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# The Effect of a One Time Imagery Intervention on Self-Efficacy and Exercise Frequency in a Non-Exercising Population

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THE EFFECT OF A ONE TIME IMAGERY INTERVENTION ON SELF-EFFICACY  
AND EXERCISE FREQUENCY IN A NON-EXERCISING POPULATION

by

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Bachelor of Arts, Mount Allison University, 2003  
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A Dissertation

Submitted to the Graduate Faculty

of the

University of North Dakota

in partial fulfillment of the requirements

for the degree of

Doctor of Philosophy

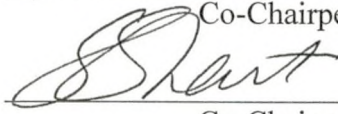
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August  
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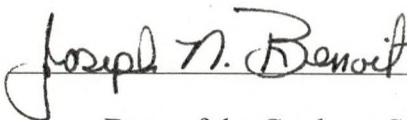
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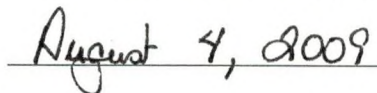
  
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## ABSTRACT

We all know physical activity is an important part of a healthy lifestyle, yet many people are still living sedentary lifestyles. One theory used to explain why some people exercise, while others do not is self-efficacy theory. Past research has indicated that people's self-efficacy may be related to their exercise behavior. It has also been shown that imagery can positively affect self-efficacy. Past research has shown that there is a relationship between imagery, self-efficacy, and exercise frequency, however no intervention studies have assessed this relationship. Therefore, the purpose of this study was to investigate the effect of a one time imagery intervention on self-efficacy beliefs and exercise frequency in a currently inactive population. Fifty-four participants were separated into three different groups, an imagery group, a group that received information on exercise, and a control group. Participants completed an exercise information and background form, the Exercise Self-Efficacy Questionnaire, the Exercise Information Inventory-Revised and companion scale, pre-intervention (time 1), and then again seven days later (time two), and fourteen days later (time 3). Results revealed that the exercise frequency level increased for all groups. Those in the exercise information group increased their exercise frequency significantly more from time one to time three than those in the imagery group. For scheduling self-efficacy, regardless of the group the participants were in their scheduling self-efficacy scores significantly increased from time one to time three. There were no significant findings for technique or coping self-efficacy. Although the findings of this study were unexpected, they still add valuable information to the discussion on imagery, self-efficacy, and exercise.

Specifically, because this is the first study to assess the above relationship through intervention based research, the findings have highlighted potential limitations for imagery interventions, but more importantly the findings have indicated what future research should focus on including imagery intervention length, individualization of the scripts, and matching the script to the persons current behavior level (e.g., adoption versus maintenance).

## CHAPTER I

### INTRODUCTION

*“Physical inactivity is one of the most important public health problems of the 21<sup>st</sup> century”*

*(Blair, 2009, p.1).*

We all know physical activity is an important part of a healthy lifestyle, yet many people are still living sedentary lifestyles. It is, therefore, important to develop theoretically based interventions that may serve to increase physical activity and exercise. Although often used interchangeably, physical activity and exercise do in fact refer to two different concepts. Physical activity is any “bodily movement that enhances health” (U.S. Department of Health and Human Services; [USHHS], 2008, p. 3). Exercise, on the other hand is defined as “a form of physical activity that is planned, structured, repetitive, and performed with the goal of improving health or fitness” (USHHS, 2008, p. 7). Therefore, all exercise is a form of physical activity, but not all physical activity would be classified as exercise. For example, mowing the lawn would be considered physical activity, but it is not considered exercise as the goal is not to improve health. Regardless of this differentiation, the terms exercise and physical activity have become synonymous with each other in the health literature, and are often used interchangeably.

There are numerous health benefits associated with engaging in physical activity and exercise. Exercise has been linked to a lowered risk of death, coronary heart disease, stroke, high blood pressure, type 2 diabetes, colon cancer, and breast cancer (USHHS, 2008). Those who regularly exercise may also reap numerous health rewards such as the prevention of

weight gain, and improvements in cardiovascular and muscular fitness (USHHS, 2008). Along with these physical benefits, exercise has been found to have mental health benefits such as a decrease in depression and anxiety, as well as improvements in mood (Penedo & Dahn, 2005), and cognitive benefits including increases in brain functioning (Sparling, 2003).

Due to the importance of exercise, the USHHS and the American College of Sports Medicine (ACSM; Haskell, 2007) have both come out with recommendations on the amount of physical activity adults should participate in for optimal health. The latest recommendations by USHHS have been supported by the ACSM (the ACSM recommendations are in parentheses). The USHHS recommend that adults do at least 150 minutes a week (30 minutes, 5 days a week) of moderate intensity, (working hard enough to raise your heart rate and break a sweat) or a minimum of 70 minutes a week (20 minutes, 3 days a week) of vigorous intensity aerobic physical activity (strenuous effort that is sustained long enough to cause one to break a sweat or to breathe heavily), if they want substantial health benefits. To obtain more extensive health benefits they suggested the amount of physical activity should be increased to 300 minutes of moderate activity or 150 minutes of vigorous activity per week, or an equivalent combination of moderate and vigorous activity. They also recommended that adults complete muscle strengthening activities, such as resistance training and lifting weights that are moderate or high in intensity and involve all of the major muscle groups on at least 2 days a week. Based on these recommendations they categorized people into four categories: inactive (no activity beyond basic daily movement: baseline), low activity (activity beyond baseline but fewer than 150 minutes a week),

medium activity (150-300 minutes a week), and high activity (more than 300 minutes a week).

Although exercise is extremely important for a healthy lifestyle and there are clear recommendations for the amount of physical activity necessary, it seems that many people are not including exercise in their daily lives, or are not doing enough. In fact, in 2007, the ACSM reported that less than half of the men and women in the United States participated in the recommended daily amount of physical activity. According to the National Center for Health Statistics (NCHS, 2007), up to 40 percent of adults are not meeting the recommended daily amount of exercise and are living sedentary lifestyles. This lack of physical activity and exercise is one reason why some believe we have a world wide epidemic of obesity and sedentary lifestyles in industrial nations (Penedo & Dahn, 2005). In fact, the number of overweight or obese people in the United States has been continually rising from 44.8 percent of the population in the early 1960's being categorized as overweight or obese, to 66 percent in 2004 (NCHS, 2007). The U.S. Center for Disease Control predicts that physical inactivity, along with a poor diet, has led to at least 300 000 preventable deaths in the United States each year. Lack of physical activity is not just a problem in the United States; the World Health Organization (WHO) predicts that each year 1.9 million deaths are attributed to a lack of physical activity (2004).

Thus, the research on the relationship between exercise and people's health has made it clear that exercise is an important component of a healthy lifestyle. Exercise has the ability to positively change peoples' physical and mental health. Unfortunately, many people are not exercising the recommended amount a week. As stated above, this lack of exercise has led to a serious health crisis in the United States and the World. Due to the importance of physical

activity and exercise, researchers are interested in ways to get people to start and continue with exercise programs. To this end, many different physical activity and/or exercise interventions have been designed and tested.

There have been numerous interventions tested to assess different ways in which people can be encouraged to increase their physical activity or/and exercise behavior. The common theme among the interventions is getting people to increase their exercise frequency (e.g., Calfas, Sallis, Oldenburg, & French, 1997; Lewis, Forsyth, Pinto, Bock, Roberts, & Marcus, 2006; Luszczynska, Gregajtys, & Abraham, 2007; Luszczynska & Tryburcy, 2008; Oulette, Hessling, Gibbons, Bergan, & Gerrard, 2005; Vergeer & Roberts, 2006) or start exercising. In addition, one or more of the following dependent variables has typically been focused on: cardiorespiratory or endurance fitness, weight change, exercise adherence or compliance (for a review see Dunn, Andersen, & Jakicic, 1998), and an increase in exercise ability (Vergeer & Roberts, 2006). Regardless of the dependent variables measured or whether the intervention was characterized as related to physical activity or exercise, the results have shown that interventions can be an effective tool in the fight against a sedentary lifestyle.

Along with the intervention research, multiple theories and models have been used to describe why some people exercise, while other people do not (Cox et al., 2003). For example theories of reasoned action, theory of planned behavior, the model of goal directed behavior, transtheoretical model, and self-efficacy have all be used to describe and explain why people do or do not engage in physical activity/exercise (Hagger & Chatzisarantis, 2005). The focus of this paper is self-efficacy theory.

### *Self-Efficacy*

One theory used to explain why some people exercise, while others do not is Bandura's social cognitive theory (1977). Bandura (2001) identified a network of causal structures that depend on people's own agentic behaviors (e.g., persistence), personal factors (e.g., beliefs), and the external environment (e.g., interactions with others). This network represents a reciprocal process in which the three factors are all interacting determinants of one another to explain motivation and behavior. For example, the proximity of a location to exercise will influence whether or not a person will exercise (external environment). If the person has a place to exercise near by they are more likely to exercise. If a person begins to exercise, their likelihood of maintaining an exercise program is influenced by their persistence (agentic behavior) even in the face of obstacles (e.g., when he/she doesn't have time). This finding is because their persistence will lead to a positive increase in their beliefs about their abilities, and motivations (personal factors). This change in beliefs will increase the likelihood that the person will continue to exercise (behavior). Although in this example a person's agentic behavior and their external environment affected their beliefs, any of these three structures can influence each other. This focus on how agentic behaviors, personal factors, and the external environment, exercise control over a person's motivation, styles of thinking, emotional life, and personal accomplishments, led to Bandura developing the self-efficacy construct (Bandura, 1997).

Self-efficacy is defined as "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (Bandura, 1997, p. 3). According to Bandura (1997), nothing is more central or pervasive than people's beliefs in their capability to exercise some measure of control over their own functioning and over our surroundings. Self-efficacy beliefs are judgments about what one thinks one can do with one's skills (e.g.,



“I think I can...”) and not judgments about what one has (e.g., “I have...”). They are also not behavioral intentions (“I will...”). That change happens through self-efficacy beliefs is at the heart of Bandura’s theory (Feltz, Sullivan, & Short, 2008).

When understanding the self-efficacy construct it is important to understand that self-efficacy beliefs are considered to be specific to distinct domains of functioning rather than an overall global trait or personality characteristic (Bandura, 1997). Thus, it would be misleading to label a person as highly efficacious with regards to their health-related behavior without referring to a specific domain of functioning. For example, a person may be highly efficacious in their ability to run, but have quite a low level of efficacy for their strength training ability. It is important to note that although these examples are focused on physical skills, self-efficacy beliefs are multifaceted. A person may possess high self-efficacy for executing physical skills, but lower self-efficacy for psychological tasks like using imagery.

Because self-efficacy is specific and not a global trait, it is important to assess many different types of efficacy opposed to focusing on “general” self-efficacy. Multiple types of efficacy beliefs related to exercise have been identified as important to investigate when assessing peoples’ efficacy for exercise behaviors. These efficacy types are identified in Table 1.

Bandura’s self-efficacy construct has given researchers and practitioners a useful way to understand why some people do not participate in the recommended amount of exercise. That is, by investigating the specific types of efficacy related to exercise, and a person’s efficacy level, researchers are better able to understand why someone does not exercise. Research investigating self-efficacy and exercise is discussed further on in this paper.

Table 1. Efficacy Types Related to Exercise Behavior

Efficacy Type	Definition	Example
Task efficacy	An individual's confidence in his/her ability to perform the basic aspects of a task.	A person's belief in his/her ability to do all the movements necessary to engage in an exercise program.
Exercise efficacy	A type of task efficacy. A belief about one's capability to successfully engage in physical activity/exercise.	A person's belief in his/her ability to successfully lift weights or run on a treadmill.
Coping efficacy	A person's confidence in his/her ability to perform tasks under challenging conditions.	A person's belief in his/her ability to exercise even when they are tired.
Barrier efficacy	The same as coping efficacy.	
Self-regulatory efficacy	The same as coping efficacy	
Scheduling efficacy	Subtype of coping efficacy; refers to a person's confidence in his/her ability to properly schedule exercise activity.	A person's belief in his/her ability to schedule exercise into his/her daily routine regardless of how hectic his/her day was.
Self-presentational efficacy	Confidence in how one presents oneself while exercising.	A person's belief regarding what he/she look like while exercising.

Another way that self-efficacy theory is particularly useful in studying exercise behavior is through the sources and outcomes that are included in the theory. The sources of self-efficacy represent what people use to gain information about their capabilities. The outcomes represent the beliefs, thoughts, and behaviors people exhibit. Thus, theoretically, the sources effect self-efficacy beliefs which, in turn, affect the outcomes. These sources are presented in the next section of the paper.

*Sources of Self-Efficacy*

Self-efficacy beliefs, whether accurate or faulty, are a product of a complex process of self-appraisal and self-persuasion that rely on the cognitive processing of diverse sources of efficacy information (Feltz et al., 2008). Bandura (1977, 1986, 1997) proposed four principal sources of information: past performance accomplishments, vicarious experiences,

verbal persuasion, and physiological and emotional states. Since then, others (Maddux, 1995, Schunk, 1995) have separated imagery from vicarious experiences to make it its own source and have separated physiological and emotional states into two separate categories.

The first source, past performance accomplishments, refers to a person's past experience actually engaging in the specific activity (Bandura, 1997). For example, peoples past experience lifting weights and their perception of how successful they were at the task will impact their self-efficacy beliefs. According to Bandura (1986, 1997), past performance accomplishments are the most influential source of efficacy information because they are based on a person's own experiences. Thus, the actual performance of behaviors that lead to success is the most powerful way to build self-efficacy (Feltz et al., 2008). According to self-efficacy theory, a successful performance should raise self-efficacy beliefs while an unsuccessful performance should lower them.

