FEELINGS OF PHYSICAL AND MENTAL ENERGY, EXERCISE-RELATED
SELF-EFFICACY BELIEFS AND EXERCISE PARTICIPATION
IN COLLEGE STUDENTS

DISSERTATION

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By

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ABSTRACT

This study utilized a path analysis approach to examine the relationship between feelings of physical and mental energy, task and scheduling self-efficacy beliefs, and participation in moderate and vigorous exercise among college students. Additionally, the mediating effect of task and scheduling self-efficacy beliefs on the relationship between the feeling of energy and exercise participation was also examined.

A total of 368 full-time, apparently healthy undergraduate students completed self-reported survey questionnaires. The result indicated that univariate relationships between feelings of physical and mental energy, task and scheduling self-efficacy beliefs and exercise behaviors were significant. The path analysis revealed that the hypothesized path model had a strong fit to the study data. The path model showed that feelings of physical energy had significant direct effects on task and scheduling self-efficacy beliefs as well as exercise behaviors. In addition, scheduling self-efficacy beliefs had direct effects on moderate and vigorous exercise behaviors. However, there was no significant direct relationship between task self-efficacy beliefs and exercise behaviors. The path model also revealed that scheduling self-efficacy beliefs partially mediated the relationship between feelings of physical energy and exercise behaviors.
Dedicated to My Father
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CHAPTER 1

INTRODUCTION

Background

Regular physical activity has been well-documented as a behavior to improve a number of health outcomes (U.S. Department of Health and Human Services, 2000). However, more than half (50.9%) of the adult population in the United States is still not physically active enough to meet the Centers for Disease Control and Prevention (CDC) and the American College of Sports Medicine (ACSM) recommendation that “US adults should engage in 30 minutes or more of moderate physical activity five or more days per week, or vigorous physical activity for 20 minutes three or more days per week to promote and maintain health (CDC, 2005; Pate, Pratt, Blair, Haskell, Macera, Bouchard, et al., 1995).

Health behaviors such as physical activity in childhood, adolescence, and young adulthood can determine quality of life in one’s later life (Buckworth, 2001). In addition, a decline in physical activity during young adulthood may lead to a pattern of sedentary behavior, which may persist throughout one’s later life (Malina, 2001). Promoting a physically active lifestyle is, therefore, a major public health concern. However, the epidemiological evidence shows that physical activity participation declines with
increasing age, and the sharpest decline occurs during adolescence and young adulthood (Caspersen, Pereira, & Curran, 2000; CDC, 2005).

Adolescents and young adults often experience major changes in their lives (Rindfuss, 1991). For example, during the transition from late adolescence to young adulthood, routines and habits that were established in the relatively structured environment of high school and parental home may be changed (e.g., entry to the workplace, military service, or higher education). This life-cycle transition is associated with an abundance of increased health risk factors including decline in physical activity and high incidence of obesity (Bray & Born, 2004). Recent data clearly show an alarming decline in physical activity in this segment of the population. Results from the 2005 Youth Risk Behavior Surveillance Survey (YRBSS) indicate that the proportion of high school students who participated in at least 20 minutes of vigorous physical activity on three or more days of the previous seven days and/or at least 30 minutes of moderate physical activity on five or more days of the previous seven days declined from grades 9th to 12th from 73.5% to 61.8% respectively. This decline continues so that only 44.2% of college students reported performing vigorous or moderate exercise on at least three out of the previous seven days (The National College Health Association, 2007). Bray and Born (2004) confirmed the pattern of the decline in physical activity in their study, showing that among the first year college students who originally reported an average of three or more bouts of vigorous physical activity lasting for 20 minutes or longer per
week in the period of the last eight weeks of high school, only one third remained at that level of vigorous physical activity. In combination, available data show a dramatic decline in physical activity during the transition from a high school to a university.

Taking into account this decline in physical activity in the transition from late adolescence to young adulthood and the fact that the decline in physical activity in young adulthood can persist and lead to a sedentary lifestyle throughout one’s later life, identifying and examining predictors of physical activity in this population is clearly important. Once identified and understood, researchers and practitioners can develop more effective interventions to maximize both exercise adoption and adherence (Baranowski, Anderson, & Carmack, 1998).

One of the most consistently identified predictors of exercise behavior is self-efficacy (McAuley & Blissmer, 2000; Trost et al., 2002). According to self-efficacy theory, self-efficacy is defined as beliefs regarding individuals’ capabilities to produce performances that will lead to anticipated outcomes (Bandura, 1997). A number of studies have shown that self-efficacy is a significant predictor of exercise adoption and adherence across different populations. For example, a recent cross-sectional study of 161 college students (Von Ah et al., 2005) found self-efficacy to be significantly related to physical activity behavior. In a recent longitudinal study over a four year period, Resnick (2004) found that self-efficacy significantly influenced maintenance of regular exercise in 78 older adults. Additionally, Oman and King (1998) examined the influence
of self-efficacy on exercise participation in 63 health sedentary adults. They reported that among subjects participating in a supervised home-based activity program, baseline self-efficacy significantly predicted exercise adherence. Further, in a review of approximately 300 studies on the determinants of adult physical activity (Trost et al., 2002), self-efficacy was found to be the most consistent correlate of physical activity behavior.

Although a considerable amount of research has examined the relationship between self-efficacy and exercise behavior, sources of information that influence self-efficacy have been examined less frequently. According to Bandura (1986), self-efficacy is influenced by four different sources: mastery experiences in successful performance, vicarious learning, verbal persuasion and interpretations of physiological and affective states. For example, successful performance experiences in a behavior strengthen self-efficacy for that behavior, whereas perceptions of failure diminish self-efficacy. Observing others succeed or fail can influence self-efficacy as people see what others are able to do and use the information to form expectancies about their own behavior. Verbal persuasion can be a further means of strengthening self-efficacy when people have the capabilities to achieve what they seek. Verbal persuasion may be a less potent source of enduring increases in self-efficacy than the two former sources of self-efficacy.

Interpretations of physiological and affective states may be an important factor in exercise-related research. Bandura (1997) indicated “physiological indicators of efficacy
play an especially influential role in health functioning and in activities requiring physical strength and stamina” (p. 106). He argued that emotions, autonomic arousal (e.g., physiological reactions in stressful situations) and physical states (e.g., fatigue, aches, and pains) can potentially influence self-efficacy. That is, enhancing physical states and reducing stress levels and negative mood can alter efficacy beliefs (Bandura, 1997; Maddux, 1995).

Unfortunately, the influence of physiological and affective states upon changes in exercise-related self-efficacy has received little attention in the extant literature. Only a few studies have shown that physiological and affective states act as sources of self-efficacy information and can reciprocally determine subsequent efficacy. For example, McAuley and Courneya (1992) found that sedentary adults with high perception of exercise self-efficacy experienced more positive feeling states (e.g., energy-related concepts) during exercise than those with lower self-efficacy. Treasure and Newbery (1998) also reported a significant relationship between feeling states and exercise self-efficacy in sedentary undergraduate students. In addition, in a study of effects of self-efficacy manipulation on feeling states (Jerome et al., 2002), participants in the high-efficacy condition reported more energy and less fatigue than those in the low-efficacy condition. More research is needed to determine if physiological and affective states influence exercise-related self-efficacy and, further, exercise behavior.
Feelings of physical and mental energy have physiological and affective aspects, and have been measured in several studies addressed above (e.g., Jerome et al., 2002; Treasure & Newberry, 1998). Feelings of physical and mental energy are distinct, biologically-based constructs, and individuals vary in their experience of the feelings as a function of not only physical influences but also psychological factors. These senses of energy refer to positive and negative feelings about the capacity to complete physical or mental activities (O’Connor & Puetz, 2005). In addition, these feelings can be referred to as a specific physical and psychological experience of possessing enthusiasm and spirit, and can correspond to the experience of oneself as a potential origin of action (DeCharms, 1968). Theoretically, the greater feelings of energy may lead to the perception of self-efficacy, and may play an important role in performing exercise behavior. A prospective, epidemiological study reported that those who reported a high level of physical activity at baseline reported more frequent feelings of energy two years later compared with those who reported a low level of baseline physical activity (Stewart et al., 1994). However, research that directly addresses this relationship is lacking.

As mentioned earlier, self-efficacy has been a robust predictor of exercise. However, a single dimension of self-efficacy may not account for behavioral variability. That is, self-efficacy is viewed as being behavior-specific and is conceptualized as being comprised of several different types of efficacy beliefs that may influence exercise behavior. For example, one would need self-efficacy for performing some basic
exercising skills when one initiates an exercise program. However, in order to maintain the regular exercise program, one may need another type of self-efficacy, such as self-efficacy for regulating barriers (Schwarzer & Renner, 2000). Maddux (1995) distinguished two different types of self-efficacy, which seem particularly relevant to exercise behavior: task self-efficacy and self-regulatory self-efficacy. Task self-efficacy refers to one’s belief in the ability to perform the elemental aspects of a task (e.g., perceived ability to walk for 30 minutes at a certain level of intensity). Self-regulatory self-efficacy, also referred to as coping self-efficacy, refers to one’s belief in the ability to perform the tasks under challenging conditions (e.g., perceived ability to exercise in spite of environmental challenges).

Besides the two types of self-efficacy, scheduling self-efficacy has also been discussed as an important predictor of regular exercise behavior (DuCharme & Brawley, 1995; Rodgers & Sullivan, 2001; Rodgers, Hall, Blanchard, McAuley, & Munroe, 2002). Scheduling self-efficacy, a specific type of self-regulatory self-efficacy, is defined as an individual’s confidence in the ability to organize regular exercise (Rodgers et al., 2002). Since research findings have shown that lack of time is one of the most frequently reported barriers to regular exercise, the confidence in the ability to effectively schedule regular exercise would have a significant impact on the engagement in regular exercise.

In summary, although perception of physiological and affective responses may be an important precursor of exercise-related self-efficacy, the relationship between
perceptions of physiological and affective states, self-efficacy beliefs, and exercise behavior has yet to be systematically investigated. Therefore, it would be necessary to examine the association between physiological and affective aspects (e.g., feelings of physical and mental energy) and exercise related self-efficacy (e.g., task and scheduling self-efficacies). In addition, both task self-efficacy and scheduling self-efficacy may be important factors in promoting exercise behavior because they are related to abilities integral to performing elemental dimensions of exercise behavior and regulating schedules under challenging conditions. Therefore, it would also be important to address whether those two types of self-efficacy are associated with exercise behavior.

Furthermore, from the self-efficacy theory perspective, the causal factors of human behavior and the behavior itself are reciprocally interactive (Bandura, 1997; Maddux, 1995). That is, variables such as feelings of physical and mental energy, task and self-regulatory self-efficacies and exercise behavior may reciprocally interact each other. Unfortunately, to date, no studies have addressed the trends among these variables.
Purpose of the study

The primary purpose of this study was to examine the relationship among feelings of physical energy and mental energy, exercise-related self-efficacy (e.g., Task Self-Efficacy and Scheduling Self-efficacy) and voluntary exercise behavior. That is, this study examined how feelings of physical and mental energy predict exercise-related self-efficacy beliefs and exercise participation. In addition, this study examined whether exercise-related self-efficacy beliefs perform a mediating role in the relationship between feelings of energy and exercise behavior.

Bandura (1997) suggested that self-efficacy should be conceptualized in a situation- or task-specific manner. In this study, outcome behavior (i.e., exercise behavior) was measured using two specific parameters: moderate exercise and vigorous exercise. Therefore, this study examined task self-efficacy and scheduling self-efficacy that specifically address the two dimensions of exercise: task self-efficacy for moderate exercise, task self-efficacy for vigorous exercise, scheduling self-efficacy for moderate exercise, and scheduling self-efficacy for vigorous exercise. Figure 1 is a graphic model of the possible relationships among these variables.
Figure 1.1. A model of the possible relationships among feelings of physical and mental energy, task and scheduling self-efficacy, and exercise behavior.
Research Hypotheses

- It is hypothesized that feelings of physical and mental energy will have direct effects on task and scheduling self-efficacy beliefs for moderate and vigorous exercise participation.

- It is hypothesized that feelings of physical and mental energy will have direct effects on moderate and vigorous exercise participation.

- It is hypothesized that task and scheduling self-efficacy beliefs will have direct effects on moderate and vigorous exercise participation.

- It is hypothesized that task and scheduling self-efficacy beliefs will mediate the direct effects of feelings of physical and mental energy on moderate and vigorous exercise participation (i.e., the effect of feelings of physical and mental energy will be indirect on moderate and vigorous exercise participation operating through the mediating effect of task and scheduling self-efficacy beliefs).
Limitations

1. The cross-sectional, correlational nature of this study precludes making causal statements.

2. Subjects were contacted via mail for invitations to complete the survey. Therefore, only subjects who had correct mail addresses received the invitation.

3. Data collection relied on self-reported measures. Therefore, the environment in which the participants completed the survey was unsupervised, and the participants could complete the survey where and when they were available.

4. The low response rate may have limited the findings by limiting the power for finding significant results.

5. The survey was completed between March and May. The season of data collection may have limited the availability of exercise options for the participants, and therefore, limited the findings of the study.
Delimitation

This study included only full-time, undergraduate students at The Ohio State University in Columbus, Ohio, who were between 18 and 25 years of age and reported a health status that was sufficient to voluntarily participate in regular exercise in the past month. Therefore, the results may not be able to be generalized to other types of students or other populations.
Definition of Terms

- Exercise: planned, structured, and repetitive bodily movement done to improve or maintain one or more components of physical fitness (U.S. Department of Health and Human Services, 2000). For this study, exercise was measured in two dimensions (i.e., moderate-intensity exercise and vigorous-intensity exercise) as total self-reported minutes spent voluntarily participating in each intensity exercise in the previous seven days using a valid, reliable 7-day recall instrument (Petosa, 1995).
  - Moderate-intensity Exercise: Exercise that causes some increase in breathing or heart rate (U.S. Department of Health and Human Services, 1996).
  - Vigorous-intensity Exercise: Exercise that may be intense enough to represent a substantial challenge to an individual and causes a substantial increase in breathing or heart rate (U.S. Department of Health and Human Services, 1996).

- Feeling of Mental Energy: an individual’s positive feelings about the capacity to complete mental activities (O’Connor, 2005). In this study, feeling of mental energy was defined as a mean score of three items that specifically measured mental energy in the previous seven days using a valid, reliable Feelings of Physical and Mental Energy and Fatigue Scale (O’Connor, 2004). Each item ranged from 0 to 10 where higher scores indicated greater feeling of mental energy.
• Feeling of Physical Energy: an individual’s positive feelings about the capacity to complete physical activities (O’Connor, 2005). In this study, feeling of physical energy was defined as a mean score of three items that specifically measured physical energy in the previous seven days using a valid, reliable Feelings of Physical and Mental Energy and Fatigue Scale (O’Connor, 2004). Each item ranged from 0 to 10 where higher scores indicated greater feeling of physical energy.

• Scheduling Self-efficacy: an individual’s confidence in the ability to manage one’s schedule to organize a task regularly (Rogers et al., 2002). In this study, Scheduling Self-efficacy was measured in two dimensions: Scheduling Self-efficacy for moderate exercise and Scheduling Self-efficacy for vigorous exercise.
  o Scheduling Self-efficacy for Moderate Exercise was operationalized as a mean score of nine items from a modified version of a valid, reliable Task self-efficacy scale (Rodgers et al., 2002). Each item ranged from 0 to 100 where higher scores indicated greater scheduling self-efficacy for moderate exercise.
  o Scheduling Self-efficacy for Vigorous Exercise was operationalized as a mean score of seven items from a modified version of a valid, reliable Task self-efficacy scale (Rodgers et al., 2002). Each item ranged from 0 to 100 where higher scores indicated greater scheduling self-efficacy for vigorous exercise.
• Task Self-efficacy: an individual’s confidence in the ability to perform the elemental aspects of a task (Maddux, 1995). In this study, Task Self-efficacy was measured in two dimensions: Task Self-efficacy for moderate exercise and Task Self-efficacy for vigorous exercise.
  o Task Self-efficacy for Moderate Exercise was operationalized as a mean score of five items from a modified version of a valid, reliable Task self-efficacy scale (Rodgers et al., 2002). Each item ranged from 0 to 100 where higher score indicated greater task self-efficacy for moderate exercise.
  o Task Self-efficacy for Vigorous Exercise was operationalized as a mean score of four items from a modified version of a valid, reliable Task self-efficacy scale (Rodgers et al., 2002). Each item ranged from 0 to 100 where higher score indicated greater task self-efficacy for vigorous exercise.
CHAPTER 2

REVIEW OF LITERATURE

The following chapter provides a rationale and foundation for this research project. This chapter begins with background information about the rate of physical activity behavior in young adults and continues with the review of social cognitive theory, a base theory for this research. Further, the key construct of social cognitive theory, self-efficacy, and its characteristics, such as types and determinants of self-efficacy, were also discussed. Finally, feelings of physical and mental energy and their potential impacts on self-efficacy and exercise behavior were discussed in terms of social cognitive theory.

