.e., 6.5 or higher on a 7-point scale with a standard deviation less than 1 for all conditions) for the first two items – "I am able to be physically active" and "I am confident I can be physically active." The third item, however, "It is easy to be physically active" had a mean score of 5.5 (with a standard deviation between 1 and 2 for all conditions). Students, therefore, believe they are capable of being active but don't necessarily believe it is very easy to be active.

A lack of self-efficacy does not necessarily prevent students from being active; there are likely other barriers that, to some extent, reduce their belief that physical activity is easy. The study messages addressed increasing confidence in being physically active rather than overcoming obstacles may explain why no differences were found. Message interventions in the future, then, likely need not address increasing self-efficacy but rather should focus on overcoming barriers to physical activity, in particular the ease with which one can be active. For example, students can be reminded that there are simple everyday ways of being physically active (e.g., ride their bike to campus, take the stairs rather than an elevator, or park further away from their destination). Moreover, students in Marmo's (unpublished data) equated being physically active with working out or going to the gym. Per the definition of physical activity, however, students can simply walk or bike enough to increase their heart rate. Thus, interventions

should also consider educating students on definitions of physical activity and other activities they can do to be active rather than going to the gym.

Response-efficacy (H3/RQ3) refers to students' beliefs that physical activity will reduce health threats (e.g., obesity, diabetes, etc.). As is true with other variables, response-efficacy reflected a ceiling effect in all three conditions. (i.e., mean scores above 6.40 on a 7-point scale). This indicates that students already believe physical activity is valuable. Despite the ceiling effect and although the omnibus ANOVA was not statistically significant, the planned contrast was significant indicating that those in the friend and personal trainer conditions reported higher response-efficacy scores than did the control condition. In this case, messages are equally persuasive, no matter the source.

Although positive outcome expectations significantly differed across the three conditions, negative outcome expectations (H4b/RQ4b) did not. In the present context, negative outcome expectations represent disincentives to behave a particular way (Bandura, 1998), contributing to physical inactivity. Differences in negative outcome expectations may not have appeared across conditions because the social cognitive theory messages delivered targeted increasing positive outcome expectations rather than decreasing negative outcome expectations. Mean scores indicate that students likely do not recognize the negative outcomes of physical inactivity. This could reveal that students are so individualized regarding negative physical activity outcome expectations that targeted messages are not appropriate for changing them or that they are unaware of all the negative repercussions of physical inactivity.

Overall, Time 1 ratings indicate that students held high levels of self-efficacy, favorable attitudes, response-efficacy, and low levels of negative outcome expectations toward physical activity regardless of whether or not they received messages. Those who received messages (either from a personal trainer or a friend) had higher intentions. Participants who received a message from a trainer reported more positive outcome expectations compared to the control condition. Thus, despite that they already seem to know that they are capable of being active and that physical activity is good for them; however, communicating with either a personal trainer or close friend increased students' activity intentions.

Time 2

Participants at the one week follow-up who received messages reported higher intentions (H8/RQ8), similar to Time 1. No differences appeared between the personal trainer and the friend conditions. Intention scores were stable from Time 1 to Time 2 and remained the same and in the same order across groups. This suggests that whatever increases in intentions were created at Time 1 by the personal trainer or friend were maintained until Time 2. Thus, receiving messages from an expert or referent about self-efficacy, outcome expectations, and goals sustains physical activity intentions over a one week time period.

Self-report physical activity behavior using the IPAQ (H9/RQ9) was acquired at Time 2 to assess whether receiving messages increased behavior compared to those who did not. Significant differences were found between both experimental conditions and the control condition, with no differences between

the experimental conditions. This indicates that receiving SCT messages did change physical activity behavior after one week and aligns with research both on close friends (Lacaille et al., 2011; Ullrich-French et al., 2011) and experts (Jones et al., 2003; Jung & Heald, 2009).

In order to better understand how physical activity behavior was affected, the four components of the IPAQ (i.e., vigorous, moderate, and walking activity, physical inactivity) were explored individually. Participants in the friend condition reported significantly more vigorous physical activity than did the control condition. Similarly, participants in the friend condition reported significantly reported more moderate physical activity than both the personal trainer and control conditions. No differences between conditions were found for walking activity.

These findings on levels of physical activity are interesting. First, participants in the personal trainer condition increased their behavior across each activity category more than participants in the control condition. Second, although participants in the personal trainer condition increased overall behavior, upon closer examination, participants in the friend condition reported significantly higher levels of both vigorous and moderate activity. Thus, although both experimental conditions increased intentions, for those in the personal trainer condition the intentions did not translate into higher amounts of one level of activity. Third, since participant walking scores across groups did not significantly differ, it appears that participants don't necessarily view walking as a means of physical activity. Participants in Marmo's (unpublished data) indicated

that they believed the definition of physical activity was synonymous with exercise or working out. Therefore, college student definitions of physical activity might be too narrow.

Moreover, the IPAQ includes a measure of physical inactivity. Results for physical inactivity indicated significant differences between the friend and personal trainer conditions only. Participants in the friend condition reported the least amount of inactivity, while those in the personal trainer condition reported the most amount of inactivity. Participants receiving messages from a personal trainer reported higher amounts of overall physical activity behavior compared to the control condition, yet, they also reported the most physical *inactivity*. Participants in the friend condition, on the other hand, reported higher amounts of vigorous, moderate, and overall physical activity behavior, as well as the lowest amount of physical inactivity.

Indeed, having a close friend around to talk to about being active could explain the differences between the friend and trainer conditions. In addition, participants in the friend condition could be more active with the friend as opposed to by themselves as in the personal trainer condition. As participants in the close friend group spent time with their friends over the week, a close friend can continually motivate through communication and action compared to the personal trainer with whom participants communicated only once. This time together clearly plays an important role in physical activity behavior and physical inactivity.

Similar to Time 1, no differences were found between the three conditions regarding physical activity attitudes (H6/RQ6). Mean scores across groups were still high (i.e., strong agreement and above) suggesting the ceiling effect did not change. Moreover, similar to Time 1 the planned contrast was not significant. Students have favorable attitudes toward physical activity with or without receiving messages about it.

Self-efficacy at Time 2 revealed no significant differences between conditions (H7/RQ7). However, mean scores across all conditions decreased when compared with Time 1. This suggests that students need to receive and communicate messages about their capability of being physically active on a more frequent basis and aligns with Calfas et al.'s (2000) longitudinal findings. Without repeated communication, self-efficacy levels could deteriorate. In addition, similar to Time 1, mean scores for the third item of the measure (i.e., ease of being active) revealed lower scores compared to the other two items of the measure (i.e., confidence about being active). Indeed, this one item could be contributing to the lack of differences. Thus, as mentioned above, messages need to address overcoming the difficulty of doing physical activity as well as educating students on the definition of physical activity, rather than simply students' capability of being active.