The second source of self-efficacy is vicarious experiences. In self-efficacy theory, vicarious experiences are those that involve observing and comparing oneself with others or with norms (Bandura, 1997). For example, people who are considering starting an exercise routine may look to someone they know (a model), who they considers to be similar to them self, who has started exercising and see if that person has been successful in maintaining an exercise routine. If the model has been successful, a person considering an exercise routine will be more likely to believe that he/she also has the ability to be successful.

Although Bandura (1986, 1997) originally considered imaginal experiences as part of vicarious experiences (i.e., cognitive self-modeling), other researchers have included these types of experiences as a separate source (e.g., Maddux, 1995). "Mental imagery refers to all those quasi-sensory or quasi-perceptual experiences of which we are self-consciously aware,

and which exist for us in the absence of those stimulus conditions that are known to produce their genuine sensory or perceptual counterparts, and which may be expected to have different consequences from their sensory or perceptual counterparts” (Richardson, 1969, pps. 2-3). Imagery experiences have been described as “an experience that mimics real experience. We can be aware of 'seeing' an image, feeling movements as an image, or experiencing an image of smell, tastes or sounds without actually experiencing the real thing” (White & Hardy, 1998, p. 389). Imagery is not the same as dreaming; people are awake and conscious when using imagery (Richardson, 1969; White & Hardy, 1998). For example, if people image themselves exercising successfully and perceive these images to be positive, then their self-efficacy beliefs in their ability to exercise are likely to be higher than they were before they imaged.

The third source of self-efficacy beliefs is verbal persuasion, which refers to the fact that people can be persuaded that they are equipped with the necessary tools to succeed (Bandura, 2007). For example, exercise efficacy levels may be increased if people are consistently told by their friends that they have the ability to stick to an exercise routine and achieve their desired effect. On the other hand, efficacy levels may decrease if people are consistently put down and told that they will not be successful by their trainers or workout partners.

Physiological states are another source of efficacy information. People cognitively appraise their physiological state or condition to form self-efficacy judgments in deciding whether they can successfully meet task demands (Feltz et al., 2008). An example of a physiological state would be the increased heart beat a person experiences while exercising. If people perceive changes in physiological states as positive, as a sign they are working

hard, it will lead to an increase in self-efficacy for that behavior. In his writings, Bandura (1997) combined physiological and affective states because they both have a physiological basis. However, Maddux (1995) separated physiological and affective states into two sources he called physiological and emotional states. According to Maddux (1995):

physiological states influence self-efficacy beliefs when people associate aversive physiological arousal with poor behavioral performance, perceived incompetence, and perceived failure. When people become aware of unpleasant physiological arousal, they are more likely to doubt their behavioral competence than if the physiological state were pleasant or neutral. Likewise, comfortable physiological sensations are likely to lead one to feel confident in one's ability in the situation at hand (p. 11).

Although physiological states are important components of emotions (Maddux, 1995), emotional states (i.e., subjective states of feelings and moods) are not simply the product of physiological arousal (Feltz et al., 2008). It is for this reason that physiological states and emotional states are often considered separate sources (although they are related).

The final source of efficacy beliefs is emotional experiences. Theoretically, people are more likely to have self-efficacious beliefs about performance when their emotional experience is positive (characterized by happiness, exhilaration, and tranquility) than when it is negative (characterized by sadness, anxiety, and depression) (Maddux, 1995). For example, people are more likely to have increased efficacy levels for their ability to stick to an exercise routine, if while exercising they feel a sense of exhilaration, then they will if they feel a sense of futility. Furthermore, people feel more self-efficacious when emotionally calm than when aroused or distressed (Maddux & Lewis, 1995). The more intense the emotional experience is, the greater its impact on self-efficacy beliefs (Bandura, 1997).

These six sources demonstrate how self-efficacy beliefs can be modified. From a theoretical perspective, Bandura (1977, 1986, 1997) stated that the categories of efficacy

information are not mutually exclusive in terms of the information they provide, although some are more influential than others. Personal performance accomplishments are likely to be the most influential, while vicarious experiences, verbal persuasion, physiological states, and emotional states are generally seen as less reliable but still important sources of efficacy (Feltz et al., 2008). Along with this understanding of how self-efficacy can be changed, it is equally important to understand the outcomes of self-efficacy beliefs.

### *Outcomes of Self-Efficacy Beliefs*

Self-efficacy beliefs affect the behaviors people engage in as well as their thought patterns. Specifically, self-efficacy affects the behaviors of choice, effort, and persistence, and the thought patterns related to goals, worries, and attributions (Feltz et al., 2008).

Research has shown that people are more likely to engage in behaviors they feel will be difficult but attainable (Feltz et al., 2008). For example, people are more likely to start an exercise program if they feel the program is challenging but achievable. Therefore, a high level of efficacy in one's ability to successfully complete an exercise routine will increase one's chances of engaging in the behavior of exercising.

Research has also shown that the goals one sets are influenced by their self-efficacy beliefs (e.g., Locke, Frederick, Lee, & Bobko, 1984). People are more likely to set challenging but realistic goals if they have a high level of efficacy for the task, then if they have a lower level of efficacy for the task. Furthermore, when faced with a difficult goal, people with high self-efficacy for the task will increase their effort and persist longer (or try harder) than someone with lower self-efficacy for the task. For example, if two people are given the goal of completing a two week exercise program, the person who believes that he/she has the ability to complete the program will be more likely to successfully finish the

program, regardless of the obstacles or barriers he/she faces, then the person who does not believe he/she could achieve success.

According to Bandura (1997), perceived self-efficacy influences peoples' worries, stress, and anxiety levels through their beliefs about their control of their actions, thoughts, and affect. People with high levels of self-efficacy will focus on what they need to do to meet the challenge of their goal, while people with low self-efficacy will worry about being unsuccessful and all the negative outcomes associated with failure. Those who focus on failure tend to become more anxious and nervous and develop increased tension, all of which are detrimental for performance (Feltz et al., 2008). An example of how self-efficacy affects worries, stress, and anxiety would be a person who is running on a treadmill with the goal of running for 30 minutes at a pace of 12 minute miles. If that person has low self-efficacy for his/her ability to complete this task, then he/she will spend the time on the treadmill thinking about how hard the task is, how unlikely he/she is to accomplish the task, and as a result, he/she will become more anxious, leading to an increase in tension in his/her body as he/she runs. This thought pattern decreases the person's chance of completing the activity and meeting his/her goal. On the other hand, if a person has the same goal but has a high level of self-efficacy, then he/she will likely spend his/her time on the treadmill focused on how to successfully complete his/her goal, making it more likely that he/she will be successful and complete the 30 minute run.

Peoples' efficacy level for a task also affects whether they think positively or negatively about a task. People who are highly efficacious will focus on all the ways they can be successful (which will push them to work harder and put in more effort). People who are less efficacious may, instead, focus on all the ways they will fail at the task, leading them to

believe the task is actually harder than it is, and therefore, lead them to be more likely to quit (Feltz et al., 2008). In relation to exercise, self-efficacy beliefs have a unique effect on behavior and thought pattern outcomes depending on the stage of exercise a person is currently in.

### *Using Self-Efficacy Theory at Different Stages of Exercising*

Social cognitive theory differentiates between three processes of personal change: adoption of a new behavior, use of behavior under different circumstances, and maintenance of behavior over time (Bandura, 1997). Efficacy beliefs affect each of these processes in similar, but unique ways. It is important to understand these differences when attempting to change behavior through self-efficacy beliefs.

When attempting to start a new behavior, such as a new exercise program, people's beliefs about their ability to motivate themselves and regulate their own behavior are the keys to the person actually making a behavior change (Bandura, 1997). People with high levels of efficacy in their ability to change their behavior are more likely to initiate behavior change than people with low efficacy beliefs about their ability to change their behavior (Bandura, 1997). One specific way to increase efficacy beliefs in those attempting to adopt a new behavior is to inform them about the potential barriers (things that may get in the way of their success) that they may come across when attempting to change their behavior and then giving them ways to handle these barriers (Bandura, 1997). By giving people the knowledge they need to overcome these barriers, their efficacy can be increased.

For programs attempting to encourage people to adopt a healthier choice, such as an exercise program, it is best to communicate both a sense of belief in their capabilities to succeed in the task and instructions for how they can adopt these healthier life choices



(Bandura, 1997). Along with attempts to increase knowledge and subsequently raise efficacy beliefs, it is important to understand the role of outcome expectations in behavior adoption (Bandura, 1997). A person is unlikely to adopt a new behavior if they do not believe that it will lead to an outcome they desire. For example, people who want to lose weight but do not believe exercising will lead to weight reduction, are unlikely to engage in an exercise program. It is, therefore, very important to educate those adopting a new behavior of the positive outcomes of the behavior. This knowledge can lead people to developing positive outcome expectations that increase their likelihood of adopting the new behavior. Once empowered with the knowledge and a belief in ones self, the adoption of a new behavior, such as exercise, becomes more likely (Bandura, 1997).

Once a new behavior has been adopted, people move through to the next process of change which concerns the ability to behave a certain way in different situations. In reference to exercise, this process of change refers to peoples' abilities to complete exercise programs in various situations and in the face of different barriers. Social cognitive theory differentiates between three different types of barriers; cognitive, situational, and structural (Bandura, 1997). A persons' likelihood to adhere to their new exercise program is related to how many barriers (e.g., lack of time, busy schedule, bad weather) they face at any given time (Bandura, 1997). If people have a high level of self- efficacy to self-motivate, and regulate their own behavior, regardless of the different barriers, then they are more likely to be able to exercise regardless of the actual barriers they may face. On the other hand if a person's self-efficacy level is low, when faced with a barrier, such as a busy day, they are likely to not believe they can fit exercising in to their day and therefore, skip their exercise program.

The third and final process of change is maintenance of change. Once people have adopted new behaviors they are most likely to maintain this behavior if their efficacy level is maintained at a high degree (Bandura, 1997). Having a high efficacy level for their ability to maintain the behavior will protect people from failures or setbacks (Bandura, 1997). On the other hand, if people do not believe they can maintain the behavior for a long period of time, one setback or failure may lead to them abandoning the new behavior and skills they have been taught. Regardless of the process of change a person is currently going through, any one of the sources of self-efficacy can be used to help develop a sense of resiliency and the efficacy they need to be successful in their attempt to maintain the behavior change.

#### *Exercise and Self-Efficacy*

Bandura's (1977) social cognitive theory and related self-efficacy construct both propose that self-efficacy affects adoption, use, and maintenance of exercise behavior. Theories are an important guide for research. Many researchers have investigated numerous components of social cognitive theory, including the relationship between self-efficacy and exercise. The relationship between self-efficacy and exercise has been examined by the effect of self-efficacy related interventions on the physical activity or exercise levels of normal populations (Calfas et al., 1997; Luszczynska et al., 2007; Luszczynska & Tryburcy, 2008) sedentary populations (Lewis et al., 2006), and populations with health problems (Luszczynska et al., 2007; Luszczynska & Tryburcy, 2008). Researchers have also employed questionnaire based research designs to investigate the relationship between self-efficacy and exercise/physical activity (e.g., Rodger & Gauvin, 1998; Rodgers & Sullivan, 2001; Rodgers, Hall, Blanchard, McAuley, & Munroe, 2002; Woodgate, Lawrence, Brawley, & Weston, 2005). As previously mentioned, most researchers measure multiple dependent variables. For

this reason, the following presentation of past research will focus on those results related specifically to the relationship between self-efficacy and exercise as that is the relationship of interest for this study.

The mediating effects of self-efficacy on physical activity frequency were investigated in two studies. The first study (Calfas et al., 1997) examined the effectiveness of Physician-based Assessment and Counseling for Exercise (PACE) on the hypothesized physical activity mediators indicated in social cognitive theory and the transtheoretical model (i.e., self-efficacy, social support, processes of change, and behavioral processes), and how these mediators affected physical activity change (Calfas et al., 1997). Calfas et al. had participants' fill out questionnaires at baseline to assess their physical activity and self-efficacy levels. The participants' were then divided into two groups: control or PACE. The PACE group was given an intervention by a physician that focused on the above potential mediators. For example, to enhance self-efficacy, participants; were told of the importance of having a high level of efficacy in their ability to meet their specific activity goals (verbal persuasion). Physical activity was measured by having participants', who were all healthy and inactive as defined by the ACSM guidelines, complete a self-assessment to describe the amount of exercise and the intensity of that exercise completed over the past seven days. Self-efficacy was measured using the "Self-efficacy for Behavior Scale" which consists of 12 items that assess the participant's efficacy in their ability to stick to it and make time for exercise (Sallis, Pinski, Grossman, Patteron, & Nader, 1988). Results indicated that those participants' who participated in the PACE group showed significant increases in physical activity and behavioral and cognitive processes, but did not show significant increases in self-efficacy. Results from a multiple regression analysis showed that self-efficacy for

making time and behavioral processes were predictors of physical activity. Although the findings of this study are important, it is not possible to determine exactly how self-efficacy and exercise are related to each other based on the results of this study as the intervention included numerous other components besides self-efficacy enhancement which may have affected the results. That is, it is not possible to know which part(s) of the intervention were effective and which were not as effective.