Introduction

Many studies have confirmed that leisure-time physical activity is associated with mental and physical health benefits. However, regardless of the evidence for the health benefits, approximately half of the adult population in the U.S. is physically inactive below the recommended level for health benefits (CDC, 2003). Physical activity, therefore, has been designated as one of the priority areas in the Healthy People 2010 Objectives (US Department of Health and Human Services, 2000).
Physical activity patterns established in adolescence and young adulthood can determine one’s activity level throughout adulthood, and such patterns may thereby influence long-term health (Calfas, Sallis, Lovato, & Campbell, 1994; Sparling & Snow, 2001). However, the level of physical activity declines with increasing age, and the most dramatic decline occurs between adolescence and young adulthood (Malina, 2001). While numerous personal, social and environmental variables may contribute to the decline in physical activity level, transition to postsecondary education may be one potential factor to affect that population. The transition from high school to college can be a major life stressor in many students. For example, patterns and habits established in the relatively structured, parental home environment may be disrupted as independence and sense of control are provided (Bray & Born, 2004). In addition, an abundance of increased health risk factors including sedentary lifestyle can be exposed to many college students.

Results from the 1995 Youth Risk Behavior Surveillance Survey revealed that 54.9% of high school seniors engaged in regular vigorous physical activity (Kann, Warren, Harris, Collins, Williams, Ross, et al., 1996). However, data from the 1995 United States National College Health Risk Behavior Survey revealed that only 37.6% of college students engaged in regular vigorous physical activity (Douglas, Collins, Warren, Kann, Gold, Clayton, et al., 1997). More recent data revealed similar patterns. Results from the 2007 Youth Risk Behavior Surveillance Survey indicated that the proportion of
students who have been physically active doing any kind of physical activity that increased their heart rate and made them breathe hard some of the time for a total of at least 60 minutes per day on 5 or more days during 7 days before the survey declined from grades 9th to 12th, from 38.1% to 29.5% (Eaton, Kann, Kinchen, Shanklin, Ross, Hawkins et al., 2008). In addition, only 44.2% of college students reported performing vigorous or moderate exercise on at least three out the previous seven days (The American College Health Association, 2008). Bray and Born (2004) showed the pattern of the decline in physical activity in their study, showing that only one third of the first year college students who originally reported adequate levels of physical activity in high school remained at the similar level of physical activity. Additionally, only 33% of their sample was physically active at the recommended (US Department of Health and Human Services) level in both high school and college.

The National Center for Education Statistics estimated that there will be approximately 17.1 million to 18.2 million students in higher education in 2010 (Gerald & Hussar, 2000). Therefore, undergraduate students represent a significant target population for public health research. Taking into account the health benefits of regular participation in physical activity and the decline in the participation during young adulthood, understanding behavioral changes during this period is particularly important because the decline in physical activity at this transition may lead to a pattern of inactive lifestyle which may persist throughout one’s college years and beyond.
Physical Activity Rates in Young Adults

About 3.3 million high school students are expected to graduate during the 2007–08 school year. This number exceeds the former records of 2005–06 and 2006-07, as well as the baby boom era in 1976–77. According to National Center for Education Statistics (2008), 18.0 million college students were enrolled in fall 2007. College enrollment is expected to continue setting new records throughout the fall 2008 through fall 2016 period. Between 2007 and 2016, enrollment is expected to increase by 14 percent. Thus, colleges and universities have great potential to reduce important health-risk behaviors (e.g., physical inactivity) among many young adults. However, before the national college-based survey was conducted in 1995, the prevalence of health-risk behaviors among college students nationwide was not well characterized.

To monitor the priority health-risk behaviors among young persons, in 1990, the Centers for Disease Control and Prevention (CDC) developed the Youth Risk Behavior Surveillance System (YRBSS) (Kolbe, Kann, & Collins, 1993). The YRBSS includes a) national, state, and local school-based surveys of high school students conducted biennially since 1991, b) a household-based survey conducted in 1992 among a national sample of youth aged 12-21 years, whether enrolled in school, and c) the 1995 National College Health Risk Behavior Survey (NCHRBS) conducted in 1995. The Youth Risk Behavior Surveillance System (YRBSS) monitors six categories of priority health-risk behaviors among youth and young adults, including behaviors that contribute to
unintentional injuries and violence; tobacco use; alcohol and other drug use; sexual behaviors that contribute to unintended pregnancy and sexually transmitted diseases (STDs), including human immunodeficiency virus (HIV) infection; unhealthy dietary behaviors; and physical inactivity.

The NCHRBS is the first national survey to measure health-risk behaviors among college students across the six important areas of health behaviors (unintentional and intentional injury, tobacco use, alcohol and other drug use, sexual behaviors, unhealthy dietary behaviors, and physical inactivity). It was developed by CDC in collaboration with representatives in academia, national health organizations, and federal agencies (Douglas, Collins, Qarren, Kann, Gold et al., 1997).

The 1995 NCHRBS used a two-stage cluster sample design to produce a nationally representative sample of undergraduate college students aged greater than or equal to 18 years. The first-stage sampling frame contained 2,919 primary sampling units, consisting of 2- and 4-year colleges and universities. From the 2,919 colleges and universities, seventy four 4-year institutions and another seventy four 2-year institutions were selected from 16 strata formed on the basis of the relative percentage of black and Hispanic students in the institutions. The colleges and universities were selected with probability proportional to undergraduate enrollment size. Overall, 136 (92%) of the 148 selected institutions participated in the survey. The second sampling stage consisted of a simple random sample drawn from a list of the full- and part-time undergraduate students.
aged greater than or equal to 18 years enrolled in the 136 participating colleges and universities. Differential sampling rates were used to ensure sufficient numbers of black and Hispanic students in the sample. A total of 8,810 students were selected and 7,442 were determined to be eligible for the study. Of those eligible, 4,838 (65%) completed the questionnaire. The overall survey response rate was 60%. Data from 4,609 undergraduate college students aged greater than or equal to 18 years were used in this report.

The questionnaire used in the NCHRBS was designed for self-administration, which consisted of a booklet that could be scanned by a computer. The booklet contained 96 multiple-choice questions and was sent by mail to students. Responses to the questionnaire were both voluntary and confidential, and data collection was initiated in January 1995 and completed by June 1995. The result indicated that female students represented 55.5% of the sample and that white students represented 72.8% of the sample, black students 10.3%, Hispanic students 7.1%, and 9.9% were other. Students aged 18-24 years represented 63.6% of the sample; students in 4-year institutions represented 54.4% of the sample. Students in 2-year institutions were more likely to be aged greater than or equal to 25 years (63.8%), whereas students in 4-year institutions were more likely to be aged 18-24 years (65.4%). Approximately two thirds of the students attended college full-time. More than two thirds of the students had never been married. Approximately one fourth of the students worked greater than or equal to 40 hours per
week, about a half of the sample worked 1-39 hours per week. Overall, the sample closely reflects the demographic distribution of college students in the United States (National Center for Education Statistics, 2008).

Results of the NCHRBS revealed that 20.5% of college students were classified as being overweight. Students aged greater than or equal to 25 years (28.8%) were significantly more likely to be overweight than students aged 18-24 years (15.5%). Black students (33.5%) were significantly more likely to be overweight than white (19.5%) and Hispanic (20.8%) students. Students attending 2-year institutions (24.8%) were significantly more likely to be overweight than students attending 4-year institutions (16.9%). In addition, 41.6% of college students believed themselves to be overweight. Female students (48.8%) were significantly more likely than male students (32.4%) to perceive themselves as overweight. Students aged greater than or equal to 25 years (53.6%) were significantly more likely than students aged 18-24 years (34.4%) to report themselves as overweight. Approximately half (53.6%) of college students had exercised either to lose weight or to keep from gaining weight during the 30 days preceding the survey. Female students (62.6%) were significantly more likely than male students (42.3%) to have exercised to either lose weight or keep from gaining weight.

With regard to vigorous and moderate physical activities, more than one third (37.6%) of college students had participated in activities that had made them sweat and breathe hard for at least 20 minutes on greater than or equal to 3 of the 7 days preceding
the survey (i.e., vigorous physical activity). Male students (43.7%) were significantly more likely than female students (33.0%) to report vigorous physical activity. Students aged 18-24 years (41.8%) were significantly more likely than students aged greater than or equal to 25 years (30.6%) to report this behavior. For moderate physical activity, 19.5% of college students had walked or bicycled for at least 30 minutes on greater than or equal to 5 of the 7 days preceding the survey. Black students (27.6%) were significantly more likely than white students (18.2%) to report moderate physical activity.

With regard to stretching exercises, 34.1% of college students had done stretching exercises (e.g., toe touching, knee bending, and leg stretching) on greater than or equal to 3 of the 7 days preceding the survey. Black male students (44.1%) were significantly more likely than white male students (33.0%) to report this behavior. With regard to strengthening exercises, 29.9% of college students had done strengthening exercises (e.g., push-ups, sit-ups, and weight lifting) on greater than or equal to 3 of the 7 days preceding the survey. Male students (33.9%) were significantly more likely than female students (26.8%) to have done strengthening exercises. Students aged 18-24 years (33.4%) were significantly more likely than students aged greater than or equal to 25 years (23.5%) to have reported this behavior. Black male students (46.3%) were significantly more likely than white male students (32.5%) to have done strengthening exercises, and female students attending 4-year institutions (29.5%) were significantly more likely than female students attending 2-year institutions (23.7%) to report this behavior.
The result of the NCHRBS also revealed that 20.8% of college students were enrolled in a PE class during the 1994-1995 school year. Students aged 18-24 years (26.4%) were significantly more likely than students aged greater than or equal to 25 years (11.2%) to have been enrolled in a PE class. In addition, during the 1994-1995 school year, 17.5% of college students had participated on one or more college or university sports teams (intramural or extramural). Male students (26.6%) were significantly more likely than female students (10.3%) to have participated on a sports team. Students aged 18-24 years (25.4%) were significantly more likely than students aged greater than or equal to 25 years (3.6%) to report this behavior. White (18.3%) and black (18.8%) students were significantly more likely than Hispanic students (9.4%) to have participated on a sports team. Students attending 4-year institutions (25.8%) were significantly more likely than students attending 2-year institutions (7.5%) to have done so.

In 1998, the National College Health Association (ACHA) initiated a work group to develop a survey instrument designed to collect information on a broad range of college students’ health behaviors, health indicators, and perceptions. Prior to this effort, consistent data on postsecondary students was lacking. The CDC has collected data on secondary school students since 1990 using the Youth Risk Behavior Surveillance System. As reported earlier, in 1995, Douglas and colleagues from the CDC published their results after surveying postsecondary students using the NCHRBS (Douglas, Collins,
Qarren, Kann, Gold et al., 1997). However, that study has not been repeated since then. The absence of a consistent comparable surveillance system that gathers data on postsecondary school students is filled by National College Health Association National College Health Assessment (ACHA-NCHA). Data collected from the ACHA-NCHA provide insight into our campus communities and have many uses for staff, faculty, and students for determining health priorities, monitoring trends, allocating resources, and measuring the progress or success of health initiatives. In addition, some data are gathered to create a broader perspective on student life, as well as to illustrate the link between health and academic success (The American College Health Association, 2008).

In spring 2007, 113 North American postsecondary institutions self-selected to participate in ACHA-NCHA. Among 72,786 completed surveys, the ACHA-NCHA reference group only included data from institutions that used random sampling procedure, which yielded a final data set of 71,860 students on 107 campuses.

Sampling strategies included a mixture of randomized classroom paper-based and Web-based surveying. Of the 107 schools in this reference group, 79 used the ACHA–NCHA Web version (n = 53,633; 75%), and 28 used the ACHA–NCHA paper version of the survey (n = 18,227; 25%). Among the 107 campuses, 93 were 4-year institutions, and 69 were public and 38 were private colleges or universities (The American College Health Association, 2008).
The result of ACHA-NCHA indicated that the mean estimated body mass index (BMI) was 23.8 for women (SD = 4.9) and 24.8 for men (SD = 4.6). Students reported their general health status: 90.6% said good, very good, or excellent, 7.8% said fair, and 1.3% said poor. In terms of physical activity, 42.8% of students reported exercising vigorously for at least 20 minutes or moderately for at least 30 minutes on at least 3 of the past 7 days. In addition, 48.2% reported exercising to strengthen or tone muscles on at least 2 of the past 7 days (The American College Health Association, 2008).

In summary, although there are several limitations, such as cross-sectional and self-reported data, the NCHRBS and ACHA-NCHA are good sources for us to understand college students’ health needs and capabilities. These data will challenge all professionals who are engaged in advancing college students’ health to use evidence-based approaches in planning college health initiatives.
Social Cognitive Theory

In the literature regarding physical activity promotion, one of the most widely applied theoretical approaches has been social cognitive theory. Social cognitive theory evolved from social learning theory (Bandura, 1977), which proposes that the majority of behaviors are learned through social interaction. Social cognitive theory applies cognitions in the context of social interactions and behavior to explain human action, motivation, and emotion (Bandura, 1986).

The central concept of social cognitive theory is found in the reciprocal interactions between the person, the environment, and the behavior itself. In this model, Bandura postulated that the person, the behavior, and the environment are all inseparable and interrelated to create determinant of behavior. Bandura indicates “People are neither driven by inner forces, nor automatically shaped and controlled by external stimuli. Rather, human functioning is explained in terms of a model of Triadic Reciprocity in which behavior, cognitive and other personal factors, and environmental events all operate as interacting determinants of each other” (Bandura, 1986, p. 18). Triadic Reciprocity describes the mutual interactive effects between all of the causal factors of human behavior. This reciprocal interaction does not imply that all sources of the influence have specific patterns or equal strength. Some sources of influence are stronger than others, and they do not all occur simultaneously. In fact, the interaction between the three factors (e.g., person, environment and behavior) will differ based on the difference
within individuals, the particular behavior being examined, and the specific situation in which the behavior occurs (Bandura, 1997).

In addition to the Triadic Reciprocity, Bandura (1986) discusses the issue of human capability. He says that the nature of human behavior is characterized by five basic and unique capabilities. The five capabilities are symbolizing, forethought, vicarious, self-regulatory, and self-reflective capabilities (Bandura, 1986). Brief explanations of the five capabilities are as follows.

Bandura (1986) suggests that humans possess an extraordinary capability to symbolize. The formation of symbols provides humans with means by which we can alter and adapt our behaviors to our environment. Through the use of symbols, humans store information in their memory and use it to serve as a model to guide future actions. It is through this process that people are able to model observed behavior. In addition to symbolizing capability, forethought capability is the idea that people do not just react to environmental influences alone. Human behavior is purposive and regulated by forethought. Through forethought, people can guide the behavior based on anticipated future outcomes. Vicarious capability refers to the human ability to learn not only from direct experience, but also from the observation of others. This observational learning allows one to develop an idea of how a new behavior is formed without actually performing the behavior. This vicarious capability allows one to explore situations and
activities for the attainment of new knowledge that would normally be out of reach due to constraints on time, resources, and mobility.

Self-regulatory capability is another basic and unique feature of social cognitive theory. Bandura (1986) proposes that self-regulatory capability is an internal control mechanism that governs what behavior is performed, which mediates external influences. Indeed, self-regulatory capability provides a basis for purposeful action, allowing people to have personal control over their own thoughts, feelings, motivations, and actions. Amongst the self-regulatory skills are those of goal setting, monitoring of self, creating incentives for our behaviors, and developing cognitive guides for a behavior. Finally, self-reflection capability enables people to process and analyze their experiences, think about their own thought processes, and alter their thinking accordingly. By analyzing our behaviors and experiences, we can generate knowledge about ourselves and develop judgments of our capabilities to engage in a behavior in different situations. One of the most important types of self-reflection capability is self-efficacy, and Bandura indicates that this particular type of self-reflective thought is the key construct that influences one’s behavior.
Self-efficacy

Self-efficacy is the central construct in social cognitive theory, and has been widely studied in health-related research. Self-efficacy refers to “beliefs in one’s capabilities to organize and execute the courses of action required to produce given attainments” (Bandura, 1997, p.3). Although the knowledge and skills that people possess can play critical roles in what they choose to do or not to do, the positive or negative beliefs in competency can be powerful influences on the decisions they make and the behaviors they engage in. In most cases, self-efficacy will be a powerful factor that helps translate knowledge and skills to action (Bandura, 1986). Self-efficacy perceptions are task and situation specific. For example, individuals may view themselves as highly efficacious in one domain, such as in walking one mile at a speed of 4 miles per hour, and may have low self-efficacy for another, such as swimming one mile.