Overall, at Time 2 students still held favorable attitudes; however, there were no differences between conditions. Self-efficacy levels for all three conditions, though still high, decreased, however, no significant differences between conditions were found. Those who received messages from a personal

trainer or a close friend still had higher physical activity intentions than those in the control condition. These intentions led to increased physical activity behavior as significant differences were found between both experimental conditions and the control condition. Therefore, receiving social cognitive theory messages changed intentions and physical activity behavior at Time 2.

Sources of Social Power

The manipulation verification, i.e., measurement of perceived credibility and closeness, provides interesting insight into the present results. It was expected that participants would evaluate the personal trainer as more credible regarding physical activity than the close friend. In addition, it was expected that participant would report being closer to the close friend than the personal trainer. Results for the closeness manipulation verification were consistent with these expectations.

Regarding credibility, participants believed that the personal trainer was more competent (i.e., expert) than the close friend, but they believed the close friend had higher goodwill and was more trustworthy than the personal trainer. It was important that the personal trainer be viewed as competent as expert power is based on competence in the specific field or behavior. The personal trainers, however, were viewed as less trustworthy and having less goodwill compared to the friend. Participants still agreed that the personal trainer was trustworthy and had goodwill, but since participants knew the close friend longer they are more likely to trust them. In addition, referent power is based on goodwill, benevolence, and trust (Rodin & Janis, 1979), explaining why friends experienced

higher levels for these components of the credibility measure compared to the trainer.

Theoretical Contributions

Social cognitive theory is a model of human behavior that describes how people determine their behavior through a reciprocal process involving personal factors, environmental factors, and prior behavior (Bandura, (2001). It is through a continuous interplay of these three components that people regulate their behavioral decisions. Within this process, five core factors determine behavior – knowledge, self-efficacy, outcome expectations, goals, and environmental factors.

For this study, response-efficacy assessed participants' knowledge of the benefits of physical activity. Bandura (2004) argues that knowledge is the precursor to behavior, and thus if people are unaware of the benefits of physical activity, physical activity levels are unlikely to change. All participants reported high levels of response-efficacy, but those who received messages reported significantly higher levels of physical activity behavior. Thus, knowledge is certainly involved in the initial phase of change as students seem to be aware of the threats physical activity can prevent, but is not the only contributing factor to changing behavior as SCT suggests.

Students clearly realize that physical activity is beneficial, hold favorable attitudes toward it, believe they are fully capable of being active, and know physical activity can decrease negative, and increase positive, health outcomes. Students have clearly been educated about the importance of physical activity. Unfortunately, knowing the importance of a particular behavior does not

necessarily mean people will do it. Case in point, many students do not meet recommended physical activity requirements or are inactive (Keating et al., 2005; Racette et al., 2005). Moreover, the control condition supports this sentiment as those participants reported the same ceiling effects as those in the experimental conditions but reported significantly lower levels of intentions and participated in significantly less physical activity behavior.

Intentions are strong predictors of behavior (Ajzen, 2002; Bandura, 1998, 2004). According to Bandura's (2004) model, self-efficacy, outcome expectancies, and attitudes all contribute to intentions and behavior. Since students in all conditions held high levels of self-efficacy, favorable attitudes, low levels of negative outcome expectations, and high levels of positive outcome expectations, it begs the question why all students aren't engaging in more physical activity. Levels of intention varied across conditions, however, such that experimental conditions receiving messages promoting self-efficacy, positive outcome expectations, and goals also reported greater intentions.

Although higher intentions translated into higher levels of physical activity behavior, the link varied across conditions. Moreover, participants in the friend and personal trainer conditions both had equally high intentions at Time 1 and Time 2, yet reported significantly different levels of physical activity behavior (i.e., moderate and vigorous) and inactivity at time 2. Although participants reported relatively high intentions and overall physical activity behavior, clearly something differentiates the friend condition from the personal trainer condition in the consistency between these variables. Intentions translated

into physical activity behavior in the friend conditions more than the trainer condition. The friend (but not the trainer) spent time with the participant throughout the week between Time 1 and Time 2. Moreover, unmeasured obstacles might prevent students (particularly in the trainer condition) from being more active.

General Experimental Conclusions

Although targeted message interventions are widely used in health research (e.g., Kreuter & Way, 2003; Rimal & Adkins, 2003), this study only found that targeted messages were successful in changing intentions at Time 1 and Time 2, positive outcome expectations at Time 1, and physical activity behavior at Time 2. This limited success is likely due to college students already holding favorable attitudes toward physical activity, knowledge that it can prevent serious illnesses and diseases, and beliefs they are capable of being active. Targeted messages are more effective for populations with low understanding or awareness of the importance of the behavior (Kreuter & Way, 2003). Indeed, participants engaging in a conversation, even a brief one, that focuses on SCT messages from a personal trainer or friend promotes physical activity behavior.

Given the ceiling effects for several variables, it is possible that tailored message interventions might be more effective in changing behavior (e.g., Bock et al., 2001; Bull et al., 1999; Fahrenwald et al., 2004; Marcus et al., 1998; Spittaels et al., 2006). Tailored interventions create individualized messages to meet unique needs, and thus students who already have favorable attitudes, high self-efficacy, and high response-efficacy would receive messages promoting other

factors, such as increasing intentions and education on the definition of physical activity. Tailored messages might be particularly effective given the large effect size for physical activity level as a covariate in the present analyses. Specifically, lower physical activity levels are associated with lower scores in attitudes, self-efficacy, response-efficacy, outcome expectations, intentions, and physical activity behavior. This also suggests that tailored interventions could be more successful at promoting physical activity in college students if the messages are designed specifically to each student's needs. According to SCT, these factors (i.e., attitudes, self-efficacy, response-efficacy, and outcome expectations) contribute to decisions to behave (i.e., engage in physical activity behavior). Thus, if one indicator, attitudes for example, is high and physical activity behavior is low, other indicators that are lower should be the focus of the message intervention. These findings support Jung and Heald's (2009) conclusion that communication interventions need to address areas in which students do not already have high beliefs.