The second study to assess the mediating role of self-efficacy was conducted by Lewis et al. (2006). Specifically, they investigated the effects of a physical activity intervention based on both the transtheoretical model and social cognitive theory (tailored intervention) in comparison to the effects of a standard non-theory based physical activity intervention on exercise frequency, behavioral processes, cognitive processes, self-efficacy, and decisional balance. The study was conducted using participants' who were sedentary according to the ACSM guidelines. They completed a mailed package of questionnaires at baseline, as well as one, three, and six months later. Included in the package was a self-report questionnaire asking about physical activity frequency in minutes and intensity of the physical activity over the last seven days, and a self-efficacy for physical activity questionnaire that consisted of five questions related to the participant's ability to engage in physical activity even in the face of different obstacles (i.e., a coping/barrier efficacy measure). Those in the tailored intervention group were given a print-based self-help intervention that focused on reinforcing successes and targeting deficiencies. The part of the intervention designed to increase self-efficacy assessed the participant's confidence and explained the importance of being confident in ones abilities even in the face of obstacles (which would be considered to be verbal persuasion). The analysis focused on assessing the

different constructs mediating effects based on Baron and Kenny (1986) four criteria (effect on physical activity, effect on hypothesized mediator, effect of mediator on physical activity, and the relationship between the intervention and physical activity when controlling for the mediator). Results indicated that all participants' exercise frequency increased from baseline to six months. However, the tailored group showed a significantly larger increase than the standard group (effect on physical activity). The tailored group showed a marginally significant ( $p = .06$ ) increase in self-efficacy over the 6 months compared to the standard group (effect on hypothesized mediator). Overall they found that self-efficacy was increased from baseline to three months and that this increase was related to an increase in exercise frequency at six months (effect of mediator on physical activity). The analysis of the relationship between the intervention and physical activity when controlling for the mediator indicated that, although self-efficacy was a predictor of physical activity frequency, the relationship between the intervention group and physical activity frequency was not significantly different when controlling for self-efficacy level. This finding indicated that self-efficacy had not met the fourth criterion for mediation. One reason why self-efficacy may not have met this final criterion could have been because the researchers assessed self-efficacy by asking questions that only related to coping/barrier self-efficacy, and therefore may not have accessed all the participant's self-efficacy beliefs in regards to their physical activity (e.g., task efficacy). Another limitation of this study that may have impacted the findings was discussed by Lewis et al. when they acknowledged their study "was not powered to detect mediating effects of the constructs" (p. 202). Even with these limitations, this study offers support for Bandura's (1997) proposal that self-efficacy does influence

physical activity frequency. This study also highlights the need for more self-efficacy intervention studies in the field of physical activity research.

Although the above studies are the only ones to specifically assess self-efficacy as a mediator of exercise, there have been a few intervention studies that have also assessed the relationship between self-efficacy and exercise. Intervention studies have tended to focus on populations that have health issues. For example, Luszczynska and colleagues assessed the role of verbal persuasion interventions on exercise behavior in relation to those with spondylosis (Luszczynska Gregajtys, & Abraham, 2006), and those with diabetes or cardiovascular disease (Luszczynska & Tryburcy, 2008).

In their first study, Luszczynska et al. (2006) investigated whether a self-efficacy intervention would affect exercise program adherence by people with spondylosis (a degenerative disorder affecting the spinal structure). They divided participants' into either a control group (given rehabilitation guidelines), or an intervention group, where participants' were given the rehabilitation guidelines as well as an opportunity to practice the rehabilitation exercises (i.e., past performance/mastery experiences source of self-efficacy) while a staff member praised their work (verbal persuasion). Participants' completed a questionnaire before and after the intervention (3 weeks later) to assess their adherence to the rehabilitation exercise program and their self-efficacy level. Self-efficacy was measured using three questions related to coping self-efficacy. Exercise adherence was self-reported based on the number of days the participant had engaged in the desired activity. Results indicated that self-efficacy scores for those participants' in the intervention group were significantly higher than those in the control group after the intervention was given. In fact those in the control group tended to show a decrease in self-efficacy scores from Time 1 to

Time 2, while the opposite was true for those in the intervention group. Of particular interest was whether those in the intervention group would report exercising more than those in the control group at Time 2. Results indicated that those in the intervention group reported higher frequency of participation than those in the control group, with over 50% of participants in the intervention group reporting daily exercise, and only 36% of those in the control group reporting daily participation.

In their second study, Luszczynska and colleagues (2008) again investigated the effect of a one-time self-efficacy intervention on self-efficacy beliefs and exercise frequency. A one-time intervention is when the intervention is given to the participant (visual or auditory), only once at the beginning of the intervention without instructions for the participant to repeat the intervention on their own. For this study they included participants' who had spondylosis as well as those with cardiovascular disease or diabetes and those who did not have either health condition. They randomly assigned 187 participants' to either a control condition or an experimental intervention group. Those in the experimental group were given a one-time self-efficacy intervention based on the source verbal persuasion. Participants' were given a definition of self-efficacy and information on the importance of having a high sense of efficacy was given to the participants. They were then given feedback about their current level of self-efficacy (as indicated by the participants' on a questionnaire before the intervention) in comparison to the average self-efficacy level of participants' in the sample. Finally, participants' were asked to recall and write down an experience when they successfully acted upon their intentions and remember the emotions they felt when they were successful. The experimenters attempted to increase the participant's self-efficacy by telling them they were effective and successful (verbal persuasion).

Participants' exercise behavior was measured before and after the intervention by having participants' self report how often they had exercised intensely or moderately in the last two weeks, and how often they had participated in a physical activity over the last two weeks. Participant's self-efficacy levels were also assessed before and after the intervention through self-report. More specifically, participants' answered four questions using a 4 point Likert-type scale (1 = definitely not, 4 = exactly true). The questions all related to the participants' efficacy in their ability to exercise when faced with obstacles. The results of the intervention were mixed. Regardless of the participant's health status, those in the control group did not show a change in self-efficacy or exercise frequency at post test. There was a change in self-efficacy level and exercise frequency for those in the intervention group, only if they had cardiovascular disease or diabetes. They found that the positive self-efficacy change predicted positive changes in exercise. After they controlled for self-efficacy changes based on the intervention, the relationship between group and exercise changes was no longer significant. This finding indicates that the relationship between the intervention and exercise change was mediated by self-efficacy. Those who were in the non diabetes/cardiovascular groups did not show a significant difference in self-efficacy level or exercise frequency. This result is surprising and seems to be in conflict with Bandura's (1997) self-efficacy theory, as Bandura states that self-efficacy level differences do affect exercise frequency. However, when investigated further, it appears that the statistical power was quite low for the non diabetes/cardiovascular disease participant group analyses. Another reason why the intervention may not have led to a change in self-efficacy levels or exercise frequency in the non diabetes/cardiovascular disease group could be that verbal persuasion is not one of the most powerful sources of self-efficacy, and therefore was not able to lead to change on its



own after a one-time intervention. Overall, the findings suggest that one time brief self-efficacy based interventions can affect both self-efficacy and exercise behavior, however this relationship may be affected by factors such as health of the participant.

The effect of efficacy on exercise behavior in those with health issues has also been assessed through questionnaire based research. Woodgate et al. (2005) investigated whether self-efficacy determined adherence to an exercise cardiac rehabilitation program. They assessed the responses of post myocardial infarction patients to questions relating to scheduling efficacy, walking efficacy (confidence in performing a walking task), in class self-efficacy (confidence in ability to complete the in class tasks), exercise intensity, and attendance. Results from a hierarchical regression analysis indicated that scheduling and walking efficacy significantly predicted participant's attendance while in-class efficacy did not. Results from a second hierarchical regression revealed that in class efficacy accounted for a significant amount of the variance in exercise intensity, while walking efficacy did not (scheduling efficacy was not included in this test as it did not relate to the specific exercise behavior). Given that Bandura's (1997) self-efficacy construct is based on the idea that there is a reciprocal relationship between self-efficacy and performance, Woodgate et al. (2005) also investigated the role of past attendance (as self reported) on self-efficacy beliefs via multiple regression analyses. The results indicated that scheduling, in class, and walking self-efficacy were all predicted by past performance (mastery experiences). Overall, these findings emphasized the importance of assessing multiple types of self-efficacy. They also lent evidence to Bandura's (1997) claim of a reciprocal relationship between performance and self-efficacy.

Not all research related to self-efficacy has focused on populations with health issues. Studies have also investigated the relationship between self-efficacy and exercise in healthy populations (Rodger & Gauvin, 1998; Rodgers & Sullivan, 2001; Rodgers et al., 2002). One such study examined the motivational characteristics of highly versus moderately active women who considered themselves to be regular exercisers (Rodgers & Gauvin, 1998). Participants' completed a packet of questionnaires before an exercise class and then again five to six weeks later. Self-efficacy was assessed using a five item questionnaire that focused on the participants' confidence in their ability to adhere to their physical activity behaviors. Participants' were also asked to rate on a 100 point scale how confident they were in their ability to perform a behavior. Based on participants' responses to an open ended questionnaire focused on their incentives for exercising, multiple incentive categories were developed. The incentives were divided into those that were considered to be a direct result of physical activity (primary) and those that were expected due to achieving the primary goal (secondary). The primary incentives were appearance (e.g., maintain weight), fitness (e.g., firmer body), mental health (e.g., challenge self) and stress control (e.g., reduce stress). The secondary incentives were secondary appearance (e.g., delay aging), secondary mental health (e.g., more confident) and secondary physical health (e.g., improve immune system). Results of the study indicated that self-efficacy was the strongest predictor of physical activity level, followed by primary stress reduction, and secondary mental health incentives. No other incentives were significant predictors of physical activity group (moderate or active). The findings indicated that self-efficacy beliefs were much more unstable in moderate exercisers compared to those who were highly active, who did not show any changes in self-efficacy beliefs across the two times. These findings also indicate that it may not be enough to assume

differences in self-efficacy based on whether a person exercises or not, instead self-efficacy beliefs may differ within each of those categories based on the level of the person's participation, or lack thereof.

This line of research was continued by investigating the role of specific types of exercise related self-efficacy on frequency of physical activity (Rodgers & Sullivan, 2001; Rodgers et al., 2002). Specifically, they compared participants' of various exercise levels on coping, scheduling, and task efficacy (Rodgers & Sullivan, 2001). In this study, participants' were divided into groups based on self-reported exercise frequency (i.e., 5 groups: never exercise, 1-3 times per month, 4-8 times per month, 9-15 times per month, or more than 15 times per month). Self-efficacy was measured by a 10 question survey using a 10 point Likert-type scale (where 1 = *no confidence* and 10 = *complete confidence*). The items on the questionnaire were separated into task, coping, or scheduling efficacy. The results of the study indicated a main effect for all three efficacies. Post hoc tests revealed that those in the three least active groups had significantly lower scheduling and coping efficacy levels than those in the two most active groups. The results were not as clear for task efficacy as those in the second and third lowest activity levels seemed to be a part of both the low and high efficacy scores groups. According to the authors, the findings indicated that scheduling and coping efficacy were better discriminators of exercise frequency group than task efficacy. Based on these results, the authors divided the participants' into 2 groups (i.e., those who exercised less than 9 times a month and those who exercised 9 times or more a month). Subsequent analyses to see which of the 10 items were most strongly related to the exercise frequency differences showed that the coping and scheduling efficacy questions were positively related to exercise frequency more than the four task efficacy questions. In

particular, the scheduling question “arrange schedule to exercise regularly” and the coping question “exercise when you feel you don’t have time” were most strongly related to exercise frequency. Overall, the findings of this study indicate that those who exercise more have higher self-efficacy levels, and that the type of efficacy has an impact on exercise frequency. Specifically, coping and scheduling efficacy may be more important to consider compared to task efficacy when assessing a person’s likelihood to adhere to an exercise program. The finding that task efficacy was not as strongly related to exercise frequency as scheduling and coping efficacy suggests that when it comes to exercise behavior, the obstacles in ones life are a more important factor than a person’s ability to perform the skills necessary.

A follow up of this study was then conducted (Rodgers et al., 2002). The aim of this two part study was to first assess the validity of a measure of scheduling and task self-efficacy and then to use this measure to test whether task and scheduling self-efficacy would influence exercise intention and exercise behavior. To assess the validity of the two types of self-efficacy, a confirmatory factor analysis was conducted. Of the ten questions, five were expected to be related to task self-efficacy and the other five were expected to be related to scheduling efficacy. The responses of 589 exercisers were analyzed using principal components and confirmatory factor analyses. The results led to two task and two scheduling efficacy questions being dropped from the questionnaire due to problematic loadings. The second part of the study used the newly-formed six item questionnaire to test whether task and scheduling self-efficacy would influence exercise intention and exercise behavior differently.

Participants’ were exercisers who were asked to fill out the self-efficacy questionnaire, and an exercise behavior intentions and actual exercise behavior questionnaire

once at the beginning of the study and once at the end of a four week period. The results of a structural equation modeling analysis indicated that task self-efficacy had a significant direct effect on behavioral intention, but not behavior. On the other hand, scheduling self-efficacy had a significant direct effect on behavior, but not on behavior intentions. These results imply that task and scheduling efficacy affected exercise participation differently, and that scheduling self-efficacy may be a more important type of self-efficacy when considering the role of self-efficacy in people's physical activity participation. These results have important implications for future interventions as they suggest that although both types of self-efficacy are important, it may be that scheduling self-efficacy is the most important type to include in an intervention.