A number of studies have shown self-efficacy to be a significant predictor of exercise adoption and adherence in different populations. For example, Von Ah, Elbert, Ngamvitroj, Park and Kang (2004) reported the cross-sectional relationship between psychosocial variables (e.g., self-efficacy, social support, perceived threat, perceived barriers) and risky health behaviors (e.g., physical inactivity, tobacco and alcohol uses) in 161 college students. They found that self-efficacy significantly predicted physical activity behavior. Another recent cross-sectional study examined the relationship between leisure time physical activity and exercise self-efficacy, exercise barriers self-
efficacy, exercise social support, and perceived importance of physical activity (Marquez & McAuley, 2006). They found that high level of leisure time physical activity was significantly related to exercise and barriers self-efficacy in 153 Latinos.

These cross-sectional relationships were confirmed in several longitudinal studies. McAuley and colleagues (2003) examined the utility of self-efficacy in predicting the long-term exercise behavior in older adults. They found that self-efficacy was significantly related to physical activity at 6 and 18 months after the completion of a 6-month exercise program. In addition, Resnick (2004) examined the longitudinal changes in self-efficacy and outcome expectation for exercise, and the impact of these variables on maintaining regular exercise over a 4-year period in 78 older adults. The result revealed that self-efficacy significantly influenced maintenance of regular exercise.

Self-efficacy has also been shown as a significant predictor in several intervention studies. For example, Oman and King (1998) conducted a two-year randomized trial investigating the influence of self-efficacy on exercise participation. Sixty three healthy sedentary adults participated in aerobic exercise programs. They reported that baseline self-efficacy was a significant predictor of exercise adoption. Delahanty and colleagues (2006) also reported a significant association between self-efficacy and exercise behavior. They examined the relationship between psychological variables (e.g., self-efficacy, stress, anxiety and depression) and physical activity levels before (i.e., baseline), at the completion of (i.e., one year), and after a diabetic prevention program (i.e., 2 to 3 years).
Results indicated the significant and positive relationship between self-efficacy and physical activity level at baseline, and this relationship remained at one year and after the program.

Further, several review studies also found that self-efficacy is a significant factor in physical activity-related research. In a review of approximately 300 studies on the determinants of adult physical activity (Trost et al., 2002), self-efficacy was found to be the most consistent correlate of physical activity behavior. Kaewthummanukul and Brown (2006) reviewed factors that influence employee participation in physical activity. After reviewing eleven published studies investigating physical activity in samples of adult employees, they found that self-efficacy was the best predictor of physical activity among employees. In addition, Lewis, Marcus, Pate and Dunn (2002) also supported the importance of self-efficacy in physical activity behavior in their review. They reviewed physical activity interventions studies and reported that one of the most common mediators in the relationship between physical activity intervention and physical activity behavior was self-efficacy.
Types of self-efficacy

Many studies have shown that self-efficacy is a robust predictor of exercise behavior. However, McAuley and Mihalko (1998) indicated that there has been considerable variance across studies in how self-efficacy is defined and operationalized. For example, some investigators focused on generalized self-efficacy for engaging in any type of physical activity, whereas some focused on self-efficacy for engaging in specific exercises. Indeed, some have examined one’s confidence in overcoming barriers to exercise. This heterogeneity has created interpretive difficulties and likely contributed to inconsistencies in findings across studies (McAuley & Mihalko, 1998).

Bandura (1997) indicated that self-efficacy is a “multifaceted phenomenon” (p.42). High self-efficacy in one activity domain does not necessarily correspond to high efficacy in other activity domains. That is, one dimension of self-efficacy can not powerfully indicate behavioral variability, and self-efficacy is behavior and situation specific. Therefore, to achieve explanatory and predictive power, the measure of self-efficacy must be specific to domains of functioning. The more specific the measure of self-efficacy is, the greater variability in the behavior can be explained.

Maddux (1995) distinguished two different types of self-efficacy, which seem particularly relevant to exercise behavior: task self-efficacy and self-regulatory self-efficacy. Task self-efficacy refers to one’s belief in the ability to perform the constituent components of a task (e.g., simple motor skills or capabilities such as perceived ability to
walk for 30 minutes at a certain level of intensity). Self-regulatory self-efficacy, also referred to as coping self-efficacy, refers to one’s belief in the ability to perform the tasks under challenging conditions (e.g., perceived ability to exercise in spite of tiredness, or bad weather, etc.). Some studies measured barriers self-efficacy, which typically assesses beliefs in capabilities to overcome social, personal, and environmental barriers to exercising (e.g., DuCharme & Brawley, 1995; Rogers et al., 2006). However, barriers self-efficacy can be nested in the category of self-regulatory efficacy (Bandura, 1997).

In addition to these two different measures of self-efficacy, scheduling self-efficacy has been also discussed as an important predictor of regular exercise behavior (DuCharme & Brawley, 1995; Rodgers & Sullivan, 2001; Rodgers et al., 2002). Scheduling self-efficacy is defined as an individual’s confidence in the ability to organize and plan regular exercise bouts (DuCharme & Brawley, 1995; Rodgers et al., 2002). Scheduling self-efficacy may be categorized under self-regulatory efficacy. However, research findings have shown that lack of time is one of the most frequently reported barriers to regular exercise, and this particular efficacy measure is focusing on one’s confidence in scheduling and time management. It is expected that the confidence in the ability to effectively schedule regular exercise would have a significant impact on the engagement in regular exercise.

There have been several studies that examined these distinctive types of self-efficacy. DuCharme and Brawley (1995) examined whether barriers self-efficacy and
scheduling self-efficacy predicted behavioral intentions and actual attendance rates over time. Healthy adult females who were enrolling for the first time at a large women’s fitness club were assessed during week 1 (n = 63) and week 9 (n = 38). Measures of barriers and scheduling efficacy from week 1 were used to predict exercise intention and actual exercise attendance for weeks 1 through 8, while week 9 measures were used to predict intention and attendance for weeks 9 through 16. Results indicated that both forms of self-efficacy significantly predicted exercise intention throughout the exercise program, and that scheduling efficacy was a significant predictor of attendance during the last 8 weeks.

Rodgers and Sullivan (2001) examined three different types of self-efficacy (e.g., task, coping, and scheduling self-efficacy) and their associations with levels of exercise involvement. A sample of 203 adults was selected using a random-digit dialing procedure, and measures were completed through a phone survey. Subjects’ exercise behaviors were categorized into five levels ranging from never exercise to more than 15 times per month. Results indicated that the level of coping and scheduling self-efficacy significantly distinguished the level of exercise behavior. However, task efficacy did not clearly discriminate the behaviorally defined groups.

Rodgers and colleagues (2002) used task and scheduling self-efficacy in prediction of behavioral intention and exercise behavior using a structural equation model. They hypothesized 1) a stronger relation of task self-efficacy to behavioral intention than
exercise behavior and 2) a stronger relation of scheduling self-efficacy to actual exercise behavior than to behavioral intention. Participants included 243 adults in community-based exercise classes. Participants completed two survey questionnaires in the first and forth weeks of classes. The first questionnaire assessed task and scheduling self-efficacy and behavioral intention, and the second questionnaire assessed behavior for the preceding four weeks. The structural equation modeling revealed that task self-efficacy had a significant effect on behavioral intention for exercise, whereas scheduling self-efficacy did not. In addition, scheduling self-efficacy had a significant effect on exercise behavior, whereas task self-efficacy did not. Therefore, results supported their hypotheses and showed that in the exercise adoption process, task self-efficacy may be an important predictor, whereas scheduling self-efficacy may be relevant to exercise adherence.
Determinants of self-efficacy

Self-efficacy beliefs can be influenced by four primary sources: Mastery experiences, Vicarious experiences, Verbal persuasion, and Physiological and affective states (Bandura, 1997). Of these, mastery experience is believed to exert the most powerful influence on self-efficacy (Badura, 1997; Maddux, 1995).

Mastery experience. The mastery experience is achieved by actual engagement in a behavior followed by the interpretation of the result of the action. This interpretation then yields beliefs in one’s ability to engage in that behavior in the future. Successful outcomes can build robust self-efficacy, whereas failure diminishes it, especially if failures occur before a sense of efficacy is firmly established. People who have low self-efficacy often discount their success. If people experience only easy successes, they will doubt their efficacy and be easily discouraged by failure. Consequently, mastery experiences are only one way which can influence self-efficacy.

Vicarious experience. People do not rely on their previous mastery experiences as the sole source of information about the belief in their capabilities. People also form their self-efficacy beliefs through vicarious experiences. This source of information generally has weaker effect on self-efficacy belief than mastery experiences do. However, when people have low efficacy or when they have limited prior experiences in regard to a particular behavior, they become more sensitive to modeling others’ behaviors. Therefore, this observational learning serves as another powerful tool for promoting a
sense of humans’ efficacy. The effects of this vicarious experience depend on such factors as the observer’s perception of the similarity between himself and the model, the perceived power of the models, and the similarity between the problems faced by the observer and the model (Bandura, 1986, 1997).

*Verbal persuasion.* Verbal persuasions serve as a further means of determining people’s beliefs that they possess the capabilities to achieve what they seek. Verbal persuasion may play lesser role in strengthening self-efficacy beliefs than mastery experiences and vicarious experiences. However, people who are persuaded verbally that they possess the capabilities to master given tasks are likely to mobilize greater effort and sustain it. Verbal persuasions should be distinguished from knee-jerk praise or empty inspirational homilies. Effective persuaders must cultivate people's beliefs in their capabilities while at the same time ensuring that the envisioned success is attainable. Therefore, positive verbal persuasions can encourage and strengthen one’s efficacy beliefs. However, as the flip to this, negative verbal persuasions can work to diminish or destroy one’s efficacy beliefs. In fact, it is usually easier to weaken self-efficacy beliefs through negative appraisals than to strengthen such beliefs through positive encouragement. The verbal persuasion should be influenced by such factors as the expertness, trustworthiness, and attractiveness of the source (Bandura, 1997; Maddux, 1995).
Physiological and affective states. People also judge their efficacy relying on somatic information conveyed by physiological and emotional states. These somatic indicators of self-efficacy are especially relevant in domains that involve physical accomplishments, health functioning, and coping with stressors. Bandura (1997) indicated “physiological indicators of efficacy play an especially influential role in health functioning and in activities requiring physical strength and stamina” (p. 106). He argues that emotions, autonomic arousal (e.g., physiological reactions in stressful situations) and physical states (e.g., fatigue, aches, pains) can potentially influence self-efficacy. That is, enhancing physical states, reducing stress levels and negative mood, and correcting misinterpretations of body states can strengthen one’s self-efficacy beliefs (Bandura, 1997; Maddux, 1995).

Although interpretations of physiological and affective states may be an important factor of exercise-related self-efficacy, their relationship has received little attention in the literature. Only a few studies have shown that physiological and affective states act as sources of self-efficacy information and can reciprocally determine subsequent efficacy. For example, McAuley and Courneya (1992) examined the relationship between self-efficacy and affective response to exercise in sedentary, middle-aged adults. Self-efficacy was measured prior to and following a submaximal cycle ergometer exercise, and affective and exertion responses were obtained at 70% of predicted maximum heart rate. Results indicated that sedentary adults with high perception of
exercise self-efficacy experienced more positive feeling states (e.g., energy-related
congcepts) during exercise than those with lower self-efficacy. In addition, affective
responses during exercise were significant predictors of posttest self-efficacy. Their
study showed the important role of self-efficacy in the formation of exercise-related
affect and affective responses as sources of self-efficacy in exercise. In addition,
Bozoian, Rejeski, and McAuley (1994) looked at how pre-exercise perceptions of self-
efficacy influenced feeling states experienced as a function of an acute bout of exercise in
36 women. They found that participants who possessed higher pre-exercise self-efficacy
reported enhanced feelings of energy during exercise and both increased levels of
revitalization following an acute bout of exercise.

Similarly, Treasure and Newbery (1998) also reported a significant relationship
between feeling states and exercise self-efficacy in sedentary undergraduate students. In
addition, in a study of self-efficacy manipulation effects on feeling states (Jerome et al.,
2002), participants in the high-efficacy condition reported more energy and less fatigue
than those in the low-efficacy condition. There have been a limited number of studies in
this area. More research is necessary to determine if physiological and affective states
influence exercise-related self-efficacy and, further, exercise behavior.
Feelings of physical and mental energy

Feelings of physical and mental energy have physiological and affective aspects, and have been measured in several studies addressed above (e.g., Bozoian, Rejeski, & McAuley 1994; Jerome et al., 2002; Treasure & Newberry, 1998). Feelings of physical and mental energy refer to positive feelings about the capacity to complete physical or mental activities (O’Connor & Puetz, 2005). Feelings of physical and mental energy are distinct constructs, and individuals vary in their experience of the feelings as a function of not only physical influences but also psychological factors. In addition, these feelings can be referred to as a specific physical and psychological experience of possessing enthusiasm and spirit, and can correspond to the experience of oneself as a potential origin of action (deCharms, 1968). Greater feelings of physical and mental energy can accompany the experiences of self-regulation (Deci & Ryan, 1985).

This energy-related concept appears in Eastern thought as well (Clearly, 1991). For example, the Chinese concept of Chi represents a vital energy that is the source of life, creativity, and action (Jou, 1981). Similarly, in Korea and Japan, the concept of Gi holds energy and power on which one can draw and relates to physical and mental actions (Wikan, 1989). Therefore, feelings of physical and mental energy represent an active inner force that facilitates physical and mental health. In fact, feelings of low energy and fatigue are associated with various physical and psychiatric conditions and
illnesses such as heart disease, cancer, obesity, anxiety, and depression (O’Connor & Puetz, 2005).

In the social cognitive theory perspective, the greater feelings of physical and mental energy may lead to the perception of self-efficacy (Bandura, 1997). Also in turn, individuals feeling low levels of physical and mental energy may have decreased levels of self-efficacy in planning and carrying out exercise behavior. Therefore, these senses of energy may play an important role in performing exercise behavior. However, research that directly addresses this relationship is lacking.
CHAPTER 3

METHODS

Purpose of the study

The primary purpose of this study was to examine how feelings of physical energy and mental energy predict task and scheduling self-efficacy beliefs and moderate and vigorous exercise behaviors. In addition, the secondary purpose was to examine the potential mediating role of task and scheduling self-efficacy beliefs in the relationship between the feelings of physical and mental energy and exercise behaviors. The possible relationship among the variables was graphically shown in Figure 1.1.
Feelings of Physical Energy

Feelings of Mental Energy

Task Self-efficacy for Moderate Exercise

Task Self-efficacy for Vigorous Exercise

Scheduling Self-efficacy for Moderate Exercise

Scheduling Self-efficacy for Vigorous Exercise

Moderate Exercise

Vigorous Exercise

Figure 1.1. A model of the possible relationships among feelings of physical and mental energy, task and scheduling self-efficacy, and exercise behavior.
Participants

The target population for this study was full-time healthy female and male undergraduate students between 18 and 25 years of age. Potential participants were randomly obtained through the Student Enrollment Reporting and Research Services in the Office of the University Registrar. Through the random sampling procedure, information regarding participants’ names, gender, mailing addresses, telephone numbers and email addresses was provided.

Due to the exercise-related study purpose, students who had any injuries or illnesses that prevented them from exercising in the past month were excluded. In addition, students who were in an intercollegiate athletic team as well as those who were enrolled in a physical activity course were also excluded because their activities might not be voluntary.

Instruments

A self-report, paper-pencil format, questionnaire was developed as the measurement of this study. The questionnaire contained five sections and was arranged in the following order: 1) Feelings of physical and mental energy; 2) Task self-efficacy for moderate and vigorous exercise; 3) Scheduling self-efficacy for moderate and vigorous exercise; 4) 7-day physical activity recall; and 5) Demographic information.
Feelings of physical and mental energy were measured using a previously developed, valid and reliable scale (O’Connor, 2004), which will be discussed later in this chapter, and the demographic questionnaire was designed by the researcher of this study. A sample of the demographic questionnaire can be found in Appendix B. Questionnaires for task self-efficacy and scheduling self-efficacy for moderate and vigorous exercise were modified from questionnaires developed by Rodgers et al. (2002).