The targeted message intervention did change overall physical activity behavior; however, only friends reported changing both moderate and vigorous activity time. This partially aligns with Magoc et al.'s (2011) SCT intervention that found significant increases in moderate and vigorous physical activity behavior for those in the experimental group. Neither friends nor trainers in this study, though, changed walking behavior time, and importantly, those in the personal trainer conditions reported greater physical inactivity than did the friend condition. Indeed, for this study, participants receiving a SCT-based message

(i.e., targeting self-efficacy, outcome expectations, and goals) was beneficial as students in the experimental conditions had higher mean scores on all dependent variables immediately after receiving the messages, even if for some of those variables significant differences across groups did not exist. Moreover, intentions, self-efficacy, and physical activity behavior mean scores were higher for participants receiving messages one week later. Clearly, participants engaging in a brief conversation about their current physical activity choices and receiving SCT messages during this conversation benefitted in this study. As Boyle et al. (2011) argued, interventions based on social cognitive theory hold promise for changing college students' physical activity behavior.

Finally, this study compared expert and referent power. Expert power was successful at increasing physical activity intentions at Time 1 and Time 2, positive outcome expectations, and overall physical activity behavior at Time 2. Studies using experts in their interventions yielded significant increases in self-efficacy (Jung & Heald, 2009), intentions (Jones et al., 2003; Jung & Heald, 2009) and short-term increases in physical activity behavior (Boyle et al., 2011; Fischer & Bryant, 2008; Project GRAD, Project TEAM) compared to control groups. Although this experiment found analogous results regarding physical activity behavior, the expert was only successful at changing overall behavior. When examined individually, participants in the trainer condition did not differ from participants in the control condition in amount of time doing vigorous, moderate, and walking activity. Moreover, participants in the trainer condition reported the highest amount of physical inactivity. It is clear that experts can

influence some physical activity indicators and overall behavior after one brief discussion, but since they are not part of participants' daily lives and there is not opportunity for future interaction their influence is limited. It is likely that more frequent communication is needed between the personal trainer and participants to attain stronger results. More research needs to be conducted in order to understand this influence.

Referent power was successful at increasing physical activity intentions at Time 1 and Time 2, as well as physical activity behavior at Time 2. Specifically, the friend condition significantly differed from the other conditions having the highest amounts of both moderate and vigorous physical activity time over the week, as well as the least amount of physical inactivity. These findings align with Ullrich-French et al.'s (2011) study where a best friend significantly increased physical activity intentions. Similarly, Okun et al. (2002) and Prochaska et al. (2002) found that close friends were significant motivators of physical activity behavior for college students. Indeed, close friends increased motivation as is evidenced in the increased intentions; which led to increased physical activity behavior.

The differences in vigorous and moderate behavior for the friend condition could be attributed to referent power translating to more internalized forms of motivation (Rodin & Janis, 1979; Ryn, 1997). In addition, participants in the friend condition compared to the personal trainer condition saw and communicated with the friend over that week. Although they may not have discussed the study, seeing and conversing with the friend could remind the

participant of the in-lab conversation thereby increasing physical activity behavior. Social support is a significant predictor of physical activity behavior (Booth et al., 2000; Courneya & McAuley, 2005; Courneya et al., 2000; Duncan et al., 2005; Felton & Parsons, 1994; Kahn et al., 2002; Leslie et al., 1999; Okun et al., 2003; Treiber et al., 1991; Verheijden et al., 2005; Wilcox et al., 2000; Wing & Jeffrey, 1999), and thus likely played an important role in the friend condition. Furthermore, it is also possible that since both the participant and friend engaged in the conversation about physical activity, that both parties in the dyad were positively affected and their behavior played off one another; they could have engaged in the behavior together. Conversing about physical activity, its benefits, and exploring hindrances to being active, even if only for 3-5 minutes, increased participants' intentions. Moreover, receiving messages during this conversation from a close friend encouraging physical activity influenced the participant to be less active, and engage in more moderate and vigorous activity.

Indeed, a relational level should be added to Kreuter and Skinner's (2000) five levels of communication as close friends appear to have an important influence on physical activity indicators and behavior. Given the amount of time spent talking or being together, close friends can play a powerful role in increasing intentions and physical activity behavior. Moreover, referent power can create reciprocal, sustainable behaviors among those in the pair or group as they can continuously motivate one another. Referent power in regard to physical activity behavior deserves further exploration.

Strengths and Limitations

First, the present research design included several strengths. Particular to the field of communication, this study united a critical, current societal issue (i.e., physical activity) with communication theory and research. This important topic is understudied in the field such that this study highlights the importance of communication in increasing physical activity behavior in our society. Moreover, the attempt to study differences among types of social power among message sources is among the first to do so. Determining effectiveness of different message sources can help researchers develop interventions that promote physical activity behavior over the lifespan.

Specific to the methodological approach, this study utilized a strong design. The messages were developed qualitatively and empirically tested in a pilot study. In addition, the messages were based upon tenets of SCT. Moreover, the main study utilized a random assignment that balanced both participant sex and physical activity levels. Furthermore, established, reliable measures for all dependent variables were used.

As is true in all investigations, this research has several limitations. This attempt to stimulate typical conversation sacrificed some internal validity for the sake of gaining ecological validity. First, this study made an effort to explore expert and referent power. A manipulation check verified that participants believed they sources differed in expertise, trustworthiness, goodwill, and closeness, however, a direct measure of social power was not utilized. Close

friends could also be a personal trainer (or a total sloth) and, therefore, the social power for the experimental conditions is not fully known.

In the experimental conditions, friends were trained on the spot to deliver message to the participant. Close friends had only once chance to send the message and were encouraged to both recite the message verbatim yet deliver it in a natural, conversational style. The personal trainers, on the other hand, were trained in advance and delivered the messages to all same-sex participants. Although, in some ways, this is beneficial as the researcher wanted friends to deliver messages as they would in a normal conversation with the participant, it also contributes error to the study as the message delivery is not identical across and within conditions. Similarly, participants only engaged in a 3-5 minute conversation. Although changes in intentions and behavior were found, this discussion, in the grand scheme of things, is a small amount of time.

Moreover, a variety of other factors may have influence the study's results. Participants were told not to discuss this study between Time 1 and Time 2, particularly those in the friend condition. When asked in the Time 2 questionnaire if they conversed with someone about this study during the previous week, several participants admitted they had. This communication could have affected Time 2 results. Likewise, even if close friends did not discuss the study, participants in that condition spent time with their close friend over the course of the week as opposed to those in the personal trainer condition who met and saw the trainer for the lab visit only. Moreover, if the close friend is (in)active it could have affected the participant's behavior.

Third, it is possible, as with any study, that participants are responding in ways that they believe the researcher desires them to respond. Given that the study is on physical activity behavior and participants do not want to sound as if they are inactive, especially when discussing said behaviors with a close friend or personal trainer, it is possible that participants responded in more favorable ways than they truly believe. Similarly, it is possible that sensitization occurred for the variables on both the Time 1 and Time 2 measure (i.e., attitudes, self-efficacy, and intentions). Fifth, the history effect, or external factors influencing the study, could also have contributed to why physical activity behavior did not change at Time 2 for the personal trainer condition. This study was conducted from mid-November until mid-December. During this time, some participants experienced Thanksgiving break, while others might have participated during final exams. Both these events could contribute to changes in physical activity indicators and behavior, as well as a variety of other factors.