The research on the role of self-efficacy beliefs in determining exercise behavior has been predicted by theory, and shown through applied research. However, there have not been any intervention studies focused on imagery as the source of self-efficacy within the exercise field. This lack of research is surprising based on the findings in sport research that have shown that imagery use is an effective tool for increasing self-efficacy and overall performance (Short & Ross-Stewart, 2008). Although there have not been any imagery intervention studies completed to assess the effect of imagery on self-efficacy, and the effect of self-efficacy change on exercise frequency, there have been two interventions conducted to assess the role of imagery on exercise frequency (Oulette, et al., 2005; Vergeer & Roberts, 2006). There have also been numerous non-intervention studies that have investigated the relationship between imagery and self-efficacy, and imagery and exercise.

### *Imagery, Exercise, and Self-Efficacy*

Hall (1995) was the first researcher to propose a relationship between imagery and exercise by suggesting that the relationship between imagery and exercise behavior may be mediated by self-confidence. He made this assertion before any research had been done on imagery and exercise. This belief has led to researchers focusing on how imagery and exercise are related.

One of the first studies to investigate the relationship between imagery and exercise was a three part study conducted by Hausenblas, Hall, Rodgers, and Munroe (1999). In the first part, they conducted open ended interviews with aerobic exercisers to determine the nature of imagery use by exercisers. Based on the responses of the participants' they concluded that most aerobic exercisers used imagery, at a variety of times, and that their imagery could be classified into 11 different categories (i.e., motivation, feeling good about oneself, body image, strategies/techniques, fitness/health, goals, habit/routine, music, getting energized, and maintaining focus). In phase two, they constructed a questionnaire to assess imagery use by exercisers. Using a principal components factor analysis, they minimized the items from 11 categories to three: energy (images associated with being energized and relieving stress), appearance (images related to physique and fitness), and technique (images related to the correct form and body position for the activity). In addition, they compared the results of those who were low frequency exercisers (3 hours or less a week) to those who were high frequency exercisers (more than 8 hours a week) and found there was a significant difference in imagery use between the groups. Specifically, high frequency exercisers used significantly more energy, appearance, and technique imagery than low frequency exercisers. The third phase of the study was conducted to further assess the validity of the questionnaire they developed. For the third phase, a new sample of volunteer exercisers completed the

same procedures as those in studies one and two. Based on the results of a confirmatory factor analysis, they modified the questionnaire to consist of nine questions (3 per factor). They labeled the questionnaire the Exercise Imagery Questionnaire (EIQ). In a general conclusion, the authors suggested that, taken together, these findings indicated that exercisers do use appearance, technique, and energy imagery. They also stated that exercise imagery and exercise behavior may be related, although how they are related was not known. One suggestion was that imagery affected behavior by changing exercise efficacy beliefs, however they acknowledged that more research needed to be done before this could be determined.

Gammage, Hall, and Rodgers (2000) extended the findings of Hausenblas et al. (1999) by conducting a quantitative investigation of exercise and imagery. They assessed how exercise imagery use varied based on type of imagery, gender, frequency of exercise, and type of physical activity. Participants' completed a general version of the EII-R. Type of imagery results indicated that participants' used appearance imagery ( $M = 6.59$ ) significantly more than they used either technique imagery ( $M = 5.06$ ) or energy ( $M = 3.84$ ). Technique imagery was used significantly more than energy imagery. The results for gender indicated that men used technique imagery more than women, while women used appearance imagery more than men. The frequency of exercise a person engaged in also led to significant differences in the amount of imagery used. Regardless of imagery type, high frequency exercisers reported using imagery more than low frequency exercisers. The results for type of physical activity suggest that those who exercised by running used less appearance and technique imagery than those in aerobic classes, weight trainers, and those who used cardiovascular equipment. Those who weight trained also used significantly more technique

imagery than those in the aerobics classes, or those who used cardiovascular equipment. Taken together, the results of this study indicated that exercise imagery is used, however the amount of use and the type of imagery used varies depending on gender, frequency of exercise, and type of physical activity a person engages in. Based on the results, Gammage et al (2000) suggested that imagery may serve as a motivational tool for exercisers.

One issue not investigated in the above studies was Hall's (1995) assertion that exercise imagery affects exercise behavior through self-efficacy. To assess this proposed relationship, Rodgers, Munroe, and Hall, (2002) conducted a study to determine whether exercise imagery contributed to the prediction of exercise behavior and intentions over and above self-efficacy. They had 338 aerobic participants' and 223 exercisers from various activities fill out the EIQ (aerobics or general version) and a self-efficacy questionnaire that assessed coping, task, and scheduling efficacy. Participants' also filled out a self-report measure to indicate how often they engaged in physical activity over the last four week period. Participants' intentions to exercise were measured by asking how often they intended to engage in physical activity over the next four weeks. Results indicated that self-efficacy was an important predictor of both behavior and behavioral intention, while imagery contributed to the prediction of behavioral intention, but not exercise behavior. Scheduling efficacy and coping efficacy were the only predictors of exercise behavior, while appearance imagery was significantly related to behavioral intention. These results seem to imply that imagery did not predict exercise behavior when efficacy beliefs were controlled for. This result makes sense according to Bandura's (1997) self-efficacy theory as he stated that imagery is a source that affects self-efficacy which then affects behavior.



More evidence for the assertion that imagery affects exercise through self-efficacy was found in the grounded theory of exercise imagery. This theory was developed based on the comments, made by women who engaged in regular exercise, on the function of exercise imagery (Giacobbi, Hausenblas, Fallon, & Hall, 2003). The participants' comments were broken down into eight higher order themes; exercise imagery: exercise technique, exercise routines, exercise context, appearance images, competitive outcomes, fitness and health outcomes, emotions/feelings associated with imagery, and exercise self efficacy. Based on their results, the authors concluded that "exercise imagery interventions may help sustain the motivation and self-efficacy beliefs of exercise participants', which may then lead to greater involvement in physical activity" (p.173).

Because the above study results of eight imagery themes called into question the EIQ validity as it only measured three themes, a new exercise imagery measure was developed. The Exercise Imagery Inventory (EII; Giacobbi, Hausenblas, & Penfield, 2005) consisted of 41 items based on the eight functions of imagery. To test the validity of the EII, three different samples completed the EII. The results of a factorial analysis indicated that only four interpretable factors existed within the questionnaire. They were appearance/health, exercise technique, exercise feelings, and exercise self-efficacy. A confirmatory factor analysis (CFA) of the EII consisting of 4 factors was then performed on a student sample, as well as a more diverse sample. The results of both CFA's again supported a four factor structure, based on the results, numerous items were dropped. In the end, the EII consisted of 19 items.

The EII was incorporated into a comprehensive study that was conducted to determine which types of exercise imagery were significant predictors of leisure time

exercise behavior and exercise self-efficacy (Cumming, 2008). A second purpose of the study was to assess whether imagery ability moderates the relationship between imagery types and exercise related outcomes. Cumming gave 162 exercisers the exercise imagery inventory (Giacobbi et al., 2005), the ease of imaging companion scale (Cumming, 2008), leisure time exercise questionnaire (Godin & Shepard, 1985), and the exercise self-efficacy measure (Rodgers, & Sullivan, 2001) after they had completed their exercise routine. When comparing results based on gender, preliminary results pointed toward significant differences for frequency of imaging as well as significant differences for appearance and technique imagery. Means indicated that females used more appearance/health images than males, while males used more technique imagery than females. For ease of imagery, results indicated that males found it easier to see and feel technique imagery than females. The main analysis consisted of hierarchical multiple regressions with gender and age entered first, followed by all four EII subscales in step two. Overall, the findings indicated that appearance health imagery significantly predicted the amount of leisure time exercise reported by participants. Those who imaged appearance and health images more frequently also exercised more. This finding was in concordance with Gammage et al. (2000) who suggested that appearance and health imagery have motivational functions. Cumming (2008) suggested that health and appearance imagery may help increase intention to exercise and increase exercise behavior. Furthermore, technique imagery was associated with higher levels of task efficacy, and appearance imagery was positively related to coping efficacy. The results related to imagery ability showed that exercisers' abilities to create appearance-health images moderated the relationship between imagery frequency and leisure-time exercise, coping efficacy, and scheduling efficacy. Taken together, suggestions for future research that has the

goal of raising self-efficacy beliefs through imagery should be aimed at increasing both coping (which includes scheduling) and task efficacy and should include appearance/health imagery and technique imagery (Cumming, 2008).

Based on past research in exercise, and research on sport and imagery, a model of exercise imagery (Munroe-Chandler & Gammage, 2005) was proposed. The model consisted of five general components of exercise imagery; antecedents (the setting or context in which exercise imagery occurs), imagery functions based on those used in sport research (Cognitive Specific, Cognitive General, Motivation Specific, Motivation General-Arousal, Motivation General-Mastery), outcome (behavioral, cognitive), efficacy beliefs (efficacy expectancy, outcome expectancy), and moderating factors (age, gender, frequency of exercise, activity type, imagery ability, physical health, personality variables). This model of imagery, along with a recent review of the literature (Kossert & Munroe-Chandler, 2007), have both shed light on the importance of researchers conducting imagery interventions to truly understand how imagery affects exercise behavior.

Although many researchers have encouraged imagery intervention research to be conducted (e.g., Hall, 1995; Munroe-Chandler & Gammage, 2005; Kossert & Munroe-Chandler, 2007), there have been few imagery interventions employed. Two intervention studies have been completed at this time. The first study was completed by Oulette et al. (2005). They investigated the effect of an imagery intervention on exercise frequency but manipulated whether a person imaged themselves or someone else. The second study (Vergeer & Roberts, 2006) examined the effect of an imagery intervention on peoples' ability to increase their performance on a stretching task.

In the first study, Oulette et al. (2005) investigated whether imaging prototypes (image of other person) or possible selves (image of self) would lead to an increase in exercise behavior (measured by number of days a week a person exercised). Because the prototype group would be comparing themselves to a future version of themselves, the researchers were interested in whether or not a person's natural orientation of whether or not to consider future consequences when making choices would moderate the imagery -exercise frequency relationship for those in the possible selves group. They also measured a person's natural inclination to compare themselves to others (social comparison), feeling that this was an important potential moderator for those in the prototype group. Based on their responses to the Future Consequences Scale (Stratham, Gleicher, Bonninger, & Edwards, 1994) and the Iowa-Netherlands Comparison Orientation Measure (Gibbons & Buunk, 1999) participants' were classified as either high or low in future consequences orientation, and either high or low in social comparison. Participants' were then randomly assigned to one of four groups (prototype/exerciser, prototype/non-exerciser, possible self/exerciser, possible self/non-exerciser). In the possible self/group, the participants' were instructed to image themselves 10-20 years in the future if they had exercised, while those in the possible self/non-exerciser group were asked to image themselves 10-20 years in the future if they did not exercise. Those in the prototype/exerciser group were asked to image a typical person who exercised 10-20 years in the future, while those in the prototype/non-exerciser group were asked to image a typical person who did not exercise 10-20 years in the future. Regardless of the group the participant was in they were then required to write a description of different characteristics of the person they imaged. Four weeks later participants' received a phone call asking if they would participate in a study about exercise. During the phone call, the

participants' were asked how often they had exercised over the past four weeks. Results indicated that the mean amount of exercise had not changed over the four weeks. Although the exercise amount had not changed, there were multiple significant findings related to group, future consequences orientation, and social comparison orientation. Results showed that those participants' who rated high for social comparison and were in a prototype image group exercised more per week after the intervention than they did before the intervention, regardless of whether they were in the exerciser or non-exerciser imagery group. Those who were high in future consequences orientation and in the possible selves group and those in the low future consequences prototype group showed a significant increase in exercise frequency. Taken together these results suggest that imagery interventions have the potential to be effective.

The above study has a number of limitations that minimize its impact in the field. First, at time 1, 93% of participants' reported engaging in some exercise the week before the intervention ( $M = 2$  days a week). Because the percent of participants' who engaged in exercise was so high at pre test, a ceiling effect may explain why at post test exercise frequency had not changed. Another reason why the imagery intervention may not have been effective, regardless of group, future consequences, and social orientation, may be because the imagery intervention was not designed based on specific types of imagery (e.g., appearance, health, technique) that have been previously shown to be important in past research (see Kossert & Munroe-Chandler, 2007).

The second imagery intervention study focused on the relationship between mental imagery and physiological processes (Vergeer & Roberts, 2006). Specifically, it focused on whether imaging while stretching would increase flexibility in participants' who were part of

a four week stretching program. The stretching program consisted of 11 30 minute sessions consisting of seven leg stretches designed to increase hip flexibility. Participants' were put in three different groups: a control group, a movement imagery group, and a stretching imagery group. In the control group participants' stretched without using any imagery. In the movement imagery group participants' were instructed to continually image their leg moving by flexing their knee while they were stretching. In the stretching imagery group participants' were instructed to image the muscle becoming longer at the cellular level for the first 15-25 seconds of each stretch and at the muscular level for the last five seconds of the stretch. After four weeks, participants' in all three groups showed an increase in flexibility, however, there were not any significant differences in flexibility based on group. Imagery did not affect the results of the flexibility training program. Although no physical differences were found, those in the imagery groups did report being more comfortable while stretching. The authors concluded that imagery interventions have more of a psychological effect than a physiological effect. This assertion is in line with Bandura's theory that imagery affects self-efficacy (a psychological construct), which in turn affects performance (1997).

Of particular concern is that Oulette et al. (2005) and Vergeer and Roberts (2006) both failed to assess the effects of an imagery intervention on exercise behavior using images that have been found to be associated with exercise. For example, they did not use specific appearance, technique, feeling, confidence, or routine images. As well, neither study focused on the role of self-efficacy in the relationship between exercise and imagery. Given that there is limited evidence on the relationship between imagery interventions and exercise, it is important to look to research in other areas (e.g., health behaviors and sport) that have assessed the role of imagery interventions.