*Content validity.* The content and face validity of questionnaires for task self-efficacy and scheduling self-efficacy were established by a two-stage expert panel review. Five researchers in the field of physical education or exercise science were asked to serve as expert panel review members. A definition of each construct to be measured was given to the panel members, and each of the members was asked to judge the content and face validity of the items based on the definition. After the first round of the review, the items of each measurement were modified based on the expert suggestions. A sample of expert review can be found in Appendix H. The revised measurement was then sent to the expert panel for the second review. After the items met the face and content validity at the second review, the items were accepted to be measured indicating a good fit of the scale with the concept of task self-efficacy and scheduling self-efficacy in relationship to moderate and vigorous exercise behaviors.

*Test-retest reliability.* Test-retest reliability of all questionnaires was estimated using undergraduate student volunteers. Twenty one students enrolled in “Mathematical
Analysis for Business” (MATH 130) and twenty three students in “Second Writing Course – Social Psychology” (PSYCH 367) voluntarily participated in the reliability test.

The questionnaire packet was distributed to students after the researcher provided them with a brief overview of the purpose of the investigation. Students were instructed to read the directions and to complete all sections of the questionnaire. In an effort to ensure anonymity, students were asked to place the following pieces of personal information on the front page of the questionnaire at the pretest and posttest administration: the first two alphabet letters of their last name and last four digits of their home phone number. The questionnaire was re-administered to the same students one week after they initially completed the questionnaire. Thirty eight students (14 men and 24 women; 21.3 ± 2.5 years of age) completed both the pretest and posttest measures: twenty one students in MATH 130 and seventeen students in PSYCH 367. Demographic characteristics are presented in Table 3.1.

Data were analyzed using the Statistical Package for the Social Sciences (SPSS for Windows 12.0, SPSS Inc., Chicago, Illinois). Test-retest reliability was determined by computing the stability reliability coefficient (R).
Feelings of physical and mental energy. The State and Trait Feelings of Physical and Mental Energy and Fatigue Scale (O’Connor, 2004) was originally designed to measure: 1) Acute feelings of physical and mental energy and fatigue, and 2) Chronic feelings of physical and mental energy and fatigue. For this study, the scale for acute feelings of physical and mental energy and fatigue was revised to capture a specific time frame (i.e., feelings of energy and fatigue during the previous 7 days), which was mainly used for data analysis in the present study because it was expected that a measure with a specific time frame would better predict self-efficacy and exercise behavior. Each scale (e.g., state and trait) consisted of 12 items that measure four dimensions of energy and fatigue feelings: physical energy, physical fatigue, mental energy, and mental fatigue. Each construct was inferred from three items. A sample of the feelings of physical and mental energy scale can be found in Appendix C.

For the revised part that measured the feelings of energy and fatigue during the previous 7 days, the visual analogue scale format (e.g., 10-cm visual analogue scale) was
used to measure the intensity of feelings ranging from the absence of feelings to the strongest feelings that an individual experienced during the past 7 days. Raw scores for all 12 items were determined by using a ruler to measure the distance in millimeters from the left edge of each horizontal line to the X mark made on the line by the respondent. For example, a participant marked 33mm from the left edge, the score would be 3.3. These scores ranged from 0 to 10. Scores for the four subscales (physical energy, physical fatigue, mental energy and mental fatigue) were computed by adding the raw scores from the three items that made up each subscale. Therefore, the total score of each subscale ranged from 0 to 30.

For the second part that measured the trait feelings of energy and fatigue, the questions inquired about the frequency of usual feelings. The response categories were “never,” “a little bit of the time,” “sometimes,” “most of the time,” and “always.” Raw scores for all 12 items ranged from 0 to 4. The scoring was as follows: never = 0, a little bit of the time = 1, sometimes = 2, most of the time = 3, and always = 4. Scores for the four subscales (physical energy, physical fatigue, mental energy and mental fatigue) in this part were computed by adding the raw scores from the three items that made up each subscale. Therefore, the total score of each subscale ranged from 0 to 12.

Reliability and structural validity for this scale was tested by O’Connor (2004). Reliability for the state scales ranged from .89 to .91, and that for the trait scales ranged
from .82 to .85. The confirmatory factor analysis provided an excellent model-data fit based on a telephone survey of 202 adults (O'Connor, 2004).

Test-retest reliability of the revised Feelings of Physical and Mental Energy and Fatigue Scale was examined in this study over a one week period, and the results are presented in Table 3.2.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pretest Mean (S.D.)</th>
<th>Posttest Mean (S.D.)</th>
<th>Stability reliability coefficient (R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feeling of Physical Energy</td>
<td>5.58 (2.17)</td>
<td>5.71 (2.13)</td>
<td>.94</td>
</tr>
<tr>
<td>Feeling of Mental Energy</td>
<td>5.07 (2.25)</td>
<td>5.18 (2.27)</td>
<td>.95</td>
</tr>
</tbody>
</table>

Table 3.2. Consistency of Feelings of Physical and Mental Energy among students who participated in the reliability test.

Task self-efficacy. The method to develop this task self-efficacy scale was consistent with recommendations of Bandura (1997) and McAuley and Mihalko (1998). They suggested that task or behavioral self-efficacy measures consist of hierarchical properties. That is, items asking whether or not respondents can execute increasingly difficult behavioral tasks can adequately assess along the dimensions of level (whether or not one has the confidence in the ability to execute the behavior) and strength (the degree of one’s confidence in the ability to successfully execute the behavior).
For task self-efficacy assessment, a modified version of Task Self-efficacy Scale (Rodgers et al., 2002) was used to capture the task-specific self-efficacy beliefs to be related to moderate and vigorous exercise participation as Bandura (1997) recommended that conceptualization of self-efficacy beliefs in a situation- or task-specific manner improve the accuracy of the measurement. Therefore, due to the two parameters of exercise behavior (e.g., moderate and vigorous intensity), items specifically addressed the two intensities: task self-efficacy for moderate exercise and task self-efficacy for vigorous exercise. This instrument consisted of 9 items using a 100% confidence scale ranging from 0% (no confidence) to 100% (complete confidence). Examples of the items were as follows. Following the stem, “How confident are you that you can…”, one of the items for the task self-efficacy for moderate exercise was “exercise at a moderate pace without stopping for 10 minutes?”, and an item for task self-efficacy for vigorous exercise was “exercise at a vigorous pace without stopping for 10 minutes?” The sample of the task self-efficacy questionnaire can be found in Appendix D. The mean of each part (e.g., task self-efficacy for moderate intensity exercise and for vigorous intensity exercise) was calculated. The results of test-retest reliability analysis for task self-efficacy scale are presented in Table 3.3.
### Table 3.3: Consistency of Task Self-efficacy Scale among students who participated in the reliability test.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pretest Mean (S.D.)</th>
<th>Posttest Mean (S.D.)</th>
<th>Stability reliability coefficient (R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task Self-efficacy for Moderate Exercise</td>
<td>8.50 (1.94)</td>
<td>8.33 (1.99)</td>
<td>.90</td>
</tr>
<tr>
<td>Task Self-efficacy for Vigorous Exercise</td>
<td>7.56 (2.35)</td>
<td>7.58 (2.31)</td>
<td>.92</td>
</tr>
</tbody>
</table>

*Scheduling self-efficacy.* The modified version of Scheduling self-efficacy scale (Rodgers et al., 2002) was used. Sixteen items asked the level of scheduling self-efficacy for the two-intensity exercises (e.g., scheduling self-efficacy for moderate intensity exercise and for vigorous intensity exercise) using the same procedure as task self-efficacy. For example, following the stem, “How confident are you that you can…”, an item for scheduling self-efficacy for moderate exercise was “Schedule any moderate-intensity exercise during a typical week?”, and an item for vigorous exercise was “Schedule any vigorous-intensity exercise during a typical week?” The sample of the scheduling self-efficacy questionnaire can be found in Appendix E.

The factorial validity of the original two self-efficacy scales was tested using a confirmatory factor analysis (Rodgers et al., 2002). The model fit indices suggested an acceptable model fit, where $\chi^2 = 9.67$ ($p = .28$); $df = 8$; adjusted goodness of fit index
(AGFI) = .97; comparative fit index (CFI) = .97; root mean square error of approximation (RMSEA) = .03. The Cronbach’s alphas were .71 and .80 for the task and scheduling self-efficacy scales respectively. Table 3.4 presents the results of test-retest reliability for scheduling self-efficacy that was examined in this study.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pretest Mean (S.D.)</th>
<th>Posttest Mean (S.D.)</th>
<th>Stability reliability coefficient (R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scheduling Self-efficacy for</td>
<td>6.16 (2.61)</td>
<td>6.53 (2.41)</td>
<td>.95</td>
</tr>
<tr>
<td>Moderate Exercise</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scheduling Self-efficacy for</td>
<td>5.46 (3.06)</td>
<td>5.85 (2.72)</td>
<td>.86</td>
</tr>
<tr>
<td>Vigorous Exercise</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3.4: Consistency of Scheduling Self-efficacy Scale among students who participated in the reliability test.

Exercise behavior. The 7-day recall questionnaire developed by Petosa (1995) was used to measure voluntary exercise behavior (i.e., voluntary physical activities that are planned and conducted for the purpose of enhancing health and fitness). Participants were asked to recall any moderate and vigorous exercises conducted during the previous 7 days before the survey. They were prompted to report frequency, duration and names of moderate exercises. Moderate exercise was defined as any activity that mildly
elevated heart and breathing rates and could be conducted while holding a conversation. Examples of moderate activity included recreational sports (volleyball, soccer, etc), brisk walking, cycling less than 3 miles, calisthenics, golfing without a cart, hiking, half-court basketball, and weight lifting. A sample of the 7-Day recall questionnaire can be found in Appendix F.

Participants were also prompted to report frequency, duration, and name of vigorous exercises. Vigorous exercise was defined as any activity that caused the heart rate to increase significantly and could not be done while holding a conversation. Examples of vigorous activity included competitive full-field sports (e.g., soccer), competitive full-court basketball, running or jogging, high-intensity aerobics classes, cycling 10 mph or more than 3 miles, swimming laps, and aerobic machines. The total minutes of each intensity (e.g., moderate and vigorous) were used as estimators of exercise behavior.

Reliability and validity for the 7-Day Recall were reported by Petosa, Suminski, and Hertz (2003). Validity for this instrument was established against 7-day diaries of physical activity, and the reported correlation was .72. Reliability was established as test-retest reliability over one week and correlations between measurements were .58 for free living activity and .72 for supervised physical activity among adolescents. Test-retest reliability for 7-Day Recall for this study was established over one week in terms of moderate and vigorous exercise behaviors performed during the previous 7 days before
pre-test and post-test. Table 3.5 presents the results of test-retest reliability for the 7-Day Recall that was examined in this study.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pretest Mean (S.D.)</th>
<th>Posttest Mean (S.D.)</th>
<th>Stability reliability coefficient (R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate Exercise (minutes)</td>
<td>136.98 (152.00)</td>
<td>134.08 (135.66)</td>
<td>.97</td>
</tr>
<tr>
<td>Vigorous Exercise (minutes)</td>
<td>56.11 (60.01)</td>
<td>55.77 (52.68)</td>
<td>.97</td>
</tr>
</tbody>
</table>

Table 3.5: Consistency of Moderate and Vigorous Exercise Behaviors among students who participated in the reliability test.

Study Design

This study was designed to use a cross-sectional mailing survey. Because one of the important determinants of response rate in survey study is the number of times a respondent is contacted (Dillman, 2000), it is necessary that multiple contacts be made. For this study, data were collected via a three-staged mailing process, over an eight-week period.

The mailing packet contained a cover letter that explained the purpose of the study, the significance of participation, the protection of participants’ confidentiality and the incentive for participating, in addition to a series of questionnaires. A sample of the
cover letter can be found in Appendix A. All potential participants were sent the packet, which included a return envelope that was already stamped and addressed. They were asked to return the consent form and questionnaire in the return envelope. To be eligible for the drawing of $50 gift certificate incentives to the Target store, participants had to voluntarily provide their email on a specified column of the packet.

The first round of mailing was sent out to all potential participants on March 26, 2007. They were asked to return the consent form and questionnaire within ten days. All responders who met the ten day deadline had the opportunity to be entered into a random drawing to win one of two available $50 gift certificates to the Target store. The first lottery took place on April 9, 2007.

The second round of mailing was sent out to all non-responders on April 16, 2007. They were again asked to return the consent form and questionnaire within ten days. Responders of the second round mailing also had the opportunity to be entered into a random drawing to win the last $50 gift certificate to the Target store. The second lottery was held on April 30, 2007.

For remaining non-responders, the third round mailing was sent out on May 7, 2007. Subjects included in the final mailing were again asked to return the consent form and questionnaire within ten days. Responders of the third round mailing, however, did not have the opportunity of the random drawing to win a $50 gift certificate to the Target store.
After the deadline of the third round mailing (May 21, 2007), a copy of the 7-day physical activity recall was mailed to non-responders in order to control for non-response error. Subjects receiving the mail were asked to complete the 7-day physical activity recall and return it to the researcher within a week. Data received from these subjects were compared to the exercise behavior of the previous responders.

Data Analysis

Descriptive data were analyzed using the Statistical Package for the Social Sciences, version 15.0 (SPSS, Inc., Chicago, IL, 2006). The proposed model (Figure 1) was tested via observed variable path analysis using maximum likelihood parameter estimation (AMOS, 4.0). Model fit was based on generally accepted thresholds for the Chi-square ($\chi^2$), goodness of fit index (GFI), adjusted GFI (AGFI) (GFI, AGFI > .90), the root mean square error of approximation (RMSEA) (RMSEA < .05), normed-fit index (NFI), and comparative fit index (CFI). The chi-square index provides a test of the fundamental statistical hypothesis (e.g., that the model fits the data). The GFI is a measure of the similarity between the sample and model-implied covariance matrixes. The GFI ranges from 0 to 1, with values exceeding .90 indicating a good fit to the data, and above .95 indicating an excellent fit. The AGFI adjusts the GFI for degrees of freedom. The AGFI also ranges from 0 to 1, with values above .90 indicating a good fit to the data. The RMSEA accesses closeness of fit, with values approximating .08, .05,
and 0 indicating reasonable, close and exact fits, respectively. Values of the NFI may range from 0 to 1, with values over .90 indicative of an acceptable fit. The CFI provides an assessment of comparative fit independent of sample size. Values of the CFI will always lie between 0 and 1, with values over .90 indicating a good fit.

**Sample Size.** Because path analysis is a part of structural equation modeling (SEM), determination of sample size was based on SEM recommendations. In general, the analysis of a complex model requires more samples than does the analysis of a simpler model. Kline (2005) indicated that although there is no absolute determination of sample size because the model’s complexity should be considered, sample size less than 100 would be considered small. Unless a very simple model is evaluated, sample sizes under 100 may be “untenable” in almost any type of SEM analysis. Kline (2005) also indicated that a medium sample size could be between 100 and 200 and that sample sizes exceeding 200 cases could be considered large. A survey of 72 studies in which SEM was conducted found the median sample size was 198 (Breckler, 1990). Loehlin (1992) recommends at least 100 cases, preferably 200. Hoyle (1995) also recommends a sample size of at least 200 with over ten variables.

This study has eight observed variables (feeling of physical energy, feeling of mental energy, task self-efficacy for moderate exercise, task self-efficacy for vigorous exercise, scheduling self-efficacy for moderate exercise, scheduling self-efficacy for vigorous exercise, moderate exercise, and vigorous exercise), and the path analysis was
based on the eight variables. According to the literature, a sample size of 200 is acceptable for a model with eight measured variables. A sample size of 200 in the model with eight variables meets other recommendations as well. Mitchell (1993) recommends 10 to 20 times as many cases as variables, and Stevens (1996) recommends at least 15 cases per measured variable or indicator. It is reasonable to go beyond these minimum sample size recommendations.