Indeed, the internal validity of this experiment is somewhat compromised. This contributes to a lower level of external validity. Use of random sampling in a true experiment increases the generalizability of these findings; however, although physical activity level and sex were controlled for in the design, the distribution of class levels favored upper division students.

Future Research

First, more research is needed on expert and referent power in regards to increasing physical activity. It seems there could be a better way to train the close friend and have them deliver the messages in a manner more consistent with the

personal trainers. In addition, it is important to know the beliefs of the close friend regarding physical activity behavior. If the close friend who delivered a messages that were inconsistent with their beliefs and behaviors, it would be unlikely to be persuasive. What is more, dyadic data could be particularly helpful in explaining physical activity changes.

Second, theory is particularly beneficial to understanding and changing behavior. Specifically, SCT was useful in this study in changing physical activity intentions and behavior. Environmental factors, however, were not analyzed in this study and could play a significant role in college student physical activity behaviors as Fisher et al. (2005) and Hovell et al. (2005) have argued. Moreover, other theories and models (e.g., the Theory of Planned Behavior, the Transtheoretical Model) are effective in explaining physical activity behaviors (see Jung & Heald, 2009; Buckworth, 2001, respectively), as well. Interventions should continue to explore other theories and factors contributing to physical activity. Moreover, they should be examined in regards to expert and referent power.

Third, although this study examined self-report physical activity behavior, future research should include actual measures of physical activity behavior. For example, participants could come to the lab and receive the messages. Until the Time 2 collection, participants could wear a pedometer or accelerometer to assess their actual behavior. Along these lines, future research should continue to explore consequences of time. Studies could include several measures over time, for example, at one week, two weeks, and one month. Aligning with this point,

future research could have participants receive messages more than once to see if that changes the outcomes. For example, self-efficacy, in particular, revealed that continued communication over the one week could likely prevent deterioration in self-efficacy levels.

Future research should also examine tailored versus targeted message interventions using social cognitive theory. Given the ceiling effects for attitudes, response-efficacy, and self-efficacy, tailored message interventions could focus on the physical activity indicators that deserve addressing (i.e., outcome expectations, overcoming the ease of self-efficacy, and defining physical activity). In this way, studies could also compare tailored and targeted to expert and referent power by having experts and referents deliver both tailored and targeted information. This would provide more information on which intervention type is more appropriate for college students as well as continue to explore whether different message sources affect the outcomes.

Message interventions should also address different communication channels (e.g., text, email, websites, or phone). Given the abundance of technology, as well as the documented evidence that internet interventions (Cholewa & Irwin, 2008; Magoc et al., 2011) and text messaging interventions (Gerber, Stolley, Thompson, Sharp, & Fitzgibbon, 2009; Hurling et al., 2007) are successful in promoting physical activity behavior, the channel through which participants receive messages could affect their behaviors. For example, targeted message interventions via the Internet are successful at increasing physical activity behavior (Napolitano et al., 2002). College students use cell phones as a

primary way to communicate, reporting the highest level of cell phone use (Faulkner, & Culwin, 2005; Koivusilta, Lintonen, & Rimpela, 2007). Thus, having an expert or close friend send message(s) via text or talk on the cell phone might have a more significant impact on physical activity intentions and behaviors than face-to-face delivery.

Finally, this study utilized same-sex dyads. Future research should aim to explore whether mixed-sex dyads affect results. Moreover, studies should evaluate whether there are sex differences in the intervention. Although this study controlled for sex in the design, sex differences could not be analyzed because it was unknown as to whether differences between sexes were contributed to the sex of the participant or sex of the message source or both. Research finds that college women are more receptive to physical activity interventions compared to men (Calfas et al., 1994; Calfas et al., 2000), thus sex differences deserve exploration.

Implications for Interventions

Results of the present investigation have several important implications for future interventions. First, targeted messages, overall, were moderately successful at changing physical activity indicators (i.e., intentions and positive outcome expectations) and physical activity behavior. For the remaining indicators (i.e., attitudes, self-efficacy, and response-efficacy), targeted messages did not work; however, given the ceiling effect of these factors likely no message intervention would work. Thus, targeted message interventions should address factors for which college students do not already report high beliefs. Targeted

messages were also effective at changing behavior. Given participant changes in physical activity behavior after hearing six messages in a 3-5 minute discussion, message interventions would likely more and sustainable behaviors if messages are delivered more frequently. Furthermore, given the large effect size of the covariate (i.e., current physical activity level) to the variables, message interventions should differ in content based on if the participant is currently active or inactive.

Second, message source appeared to make little difference for the physical activity variables except for positive outcome expectations. Only the expert source significantly increased positive outcome expectations. Both expert and referent sources were able to significantly increase intentions compared to the control condition, as well as overall physical activity behavior. Upon closer examination of physical activity behavior, however, the friend condition significantly differed from the other conditions on amount of time doing moderate and vigorous physical activity behavior. This reveals that friends were able to substantially increase both moderate and vigorous behaviors over the one week. Moreover, friends were significantly different from the personal trainer condition in that participants in the friend condition reported the least amount of inactivity while those in the personal condition reported the most. These findings reveal that referent power is more likely to create changes; however, future interventions should continue to explore different message sources as this is the first study to compare expert and referent power.

Third, SCT was particularly useful in explaining college student physical activity beliefs and behavior as all of the variables were correlated and most contributed to behavior (notable exception includes response-efficacy). Interventions should continue to utilize components of social cognitive theory, as well as explore other factors affecting college student physical activity behavior. In addition, given that students in the experimental conditions had substantially higher intentions and physical activity behavior it seems that intentions are a strong predictor to behavior. This study did not include environmental forces, such as social support or facility accessibility, a key social cognitive theory factor, that should be included in future interventions. These forces, including both facilitators and barriers, could explain more about physical activity behavior.

Fourth, time revealed a significant, negative impact on self-efficacy levels, such that over the course of one week participants not receiving messages significantly decreased their self-efficacy levels differing from those receiving messages. Interventions should address time by communicating messages more often in order to prevent deterioration in the self-efficacy belief.

Finally, this experiment attempted to increase physical activity behavior in college students. Although significant differences were not found across conditions, scores on both the SBAS and IPAQ revealed that students vary substantially on their college physical activity behaviors. Similarly, BMI scores exposed students who are severely underweight and students who are morbidly obese. Moreover, descriptive measures indicated that more than half the students in this study believed they need more physical activity likely because more than

half reported they are inactive for six or more hours per day. The evidence supports that interventions need to target college students in addition to children, elderly adults, and minority populations. Researchers should continue to explore ways to increase college student physical activity behaviors so that a foundation of these behaviors can be achieved and sustained.