One line of research to assess the relationship between imagery interventions and health behaviors has been conducted by Libby and colleagues (Libby & Eibach, 2002; Libby, Eibach, & Gilovich, 2005; Libby, Shaffer, Eibach, & Slemmer, 2007). Libby and colleagues had participants' image either from a first person or a third person perspective (imagery perspective) and assessed the effect these images had on a persons' perceptions of themselves. Specifically, they investigated perceptions of ones likelihood to overeat at a future dinner (Libby & Eibach 2002, Libby et al., 2005), self change after therapy (Libby et al., 2005), social acceptance or awkwardness (Libby et al., 2005). For example, to assess the role of imagery in perception of current social acceptance or awkwardness, they had participants' who felt they were awkward in high school image an awkward moment from high school in either the first or third person perspective. After the imagery task had been completed, the participants' were instructed to complete a questionnaire in a room with another participant (who was actually a confederate). The number of times the participant attempted to engage the confederate in conversation was recorded. The confederate also rated the sociability of the participant. These two measures were then used to judge the participants' post imagery sociability. Results showed that imagery perspective did in fact influence a person's perception of their current social awkwardness. Those who imaged from a third person perspective felt they had changed more than those in the first person group and were less socially awkward now then they had been in high school. Imagery perspective also affected the person's social behavior after the study. Those in the third person group engaged in significantly more social behavior (based on both social interaction measures) than those in the first person group. The finding that imagery affected both perceptions and behaviors,

and the finding that imagery perspective was an important factor in this relationship is constant in Libby et al's line of research.

One of Libby et al's studies of particular importance to the current research investigated the role of a one time imagery intervention on voting turnout at a national election (2007). In particular, this voting study is of particular importance to the present study because it investigated the effect of an imagery intervention on behavior measured at a later date, opposed to immediately after the intervention. The study consisted of 146 college students (*Mean age* = 19.3 years) who registered to vote, but had not yet voted, completing a questionnaire and reading and imaging a imagery script that was sent to them over email. The imagery intervention was given one day prior to Election Day. The imagery scripts instructed the participants' to picture them selves voting in either the first or the third person in the upcoming presidential election. After imaging, the participants' then completed a questionnaire that asked their opinion as to whether it was good or bad to vote in the upcoming election, and whether or not they would vote even in the face of three different obstacles. If they felt it was important to vote regardless of the obstacles they faced they were considered to have a pro-voting mindset. Two weeks after the election, the participants' were sent another email asking them to respond to a survey that assessed whether they had voted. They found that over 80% of the participants' in the study voted in the election. This value compares to the national average of 64% of the electorate voting, and the national average of 47% for the equivalent age range (18 – 24 years) (as reported by the US National Census). The results also showed that imagery perspective influenced the effect of the imagery script, specifically 90% of those who imaged from a third person voted, while 72% of those who used a first person imaged. They also found that those in the third person group had a



stronger pro-voting mindset compared to those in the first person group. This pro-voting mindset was considered a mediator for the imagery perspective and voting behavior relationship. These results have implications for imagery interventions in exercise, as they illustrate that an imagery intervention can modify a behavior. Although the behavior may be voting, opposed to exercise, many of these findings should transfer to studies on imagery interventions and exercise as both voting, and exercising are desirable behaviors people control for themselves. One reason why this study is so important is because that it found that a person's view of whether they would engage in a behavior even in the face of barriers to be particularly important. This finding has been shown in exercise and imagery research that has found coping/barrier efficacy to be the strongest type of efficacy when predicting a person's likelihood to exercise (See self-efficacy and exercise review above). Another reason why this study is of particular importance in reference to the current study is because this study assessed the role of a one-time imagery intervention on behavior, which will be the procedure for the present research.

Along with research on other desired behaviors, we can learn about the potential effects of an imagery intervention on self-efficacy and exercise frequency by turning to the sport literature. Although imagery research in sport has focused on psychological factors such as self-efficacy extensively, due to the nature of the topic when performance is measured in sport research, it is an increase in performance researchers are typically examining. Even with this difference, there are many similarities between an imagery intervention designed to increase sport performance, and ones designed to increase exercise frequency. It is for this reason that information on imagery interventions in sport is presented here.

The role of imagery interventions in sport has been extensively researched (for a more detailed discussion see Cumming & Ramsey, 2008). Imagery has consistently been shown to be an effective tool for performance enhancement (Cumming & Ramsey, 2008). Both Goginsky and Collins (1996) and Cumming and Ramsey (2008) have done reviews of the imagery interventions in sport and made recommendations for those in the field who plan on doing imagery interventions in the future. These suggestions, taken together with the suggestions of Driskell, Copper, and Moran (1994) in their literature review, outline numerous areas within an intervention that must be considered. Driskell et al. suggested that an imagery intervention should not last longer than 20 minutes, while Goginsky and Collins suggested that an imagery intervention focusing on cognitive factors be under one minute while those that focus on strength or motor skills be between 15-20 minutes. Regardless of the focus on the intervention, Goginsky and Collins suggested that either less than six or between 36 and 46 sessions should be employed for maximum results in sport. Cumming and Ramsey (2008) did not give a time specification or a number of sessions suggestion, however they did focus on the importance of individualized interventions. They stated the individualized interventions can make the intervention more meaningful, enjoyable and easier to perform for the participants'. Making interventions specific to the individual can also increase adherence and a continued use of the imagery after the intervention has been completed. Driskell et al. (1994) suggested that the effects of an imagery intervention are weakened over time to the point where the effects are reduced by half of their initial magnitude 14 days later, and no longer show a significant effect after 21 days. Therefore, it would stand to reason that is important to repeat the intervention at least every 14 days for long term adherence.

These suggestions for effective interventions in sport suggest that an imagery intervention in sport may be at its most effective if it is tailored to the participants', and no longer than 20 minutes in duration. The number of sessions necessary seems to be less consistent across the reviews, although Libby's research in health behaviors would suggest that a one-time imagery intervention can have a significant effect on behavior. Past research in sport) also suggest that the intervention should be expected to show results up to 14 days later (Driskel et al., 1994). Therefore, it would seem important to assess exercise frequency no later than 14 days after the intervention.

### *Summary*

Research in the field of exercise has found there to be a relationship between imagery and exercise. Researchers have also suggested that this relationship is, affected by a person's efficacy beliefs (e.g., Giacobbi et al., 2003; Hall, 1995; Rodgers, et al., 2002). Numerous researchers have suggested that future researchers employ imagery intervention studies to examine the relationships among imagery use, exercise behavior and self-efficacy. However, at this point, there have not been any studies done that have specifically investigated the effect of an imagery intervention on self-efficacy and exercise frequency (Kossert & Munroe-Chandler, 2007).

Therefore, the purpose of this study was to investigate the effect of an imagery intervention on self-efficacy beliefs and exercise frequency in a currently inactive population (no activity beyond daily movements). This investigation will be done by comparing the effects of an imagery intervention, to the effect of an exercise information intervention and control group, on self-efficacy and exercise frequency. An exercise information group is

being utilized in this study to make sure any results found in the imagery group are due to the imagery itself, not the fact that exercise is being discussed.

Based on the findings of imagery interventions related to socially desired behaviors (e.g., Libby & Eibach, 2002; Libby et al., 2005; Libby et al., 2007), it seems a one-time imagery intervention has the ability to change a person's behavior. Research from the sport domain suggests that imagery interventions should be short, and can show effects that last for no longer than 14 days. Therefore, this study employed a short, one-time imagery intervention, which was assessed on day seven and day 14. As past research on the relationship between imagery and exercise has found that both coping/barrier efficacy and appearance/health and technique imagery to be of particular importance when attempting to increase a person's exercise efficacy and exercise frequency (e.g., Cumming, 2008; Giacobbi, 2007), the imagery script used in the imagery condition focused on both coping/barrier efficacy including scheduling efficacy related statements, appearance/health imagery and technique imagery. Finally, past researchers have suggested that individualized imagery scripts may be the most effective for exercise behavior change (e.g., Kossert & Munroe-Chandler, 2007; Munroe-Chandler & Gammage, 2005). This study employed the same script for each participant, however participants' were able to choose their own exercise to image, to make the script some what individual to their interests.

Based on the findings of past research two hypotheses were made for this study. First, it was expected that for exercise frequency there would be significant group differences at Time 2 and Time 3. Specifically, those in the imagery condition would report significantly higher exercise frequency scores from Time 1 to Time 2, from Time 1 to Time 3, and from Time 2 to Time 3, while those in the exercise information and control conditions would not

show a significant difference across time, therefore there would be a group difference at Time 2 and 3 for exercise frequency. The second hypothesis was that there would be a significant group difference at Time 2 and Time 3 for self-efficacy. Specifically, those in the imagery condition would have significantly higher efficacy scores at Time 2 and 3, than they did at Time 1, while those in the exercise information and control conditions would not show a significant difference across time, therefore there would be a group difference at Time 2 and 3 for coping, technique, and scheduling self-efficacy.

## CHAPTER II

### METHOD

#### *Participants*

Eighty-one undergraduate students from psychology courses at the University of North Dakota completed the first phase of the study however, 15 were not included in the analysis as they reported having exercised the week before the study, and therefore, did not satisfy the study requirement of being inactive. Therefore the final sample size was 66 participants' at Time 1. Of those 66 participants' 61 completed Time 2 and 54 of those who completed Time 2 completed Time 3. Therefore, the final sample size for this study was 54 participants (18 per group). Participants' ranged in age from 18-41 ( $M = 20.57$ ,  $SD = 4.11$ ). Fifteen were male (27.8%), while 39 (72.2%) were female. In relation to their imagery training 92.6% did not have any previous imagery training ( $n = 50$ ), the majority used a first person imagery perspective ( $M = 59.3\%$ ,  $n = 32$ ), while 7.4% used a third person perspective ( $n = 4$ ), and 33.3% ( $n = 18$ ) reported using both a 1<sup>st</sup> and 3<sup>rd</sup> person imagery perspective.

#### *Measures*

*Background Information Form* (see Appendix A). A background information form that consisted of demographic information related to the participant's sex and age was included in the study. Questions about the participants imagery use were also asked. These questions were forced choice questions asking if the participant has ever had any formal imagery training, what perspective they take when imaging (internal, external, or both), and a

general imagery ability question about how easy or hard it is for them to image (1= *very easy* and 7= *very hard*).

*Exercise Background Questionnaire* (see Appendix A). There is no universal measure of exercise frequency (Bray & Born, 2004), therefore, a self report measure designed to gain information about the amount of exercise the participant is currently engaged in was developed for this study. Participants' read the definition "Exercise is an activity requiring moderate to strenuous effort that is sustained long enough to cause one to break a sweat or to breathe heavily" as this definition has been used in past research investigating exercise frequency (e.g., Bray & Born, 2004). After reading the definition of exercise, participants' reported the amount of minutes they exercised each day for the past seven days (past studies have had participants' follow this methodology, recounting their exercise up to four months prior; Bray & Born, 2004; Bray, 2007).

*Exercise Self-Efficacy Questionnaire - Revised* (see Appendix B; Rodgers, Wilson, Hall, Frazer, & Murray, 2008). The Exercise Self-Efficacy Questionnaire - Revised assesses coping, task, and scheduling exercise self-efficacy through nine items rated on a 10-point Likert-type scale ranging from 1 (*no confidence*) to 10 (*complete confidence*). Confirmatory factor analysis supported the three factor structure of the questionnaire (Rodgers et al., 2008). The Exercise Self-Efficacy Questionnaire demonstrated adequate construct validity (above .70; Nunnally, 1970) and internal with alpha coefficients of 0.81 for both coping and task efficacy and 0.91 for scheduling self-efficacy (Rodgers et al., 2008). In this study, the alpha coefficients for all subscales were acceptable, ranging from .79 to .94. See Table 2 for the specific alpha levels at each time for each subscale.

Table 2. Descriptive Statistics for Self Efficacy Questionnaire, Exercise Imagery Questionnaire-Revised and Companion Scales

Scales	Time 1			Time 2			Time 3		
	Mean	SD	Alpha	Mean	SD	Alpha	Mean	SD	Alpha
SEQ									
Coping	4.58	1.97	.79	4.93	1.86	.86	5.04	2.02	.94
Schedule	2.96	1.61	.86	3.32	1.60	.88	3.67	1.89	.90
Technique	7.34	1.54	.86	7.14	1.67	.91	6.88	1.79	.90
EII-R									
Appearance	5.85	.89	.91	5.78	.93	.92	5.62	1.05	.93
Technique	4.17	1.31	.90	4.24	1.27	.91	4.33	1.41	.93
Feelings	4.92	1.14	.74	5.24	1.07	.83	5.07	1.39	.86
Confidence	4.83	1.08	.65	4.99	1.14	.85	4.84	1.24	.81
Routines	3.92	1.17	.81	4.21	1.11	.81	4.41	1.37	.86
EII-R See									
Appearance	5.72	1.04	.92	5.59	1.13	.94	5.54	1.24	.96
Technique	4.01	1.34	.92	4.35	1.33	.92	4.60	1.36	.93
Feelings	5.18	1.25	.85	5.07	1.24	.89	5.2	1.29	.86
Confidence	4.77	1.21	.86	4.80	1.36	.85	4.89	1.29	.81
Routines	4.17	1.25	.84	4.42	1.23	.86	4.72	1.37	.92
EII-R Feel									
Appearance	5.22	1.26	.95	5.26	1.29	.95	5.12	1.42	.97
Technique	3.76	1.43	.93	3.98	1.32	.90	4.01	1.56	.93
Feelings	5.00	1.46	.90	4.88	1.49	.91	4.90	1.57	.92
Confidence	4.36	1.36	.81	4.45	1.29	.83	4.60	1.40	.87
Routines	3.80	1.34	.84	3.93	1.37	.89	4.09	1.64	.96

*Exercise Imagery Inventory - Revised* (see Appendix C; EII- R; Giacobbi, 2009). The EII-R is a 22 item self-report questionnaire that measures imagery frequency on a 7-point Likert-type scale ranging from 1 (*rarely*) to 7 (*often*). There are five different subscales; appearance-health imagery (8 items), exercise technique imagery (4 items), exercise feelings imagery (4 items), exercise confidence imagery (3 items), and exercise routines imagery (3 items). The alpha coefficients, for this sample, for almost all subscales were acceptable, ranging from .74-.93. The exception was the confidence subscale that had a .65 alpha level at



time 1. Although the confidence subscale was slightly below .70, the confidence subscale results were still analyzed, however, the results should be interpreted with caution (Cortina, 1991). See Table 2 for the specific alpha levels for each subscale.