This study used a mailing survey method to collect data. Dillman (2000) indicated typical response rate of mail-based survey would be 20-30%. A survey study in college students by Pinto and Marcus (1995) reported a 23% response rate. Also, a comparable survey study by Wallace and colleagues (2000) reported a 28% response rate. Although multiple contacts (i.e., a three-staged mailing process) may increase the response rate, to be on the safer side, 20% of the response rate would be expected. For this study, 1,000 survey packets were distributed to obtain the recommended sample size of 200.
CHAPTER 4

RESULTS

Introduction

The primary purpose of this study was to examine the relationship between feelings of physical energy and mental energy, task and scheduling self-efficacy beliefs, and participation in moderate and vigorous exercise. A secondary purpose was to examine the potential mediating role of task and scheduling self-efficacy beliefs in the relationship between feelings of physical and mental energy and moderate and vigorous exercise behaviors. It was hypothesized that feelings of physical and mental energy would have direct effects on self-efficacy beliefs for moderate and vigorous exercise participation. It was also hypothesized that feelings of physical and mental energy would have direct effects on the participation in moderate and vigorous exercise. In addition, it was hypothesized that task and scheduling self-efficacy beliefs would have direct effects on the participation in moderate and vigorous exercise. Furthermore, it was hypothesized that task and scheduling self-efficacy beliefs would mediate the direct effects of feelings of physical and mental energy on the self-reported moderate and vigorous exercise participation.
Demographic Description

One thousand survey invitations were mailed out to randomly recruited students. One hundred eighty-nine surveys were not deliverable because of incorrect and/or old addresses. A total of 399 students agreed to participate in this study and mailed the survey back to the researcher. The response rate was 39.9%. Among the 399 surveys, 31 surveys were not included in data analysis because they were under exclusion criteria (i.e., students who had any injuries or illnesses that prevented them from exercising, who were on an intercollegiate athletic team, and who were enrolled in a physical activity course were excluded). Therefore, 368 surveys were included in the final data analysis. The schematic presentation of the mailing procedure of the survey can be found in Figure 4.1.

Descriptive data were analyzed using the Statistical Package for the Social Sciences, version 15.0 (SPSS, Inc., Chicago, IL, 2006). The sample of 368 participants was comprised of 151 males (41%), and 217 females (59%). The mean age was 21 years ($SD = \pm 2.32$). Participants were fairly distributed among academic levels: 88 freshmen (23.9%), 74 sophomores (20.1%), 92 juniors (25.0%), 99 seniors (26.9%), and 15 others (4.1%). The majority of the participants were Caucasian ($N = 275, 75\%$), followed by Asian ($N = 39, 10.6\%$) and African-American ($N = 29, 7.9\%$). The mean BMI (kg/m$^2$) of the 368 participants was 24.72 ($SD = \pm 4.96$).
1
1st Round of Mailing to All Potential Participants (N = 1,000)
March 26, 2008

- 280 competed surveys received
- 180 surveys were not deliverable
- Random drawing of 2 gift certificates (April 9, 2008)

2
2nd Round of Mailing to All Non-responders (N = 540)
April 16, 2008

- 91 competed surveys received
- 9 surveys were not deliverable
- Random drawing of 1 gift certificate (April 30, 2008)

3
3rd Round of Mailing to All Non-responders (N = 440)
May 7, 2008

- 28 completed surveys received

As of the deadline of the 3rd mailing on May 21, 2008, 399 completed surveys were received, and 189 surveys were undeliverable

Figure 4.1. The mailing procedure of the survey
Most participants were single (never married) (92.9%). Living with roommate(s)/friend(s) (68.6%) was the most common arrangement reported by undergraduate students, followed by living alone (9.7%) and with parent(s)/guardian(s) (8.7%). Almost half of the participants (48.5%) lived in an off-campus house or apartment. Approximately one third (33.0%) resided in a dormitory or residence hall.

The characteristics of participants are presented in Table 4.1 and Table 4.2

<table>
<thead>
<tr>
<th>Demographic Variable</th>
<th>Men</th>
<th>Women</th>
<th>Overall</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$N = 151$ (41%)</td>
<td>$N = 217$ (59%)</td>
<td>$N = 368$</td>
<td></td>
</tr>
<tr>
<td>Age (year)</td>
<td>$22 \pm 2.22$</td>
<td>$21 \pm 2.35$</td>
<td>$21 \pm 2.32$</td>
<td>$18 - 25$</td>
</tr>
<tr>
<td>Height (in.)</td>
<td>$71 \pm 4.23$</td>
<td>$65 \pm 3.10$</td>
<td>$67 \pm 4.66$</td>
<td>$60 - 76$</td>
</tr>
<tr>
<td>Weight (lb.)</td>
<td>$185 \pm 25.65$</td>
<td>$140 \pm 30.15$</td>
<td>$158 \pm 36.01$</td>
<td>$109 - 212$</td>
</tr>
<tr>
<td>Body Mass Index (kg/m$^2$)</td>
<td>$26 \pm 4.28$</td>
<td>$24 \pm 5.12$</td>
<td>$25 \pm 4.96$</td>
<td>$18 - 31$</td>
</tr>
</tbody>
</table>

Table 4.1. Biological characteristics of participants (Mean ± SD)
<table>
<thead>
<tr>
<th>Demographic Variable</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Race and Ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>African-American or Black</td>
<td>29</td>
<td>7.9</td>
</tr>
<tr>
<td>American Indian or Alaskan Native</td>
<td>8</td>
<td>2.2</td>
</tr>
<tr>
<td>Asian</td>
<td>39</td>
<td>10.6</td>
</tr>
<tr>
<td>Hispanic</td>
<td>8</td>
<td>2.2</td>
</tr>
<tr>
<td>Multi-racial</td>
<td>9</td>
<td>2.4</td>
</tr>
<tr>
<td>White</td>
<td>275</td>
<td>74.7</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Class Standing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freshman</td>
<td>88</td>
<td>23.9</td>
</tr>
<tr>
<td>Sophomore</td>
<td>74</td>
<td>20.1</td>
</tr>
<tr>
<td>Junior</td>
<td>92</td>
<td>25.0</td>
</tr>
<tr>
<td>Senior</td>
<td>99</td>
<td>26.9</td>
</tr>
<tr>
<td>Other (5th yr or more)</td>
<td>15</td>
<td>4.1</td>
</tr>
<tr>
<td>Marital Status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single (Never married)</td>
<td>342</td>
<td>92.9</td>
</tr>
<tr>
<td>Married/partnered</td>
<td>12</td>
<td>3.3</td>
</tr>
<tr>
<td>Widowed</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Separated</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Divorced</td>
<td>14</td>
<td>3.8</td>
</tr>
<tr>
<td>Living Situation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alone</td>
<td>36</td>
<td>9.7</td>
</tr>
<tr>
<td>Parent(s)/guardian(s)</td>
<td>32</td>
<td>8.7</td>
</tr>
<tr>
<td>Other relatives</td>
<td>2</td>
<td>0.6</td>
</tr>
<tr>
<td>Roommate(s)/friend(s)</td>
<td>252</td>
<td>68.6</td>
</tr>
<tr>
<td>Spouse/domestic partner</td>
<td>29</td>
<td>7.8</td>
</tr>
<tr>
<td>Your children</td>
<td>17</td>
<td>4.6</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Place of Residence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>College dormitory or residence hall</td>
<td>121</td>
<td>33.0</td>
</tr>
<tr>
<td>Other university housing</td>
<td>17</td>
<td>4.5</td>
</tr>
<tr>
<td>Off-campus housing or apartment</td>
<td>178</td>
<td>48.5</td>
</tr>
<tr>
<td>Fraternity or sorority house</td>
<td>19</td>
<td>5.2</td>
</tr>
<tr>
<td>Parent/guardian’s home</td>
<td>29</td>
<td>7.8</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Table 4.2. Demographic characteristics of participants (N = 368)
Table 4.3 represents means and standard deviations of the study variables. Participants reported engaging in an average of 15.74 minutes of moderate exercise per day and 7.75 minutes of vigorous exercise per day over the previous 7 days. Range indicates the lowest and the highest values that participants reported. Table 4.4 represents correlations of the study variables. All correlations were significant at the .05 level. Most of them showed moderate to high correlations except for the relationships of feelings of physical and mental energy and task self-efficacy beliefs on exercise behaviors.

<table>
<thead>
<tr>
<th>Study Variable</th>
<th>Range</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feeling PEn</td>
<td>0-10</td>
<td>5.47</td>
<td>2.52</td>
</tr>
<tr>
<td>Feeling MEn</td>
<td>0-10</td>
<td>5.36</td>
<td>2.51</td>
</tr>
<tr>
<td>Task SE Mod Ex</td>
<td>0-100</td>
<td>80.2</td>
<td>23.3</td>
</tr>
<tr>
<td>Task SE Vig Ex</td>
<td>0-100</td>
<td>74.5</td>
<td>26.6</td>
</tr>
<tr>
<td>Sched SE Mod Ex</td>
<td>0-100</td>
<td>66.8</td>
<td>24.8</td>
</tr>
<tr>
<td>Sched SE Vig Ex</td>
<td>0-100</td>
<td>60.7</td>
<td>26.5</td>
</tr>
<tr>
<td>Mod Ex (min/day)</td>
<td>0-150</td>
<td>15.74</td>
<td>17.13</td>
</tr>
<tr>
<td>Vig Ex (min/day)</td>
<td>0-90</td>
<td>7.75</td>
<td>11.13</td>
</tr>
</tbody>
</table>

Table 4.3. Means and standard deviations of the study variables.

Note: Feeling PEn = Feelings of physical energy; Feeling MEn = Feelings of mental energy; Task SE Mod Ex = Task self-efficacy for moderate exercise; Task SE Vig Ex = Task self-efficacy for vigorous exercise; Sched SE Mod Ex = Scheduling self-efficacy for moderate exercise; Sched SE Vig Ex = Scheduling self-efficacy for vigorous exercise; Mod Ex = Moderate exercise behavior; Vig Ex = Vigorous exercise behavior; SD = Standard Deviation.
Table 4.4. Correlation matrix of the study variables.

<table>
<thead>
<tr>
<th>Study Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Feeling PEn</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Feeling MEn</td>
<td>.70**</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Task SE Mod Ex</td>
<td>.60**</td>
<td>.44**</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Task SE Vig Ex</td>
<td>.59**</td>
<td>.43**</td>
<td>.84**</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Sched SE Mod Ex</td>
<td>.47**</td>
<td>.36**</td>
<td>.49**</td>
<td>.52**</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Sched SE Vig Ex</td>
<td>.43**</td>
<td>.32**</td>
<td>.45**</td>
<td>.55**</td>
<td>.82**</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Mod Ex</td>
<td>.29**</td>
<td>.14*</td>
<td>.29**</td>
<td>.29**</td>
<td>.45**</td>
<td>.44**</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>8. Vig Ex</td>
<td>.28**</td>
<td>.13*</td>
<td>.19**</td>
<td>.21**</td>
<td>.33**</td>
<td>.37**</td>
<td>.35**</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Note: Feeling PEn = Feelings of physical energy; Feeling MEn = Feelings of mental energy; Task SE Mod Ex = Task self-efficacy for moderate exercise; Task SE Vig Ex = Task self-efficacy for vigorous exercise; Sched SE Mod Ex = Scheduling self-efficacy for moderate exercise; Sched SE Vig Ex = Scheduling self-efficacy for vigorous exercise; Mod Ex = Moderate exercise behavior; Vig Ex = Vigorous exercise behavior; ** p < .01; * p < .05
Path Analysis

Model fit was based on generally accepted thresholds for the Chi-square ($\chi^2$), goodness of fit index (GFI), adjusted GFI (AGFI), a root mean square error of approximation (RMSEA), normed-fit index (NFI), and comparative fit index (CFI).

The model provided a good fit to the data. The $\chi^2$ statistics provides a statistical test of the goodness of fit of the sample covariance matrix to the hypothesized model. A statistically significant value indicates misfit. In this study, the value of $\chi^2$ was 3.38 ($df = 4, p = .496$), indicating a good-fit model. The GFI is an indicator of the amount of variance explained by the sample model. Values of the GFI can range between 0 and 1, with values greater than .90 indicating a good fit. In this study, the value of GFI was .998, indicating a strong fit. The AGFI adjusts the GFI for the degrees of freedom in the model. The AGFI also ranges from 0 to 1, with values above .90 indicating a good fit. In this study, the AGFI was .979, indicating a strong fit. The RMSEA quantifies the amount of error when estimating the population covariance matrix (hypothesized model) from the sample covariance matrix (observed model/data). Values less than .05 indicate a good fit. In this model, the RMSEA was .00, representing a strong fit. The NFI is an alternative to the chi-square index. Values of this index may range from 0 to 1, with values over .90 indicative of an acceptable fit. The value of NFI was .998, indicating a good fit. The CFI provides an assessment of comparative fit independent of sample size. Values of the CFI will always lie between 0 and 1, with values over .90 indicating a good
fit. The value of CFI was 1.00, indicating a strong fit. The hypothesized path model with coefficients and squared multiple correlations ($R^2$) can be found in Figure 4.2. The full figure of path diagram that was used in AMOS is represented in Appendix G, which includes correlations between errors in the equations among the mediating variables and the final variables. The model explained 36% of the variance in task self-efficacy for moderate exercise, 35% of task self-efficacy for vigorous exercise, 21% of scheduling self-efficacy for moderate exercise, 19% of scheduling self-efficacy for vigorous exercise, 23.0% of moderate exercise participation, and 18% of vigorous exercise participation.
Figure 4.2. Hypothesized model with path coefficients.

Note: Feeling PEn = Feelings of physical energy; Feeling MEn = Feelings of mental energy; Task SE Mod Ex = Task self-efficacy for moderate exercise; Task SE Vig Ex = Task self-efficacy for vigorous exercise; Sched SE Mod Ex = Scheduling self-efficacy for moderate exercise; Sched SE Vig Ex = Scheduling self-efficacy for vigorous exercise; Mod Ex = Moderate exercise behavior; Vig Ex = Vigorous exercise behavior; bold number and * indicate significant relationship at p<.01.
Direct relationship between feelings of energy and exercise-related self-efficacy beliefs

Direct effects of the feeling of physical energy on task and scheduling self-efficacies were significant ($p < .001$). The feeling of physical energy was significantly related to task self-efficacies for moderate and vigorous exercises ($\gamma_{\text{FeelingPEn-Task SE ModEx}} = .67; \gamma_{\text{FeelingPEn-Task SE VigEx}} = .64; p < .001$). In addition, the feeling of physical energy also had a significant direct effect on scheduling self-efficacies for moderate and vigorous exercise ($\gamma_{\text{FeelingMEn-Sched SE ModEx}} = .46; \gamma_{\text{FeelingMEn-Sched SE VigEx}} = .47; p < .001$). Based on Cohen’s effect size estimates (Cohen, 1992) for standardized path coefficients (small = 0.10, medium = 0.30, large = 0.50), large effects of feelings of energy on exercise-related self-efficacy beliefs were found. The result supports the hypotheses that the feeling of physical energy would have direct effects on task and scheduling self-efficacies. However, direct effects of the feeling of mental energy on task self-efficacy and scheduling self-efficacy were not significant. Therefore, the hypotheses that the feeling of mental energy would have direct effects on task and scheduling self-efficacies were not supported. Table 4.5 presents the direct effect of feelings of energy on exercise-related self-efficacies.
<table>
<thead>
<tr>
<th>Direct Relationship</th>
<th>Estimate</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feeling PEn → Task SE Mod Ex</td>
<td>.67</td>
<td>***</td>
</tr>
<tr>
<td>Feeling PEn → Task SE Vig Ex</td>
<td>.64</td>
<td>***</td>
</tr>
<tr>
<td>Feeling PEn → Sched SE Mod Ex</td>
<td>.46</td>
<td>***</td>
</tr>
<tr>
<td>Feeling PEn → Sched SE Vig Ex</td>
<td>.47</td>
<td>***</td>
</tr>
<tr>
<td>Feeling MEn → Task SE Mod Ex</td>
<td>.18</td>
<td>.22</td>
</tr>
<tr>
<td>Feeling MEn → Task SE Vig Ex</td>
<td>.17</td>
<td>.32</td>
</tr>
<tr>
<td>Feeling MEn → Sch SE Mod Ex</td>
<td>.01</td>
<td>.92</td>
</tr>
<tr>
<td>Feeling MEn → Sch SE Vig Ex</td>
<td>.04</td>
<td>.59</td>
</tr>
</tbody>
</table>

Table 4.5 Standardized estimates of feelings of energy on exercise-related self-efficacies.