Conclusions

This study utilized targeted messages and expert and referent sources in an effort to promote physical activity behavior in college students. Targeted messages were developed using social cognitive theory. Thus, this experiment helped determine if participants receiving messages significantly differed in physical activity indicators than those who did not. In addition, participants received messages from either a personal trainer (i.e. expert power) or a close friend (i.e., referent power), thus determining if message source affects physical activity outcomes. Finally, participants completed measures immediately following message delivery and one week later to determine if changes occurred over time. Results indicated that both the personal trainer and close friend conditions had significantly higher scores than the control condition for intentions at Time 1 and Time 2, as well as Time 2 physical activity behavior. Moreover, the personal trainer condition had significantly higher positive outcome expectations compared to both the friend and control conditions. No other significant differences were found across conditions for Time 1 attitudes, response-efficacy, negative outcome expectations, self-efficacy, and Time 2 attitudes, and self-efficacy.

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APPENDIX A

IRB APPROVAL LETTER FOR PILOT STUDY

ASU Knowledge Enterprise Development

Office of Research Integrity and Assurance

To:	Daniel Canary STAUF
From:	Mark Roosa, Chair SM Soc Beh IRB
Date:	04/22/2011
Committee Action:	**Exemption Granted**
IRB Action Date:	04/22/2011
IRB Protocol #:	1104006355
Study Title:	College Students' Physical Activity Behavior

The above-referenced protocol is considered exempt after review by the Institutional Review Board pursuant to Federal regulations, 45 CFR Part 46.101(b)(2) .

This part of the federal regulations requires that the information be recorded by investigators in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects. It is necessary that the information obtained not be such that if disclosed outside the research, it could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.

You should retain a copy of this letter for your records.

APPENDIX B

PILOT STUDY TARGETED MESSAGES

On a scale from 1 being not effective at all and 7 being highly effective, rate the extent to which you believe each message would be effective in motivating you to be physically active.

Physical activity will be beneficial in the end.
I'll feel better about myself after being active.
I will be happy with myself after I do physical activity.
It is valuable for you to be physically active.
Physical activity is not going to kill me; I can do it.
I am working out because I will feel good.
Physical activity is not that bad; it will get easier the more I do it.
I can get in better shape - be more active.
By doing this activity, I am getting stronger.
I owe it to my body to give it one hour of activity.
Push; I can do this activity.
I'm trying to get to this overall goal, if I'm not active I won't get there.
Get up and go; be active! I can do it!
Bear through this physical activity.
I look good and feel good now all because of the physical activity.
Changes don't occur overnight when you are active, remember your goals.
If s/he can be active, I can do it.
Don't be weak in this activity.
If I can do this activity, imagine what else I can do.
There's no good reason for me to quit or not do physical activity.
I'm doing this to stay active.
I want to look good for this guy or girl.
I have discipline to do this activity.
I'm already being active, I might as well finish.
Look at those people who are being physically active, so should I.
My goal is not beneficial unless I am active.
I can get guys/girls with this body.
By doing this activity I am losing weight.
I have nothing better to do, might as well be active.
I need to burn the calories I already ate or the calories I want to be eating.
My clothes don't fit like they should; I need to get to the gym.
The people around me are working hard in their physical activities.
If I do physical activity X many times this week, I can do Z event (e.g., party, wear bathing suit, go out).
I was in such better shape a few years ago.
If I do physical activity X many times this week, I can eat X.
If I do physical activity X many times this week, I can drink Y.
I was not in shape before being active; I don't want to go back to that.

APPENDIX C

PILOT STUDY STANFORD BRIEF ACTIVITY SURVEY (SBAS)

On-the-Job and At-School Activity

A. ☐ If you have no job or regular work, check box A and go on to Appendix Table 2.

B. ☐ I spent most of the day sitting or standing. When I was at work or school, I did such things as writing, typing, talking on the phone, assembling parts, or operating a machine that takes very little exertion or strength. I did not lift or carry anything for more than a few minutes each day.

C. ☐ I spent most of the day walking or using my hands and arms at work or school that required moderate exertion. When I was at work, I did such things as delivering mail, patrolling on guard duty, doing mechanical work on automobiles or other large machines, house painting, or operating a machine that requires some moderate-activity work of me. I lift and carry things frequently at work or to and from school.

D. ☐ I spent most of the day lifting or carrying heavy objects or moving most of my body in some other way. When I was at work, I did such things as stacking cargo or inventory, handling parts or materials, or doing work like that of a carpenter who builds structures or a gardener who does most of the work without machines.

E. ☐ I spent most of the day doing hard physical labor. When I was at work, I did such things as digging or chopping with heavy tools or carrying heavy loads (bricks, for example) to the place where they were to be used. IfI drove a truck or operated equipment, my job also required me to do hard physical work most of the day with only short breaks.

Leisure-time Activity

F. ☐ Most of my leisure time was spent without very much physical activity. I mostly did things like watching television, reading, playing cards, or playing on the computer. If I did anything else, it was likely to be light chores around the house or yard or some easy-going game like bowling or catch. Only occasionally, no more than once or twice a month, did I do anything more vigorous, like jogging, playing tennis, or active gardening.

G. ☐ Weekdays, when not at work or school, I did few active things, but most weekends I was able to get outdoors for some light exercise – going for walks, playing a round of golf (without motorized carts), or doing some active chores around the house.

H. ☐ Three times per week, on average, I engaged in some moderate activity, such as brisk walking or slow jogging, swimming, or riding a bike for 15-20 minutes or more or I spent 45 minutes to an hour or more doing moderately difficult chores, such as raking or washing windows, mowing the lawn or vacuuming, or playing games such as doubles tennis or basketball.

I. ☐ During my leisure time over the past year, I engaged in a regular program of physical fitness involving some kind of heavy physical activity at least three times per week. Examples of heavy physical activity are jogging, running, or riding fast on a bicycle for 30 minutes or more; heavy gardening or other chores for an hour or more; active games or sports such as handball or tennis for an hour or more; or a regular program involving calisthenics and jogging or the equivalent for 30 minutes or more.

J. ☐ Over the past year, I engaged in a regular program of physical fitness along the lines described in the last paragraph (I), but I did it almost *daily* – five or more times per week.