*Ease of Imaging Companion Scale* (see Appendix C; Cumming, 2008). An ease of imaging companion scale was added to the EII-R to assess the imagery ability of each participant. The ease of imaging companion scale includes a place for participants' to indicate how easy or difficult it was for them to image both seeing and feeling each of the EII-R images using a 7-point Likert-type scale (1 (*very hard to see/feel*) to 7 (*very easy to see/feel*)). For both seeing and feeling, the reliability coefficients for the ease of imaging companion scale were acceptable (see = .81 -.96, feel = .81-.97). See Table 2 for the specific alpha levels for each subscale at Time 1, 2 and 3.

### *Materials*

*Zip Survey:* Zip survey is an online survey program that housed the surveys that the participants' accessed. Participants' were able to access the questionnaires via a link sent to their email accounts. Each participant got a unique key making it possible for the researcher to know who had completed the questionnaires and to keep track of who was in each group.

### *Procedure*

Participants' for this study were recruited from the University of North Dakota student body. Participants' each met individually with a researcher where they were given a participant number which served to randomly assign them to one of three groups; imagery, exercise intervention, and control. Once they were assigned a number, they filled out the Background Information Form, the Exercise Background Questionnaire, the Exercise Self-efficacy Questionnaire, the EII-R and the Exercise Companion Scale. After completing the

questionnaires, participants' were told that they would either be listening to a tape (imagery and exercise information condition), or that they were done with the first stage of the study (control condition).

*Imagery Condition.* Those in the imagery group were told that they would be listening to a tape on imagery. They were told that closing their eyes may make doing the imagery exercise easier. They then listened to a tape that gave a definition of imagery. Participants' were asked if they understood the definition. All participants' said they understood the definition. An imagery script was then played. Participants' were asked to image each image described on the tape. After each image was explained on the tape, participants' were given 10 seconds to image what they had just heard. After the imagery script had been played, the participants' were asked to write their email address down and told they would be contacted via email seven days later, and 14 days later with a link to a set of questionnaires. They were asked to complete the questionnaires within 24 hours of receiving the emails.

Research has consistently shown that coping/barrier efficacy including scheduling related statements are the most related to increases in self-efficacy and behavior change (e.g., Cumming, 2008; Rodgers & Sullivan, 2001). Rodgers and Sullivan (2001) found that the statements "How confident are you that you can arrange your schedule to exercise regularly" (scheduling) and "How confident are you that you can exercise when you feel you don't have time" (coping) were most strongly related to exercise frequency. Therefore these two statements were turned into images in the imagery script (see Appendix D). Imagery related to appearance/health and technique imagery has also been found to be related to a high exercise frequency (e.g., Cumming, 2008). Therefore the imagery script included images designed to specifically address these subscales

*Exercise Information Condition.* To ensure the results of the imagery intervention were due to the effects of using imagery not the effects of simply thinking about exercise, it was important to have another group that was also given exercise information, and required to complete a cognitive task, other than imagery. Therefore, an exercise information group was included in this study. Instead of an imagery script, those in the exercise information condition engaged in a different cognitive task. They were told they would be listening to a tape about exercise benefits. They were asked to pay attention as they listened to the tape as there would be a short quiz after the tape was done. The purpose of the quiz was to encourage participants' to listen to the tape and to minimize the potential of the participants' engaging in spontaneous imagery use. Participants' listened to a tape of a person reading an article on the importance of exercise (see Appendix E). Participants' were then given a five true/false question quiz to complete. Participants' were given the same instructions post intervention as those in the imagery condition.

*Control Condition.* Those in the control condition did not engage in any intervention after completing the questionnaires. They were given the same instructions the other two conditions were given, but instead of getting the instructions after the intervention, they were given them as soon as they had completed the questionnaires

Seven days after initial contact (Day 1), all participants', regardless of group, were sent an email with a link that connected them to a survey on the zip survey system that included the Exercise Background Questionnaire, the Exercise Self-Efficacy Questionnaire, the EII-R and the EII-R Companion Scale. They were instructed to fill out the questionnaires within 24 hours of receiving the link. Those participants' who had not completed the questionnaires within 12 hours of receiving them were sent a reminder email at hour 12. This

procedure was replicated at Time 3 which was day 14 for the participant. Only those participants' who completed all the questionnaires within the given time limits at all three times were included in the final analysis

## CHAPTER III

### RESULTS

The results section is divided into three sections. The first section analyses the hypothesis that there will be significant group differences in exercise frequency across time. Specifically, it was hypothesized that those in the imagery group would increase their exercise frequency from Time 1 to Time 2, from Time 2 to Time 3, and from Time 1 to Time 3, while those in the information and control groups would not show any differences in exercise frequency. The group differences and time differences were assessed via repeated measures ANOVA main effects. The group by time difference was assessed with the repeated measures ANOVA interaction, and follow up simple effect comparisons.

The second section assesses the hypothesis that there will be a significant group difference in self-efficacy across time. Specifically, that self-efficacy would increase for the imagery group from Time 1 to Time 2, from Time 2 to Time 3, and from Time 1 to Time 3, but not for those in the information and control groups. Separate repeated measures ANOVAs were run for each of the three types of exercise self-efficacy assessed (coping, scheduling, and technique). The group differences and time differences were assessed via repeated measures ANOVA main effects. The group by time differences were assessed with the repeated measures ANOVA's interactions.

The third section includes supplemental analyses conducted to assess whether imagery frequency (measured by the EII-R) and imagery ability (measured by both the EII-R

companion scales, and participants' self-reported ability to see and feel images), changed across time, by group, or by group across time. These analyses were done using repeated measures ANOVA's. The group differences and time differences were assessed via repeated measures ANOVA main effects. The group by time differences were assessed with repeated measures ANOVA's interactions.

### *Exercise Frequency*

Descriptive statistics for exercise frequency show that exercise levels increased for all groups from Time 1 to Time 2, and from Time 2 to Time 3. When looking across the data, regardless of group, the level of exercise increased from  $M = 0$  at Time 1, to  $M = 17.59$  ( $SD = 46.59$ ) at Time 2, and to  $M = 43.39$  ( $SD = 78.79$ ) at Time 3. When group was considered, for the imagery group, the minutes exercised a week increased from 0 minutes at Time 1, to  $M = 3.33$  ( $SD = 9.70$ ) minutes at Time 2, and  $M = 10.59$  ( $SD = 23.84$ ) minutes at Time 3. Those in the exercise information group increased their exercise from  $M = 0$  minutes at Time 1, to  $M = 36.39$  ( $SD = 73.11$ ) minutes at Time 2, and  $M = 83.61$  ( $SD = 109.73$ ) minutes at Time 3. Finally, those in the control group increased from  $M = 0$  minutes at Time 1, to  $M = 13.06$  ( $SD = 26.19$ ) minutes at Time 2, and  $M = 34.17$  ( $SD = 59.46$ ) minutes at Time 3.

To examine these changes in exercise frequency over time by group, a 3 (time) X 3 (group) mixed repeated measures design was used (see Figure 1). The main effect for time was significant  $F(2, 84) = 13.04, p = .001, \eta_p^2 = .21, 1-\beta = .99$ . The main effect for group was also significant  $F(2, 50) = 4.53, p = .02, \eta_p^2 = .15, 1-\beta = .75$ . These main effects were qualified by a significant time by group interaction  $F(2, 84^1) = 3.27, p = .02, \eta_p^2 = .12, 1-\beta = .76$ . Post hoc group effects for Time 2 and Time 3 means were assessed, (Time 1 simple effects were not assessed as the Time 1 means were required to all be the same,  $M = 0, SD =$

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<sup>1</sup> Sphericity was violated, df were adjusted accordingly using Huynh Felt

0). The group effect for Time 2 was not significant  $F(2, 53) = 2.54, p = .09$ . Results revealed a significant group difference for Time 3  $F(2, 52) = 4.47, p = .02$ , such that the imagery group had increased their exercise from 0 to 10.59 minutes ( $SD = 23.84$ ) a week, while those in the information group had increased their exercise frequency from 0 to 83.61 ( $SD = 109.73$ ) minutes a week. The control group was not significantly different from either group but they did still show an increase in exercise frequency across time. See Table 3 for the descriptive statistics for exercise frequency by group.

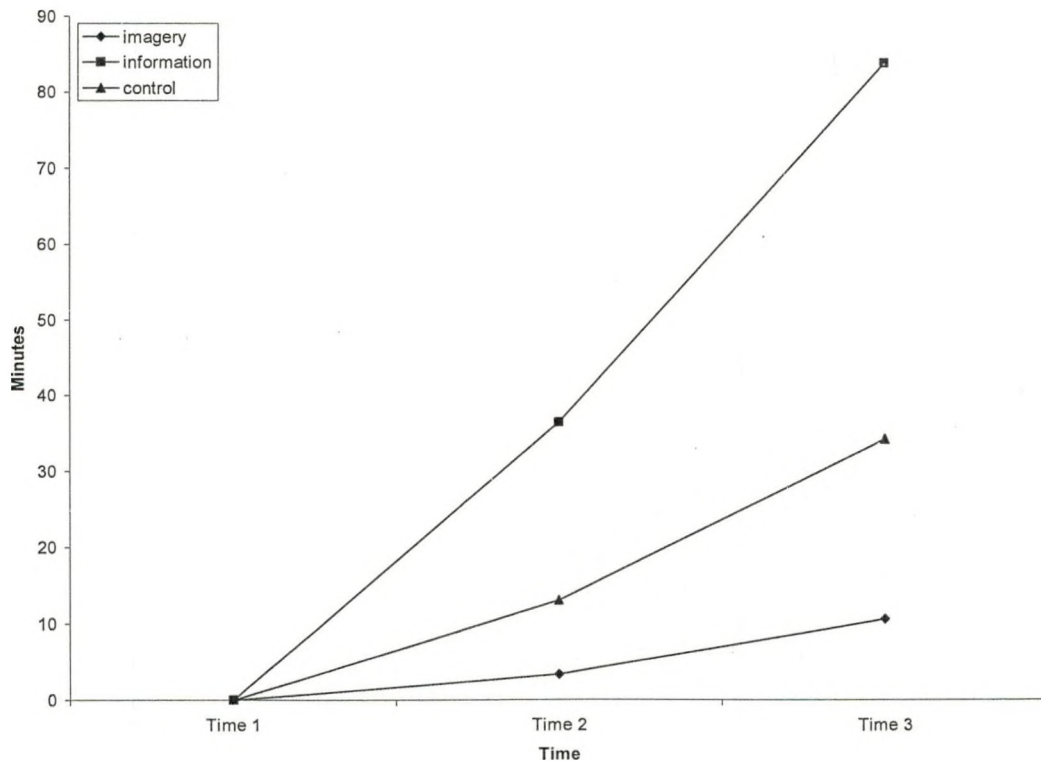


Figure 1. Exercise Frequency at Time 1, Time 2, and Time 3 by Group

### *Self-Efficacy*

The descriptive statistics for self efficacy across time, regardless of group showed that at Time 1 participants' had fairly high technique self efficacy ( $M = 7.34, SD = 1.97$ ), while their coping self-efficacy was moderate ( $M = 4.58, SD = 1.61$ ) and their scheduling

self-efficacy was fairly low ( $M = 2.96, SD = 1.54$ ). At Time 2, the mean scores for coping ( $M = 4.93, SD = 1.86$ ) and scheduling self-efficacy ( $M = 3.32, SD = 1.60$ ) slightly increased, while technique self-efficacy scores slightly decreased ( $M = 7.14, SD = 1.67$ ). This pattern continued at Time 3 (coping,  $M = 5.04, SD = 2.02$ , scheduling,  $M = 3.67, SD = 1.89$ , technique,  $M = 6.88, SD = 1.79$ ).

### *Coping Self-Efficacy*

For coping self efficacy, when group and time were considered, the imagery group showed an increase from Time 1 ( $M = 4.83, SD = 2.27$ ) to Time 2 ( $M = 4.96, SD = 1.79$ ), but this increase was followed by a decrease in coping self-efficacy at Time 3 ( $M = 4.80, SD = 1.75$ ). Those in the exercise information group showed an increase in coping self-efficacy from Time 1 ( $M = 4.45, SD = 1.76$ ) to Time 2 ( $M = 5.06, SD = 1.76$ ), and from Time 2, to Time 3 ( $M = 5.63, SD = 2.14$ ). The control group increased their coping self-efficacy from Time 1 ( $M = 4.44, SD = 1.52$ ) to Time 2 ( $M = 4.78, SD = 2.01$ ), but this increase was followed by a decrease at Time 3 ( $M = 4.69, SD = 2.14$ ). Regardless of group or time the coping self-efficacy scores indicated that participants' had moderate levels of coping self-efficacy.