Note: Feeling PEn = Feelings of physical energy; Feeling MEn = Feelings of mental energy; Task SE Mod Ex = Task self-efficacy for moderate exercise; Task SE Vig Ex = Task self-efficacy for vigorous exercise; Sched SE Mod Ex = Scheduling self-efficacy for moderate exercise; Sched SE Vig Ex = Scheduling self-efficacy for vigorous exercise; *** indicates \( p < .001 \)
Direct relationship between feelings of energy and exercise behaviors

Feelings of physical and mental energy had significant direct effects on moderate and vigorous exercise behaviors. For instance, the feeling of physical energy had significant direct effects on both moderate and vigorous exercise behaviors ($\gamma_{\text{FeelingPEn-Mod Ex}} = .26, p < .01$; $\gamma_{\text{FeelingPEn-Vig Ex}} = .36, p < .001$). In addition, the feeling of mental energy had significant direct effects on both moderate and vigorous exercise behaviors ($\gamma_{\text{FeelingMEn-Mod Ex}} = .22, p < .01$; $\gamma_{\text{FeelingMEn-Vig Ex}} = .22, p < .01$). Based on Cohen's effect size estimates (Cohen, 1992) for standardized path coefficients, medium effects of feelings of physical energy on exercise behaviors were found. Additionally, close to medium effects of feelings of mental energy on exercise behavior were also found. Therefore, the hypotheses that feelings of energy would have direct effects on both moderate and vigorous exercise behaviors were supported. The result of the direct relationship of feelings of energy on exercise behaviors was presented in Table 4.6.
Direct Relationship Estimate $p$

| Feeling PEn $\rightarrow$ Mod Ex | .26 | .002 |
| Feeling PEn $\rightarrow$ Vig Ex | .36 | *** |
| Feeling MEn $\rightarrow$ Mod Ex | .22 | .005 |
| Feeling MEn $\rightarrow$ Vig Ex | .22 | .003 |

Table 4.6. Standardized estimates of feelings of energy on exercise behaviors.

Note: Feeling PEn = Feelings of physical energy; Feeling MEn = Feelings of mental energy; Mod Ex = Moderate exercise behavior; Vig Ex = Vigorous exercise behavior; *** indicates $p < .001$

*Direct relationship between exercise-related self-efficacy and exercise behaviors*

Direct effects of task self-efficacies for moderate and vigorous exercises on both exercise behaviors were not significant. However, scheduling self-efficacies for moderate and vigorous exercises significantly predicted both moderate and vigorous exercise behaviors, respectively ($\beta_{\text{Sched SE ModEx-Mod Ex}} = .39; \beta_{\text{Sched SE VigEx-Vig Ex}} = .33; p < .001$). Based on Cohen's effect size estimates (Cohen, 1992) for standardized path coefficients, above-medium effects of scheduling self-efficacy beliefs on exercise behaviors were obtained. Therefore, the hypotheses that scheduling self-efficacies for moderate and vigorous exercises would have direct effects on both moderate and vigorous exercises, respectively, were supported. The result of this relationship can be found in Table 4.7.
Table 4.7. Standardized estimates of exercise-related self-efficacies on exercise behaviors.

<table>
<thead>
<tr>
<th>Direct Relationship</th>
<th>Estimate</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task SE Mod Ex → Mod Ex</td>
<td>.04</td>
<td>.55</td>
</tr>
<tr>
<td>Task SE Vig Ex → Vig Ex</td>
<td>-.09</td>
<td>.17</td>
</tr>
<tr>
<td>Sched SE Mod Ex → Mod Ex</td>
<td>.39</td>
<td>***</td>
</tr>
<tr>
<td>Sched SE Vig Ex → Vig Ex</td>
<td>.33</td>
<td>***</td>
</tr>
</tbody>
</table>

Note: Task SE Mod Ex = Task self-efficacy for moderate exercise; Task SE Vig Ex = Task self-efficacy for vigorous exercise; Sched SE Mod Ex = Scheduling self-efficacy for moderate exercise; Sched SE Vig Ex = Scheduling self-efficacy for vigorous exercise; Mod Ex = Moderate exercise behavior; Vig Ex = Vigorous exercise behavior; *** indicates $p < .001$

*Indirect relationship between feelings of energy and exercise behaviors through exercise-related self-efficacy beliefs*

When the direct paths were not significant between the mediating variable (i.e., task and scheduling self-efficacy beliefs) and either independent variable (i.e., feelings of physical and mental energy) or dependent variable (i.e., moderate and vigorous exercise), the criteria required for testing mediation was not satisfied. In this study, direct paths between task self-efficacy beliefs and exercise behaviors were not significant. Consequently, the mediating effect through task self-efficacy beliefs was not satisfied in this study.
Scheduling self-efficacy, however, had the required univariate relationship with both feelings of energy and exercise behaviors. Therefore, the criteria for mediation through scheduling self-efficacy were satisfied. To test for mediating effects, the direct effect path coefficients in the model without mediating variables were compared to those in the full model (Figure 4.2) with mediating variables (Holmbeck, 1997). That is, the direct effects of the path coefficients in the model with mediating variables should be reduced to non-significance as compared to those in the model without mediating variables in the case of full mediation, or reduced in magnitude but remain significant in the case of partial mediation. The model without mediating variables showed that moderate exercise behavior ($R^2 = 11\%$) was significantly predicted by feelings of physical energy ($\gamma_{\text{Feeling PEn - Mod Ex}} = .46, p < .001$) and that vigorous exercise behavior ($R^2 = 10\%$) was also significantly predicted by feelings physical energy ($\gamma_{\text{Feeling PEn - VigEx}} = .45, p < .001$), while the model with mediating variables showed that moderate exercise behavior ($R^2 = 23\%$) was significantly predicted by feelings of physical energy ($\gamma_{\text{Feeling PEn - Mod Ex}} = .26, p < .05$) and that vigorous exercise behavior ($R^2 = 18\%$) was also significantly predicted by feelings physical energy ($\gamma_{\text{Feeling PEn - VigEx}} = .36, p < .001$). The path coefficients for feelings of physical energy predicting moderate exercise and vigorous exercise decreased by .20 and .09, respectively, and they remained significant. This suggests that these effects are partially mediated by scheduling self-efficacy beliefs. The significance of the direct and indirect effects of feelings of physical energy on
moderate and vigorous exercise behaviors in the hypothesized model (Figure 4.2) further supports partial mediation by scheduling self-efficacy beliefs.

Summary

The result indicated that univariate relationships between feelings of physical and mental energy, task and scheduling self-efficacy beliefs and exercise behaviors were significant. The path analysis revealed that the hypothesized model had a strong fit to the study data. The path model showed that feelings of physical energy had significant direct effects on task and scheduling self-efficacy beliefs as well as exercise behaviors. In addition, scheduling self-efficacy beliefs had direct effects on moderate and vigorous exercise behaviors. However, there was no significant direct relationship between task self-efficacy beliefs and exercise behaviors. The path model also revealed that scheduling self-efficacy beliefs partially mediated the relationship between feelings of physical energy and exercise behaviors.
CHAPTER 5

DISCUSSION

Promoting a physically active lifestyle across the lifespan is a major public health concern. However, epidemiological evidence shows that physical activity participation declines with increasing age, and the sharpest decline occurs during young adulthood (Caspersen, Pereira, & Curran, 2000; CDC, 2005). Identifying and examining predictors of physical activity in young adulthood is an important consideration in developing more effective interventions to maximize both exercise adoption and adherence (Baranowski, Anderson, & Carmack, 1998).

One of the most consistently identified predictors of exercise behavior is self-efficacy (McAuley & Blissmer, 2000; Trost et al., 2002). From the self-efficacy theory perspective, self-efficacy beliefs are influenced by four different sources: mastery experiences in successful performance, vicarious learning, verbal persuasion and interpretations of physiological and affective states (Bandura, 1997). Although each of these sources of efficacy information is of importance, interpretations of physiological and affective states may be a particularly important factor in influencing exercise-related self-efficacy beliefs. Consistent with the predictions of self-efficacy theory, changes in
physiological and affective (e.g., improving physical states, reducing stress levels and negative mood) states may alter efficacy beliefs (Bandura, 1997; Maddux, 1995). However, the influence of physiological and affective states upon changes in exercise-related self-efficacy has received little attention in the extant literature.

This study utilized a path analysis approach to examine the relationship between feelings of physical and mental energy, task and scheduling self-efficacy beliefs, and participation in moderate and vigorous exercise among college students. Additionally, the potential mediating effect of task and scheduling self-efficacy beliefs on the relationship between the feeling of energy and exercise participation was also examined. It was hypothesized that the feelings of energy would predict exercise-related self-efficacy beliefs and exercise behaviors, and that exercise-related self-efficacy beliefs would mediate the relationship between feelings of energy and exercise behavior. Using 368 full-time, apparently healthy undergraduate students, the path analysis showed that the hypothesized model was a good fit to the data. The path model revealed that (1) feelings of physical energy had significant direct effects on both task and scheduling self-efficacy beliefs as well as moderate and vigorous exercise behaviors, (2) scheduling self-efficacy had significant direct effects on exercise behaviors, and (3) feelings of physical energy had indirect effects on exercise behaviors operating through scheduling self-efficacy.
Bandura (1997) posited that enhancing physical and affective states can improve efficacy beliefs. In this study, feelings of physical energy significantly predicted both task and scheduling self-efficacy beliefs. That is, people who reported greater feelings of physical energy were more efficacious in their ability to schedule and engage in regular exercise participation. This finding is in accordance with results in previous research reporting that more positive affective states predicted greater perceptions of exercise-related self-efficacy (Robbins, Pis, Pender, & Kazanis, 2004; Treasure & Newbery, 1998). These findings support Bandura’s contention in self-efficacy theory that physiological and affective responses can serve as primary sources of efficacy information (Bandura, 1997).

This study measured feelings of physical and mental energy separately and demonstrated unique relationships between these distinct feelings of energy and self-efficacy beliefs. That is, the direct effects of feelings of physical energy on self-efficacy beliefs were significant, whereas feelings of mental energy did not have any significant effects on self-efficacy beliefs. The reason for the absence of direct effects between feelings of mental energy and self-efficacy beliefs is unclear. It is possible that the scale specifically addressing the response of mental energy might not have predicted exercise-related self-efficacy beliefs. That is, the scale in feelings of mental energy questionnaire specifically focused on the level of mental activities of participants (e.g., During the previous 7 days, how often did you feel with regard to your capacity to perform mental
activities?), whereas scales of exercise-related self-efficacy beliefs specifically addressed self-perceptions related to physical activities. Therefore, the response of feelings of mental energy might have lost power in predicting exercise-related self-efficacy beliefs, which have stronger physical components rather than mental components. As suggested in the development of self-efficacy measurements (Bandura, 1997), the conceptualization of the feeling of energy in a task specific manner may improve the accuracy of the measurement.

The result indicated significant direct effects of feelings of physical and mental energy on moderate and vigorous exercise behaviors. This finding suggests that individuals reporting greater perceptions of energy may participate in more exercise behaviors. The positive relationship between feelings of energy and exercise participation revealed in the present study is consistent with the findings of previous studies (O’Conner & Puetz, 2005; Puetz, 2006). Specifically, results of prior investigations demonstrated that people who are physically active in their leisure time have a reduced risk of experiencing feelings of low energy compared to sedentary people. A recent randomized control study supported the positive association between feelings of energy and exercise participation, showing significant increases in feelings of energy over the course of 6 weeks of exercise training compared to control condition (Puetz, Flowers, & O’Connor, 2008).
Path analysis of the relationship between exercise-related self-efficacy beliefs and exercise behaviors revealed that while scheduling self-efficacy beliefs had significant direct effects on exercise behaviors, none of the direct effects of task self-efficacy beliefs on exercise behaviors were significant. This finding seems to indicate that confidence in one’s self-regulatory abilities to effectively schedule exercise is more strongly associated with self-reported exercise behavior than simply being confident in one’s exercise task capability. This result supports the idea of different types of efficacy beliefs in predicting exercise behavior. Several previous studies demonstrated different influences of task and scheduling self-efficacy beliefs on exercise behavior (Rodgers & Sullivan, 2001; Rodgers, Hall, Blanchard, McAuley, & Munroe, 2002). For example, Rodgers et al. (2002) showed that task self-efficacy exerted a causal effect on behavioral intention, but there was no effect on exercise behavior. Scheduling self-efficacy in their study, however, significantly predicted exercise behavior, but did not predict behavioral intention. Schwarzer and Renner (2000) also demonstrated similar effects, suggesting that action self-efficacy (for the initiation of a behavior) and coping self-efficacy (for the maintenance of a behavior) were related to a motivation phase (resulting in a behavioral intention) and a volition phase (resulting in the self-regulation of the behavior), respectively. Scheduling self-efficacy has been posited as a specific subtype of self-regulatory or coping self-efficacy (Rodgers & Sullivan, 2001). Taken collectively, basic skill self-efficacy may be only related to initial intention of exercise behavior, whereas
self-regulatory or coping self-efficacy may be more strongly related to actual behavior. In light of these findings, it seems reasonable to propose that task self-efficacy and scheduling self-efficacy play different roles in predicting exercise behaviors.

In the present study, of exercise of two intensities (e.g., moderate and vigorous intensity exercises) was examined to capture a broad range of exercises in which participants were likely to engage during their leisure time. Accordingly, exercise-related self-efficacy beliefs were also examined specifically addressing the two exercise intensities based on Bandura’s (1997) proposition that self-efficacy is inherently task specific (i.e., task self-efficacy for moderate exercise, task self-efficacy for vigorous exercise, scheduling self-efficacy for moderate exercise, and scheduling self-efficacy for vigorous exercise). Addressing this specificity in self-efficacy measure is important to enhancing predictive validity. For example, a previous study reported coping self-efficacy was not directly related to vigorous physical activity behaviors (Gyurcsik, Bray & Brittain, 2004), which is inconsistent with the findings in the present study as well as other studies (Rodger & Sullivan, 2001; Rodgers et al., 2002, Schwarzer & Renner, 2000). The inconsistent finding might be attributable to several factors, which include differences in measurement approaches. In the research by Gyurcsik et al., outcome variable (i.e., vigorous physical activity) was measured only using vigorous physical activity, and the questionnaire that measured coping self-efficacy in that study did not specifically address the vigorous physical activity. Therefore, it is important to note that
consistent with Bandura’s (1997) contention, self-efficacy should be measured in a situation – or task – specific manner.

This study also examined whether task and scheduling self-efficacy beliefs act as a mediator of the relationship between feelings of energy and exercise behaviors. To determine the potential mediation through exercise-related self-efficacy beliefs, the direct effects path coefficients in the model without the mediating variables was compared with those in the full model with the mediating variables. That is, in case of full mediation, the direct effects of feelings of physical energy and exercise behaviors in the model without mediating variables should be decreased to non-significance as compared with those in the full model with mediating variables (Holmbeck, 1997). In case of partial mediation, the direct effects should be reduced in magnitude, but remain significant. After establishing required univariate relationship among study variables, testing mediation through task self-efficacy beliefs was not satisfied because direct paths between task self-efficacy beliefs and exercise behaviors were not significant. Scheduling self-efficacy beliefs, however, met the criteria required for testing mediation (i.e., scheduling self-efficacy beliefs were significantly predicted by feelings of physical energy and significantly predicted moderate and vigorous exercise behaviors).

As reported in Chapter 4, the direct effects path coefficients of feelings of physical energy on moderate and vigorous exercise behaviors were decreased from .46 and .45 to .26 and .36, respectively, when compared to the model with mediating
variables, and the direct effects remained significant. This result supports that the partial mediation through scheduling self-efficacy beliefs exists. Further, the significance of both direct and indirect effects in the full path model (Figure 4.2) also supports the partial mediation of scheduling self-efficacy (i.e., the direct effect of feelings of physical energy on exercise behaviors was significant, and their indirect effect through scheduling self-efficacy was also significant).

It is possible that although individuals who feel strong physical energy may engage in exercise behaviors, their efficacy beliefs in scheduling regular exercises are a more potent influence upon their exercise participation. These findings are important because they emphasize the attention of self-regulatory or coping self-efficacy in the area of exercise adherence. For example, these results suggest that an intervention targeted to provide strategies that help students develop stronger scheduling self-efficacy (i.e., self-regulatory or coping self-efficacy) for overcoming barriers and fitting exercise into their busy schedules may be more effective in promoting exercise participation than an approach emphasizing the development of task self-efficacy.

While the results of the present study offer insights into the relationship between feelings of energy, exercise-related self-efficacy beliefs and exercise behaviors, the present study contains some important limitations. First of all, the direct and indirect relationships among variables found in the present study are based on self-efficacy theory, and the hypothesized model provided a good fit to the data. However, previous research
suggests there are additional categorical affective responses that may influence the self-efficacy – physical activity behavior relationship such as ratings of enjoyment (Hu, Motl, McAuley, & Konopack, 2007; Motl, Dishman, Ward, Saunders, Dowda, Felton, et al., 2005) and positive engagement (Focht, Knapp, Gavin, Raedeke, & Hickner, 2007). Future studies that investigate other potential variables are necessary to delineate the mediating effect of self-efficacy in the affective state – exercise relationship.