APPENDIX D

PILOT STUDY INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE (IPAQ)

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

1. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

   _____ **days per week**

   ☐ No vigorous physical activities → ***Skip to question 3***

2. How much time did you usually spend doing **vigorous** physical activities on one of those days?

   _____ **hours per day**

   _____ **minutes per day**

   ☐ Don't know/Not sure

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

   _____ **days per week**

   ☐ No moderate physical activities → ***Skip to question 5***

4. How much time did you usually spend doing **moderate** physical activities on one of those days?

   _____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.

5. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

_____ **days per week**

☐ No walking → ***Skip to question 7***

6. How much time did you usually spend **walking** on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the **last 7 days**, how much time did you spend **sitting** on a **week day**?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

APPENDIX E

IRB APPROVAL LETTER FOR EXPERIMENTAL STUDY

ASU Knowledge Enterprise Development

Office of Research Integrity and Assurance

To:	Anthony Roberto
From:	Mark Roosa, Chair Soc Beh IRB
Date:	11/09/2011
Committee Action:	**Exemption Granted**
IRB Action Date:	11/09/2011
IRB Protocol #:	1110007034
Study Title:	Testing Theory in Communication: Using Friends to Increase College Student Physical Activity Behavior

The above-referenced protocol is considered exempt after review by the Institutional Review Board pursuant to Federal regulations, 45 CFR Part 46.101(b)(2) .

This part of the federal regulations requires that the information be recorded by investigators in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects. It is necessary that the information obtained not be such that if disclosed outside the research, it could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.

You should retain a copy of this letter for your records.

APPENDIX F

CONSENT FORM FOR EXPERIMENTAL STUDY PARTICIPANT

Dear ASU Student,

My name is Jen Marmo and I am a graduate student under the supervision of Dr. Anthony J. Roberto in the Hugh Downs School of Human Communication at Arizona State University.

I am writing to ask for your participation in a study about physical activity. I am asking ASU students like yourself to complete a study. Your participation in this study is very important and will not only further research at ASU, but help in advancing knowledge on physical activity. Today we are going to complete an approximately 30 minute lab study. You will engage in a brief discussion for 3-5 minutes on your physical activity behavior and then complete a questionnaire.

You have been invited to participate in this study because you completed and met the inclusion criteria. Your participation in this study is voluntary. If you choose not to participate or to withdraw from the study at any time, you will not be penalized; partial credit will be awarded for the lab study and full extra credit for the completion of the entire study. All extra credits points are at the discretion of your instructor.

There are no foreseeable risks or discomforts to your participation; this study is based on your current physical activity behaviors. You will be providing your name on your questionnaire; however this information will remain confidential – only the researchers will know it. Once data collection is complete, your name will change to a participant number and your responses will be anonymous. The results of this study may be used in reports, presentations, or publications but your name will not be known.

I appreciate your time and thank you for your participation. You will participate in the online questionnaire one week following your lab visit. Once you complete the online questionnaire, you will receive extra credit.

If you have any questions concerning this study, please contact me at jmarmo@asu.edu. If you have any questions about your rights as a participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788.

Cheers,

Jennifer Marmo, M.A.

Your signature below indicates that you consent to participate in the above study.

_____	_____	_____
Subject's Signature	Printed Name	Date

APPENDIX G

CONSENT FORM FOR EXPERIMENTAL STUDY FRIEND

Dear Friend:

My name is Jen Marmo and I am a graduate student under the direction of Dr. Anthony J. Roberto in the Hugh Downs School of Human Communication at Arizona State University. I am conducting a research study regarding physical activity behavior.

I am inviting your participation, which will involve a brief 3-5 minute discussion with your friend and then completion of a brief questionnaire. Your participation should require no more than 30 minutes to complete.

Your participation in this study is voluntary. If you choose not to participate or to withdraw from the study at any time, there will be no penalty; however, your friend (the participant) will not be able to receive credit for the study.

There are no direct benefits to you as a participant; however, possibly due to discussing physical activity you might become more aware of your physical activity behaviors and potentially increase your physical activity intentions or behaviors. There are no foreseeable risks or discomforts to your participation.

In order to ensure confidentiality, your name will not be associated with any response. In addition, you will be assigned a participant number that will be used in research manuscripts. Others will only see the data in summary form (that is, a summary of everyone who participates) or as selected comments without your name attached. Your responses will be confidential. The results of this study may be used in reports, presentations, or publications but your name will not be known.

If you have any questions concerning the research study, please contact Jennifer Marmo at jmarmo@asu.edu. If you have any questions about your rights as a participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788. Please let me know if you wish to be part of the study.

Respectfully,

Jennifer Marmo, M.A.

By signing below you are agreeing to participate to in the study.

_____ _____

Signature Date

APPENDIX H

EXPERIMENTAL MESSAGES DELIVERED BY MESSAGE SOURCE

Outcome Expectations	Self-Efficacy	Goal-Oriented
Physical activity will be beneficial to you in the end.	Physical activity is not that bad; it will get easier the more you do it.	You can get in better shape - be more active.
You'll feel better about yourself after being active.	Physical activity is not going to kill you; you can do it.	By doing this activity, you are getting stronger.

APPENDIX I

EXPERIMENTAL STUDY SCREENING QUESTIONNAIRE

1. Are you aged 18-25?
   - ❑ Yes
   - ❑ No
2. Did you participate in the procedural pilot study?
   - ❑ Yes
   - ❑ No
3. Are you a current athlete participating in a university-sponsored sport or club team (this does not include intramural sports)?
   - ❑ Yes
   - ❑ No

∗4. Please think about your activity levels on-the-job and at-school and select the best response.

◯ A. If you have no job or regular work, check box A and go on to Appendix Table 2.

◯ B. I spent most of the day sitting or standing. When I was at work or school, I did such things as writing, typing, talking on the phone, assembling parts, or operating a machine that takes very little exertion or strength. I did not lift or carry anything for more than a few minutes each day.

◯ C. I spent most of the day walking or using my hands and arms at work or school that required moderate exertion. When I was at work, I did such things as delivering mail, patrolling on guard duty, doing mechanical work on automobiles or other large machines, house painting, or operating a machine that requires some moderate-activity work of me. I lift and carry things frequently at work or to and from school.

◯ D. I spent most of the day lifting or carrying heavy objects or moving most of my body in some other way. When I was at work, I did such things as stacking cargo or inventory, handling parts or materials, or doing work like that of a carpenter who builds structures or a gardener who does most of the work without machines.

◯ E. I spent most of the day doing hard physical labor. When I was at work, I did such things as digging or chopping with heavy tools or carrying heavy loads (bricks, for example) to the place where they were to be used. If I drove a truck or operated equipment, my job also required me to do hard physical work most of the day with only short breaks.