To investigate the changes in coping self-efficacy across time and by group, a 3 (time) X 3 (group) mixed repeated measures design was used (see Figure 2). The main effect for the time was not significant ( $F(2, 98) = 2.37, p = .10, \eta_p^2 = .05, 1-\beta = .47$ ). The main effect for group was also not significant ( $F(2, 49) = .22, p = .81, \eta_p^2 = .01, 1-\beta = .08$ ). The coping self-efficacy time by group interaction was also not significant ( $F(4, 98) = 1.14, p = .34, \eta_p^2 = .04, 1-\beta = .35$ ). The descriptive statistics for coping self-efficacy by time and group are presented in Table 3.



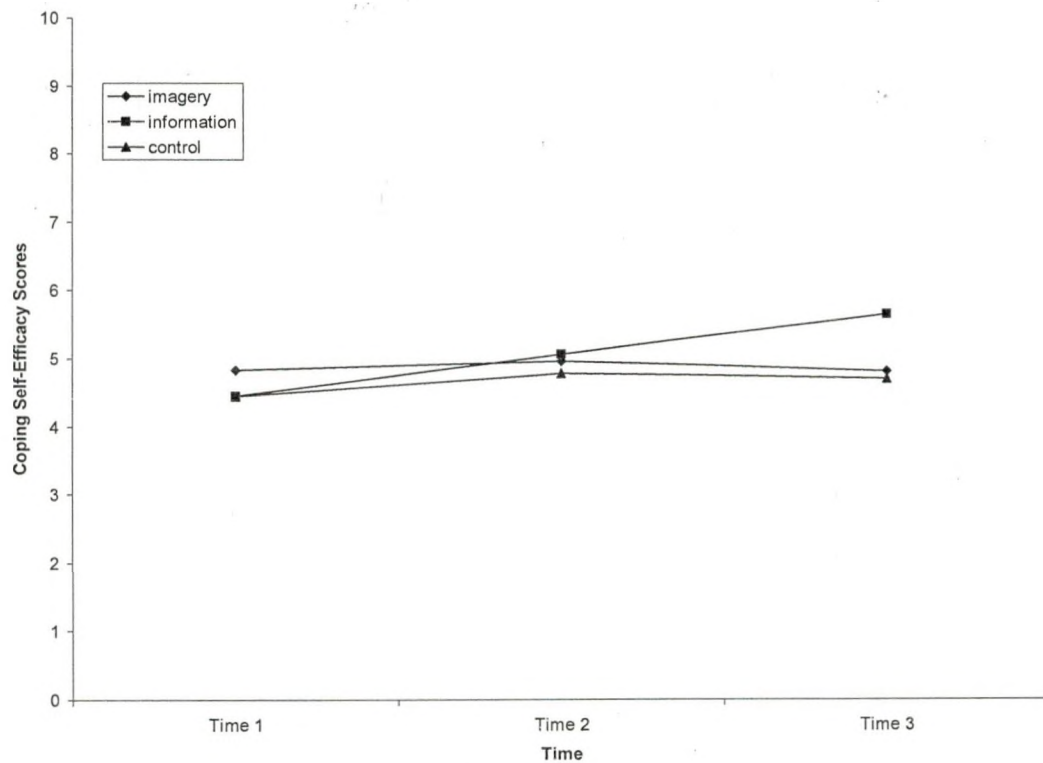


Figure 2. Coping Self-Efficacy at Time 1, Time 2, and Time 3 by Group

### *Scheduling Self-Efficacy*

For scheduling self efficacy, when group and time were considered, the imagery groups scores increased from a mean of 2.94 ( $SD = 1.74$ ) at Time 1, to a mean of 3.01 ( $SD = 1.45$ ) at Time 2, and a mean of 3.46 ( $SD = 1.79$ ) at Time 3. Those in the exercise information groups scheduling self-efficacy scores increases from a mean of 3.17 ( $SD = 1.59$ ) at Time 1, to a mean of 3.59 ( $SD = 1.61$ ) at Time 2, however, this score dropped slightly at Time 3 ( $M = 3.35$ ,  $SD = 1.75$ ). The control group increased their scheduling self-efficacy from Time 1 ( $M = 2.78$ ,  $SD = 1.56$ ) to Time 2 ( $M = 3.35$ ,  $SD = 1.75$ ), however the scores from Time 2 to Time 3 did not change ( $M = 3.35$ ,  $SD = 1.92$ ). Regardless of group or time the scores were all

in the low range, indicating that participant's perceived themselves to have fairly low scheduling self-efficacy levels.

A 3 (time) X 3 (group) mixed repeated measures ANOVA was used to examine the changes in scheduling self-efficacy over time by group (see Figure 3). The main effect for time was significant  $F(2, 85^2) = 5.99, p = .01, \eta_p^2 = .10, 1-\beta = .82$ . Post hoc comparison of means was conducted using an adjusted alpha (using Bonferroni adjustment computed on SPSS). Analyses indicated that scheduling self-efficacy scores at Time 3 ( $M = 3.67, SD = 1.89$ ) were significantly higher than those at Time 1 ( $M = 2.96, SD = 1.61$ ). Scores from Time 2 ( $M = 3.32, SD = 1.60$ ) was not significantly different from Time 1 or Time 2. The main effect for group was not significant  $F(2, 51) = .70, p = .50, \eta_p^2 = .03, 1-\beta = .16$ . The scheduling self-efficacy time by group interaction was also not significant ( $F(4, 85) = .66, p = .60, \eta_p^2 = .02, 1-\beta = .19$ ). The descriptive statistics for scheduling self-efficacy for time and group are presented in Table 3.

#### *Technique Self-Efficacy*

For technique self efficacy, scores dropped across time for both the imagery and the exercise information groups. Specifically, for the imagery group at Time 1, the mean was 7.35 ( $SD = 1.57$ ), at Time 2 the mean was 6.81 ( $SD = 1.66$ ), and at Time 3 the mean was 6.50 ( $SD = 1.89$ ). For the exercise information group, the mean at Time 1 was 7.83 ( $SD = 1.35$ ) at Time 2 the mean was 7.75 ( $SD = 1.46$ ) and at Time 3 the mean was 7.52 ( $SD = 1.91$ ). Those participants' in the control group had a mean of 6.83 ( $SD = 1.62$ ) at Time 1, this mean slightly increased to 6.85 ( $SD = 1.78$ ) at Time 2, and then slightly decreased to a mean of 6.6.1 ( $SD = 1.44$ ) at Time 3. Regardless of group or time these scores indicate that the participant's perceived themselves to have moderately high technique self-efficacy.

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<sup>2</sup> Sphericity was violated, df were adjusted accordingly using Huynh Felt

A 3 (time) X 3 (group) mixed repeated measures ANOVA was run to examine the changes in technique self-efficacy over time by group (see Figure 4). The main effect for the time was not significant ( $F(2, 90^3) = 2.57, p = .09, \eta_p^2 = .05, 1-\beta = .47$ ). The main effect for group was not significant ( $F(2, 51) = 2.41, p = .10, \eta_p^2 = .09, 1-\beta = .46$ ). The technique self-efficacy time by group interaction was also not significant ( $F(4, 90) = .70, p = .68, \eta_p^2 = .02, 1-\beta = .17$ ). The descriptive statistics for technique self-efficacy by group are presented in Table 3.

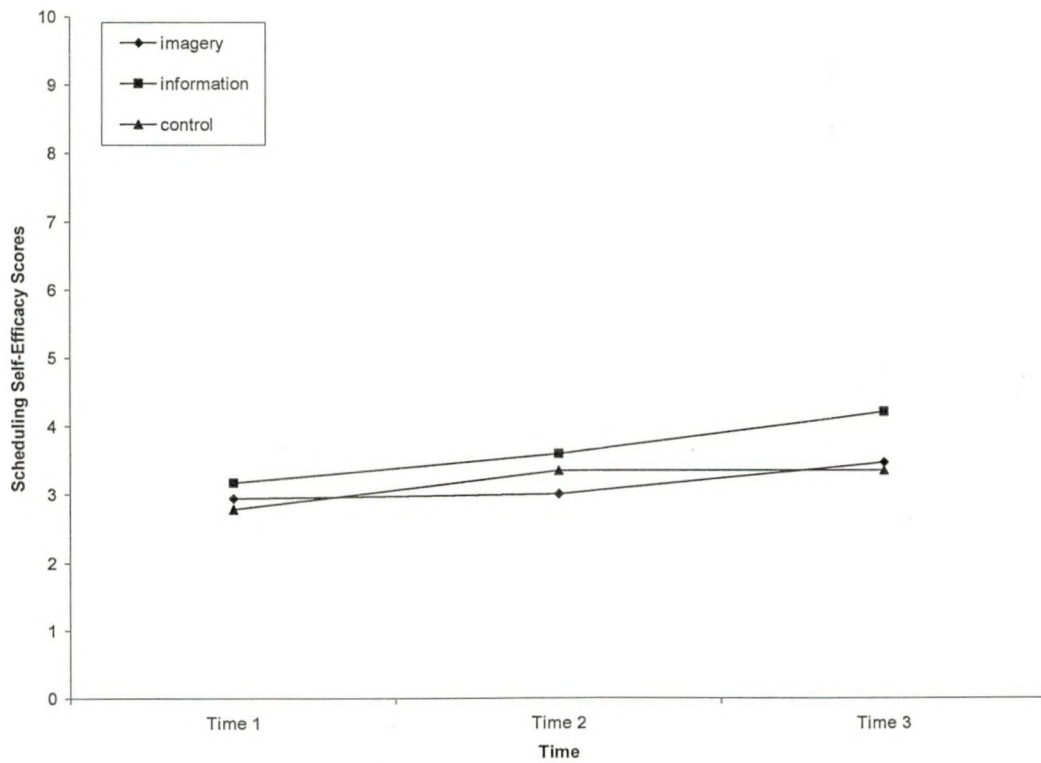


Figure 3. Scheduling Self-Efficacy at Time 1, 2, and 3 by Group

<sup>3</sup> Sphericity was violated, df were adjusted accordingly using Huynh Felt

Table 3. Descriptive Statistics by Group

	<u>Imagery</u>		<u>Time 1</u>				<u>Imagery</u>				<u>Time 2</u>				<u>Time 3</u>			
			<u>Info</u>		<u>Control</u>		<u>Imagery</u>		<u>Information</u>		<u>Control</u>		<u>Imagery</u>		<u>Information</u>		<u>Control</u>	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Exercise SEQ	0.00	0.00	0.00	0.00	0.00	0.00	3.33	9.70	36.39	73.11	13.06	26.19	10.59	23.84	83.61	109.73	34.17	59.46
Coping	4.83	2.27	4.45	1.76	4.44	1.92	4.96	1.79	5.06	1.76	4.78	2.01	4.80	1.75	5.63	2.14	4.69	2.14
Schedule	2.94	1.74	3.17	1.59	2.78	1.56	3.01	1.45	3.59	1.61	3.35	1.75	3.46	1.79	4.20	1.94	3.35	1.92
Technique	7.35	1.57	7.83	1.35	6.83	1.62	6.81	1.66	7.75	1.46	6.85	1.78	6.50	1.89	7.52	1.91	6.61	1.44
EII-R																		
Appearance	5.74	0.92	6.00	0.79	5.83	0.97	5.69	0.97	6.05	0.61	5.61	1.12	5.64	0.86	6.03	0.72	5.20	1.34
Technique	3.89	1.31	4.49	1.36	4.12	1.26	4.00	1.26	4.71	1.21	3.96	1.26	3.88	1.52	5.01	1.28	4.10	1.21
Feelings	4.75	1.30	4.97	1.02	5.03	1.13	5.12	1.12	5.37	0.98	5.24	1.14	4.99	1.51	5.38	1.20	4.86	1.47
Confidence	4.69	0.87	4.76	1.15	5.03	1.23	4.71	1.26	5.26	0.95	5.00	1.17	4.61	1.26	5.19	1.24	4.72	1.22
Routine	3.52	1.14	4.15	1.10	4.09	1.23	3.84	0.99	4.54	1.15	4.22	1.14	3.98	1.49	4.91	1.20	4.33	1.31
EII-R See																		
Appearance	5.73	0.81	6.10	0.77	5.32	1.34	5.66	0.88	6.03	0.78	5.13	1.44	5.65	0.78	6.06	0.84	4.92	1.65
Technique	3.58	1.37	4.61	1.55	3.85	0.86	4.10	1.42	4.78	1.23	4.15	1.30	4.01	1.39	5.38	1.18	4.37	1.17
Feelings	4.93	1.44	5.60	1.03	5.01	1.18	4.94	1.42	5.40	1.17	4.87	1.12	4.96	1.31	5.69	0.95	5.00	1.48
Confidence	4.61	1.00	5.07	1.43	4.61	1.15	4.80	1.35	5.11	1.28	4.50	1.45	4.35	1.35	5.35	1.18	4.92	1.22
Routine	3.70	0.88	4.41	1.48	4.39	1.24	3.92	1.19	4.83	1.16	4.48	1.24	4.07	1.00	5.35	1.23	4.72	1.12
EII-R Feel																		
Appearance	5.42	0.90	5.54	1.10	4.68	1.58	5.29	0.97	5.64	1.78	5.13	1.44	4.96	1.22	5.65	1.12	4.74	1.75
Technique	3.44	1.52	4.24	1.31	3.60	1.40	3.72	1.30	4.35	1.56	4.15	1.30	3.56	1.59	4.76	1.41	3.72	1.44
Feelings	4.68	1.74	5.36	1.25	4.94	1.36	4.72	1.81	5.17	1.30	4.87	1.12	4.53	1.57	5.42	1.37	4.75	1.71
Confidence	4.20	1.43	4.72	1.30	4.17	1.35	4.39	1.25	4.69	1.22	4.50	1.45	4.24	1.50	5.16	1.25	4.43	1.34
Routine	3.24	1.18	4.07	1.30	4.09	1.41	3.55	1.40	4.26	1.41	4.48	1.24	3.59	1.80	4.69	1.42	4.00	1.58
Self report																		
See	2.67	1.19	2.65	0.93	2.83	0.86	2.72	0.89	2.50	0.86	3.28	0.89	3.17	1.47	2.67	1.28	3.06	1.21
Feel	3.67	1.46	3.56	1.42	4.00	0.84	3.82	1.01	3.12	0.99	4.22	1.26	3.83	1.62	3.33	1.46	4.50	1.47