Another limitation of the present study is that participants in this study were ethnically homogeneous. For example, in this study, approximately 75% of the total participants were Caucasian. Therefore, replication of the findings in more diverse samples is necessary to determine the extent to which the results of the present study are representative of the young adult population. In addition, this study did not test the effects of variables (e.g., body weight, gender) that could moderate the relationships in study variables. For example, nearly half of the participants in this study would be classified as overweight based on a body mass index (BMI).

Recent evidence suggests that overweight individuals report less favorable affective responses to acute exercise (Ekkekakis & Lind, 2006). Although Ekkekakis and Lind focused upon global ratings of pleasure-displeasure while this study focused upon the categorical affective response of feelings of energy, their study clearly showed different pattern of affective responses to acute exercises between normal-weight and overweight participants. Therefore, the extent to which body weight might influence the
affective state and subsequently, exercise-related self-efficacy beliefs and exercise involvement warrants consideration in future studies. Future studies should also examine potential gender differences because men and women may differ in the ways that they interpret feelings of energy and self-efficacy (Arch, 1992; Robbins, Pis, Pender, & Kazanis, 2004).

It should be noted that the hypothesized model in this study was tested within a cross-sectional design and that such data do not permit assumptions about causality to be made between the variables. Future studies may need a longitudinal and/or experimental design to provide stronger support for the directionality of the proposed relationships (i.e., that feelings of energy predicts exercise-related self-efficacy, which subsequently predicts exercise involvement) and whether these links are causal relationships. In addition, data collection relied on mailed and self-reported measures. Therefore, the environment in which the participants completed the survey was not supervised, and the participants could complete the survey where and when they were available. A more refined measurement of variables, such as a diary or an objective measure, is recommended in future studies.

Additionally, this study was conducted between March and May, and the early spring season in the state of Ohio may have had an effect on lowering participants’ activity rates. Previous research showed that season may have an effect on various levels of leisure time physical activity (Matthews et al., 2001), where higher rates of physical
activity are shown in the warmer months. Although the design of this study precluded using season as a predictor, data in this study were obtained in the single location, which means that all participants were under the same seasonal effects.

While there are such limitations, this study enhances understanding of the link between feelings of energy, self-efficacy and exercise behavior and suggests potentially useful directions for future studies. For example, improving feelings of physical energy may be an important factor that should be taken into account in the future intervention studies. It is possible that improved feelings of physical energy result from exercise involvement. It is also possible that increased feelings of energy may lead to increased exercise participation. Ultimately, it is possible that each reciprocally influences the other creating upward spirals of increased feelings of energy and exercise participation which would also be consistent with the reciprocal determinism outlined in Bandura’s social cognitive theory (1997).

The positive relationship between the feeling of energy and chronic exercise has been reported in previous studies (O’Connor & Puetz, 2005; Puetz, O’Connor & Dishman, 2006). Especially, Yoga or Tai Chi has been shown to be related to improvement in mental health and emotional well-being (Taylor-Piliae, Haskell, Waters, & Froelicher, 2006; Wood, 1993). Maddux (1995) noted that people feel more efficacious when they are emotionally calm. It is possible that participation in a Yoga or Tai Chi program may help individuals’ emotion keep calm and improve their affective
state. The improved feeling of energy may subsequently result in the increase in their efficacy beliefs and ultimately, the increase in the same or other exercise behaviors. The increases in the level of efficacy beliefs and exercise behaviors may in turn improve their mental health and emotional well-being. This reciprocal relationship is consistent with Bandura’s (1997) contention.

In conclusion, this study showed the potential effect of the feeling of energy on exercise-related self-efficacy and exercise behavior. Participants who have more positive feeling of physical energy tend to be more efficacious in exercise involvement. Participants who have high feelings of energy also seem to engage in more exercise behaviors, and their relationship would become stronger when they are efficacious in coping barriers for effectively scheduling regular exercises. This result is an important consideration in future intervention studies.
REFERENCES


Petosa, S. (1995). *Use of social cognitive theory to explain exercise behavior among adults*. The Ohio State University, Columbus, Ohio.


APPENDIX A

SURVEY INVITATION LETTER
Dear Students:

You have been selected to participate in a research study to gain important information about the relationship among feelings of physical and mental energy, exercise confidence, and exercise behavior. This study is being conducted by Seok Yoon, a doctoral candidate in the School of Physical Activity and Education Services and his faculty committee members. Your responses will help us find out important information about physical activity promotion.

All of your responses are confidential. Your responses will be anonymous and we will use a random alphanumeric identifying code that will not be linked back to you. The data do not include any personally identifiable information. Your responses will be used only for research purposes.

Your participation is voluntary. You can refuse to answer questions that you do not wish to answer. In addition, you can refuse to participate, or you can withdraw at anytime without penalty or repercussion.

The usefulness of this survey depends on receiving thoughtful responses from every participant. It should take you between 10 and 15 minutes to complete all the questions. Please return your completed survey within ten days.

As a way of thanking you, you are invited to participate in a drawing for one of three $50 gift certificates to Target. If you wish to participate in the drawing, please provide your email address on the last page of this questionnaire packet. This page will be removed from your responses and included in the drawing as soon as we receive your survey.

Thank you very much for your cooperation and the valuable information you are providing in this survey. If you have any questions, you may contact me at yoon.124@osu.edu.

Sincerely,

Seok Yoon
Ph.D. Candidate
School of Physical Activity and Educational Services
College of Education and Human Ecology
The Ohio State University

Dr. Janet Buckworth
Associate Professor
School of Physical Activity and Educational Services
College of Education and Human Ecology
The Ohio State University

Dr. Brian Focht
Assistant Professor
Health Behavior and Health Promotion
School of Public Health
The Ohio State University
APPENDIX B

DEMOGRAPHIC QUESTIONNAIRES
DEMOGRAPHIC INFORMATION

The following statements ask you to identify some basic information about yourself. Your answers will NOT be shared by anyone except for the investigator. Please fill in the blank or check the appropriate box(es).

1. What is your age? ________________ (years)
2. Sex: ☐ Male  ☐ Female
3. Height without shoes ________________ feet / inches
4. Weight ________________ pounds
5. What is your race? (Please check one or more)
   ☐ Asian
   ☐ African-American or Black
   ☐ American Indian or Alaskan Native
   ☐ Hispanic
   ☐ Multi-racial
   ☐ White
   ☐ Other (Please Specify)__________________________
6. Academic Year:
   ☐ Freshman  ☐ 5th Year or more
   ☐ Sophomore  ☐ Graduate
   ☐ Junior  ☐ Other
   ☐ Senior
7. What is your major? (Please check your college)
   ☐ Allied Medical Professions  ☐ Human Ecology
   ☐ Architecture  ☐ Humanities
   ☐ Arts  ☐ Mathematical and Physical Sciences
   ☐ Arts and Sciences  ☐ Medicine and Public Health
   ☐ Biological Sciences  ☐ Music
   ☐ Business  ☐ Nursing
   ☐ Communication  ☐ Optometry
   ☐ Dentistry  ☐ Public Health
8. Academic Course Load: □ Full-time (≥ 12 credit hours) □ Part-time (< 12 credit hours)

9. Are you an international student? □ NO □ YES

10. Do you work? □ NO □ YES
    If YES, How many hours a week do you usually work?
    □ Less than 1 hours □ 1 – 9 hrs □ 10 – 19 hrs □ 20 – 29 hrs □ 30 or more hrs
    How many hours did you work during the past 7 days?
    □ Less than 1 hours □ 1 – 9 hrs □ 10 – 19 hrs □ 20 – 29 hrs □ 30 or more hrs

11. Where do you currently live?
    □ College dormitory or residence hall □ Fraternity or sorority house
    □ Other university housing □ Parent/guardian’s home
    □ Off-campus housing or apartment □ Other ____________________________

12. With whom do you currently live? (Select all that apply.)
    □ Alone □ Roommate(s)/friend(s)
    □ Parent(s)/guardian(s) □ Spouse/domestic partner
    □ Other relatives □ Your children
    □ Other ____________________________

13. What is your marital status?
    □ Single (Never married) □ Married/partnered □ Widowed
    □ Separated □ Divorced

14. How much time do you usually spend watching TV per day (including videos on VCR/DVD)?
    □ Less than 1 hours □ 1 – 2 hr □ 2 – 3 hrs □ 3 – 4 hrs □ 5 – 6 hrs □ 6 or more hrs
15. How much time do you usually spend playing computer or video games per day?
☐ Less than 1 hours ☐ 1 – 2 hrs ☐ 2 – 3 hrs ☐ 3 – 4 hrs ☐ 5 – 6 hrs
☐ 6 or more hrs

16. Did you take any medications or nutritional supplements (e.g., herbs, vitamins, creatine, etc…) during the past 7 days?
☐ NO ☐ YES If YES, Please list _______________ _______________

17. Do you take any caffeinated beverages daily?
☐ NO ☐ YES If YES, How many cups (one cup = 8 oz or 235 cc) do you usually take per day?
☐ Less than 1 cup ☐ 1 – 2 cups ☐ 3 – 5 cups ☐ 5 or more cups

18. Did you have any injuries or illnesses that prevent you from exercising during the past one month?
☐ NO ☐ YES If YES, Please list _______________ _______________

19. Are you currently enrolled in physical activity courses?
☐ NO ☐ YES If YES, Please list _______________ _______________

20. Are you currently a member of an intercollegiate athletic team?
☐ NO ☐ YES If YES, Please list _______________ _______________
APPENDIX C

FEELINGS OF PHYSICAL AND MENTAL ENERGY SCALE
FEELINGS OF PHYSICAL AND MENTAL ENERGY

PART I. HOW YOU FELT DURING THE PAST 7 DAYS

This part asks about how you felt during the past 7 days. The first part refers to how you felt when you perform PHYSICAL activities (e.g., walking to class, moving furniture, etc.), and the second part refers to how you felt when you perform MENTAL activities (e.g., reading, learning, organizing or analyzing information or solving problems, etc.).

Make a vertical line through each horizontal line below to indicate the intensity of your feelings during the last 7 days. If your feelings are the strongest intensity that you have ever experienced then place a vertical mark at the right edge of the horizontal line. If your feelings are between these two extremes, then use the distance from the left edge to represent the intensity of your feelings. There is no right or wrong answer. Please be as honest and accurate as possible in your responses.

Example:

- I feel I have no energy
- I feel no fatigue
- I feel no vigor
- I feel no exhaustion
- I feel no pep
- I have no feelings of being worn out

A. During the previous 7 days, how often did you feel with regard to your capacity to perform PHYSICAL ACTIVITIES?

- I feel I have no energy
- I feel no fatigue
- I feel I have no vigor
- I feel no exhaustion
- I feel I have no pep
- I have no feelings of being worn out

B. During the previous 7 days, how often did you feel with regard to your capacity to perform MENTAL ACTIVITIES?

- I feel I have no energy
- I feel no fatigue

Strongest feelings of energy ever felt

Strongest feelings of fatigue ever felt

Strongest feelings of vigor ever felt

Strongest feelings of exhaustion ever felt

Strongest feelings of pep ever felt

Strongest feelings of being worn out ever felt
<table>
<thead>
<tr>
<th>Statement</th>
<th>Feeling</th>
</tr>
</thead>
<tbody>
<tr>
<td>I feel I have no vigor</td>
<td>Strongest feelings of vigor ever felt</td>
</tr>
<tr>
<td>I feel no exhaustion</td>
<td>Strongest feelings of exhaustion ever felt</td>
</tr>
<tr>
<td>I feel I have no pep</td>
<td>Strongest feelings of pep ever felt</td>
</tr>
<tr>
<td>I have no feelings of being worn out</td>
<td>Strongest feelings of being worn out ever felt</td>
</tr>
</tbody>
</table>
PART II. HOW YOU USUALLY FEEL

This part asks about how you usually feel. Therefore, it is important that you focus on how you usually feel in responding each item. There are no right or wrong answers. Please be honest and accurate as possible in your response. Circle the response that best represents how you usually feel.

A. With regard to your capacity to perform Physical Activities, how often do you usually feel...?

1. ENERGETIC
   NEVER   A LITTLE BIT OF TIME  SOMETIMES  MOST OF THE TIME  ALWAYS

2. FATIGUED
   NEVER   A LITTLE BIT OF TIME  SOMETIMES  MOST OF THE TIME  ALWAYS

3. VIGOROUS
   NEVER   A LITTLE BIT OF TIME  SOMETIMES  MOST OF THE TIME  ALWAYS

4. EXHAUSTED
   NEVER   A LITTLE BIT OF TIME  SOMETIMES  MOST OF THE TIME  ALWAYS

5. FULL OF PEP
   NEVER   A LITTLE BIT OF TIME  SOMETIMES  MOST OF THE TIME  ALWAYS

6. WORN OUT
   NEVER   A LITTLE BIT OF TIME  SOMETIMES  MOST OF THE TIME  ALWAYS

B. With regard to your capacity to perform Mental Activities, how often do you usually feel...?

1. ENERGETIC
   NEVER   A LITTLE BIT OF TIME  SOMETIMES  MOST OF THE TIME  ALWAYS

2. FATIGUED
   NEVER   A LITTLE BIT OF TIME  SOMETIMES  MOST OF THE TIME  ALWAYS

3. VIGOROUS
   NEVER   A LITTLE BIT OF TIME  SOMETIMES  MOST OF THE TIME  ALWAYS
### 4. EXHAUSTED

<table>
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<tr>
<th></th>
<th>NEVER</th>
<th>A LITTLE BIT OF TIME</th>
<th>SOMETIMES</th>
<th>MOST OF THE TIME</th>
<th>ALWAYS</th>
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### 5. FULL OF PEP

<table>
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<tr>
<th></th>
<th>NEVER</th>
<th>A LITTLE BIT OF TIME</th>
<th>SOMETIMES</th>
<th>MOST OF THE TIME</th>
<th>ALWAYS</th>
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### 6. WORN OUT

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<tr>
<th></th>
<th>NEVER</th>
<th>A LITTLE BIT OF TIME</th>
<th>SOMETIMES</th>
<th>MOST OF THE TIME</th>
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</thead>
</table>
APPENDIX D

TASK SELF-EFFICACY QUESTIONNAIRE
TASK SELF-EFFICACY

The following items refer to your belief in your ability to successfully participate in regular exercise. “Regular Exercise” means that activities are performed:

- 5 or more days of the week at a moderate intensity (in bouts of at least 10 minutes for a total of at least 30 minutes per day), or
- 3 or more days of the week at a vigorous intensity (for 20 or more minutes per session).

Using the scale listed below, please indicate how confident you are that you can successfully carry out each of the activities listed below.

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<td>NOT AT ALL CONFIDENT</td>
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For example, on item #1, if you are completely confident that you can exercise at a moderate level without stopping for 10 minutes, you would circle 100%. However, if you have no confidence at all that you can exercise at a moderate level without stopping for 10 minutes, you would circle 0%.

Please remember to answer honestly and accurately. There is no right or wrong answer.

PART I. Your belief in your ability to successfully participate in a Moderate-intensity Exercise

Moderate-intensity Exercise is planned physical activity done to enhance your health and fitness, which:

- is continuous (20 minutes or more duration)
- mildly elevates heart rate
- mildly elevates breathing rate
- can hold conversation while exercising

Examples include:

- weight lifting
- swimming (no laps)
- golfing without a cart
- half-court basketball
- doubles tennis
- recreational team sports
- low-impact exercise/strength classes
- light cycling, less than 3 miles

HOW CONFIDENT ARE YOU THAT YOU CAN...

1. Exercise at a moderate level without stopping for 10 minutes?

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<td>MODERATELY CONFIDENT</td>
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108
2. Exercise at a moderate level without stopping for 20 minutes?

   0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
   NOT AT ALL CONFIDENT  MODERATELY CONFIDENT  COMPLETELY CONFIDENT

3. Exercise at a moderate level without stopping for more than 30 minutes?

   0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
   NOT AT ALL CONFIDENT  MODERATELY CONFIDENT  COMPLETELY CONFIDENT

HOW CONFIDENT ARE YOU THAT YOU CAN...