5. Please think about your activity during leisure-time and select the best response.

◯ F. Most of my leisure time was spent without very much physical activity. I mostly did things like watching television, reading, playing cards, or playing on the computer. If I did anything else, it was likely to be light chores around the house or yard or some easy-going game like bowling or catch. Only occasionally, no more than once or twice a month, did I do anything more vigorous, like jogging, playing tennis, or active gardening.

◯ G. Weekdays, when not at work or school, I did few active things, but most weekends I was able to get outdoors for some light exercise – going for walks, playing a round of golf (without motorized carts), or doing some active chores around the house.

◯ H. Three times per week, on average, I engaged in some moderate activity, such as brisk walking or slow jogging, swimming, or riding a bike for 15-20 minutes or more or I spent 45 minutes to an hour or more doing moderately difficult chores, such as raking or washing windows, mowing the lawn or vacuuming, or playing games such as doubles tennis or basketball.

◯ I. During my leisure time over the past year, I engaged in a regular program of physical fitness involving some kind of heavy physical activity at least three times per week. Examples of heavy physical activity are jogging, running, or riding fast on a bicycle for 30 minutes or more; heavy gardening or other chores for an hour or more; active games or sports such as handball or tennis for an hour or more; or a regular program involving calisthenics and jogging or the equivalent for 30 minutes or more.

◯ J. Over the past year, I engaged in a regular program of physical fitness along the lines described in the last paragraph (I), but I did it almost daily – five or more times per week.

6. What is your age?

☐ Years

7. What is your sex?

❑ Male

❑ Female

8. What is your year in school based on credits completed?

❑ Freshman

❑ Sophomore

❑ Junior

❑ Senior

❑ Fifth Year

9. Please check the category that best describes your ethnic background: (check as many as apply).

❑ Caucasian

❑ African American

❑ Hispanic

❑ Asian/Pacific Islanders

❑ Native American

❑ Other (please specify) ☐

10. What is your current height (e.g., 5'5'')?

☐ Feet ☐ Inches

11. What is your current weight (e.g., 125 pounds)?

☐ Pounds

12. How inactive would you say you are during a typical day, aka how much do you sit excluding sleeping hours?

❑ 0-2 hours

❑ 3-5 hours

❑ 6-7 hours

❑ 8-10 hours

❑ 12+ hours

13. Which of these statements best represents your current view on physical activity?

❑ I do enough physical activity to keep healthy

❑ I ought to be more physically active

❑ Don't know

14. Regular physical activity is any physical exertion intended to improve or maintain physical fitness and health, performed at least 30 minutes of moderate physical activity five days per week or at least 45 minutes of vigorous physical activity three days per week.

If you had to select a physical activity stage, which one is your current level of physical activity?

❑ I am inactive and not thinking about becoming more active

❑ I am inactive and thinking about becoming more active

❑ I am doing some physical activity but not on a regular basis

❑ I am doing enough physical activity but I have only done so within the last 6 months

❑ I make physical activity a habit by engaging in regular activity and I've done so for longer than 6 months

APPENDIX J

EXPERIMENTAL STUDY TIME 1: CONTROL CONDITION

Physical activity is defined as activities that you can do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport. The recommended amount is at least 30 minutes of moderate physical activity five days per week or at least 45 minutes of vigorous physical activity three days per week.

1. Please rate your confidence regarding your ability to be physically active on a 1 (strongly disagree) to 7 (strongly agree) scale.

	Strongly Disagree 1	Somewhat Disagree 2	Disagree 3	Neutral 4	Agree 5	Somewhat Agree 6	Strongly Agree 7
I am able to be physically active	☐	☐	☐	☐	☐	☐	☐
I am confident I can be physically active	☐	☐	☐	☐	☐	☐	☐
It is easy to be physically active	☐	☐	☐	☐	☐	☐	☐

2. Please rate the following statements regarding the importance of physical activity on a 1 (strongly disagree) to 7 (strongly agree) scale.

	Strongly Disagree 1	Somewhat Disagree 2	Disagree 3	Neutral 4	Agree 5	Somewhat Agree 6	Strongly Agree 7
Physical activity is valuable to a healthy life	☐	☐	☐	☐	☐	☐	☐
Physical activity prevents health conditions, such as diabetes, obesity, high cholesterol, high blood pressure, and other illness	☐	☐	☐	☐	☐	☐	☐
Physical activity prolongs my life	☐	☐	☐	☐	☐	☐	☐
Physical activity helps with weight management	☐	☐	☐	☐	☐	☐	☐

3. Please rate your attitudes regarding physical activity on the following scale.

Physical activity is…

Bad	___	___	___	___	___	___	___	Good
Undesirable	___	___	___	___	___	___	___	Desirable
Unfavorable	___	___	___	___	___	___	___	Favorable
Unimportant	___	___	___	___	___	___	___	Important
Insensible	___	___	___	___	___	___	___	Sensible

4. Please rate your intentions regarding physical activity on a 1 (strongly disagree) to 7 (strongly agree) scale.

	Strongly Disagree 1	Somewhat Disagree 2	Disagree 3	Neutral 4	Agree 5	Somewhat Agree 6	Strongly Agree 7
I will try to be participate in physical activity	☐	☐	☐	☐	☐	☐	☐
I intend to participate in physical activity	☐	☐	☐	☐	☐	☐	☐
I have decided to participate in physical activity	☐	☐	☐	☐	☐	☐	☐
I am determined to participate in physical activity	☐	☐	☐	☐	☐	☐	☐

5. Below is a list of possible outcomes of participating in regular exercise. Please indicate *how likely it is* that you would experience the outcomes below on a 1 (not at all likely) to 5 (extremely likely) scale.