4. Pace yourself to avoid over-exertion during a moderate-intensity exercise session?

   0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
   NOT AT ALL CONFIDENT  MODERATELY CONFIDENT  COMPLETELY CONFIDENT

5. Complete all the planned movements during a moderate-intensity exercise session?

   0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
   NOT AT ALL CONFIDENT  MODERATELY CONFIDENT  COMPLETELY CONFIDENT

PART II. Your belief in your ability to successfully participate in a Vigorous-intensity Exercise

**Vigorous-level Exercise** is planned physical activity done to enhance your health and fitness, which:
- is continuous (20 minutes or more duration)
- causes your heart to beat rapidly
- results in rapid and deep breathing
- is sufficiently strenuous to make it difficult to hold a conversation while exercising

**Examples** include:
- running or jogging
- martial arts
- swimming laps
- calisthenics (push-ups, sit-ups)
- high-intensity aerobics classes
- competitive field sports (soccer)
- competitive full-court basketball
- cycling (10mph for more than 3 miles)

HOW CONFIDENT ARE YOU THAT YOU CAN...

6. Exercise at a vigorous level without stopping for 10 minutes?

   0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
7. Exercise at a vigorous level without stopping for more than 20 minutes?

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

NOT AT ALL  CONFIDENT  MODERATELY  CONFIDENT  COMPLETELY  CONFIDENT

8. Pace yourself to avoid over-exertion during a vigorous-intensity exercise session?

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

NOT AT ALL  CONFIDENT  MODERATELY  CONFIDENT  COMPLETELY  CONFIDENT

9. Complete all the planned movements during a vigorous-intensity exercise session?

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

NOT AT ALL  CONFIDENT  MODERATELY  CONFIDENT  COMPLETELY  CONFIDENT
APPENDIX E

SCHEDULING SELF-EFFICACY QUESTIONNAIRE
SCHEDULING SELF-EFFICACY

The following items refer to your belief in your ability to successfully schedule regular exercise sessions.

Again, “Regular Exercise” means that activities are performed:

- 5 or more days of the week at a moderate-intensity (in bouts of at least 10 minutes for a total of at least 30 minutes per day), or
- 3 or more days of the week at a vigorous-intensity (for 20 or more minutes per session).

Using the scale listed below, please indicate how confident you are that you can regulate your exercise sessions.

For example, on item #1, if you have complete confidence that you can schedule your moderate-intensity exercise each week, you would circle 100%. However, if you have no confidence at all that you can schedule your moderate-intensity exercise each week, you would circle 0%.

Please remember to answer honestly and accurately. There is no right or wrong answer.

PART I. Your belief in your ability to successfully schedule a Moderate-intensity Exercise

<table>
<thead>
<tr>
<th>Moderate-intensity Exercise</th>
<th>Examples include:</th>
</tr>
</thead>
<tbody>
<tr>
<td>is planned physical activity done to enhance your health and fitness, which:</td>
<td>- weight lifting</td>
</tr>
<tr>
<td>- is continuous (20 minutes or more duration)</td>
<td>- aerobic dance</td>
</tr>
<tr>
<td>- mildly elevates heart rate</td>
<td>- swimming (no laps)</td>
</tr>
<tr>
<td>- mildly elevates breathing rate</td>
<td>- brisk walking</td>
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<tr>
<td>- can hold conversation while exercising</td>
<td>- golfing without a cart</td>
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<td></td>
<td>- light cycling (&lt; 3 miles)</td>
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<td></td>
<td>- doubles tennis</td>
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<td></td>
<td>- recreational team sports</td>
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<td></td>
<td>- low-impact exercise/strength classes</td>
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</table>

HOW CONFIDENT ARE YOU THAT YOU CAN...

1. Schedule any moderate-intensity exercise during a typical week?
HOW CONFIDENT ARE YOU THAT YOU CAN...

2. Regularly schedule any moderate-intensity exercise at least one day during a typical week?

3. Regularly schedule any moderate-intensity exercise at least two days during a typical week?

4. Regularly schedule any moderate-intensity exercise at least three days during a typical week?

5. Regularly schedule any moderate-intensity exercise at least four days during a typical week?

6. Regularly schedule any moderate-intensity exercise at least five days during a typical week?

7. Reschedule any planned moderate-intensity exercise sessions that you missed in that same week?
8. Schedule any moderate-intensity exercise even if I have limited time during a typical week?

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

9. Schedule a moderate-intensity exercise regardless of any obstacles that prevent you from regularly exercising?

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

PART II. Your Belief in Your Ability to Successfully Schedule a Vigorous-intensity Exercise

Vigorous-intensity Exercise is planned physical activity done to enhance your health and fitness, which:
- is continuous (20 minutes or more duration)
- causes your heart to beat rapidly
- results in rapid and deep breathing
- is sufficiently strenuous to make it difficult to hold a conversation while exercising

Examples include:
- running or jogging
- swimming laps
- high-intensity aerobics classes
- martial arts
- competitive field sports (soccer)
- competitive full-court basketball
- cycling (10mph for more than 3 miles)
- calisthenics (push-ups, sit-ups)

HOW CONFIDENT ARE YOU THAT YOU CAN...

10. Schedule any vigorous-intensity exercise during a typical week?

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

11. Regularly schedule any vigorous-intensity exercise at least one day during a typical week?

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
<table>
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<tr>
<th>HOW CONFIDENT ARE YOU THAT YOU CAN...</th>
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<tr>
<td>12. Regularly schedule any vigorous-intensity exercise at least two days during a typical week?</td>
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<td>0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%</td>
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<td>NOT AT ALL CONFIDENT</td>
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<tr>
<td>13. Regularly schedule any vigorous-intensity exercise at least three days during a typical week?</td>
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<td>0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%</td>
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<td>NOT AT ALL CONFIDENT</td>
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<tr>
<td>14. Reschedule any planned vigorous-intensity exercise sessions that you missed in that same week?</td>
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<td>15. Schedule any vigorous-intensity exercise even if I have limited time during a typical week?</td>
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<td>16. Schedule a vigorous-intensity exercise regardless of any obstacles that prevent you from regularly exercising?</td>
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APPENDIX F

7-DAY EXERCISE RECALL QUESTIONNAIRE
EXERCISE RECALL

This part of the questionnaire asks you about your exercise level during the past 7 days. The first part focuses on MODERATE exercises that you performed during the past 7 days, and the second part is about VIGOROUS exercises that you performed during the past 7 days.

PART I. During the LAST 7 DAYS, How much TIME did you spend doing MODERATE exercise?

**Moderate-intensity Exercise** is planned physical activity done to enhance your health and fitness, which:
- is continuous (20 minutes or more duration)
- mildly elevates heart rate
- mildly elevates breathing rate
- can hold conversation while exercising

Examples include:
- weight lifting
- swimming (no laps)
- golfing without a cart
- half-court basketball
- doubles tennis
- low-impact exercise/strength classes
- light cycling, less than 3 miles

1. In the **DAY** column, mark a “0” for no exercise, “X” each day you engaged in MODERATE exercise.
2. In the **ACTIVITIES** column, list the MODERATE exercises you did (e.g., walking, hiking).
3. In the **TOTAL MINUTES** column, write in the amount you did MODERATE exercises on that day.
4. In the **PLANNED ACTIVITY** column, specify whether the activity is part of a regular, planned exercise program. Mark “Y” if it was regular and planned activities. Mark “N” if it is not.

<table>
<thead>
<tr>
<th></th>
<th>DATE</th>
<th>1. DAY (O / X)</th>
<th>2. ACTIVITIES</th>
<th>3. TOTAL MINUTES</th>
<th>4. PLANNED ACTIVITY</th>
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PART II. During the LAST 7 DAYS, How much **TIME** did you spend doing **VIGOROUS exercise**?

**Vigorous-intensity Exercise** is planned physical activity done to enhance your health and fitness, which:
- is continuous (20 minutes or more duration)
- causes your heart to beat rapidly
- results in rapid and deep breathing
- is sufficiently strenuous to make it difficult to hold a conversation while exercising

Examples include:
- running or jogging
- high-intensity aerobics classes
- competitive field sports (soccer)
- competitive full-court basketball
- cycling (10mph for more than 3 miles)
- swimming laps
- martial arts
- calisthenics (push-ups, sit-ups)

1. In the **DAY** column, mark a “0” for **no exercise**, “X” each day you engaged in **VIGOROUS exercise**.
2. In the **ACTIVITIES** column, list the **VIGOROUS exercises** you did (e.g., running).
3. In the **TOTAL MINUTES** column, write in the amount you did **VIGOROUS exercise** on that day.
4. In the **PLANNED ACTIVITY** column, specify whether the activity is part of a regular, planned exercise program. Mark “Y” if it was regular and planned activities. Mark “N” if it is not.

<table>
<thead>
<tr>
<th>DATE</th>
<th>1. DAY (O / X)</th>
<th>2. ACTIVITIES</th>
<th>3. TOTAL MINUTES</th>
<th>4. PLANNED ACTIVITY</th>
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APPENDIX G

PATH DIAGRAM
APPENDIX H

EXPERT REVIEW SAMPLE
Directions for Expert Panel Reviewers

These instruments are designed to examine task self-efficacy and scheduling self-efficacy. Task self-efficacy is defined as one’s belief in the ability to perform the constituent components of a task (e.g., simple motor skills, or capabilities such as perceived ability to walk for 30 minutes at a certain level of intensity). Scheduling self-efficacy is defined as an individual’s confidence in the ability to organize and plan regular exercise bouts.

Both instruments were originally developed by Rodgers et al. (2002), and were modified to fit our research. In our research, the relationship between the two forms of self-efficacy and exercise behavior (i.e., moderate and vigorous exercise during the past 7 days) will be examined in college students. Items in the instruments consist of hierarchical properties (Bandura, 1997). Items asking whether or not respondents can execute increasingly difficult behavioral tasks can adequately assess along the dimensions of level (whether or not one has the confidence in the ability to execute the behavior) and strength (the degree of one’s confidence in the ability to successfully execute the behavior). The hierarchical properties of items are based on physical activity recommendations of CDC and ACSM (e.g., adults engage in at least 30 minutes of moderate intensity activities on most days, preferably all days, to have a beneficial effect on their health). It will be a self-report, paper-pencil format mail survey, and the target sample size will be 500 full-time male and female healthy undergraduate students.

Please review these instruments for the following items:

1. Content validity
2. Construct validity
3. Question Clarity
   a. Appropriateness for population
   b. Appropriateness for wording
   c. Appropriateness for scaling

If you have any question regarding these instrument, please contact us at yoon124@osu.edu. In addition, if you have any comments after reviewing them, please use the blank pages prepared at the end of this file. Thank you very much for your time.

Sincerely,
Seok Yoon.

References:


### TASK SELF-EFFICACY

The following items refer to your belief in your ability to successfully participate in regular exercise. Using the scale listed below, please indicate how confident you are that you can successfully carry out each of the activities listed below.

<table>
<thead>
<tr>
<th>Level</th>
<th>0%</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>40%</th>
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**Comment [D1]:** Please define regular exercise. Time for the rest of the instrument the reader has the ability to decide if they are indeed able to exercise.

**Comment [D2]:** Again, define moderate pace, these concepts we all accept as being straightforward but are complicated. Or possibly define terms prior to starting to answer the instrument.

**Comment [D3]:** Have you been using pace to describe intensity up until now, do you mean to use intensity if so why both?

**Comment [D4]:** Define.
9. Pace yourself to avoid over-exertion during vigorous intensity exercise?

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10. Complete all vigorous intensity exercise sessions that you plan to perform during a typical week?

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**Scheduling Self-Efficacy**

The following items refer to your belief in your ability to schedule regular exercise sessions. Using the scale listed below, please indicate how confident you are that you can schedule your exercise sessions.

<table>
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<tr>
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<th>0%</th>
<th>10%</th>
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For example, on item 9, if you have complete confidence that you can schedule your exercise sessions at specific times each week, you would circle 100%. However, if you have no confidence at all that you can schedule your exercise at specific times each week, you would circle 0%. Please consider to answer honestly and accurately. There is no right or wrong answer.

**During a typical week, how confident are you that you can...**

1. Regularly schedule exercise at a moderate pace at specific times?

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2. Plan to exercise at a moderate pace at least one day?

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3. Plan to exercise at a moderate pace at least two days?

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4. Plan to exercise at a moderate pace at least three days?

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5. Plan to exercise at a moderate pace at least four days?

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6. Plan to exercise at a moderate pace at least five days?

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7. Make up any planned moderate exercise sessions that you missed?

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8. Overcome obstacles that prevent you from regularly exercising at a moderate pace?

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9. Exercise at a moderate pace regularly no matter what?

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10. Regularly schedule exercising at a vigorous pace at specific times?

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11. Plan to exercise at a vigorous pace at least one day?

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12. Plan to exercise at a vigorous pace at least two days?

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13. Plan to exercise at a vigorous pace at least three days?

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14. Make up any planned vigorous exercise sessions that you missed?

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15. Overcome obstacles that prevent you from regularly exercising at a vigorous pace?

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16. Exercise at a vigorous pace regularly no matter what?

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Comment [D7]: What does this mean and how does it differ from an obstacle?

Comment [D8]: Again, what does this mean?
Comments on Task self-efficacy questionnaire:

Review items:

1. Content validity:
   Given the definitions of the constructs you provided, it appears to be a reasonable sample of content.
   - Task self-efficacy is defined as one's belief in the ability to perform the constituent components of a task (e.g., simple motor skills, or capabilities such as perceived ability to walk for 30 minutes at a certain level of intensity).

2. Construct validity: There are many forms of self-efficacy as Bandura defines the construct and if I were to evaluate this based upon the entire construct he defines this would lack construct validity. However, I see what you are trying to do with the instrument and its means. So I think it would benefit you to narrow the focus to strength of self-efficacy. It appears that within each operational definition that is what you are targeting, strength of self-efficacy. It may be better to call this construct strength of self-efficacy for exercise task's or the like.

3. Question Clarity

   a. Appropriateness for population: what is the population? I see nowhere if this is for adults or children. The wording is appropriate for adults and so I figured that was the target audience. If not we need to spend significant time on wording changes making the items understandable to a younger audience.

   b. Appropriateness for scaling: this scaling system will yield a great deal of variability. If that is the purpose you will be set. But I might suggest that if you are summarizing these items the increased variance could create unnecessary noise (error variance) in the instrument. Increased variability is good, provided it is not error variance! I might suggest a 1-6 Likert scale if it is to be summed across 10 items. For instance score ranges from 0-1000, is there really 1000 shades of scheduling self-efficacy as you defined it? I am not sure you are not setting your self up for low reliability later...

Comments on Scheduling self-efficacy questionnaire:

See above the comments and extend to second scale as well. Comments are made directly on the instrument and above.
APPENDIX I

IRB APPROVAL
**TITLE PAGE - APPLICATION FOR EXEMPTION**

**FROM REVIEW BY THE INSTITUTIONAL REVIEW BOARD**
The Ohio State University, Columbus OH 43210

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<th>Principal Investigator</th>
<th>Co-Investigator 1</th>
<th>Co-Investigator 2</th>
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<tbody>
<tr>
<td>Name: Dr. Janet Buckworth</td>
<td>Name: Seok Yoon</td>
<td>Name: Dr. Brian Focht</td>
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**Department or College:** School of Physical Activity and Educational Services
**Campus Address (room, building, street address):** 169 Cune Hall 1841 Millikin Rd.
Columbus, OH 43210

**Signature:** 
**Date:** 12/06/06

**Phone:** 614-292-0757
**E-mail:** buckworth.1@osu.edu

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**Campus Address (room, building, street address):** 169 Cune Hall
**Mailing Address:** 6562 Ardienne Ct.
Dublin, OH 43017

**Signatures:** 
**Date:** 12/06/06

**Phone:** 614-292-0757
**E-mail:** yoon.124@osu.edu

**Signature:** 
**Date:** 12/06/06
**Phone:** 614-292-3759
**E-mail:** bfocht@sph.osu.edu

**Co-Investigator 2**
**Campus Address (room, building, street address):** 440 Cune Hall
**Mailing Address:** 1841 Millikin Rd.
Columbus, OH 43210

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**For Office Use Only**

☑ Approved. Research has been determined to be exempt under these categories: 
Research may begin as of the date of determination listed below.

☐ Disapproved. The proposed research does not fall within the categories of exemption. Submit an application to the appropriate Institutional Review Board for review.

**Date of determination:** 12/06/06
**Signature:** Janet A. Schulte
**Office of Responsible Research Practices**

---

Approved by the Policy Coordinating IRB, 5/18/06, revised 03/26/06

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