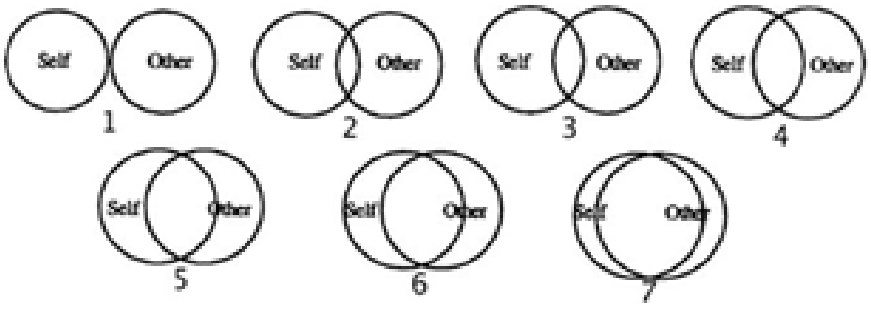
	Not at all likely 1	Somewhat Likely 2	Moderately Likely 3	Very Likely 4	Extremely Likely 5
I will build up my muscle strength	☐	☐	☐	☐	☐
It will be too time-consuming	☐	☐	☐	☐	☐
I will feel less depressed and/or bored	☐	☐	☐	☐	☐
I will improve my self-esteem	☐	☐	☐	☐	☐
It will make me feel tired	☐	☐	☐	☐	☐
I will not be good at doing the activity	☐	☐	☐	☐	☐
It will take too long t achieve the outcomes I want	☐	☐	☐	☐	☐
I will not enjoy it	☐	☐	☐	☐	☐
I will feel less tension and stress	☐	☐	☐	☐	☐
It will be too much work and effort to motivate myself to do the activity	☐	☐	☐	☐	☐
I will improve my health or reduce my risk of disease	☐	☐	☐	☐	☐
I will do better on my job	☐	☐	☐	☐	☐
I will feel physically uncomfortable while doing the activity	☐	☐	☐	☐	☐
It will be difficult to find friends to do the activity with me	☐	☐	☐	☐	☐
I will feel more attractive	☐	☐	☐	☐	☐
I will improve my heart and lung fitness	☐	☐	☐	☐	☐
It will cost too much money	☐	☐	☐	☐	☐
I will find it boring	☐	☐	☐	☐	☐
I will increase my energy level	☐	☐	☐	☐	☐
I will improve my muscle tone	☐	☐	☐	☐	☐
It will take away from the time I have to spend with my friends	☐	☐	☐	☐	☐
It will take away from the time I have for my schoolwork	☐	☐	☐	☐	☐
I will feel better about my body	☐	☐	☐	☐	☐
I will gain muscle	☐	☐	☐	☐	☐
It will decrease the energy I have for other activities	☐	☐	☐	☐	☐

APPENDIX K

EXPERIMENTAL STUDY TIME 1: PERSONAL TRAINER CONDITION

Appendix F plus the following questions:

6. The following series of diagrams shows a number of overlapping circles. The degree of overlap indicates how closely the two people represented by the circles are.



Thinking of the personal trainer, please check the box below that corresponds with the diagram that shows how close you feel to this person.

❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5 ❑ 6 ❑ 7

7. Thinking of the personal trainer, please mark the blank that aligns with how you feel about the personal trainer.

The personal trainer is…

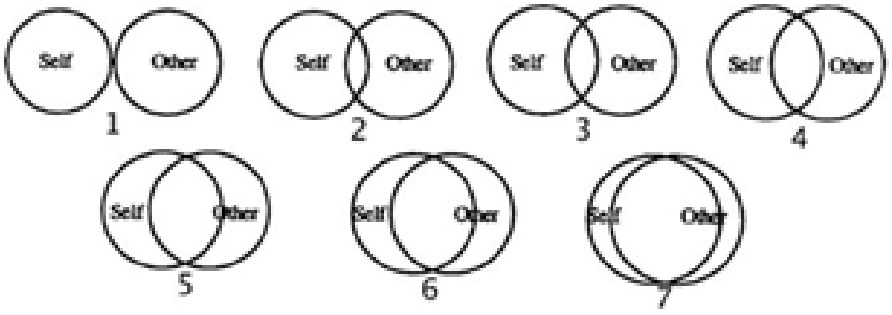
Intelligent	___ ___ ___ ___ ___ ___ ___	Unintelligent
Untrained	___ ___ ___ ___ ___ ___ ___	Trained
Inexpert	___ ___ ___ ___ ___ ___ ___	Expert
Informed	___ ___ ___ ___ ___ ___ ___	Uninformed
Incompetent	___ ___ ___ ___ ___ ___ ___	Competent
Bright	___ ___ ___ ___ ___ ___ ___	Stupid
Cares about me	___ ___ ___ ___ ___ ___ ___	Does not care about me
Has my interests at heart	___ ___ ___ ___ ___ ___ ___	Does not have my interests at heart
Self-centered	___ ___ ___ ___ ___ ___ ___	Not self-centered
Concerned with me	___ ___ ___ ___ ___ ___ ___	Unconcerned with me
Insensitive	___ ___ ___ ___ ___ ___ ___	Sensitive
Not understanding	___ ___ ___ ___ ___ ___ ___	Understanding
Honest	___ ___ ___ ___ ___ ___ ___	Dishonest
Untrustworthy	___ ___ ___ ___ ___ ___ ___	Trustworthy
Honorable	___ ___ ___ ___ ___ ___ ___	Dishonorable
Moral	___ ___ ___ ___ ___ ___ ___	Immoral
Unethical	___ ___ ___ ___ ___ ___ ___	Ethical
Phony	___ ___ ___ ___ ___ ___ ___	Genuine

APPENDIX L

EXPERIMENTAL STUDY TIME 1: FRIEND CONDITION

Appendix F plus the following questions:

6. The following series of diagrams shows a number of overlapping circles. The degree of overlap indicates how closely the two people represented by the circles are.



Thinking of your close friend, please check the box below that corresponds with the diagram that shows how close you feel to this person.

❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5 ❑ 6 ❑ 7

7. What is your close friend's sex?

❑ Male

❑ Female

8. Is your close friend an ASU student?

❑ Yes

❑ No

9. Is your close friend a family member?

❑ Yes

❑ No

10. Thinking of your close friend, please mark the blank that aligns with how you feel about your close friend.

My friend is…

Intelligent	___	____	____	____	____	____	____	Unintelligent
Untrained	___	____	____	____	____	____	____	Trained
Inexpert	___	____	____	____	____	____	____	Expert
Informed	___	____	____	____	____	____	____	Uninformed
Incompetent	___	____	____	____	____	____	____	Competent
Bright	___	____	____	____	____	____	____	Stupid
Cares about me	___	____	____	____	____	____	____	Does not care about me
Has my interests at heart	___	___	____	___	____	___	____	Does not have my interests at heart
Self-centered	___	____	____	____	____	____	____	Not self-centered
Concerned with me	___	____	____	____	____	____	____	Unconcerned with me
Insensitive	___	____	____	____	____	____	____	Sensitive
Not understanding	___	____	____	____	____	____	____	Understanding
Honest	___	____	____	____	____	____	____	Dishonest
Untrustworthy	___	____	____	____	____	____	____	Trustworthy
Honorable	___	____	____	____	____	____	____	Dishonorable
Moral	___	____	____	____	____	____	____	Immoral
Unethical	___	____	____	____	____	____	____	Ethical
Phony	___	____	____	____	____	____	____	Genuine

APPENDIX M

EXPERIMENTAL STUDY TIME 2: ALL CONDITIONS

1. IPAQ (see Appendix C)
2. Attitudes (see Appendix F)
3. Self-Efficacy (see Appendix F)
4. Intentions (see Appendix F)