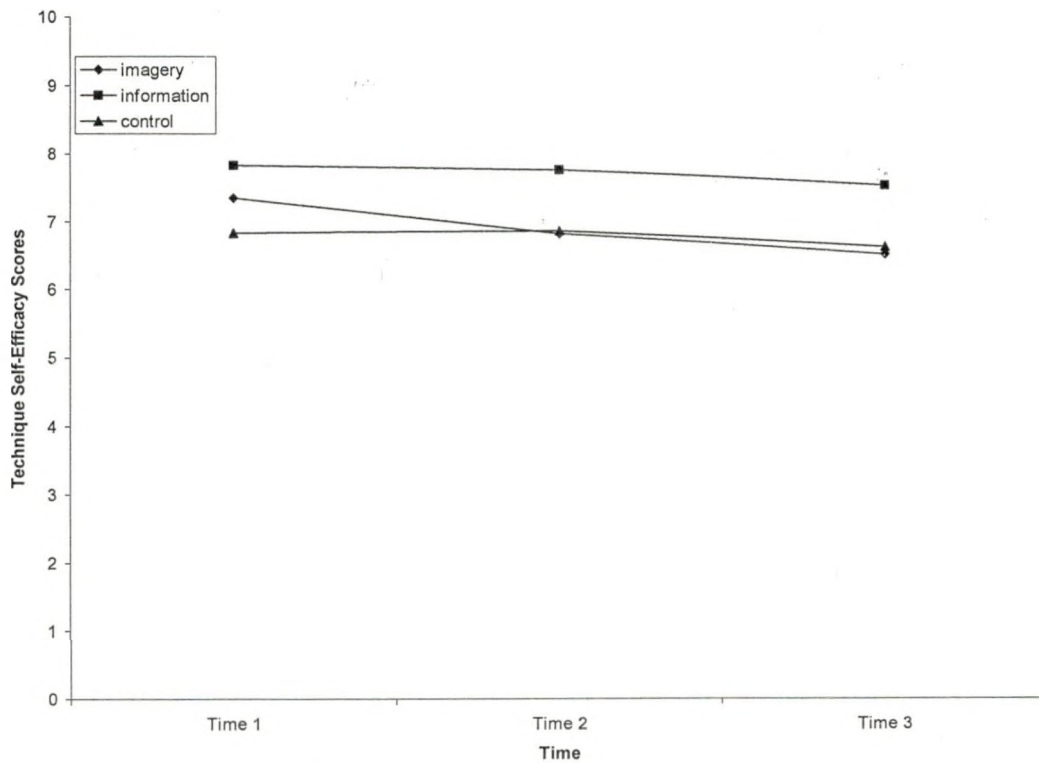


Figure 4. Technique Self-Efficacy at Time 1, 2, and 3 by Group

*Supplemental ANOVAS for Imagery Frequency and Imagery Ability*

The results of the exercise frequency ANOVA were unexpected as the imagery group did not show the greatest increase in exercise frequency. Instead, the exercise information group had the largest increase in exercise frequency. Therefore, further analysis of potential reasons for this surprising result were explored. One potential reason why the exercise information group may have shown an increase in exercise frequency greater than that of the imagery group may have been because they were actually spontaneously using imagery along with the exercise intervention. If those in the exercise information group were using imagery their imagery frequency and potentially their imagery ability scores (on the EII-R, EII-R companion scale, and self report measures) may have increased over time. Therefore, the descriptive statistics were assessed and repeated measures ANOVA's were run to investigate

whether imagery frequency scores and imagery ability scores changed across time, and if these changes were affected differently depending on group.

To assess whether or not the frequency of imagery use, and imagery ability of the groups could have been a factor in the present results were found, the descriptive statistics for the EII-R (imagery frequency), the EII-R companion scales (imagery ability by subscale), and the participant's self reported imagery ability scores, were examined to see if there were significant differences by time or group. Mean scores indicated that imagery frequency scores increased from Time 1 to Time 2, and from Time 2 to Time 3 for the EII-R subscales technique and routine. The scores for feeling and confidence subscales increased from Time 1 to Time 2, but decreased from Time 2 to Time 3. The scores for appearance imagery decreased from Time 1 to Time 2, and from Time 2 to Time 3. (see Table 2 for specific means, and standard deviations).

For imagery ability scores (EII-R companion scale) the ability to see and feel technique images, confidence images, and routine images all increased from Time 1 to Time 2, and from Time 2 to Time 3. The scores seeing and feeling the images for the feeling subscale decreased from Time 1 to time but increased from Time 2 to Time 3. The participant's ability to see appearance images decreased from Time 1 to Time 2, and from Time 2 to Time 3, however for the ability to feel the images the mean score increased from Time 1 to Time 2, but then decreased at Time 3. When participants' were asked to report how easy or hard it was for them to see images their scores indicated that at Time 1 they felt it was fairly easy to see images, at Time 2, and again at Time 3 this score increased, indicating that they actually felt it was slightly harder to see the images, however they still felt it was fairly easy. When asked how easy or hard it was to feel images participants'

reported it was neither easy nor hard with a score slightly above the mean on the seven point scale. This score stayed the same at Time 2 and increased slightly at Time 3, indicating that at Time 3 it was slightly harder to feel images (see Table 2 for specific means and standard deviations). For the mean and standard deviation scores across time by group see Table 3.

Further analysis of the mean scores differences were done using repeated measures ANOVAs for each of the EII-R subscales (5 ANOVAs), the EII-R companion scales (10 ANOVAs), and the participants' self reported ability to see and to feel images (2 ANOVAs). There were a total of 17 ANOVA's conducted, however only the significant ANOVA's are presented below. For the *F* and *p* values for the main effects and interactions for all 17 ANOVA's refer to Table 4.

Table 4. Imagery ANOVA *F* and Significance scores

	Group Main Effect <i>F</i>	Group Main Effect <i>p</i>	Time Main Effect <i>F</i>	Time Main Effect <i>p</i>	Interaction <i>F</i>	Interaction <i>p</i>
EII-R Appearance	.97	.39	1.35	.26	1.26	.29
EII-R Technique	2.91	.06	.62	.53	1.35	.26
EII-R Feelings	.31	.74	2.70	.07	1.57	.19
EII-R Confidence	.99	.38	1.77	.75	1.86	.12
EII-R Routines	2.66	.08	5.55	.00	.71	.59
See Appearance	3.29	.05	2.01	.14	.43	.76
See Technique	4.05	.02	6.85	.00	1.39	.24
See Feelings	1.65	.20	1.17	.31	.33	.86
See Confidence	1.13	.33	.17	.84	1.49	.21
See Routines	3.90	.03	6.67	.00	1.24	.30
Feel Appearance	2.27	.11	.85	.43	1.20	.31
Feel Technique	2.52	.09	1.32	.27	1.02	.40
Feel Feelings	1.01	.37	.95	.39	.53	.71
Feel Confidence	1.17	.32	.94	.38	.90	.45
Feel Routines	2.14	.13	1.18	.31	.97	.42
Self Report See	1.15	.32	1.11	.33	.84	.50
Self Report Feel	3.24	.05	.63	.53	.82	.52

*Imagery Frequency*

The only imagery frequency (EII-R) ANOVA that was significant was the 3 (time) X 3 (group) ANOVA for the routine frequency subscale. The analysis showed a significant main effect for time  $F(2, 100) = 5.55, p = .00, \eta_p^2 = .10, 1-\beta = .84$ . Post hoc comparison of means was conducted using an adjusted alpha (using Bonferroni adjustment computed on SPSS). The results revealed that the frequency of use for routine images increased significantly across time. At Time 1, the mean was 3.91 ( $SD = 1.18$ ), at Time 2 the mean was 4.21 ( $SD = 1.11$ ), and at Time 3 the mean was 4.38 ( $SD = 1.36$ ). Each of these means was significantly different from the other means. These scores indicate that participants' started with a moderately low ability to image routines, however their ability increased to slightly below the mid point of the scale, meaning they now had a moderate ability to image routines. The main effect for group was not significant nor was the interaction. This result indicates that all groups were using routine imagery and that regardless of what group they were in the amount of routine imagery they used increased over time. Thus, those in the control and the exercise information groups may have been using imagery even though they were not instructed to do so (see Table 3).

#### *Imagery Ability*

To assess the potential impact of imagery ability repeated measures ANOVA's were run using the EII-R companion scale subscales, and the participants' self-reported perceptions of their imagery ability over time, as the dependent variables, and group as the independent variable. The 3 (time) X 3 (group) ANOVA for the ability to see appearance images showed a significant main effect for group  $F(2, 47^1) = 3.29, p = .05, \eta_p^2 = .12, 1-\beta = .60$ . A Bonferroni post hoc test indicated that the exercise intervention group ( $M = 6.0, SD =$

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<sup>1</sup> Sphericity was violated, df were adjusted accordingly using Huynh Felt



.25) had significantly higher imagery ability when it came to seeing appearances images, in comparison to the control group ( $M = 5.12, SD = .24$ ). The imagery group was not significantly different from the other two groups ( $M = 5.70, SD = .25$ ). These mean scores indicate that all groups felt it was fairly easy to see appearance images, with the exercise intervention group perceiving it to be the easiest. The main effect for time was not significant, nor was the interaction (See Table 4). This result highlights the fact that those in the exercise information group had a higher imagery ability pertaining to seeing appearance based images, at Time 1, compared to the control group, and that this higher ability was maintained throughout the study. They did not have a significantly higher ability than those in the imagery group.

The 3 (time) X 3 (group) repeated measures ANOVA for ability to see technique images showed a significant main effect for time  $F(2, 96) = 6.85, p = .00, \eta_p^2 = .12, 1-\beta = .91$ . A post hoc comparison of means was conducted using an adjusted alpha (using Bonferroni adjustment computed on SPSS). Results indicated that the Time 1 scores ( $M = 4.02, SE = 1.38$ ) significantly increased by Time 2 ( $M = 4.36, SD = 1.34$ ). The Time 3 scores ( $M = 4.57, SD = 1.36$ ) were also significantly higher than the Time 1 scores. Time 2 and Time 3 scores were not significantly different from each other. These means indicate that participants' found it moderately easy to see technique images and that their ability to see technique images increased over time. The main effect for group was also significant  $F(2, 48) = 4.05, p = .02, \eta_p^2 = .14, 1-\beta = .69$ . A post hoc bonferroni test indicated that the exercise information group had a significantly higher mean score ( $M = 4.61, SD = 1.32$ ) than those in the imagery group ( $M = 3.90, SD = 1.39$ ). The control group was not significantly different from either of the other groups ( $M = 4.12, SE = 1.11$ ). These results indicate that those in the

information group thought it was significantly easier to see technique images than those in the imagery group regardless of time. The interaction was not significant.

The 3 (time) X 3 (group) repeated measures ANOVA for ability to see routine images showed a significant main effect for time  $F(2, 100) = 6.67, p = .00, \eta_p^2 = .12, 1-\beta = .91$ . A post hoc comparison of means was conducted using an adjusted alpha (using Bonferroni adjustment computed on SPSS). Results indicated that Time 1 scores ( $M = 4.17, SD = 1.26$ ) significantly increased at Time 2 ( $M = 4.42, SE = 1.23$ ), and Time 2 scores significantly increased at Time 3 ( $M = 4.69, SD = 1.38$ ). This result indicates that the participant's ability to see routine images increased over time. The main effect for group was also significant  $F(2, 50) = 3.90, p = .03, \eta_p^2 = .13, 1-\beta = .68$ . A post hoc bonferroni test indicated that the exercise information group had significantly higher mean scores ( $M = 4.86, SD = 1.29$ ) than those in the imagery group ( $M = 3.90, SD = 1.19$ ). The control group was not significantly different from either of the other groups ( $M = 4.53, SD = 1.20$ ). This shows that those in the exercise information group had higher ability scores for routine images than those in the imagery group regardless of when it was assessed. The interaction was not significant.

Related to "feeling" imagery none of the repeated measures ANOVA's assessing the ability to feel the images from the EII-R companion scale were significant. However, the 3 (time) X 3(group) ANOVA using participants' self report of their ability to feel images as the dependant variable and group as the independent variable was significant. The main effect for time was not significant, but the main effect for group was significant  $F(2, 50) = 3.24, p = .05, \eta_p^2 = .11, 1-\beta = .59$ . Post hoc bonferroni results indicated that those in the control group had significantly higher scores ( $M = 4.24, SD = 1.19$ ), than those in the exercise information group ( $M = 3.35, SD = 1.29$ ). . These results indicate that those in the control

group felt images were significantly harder to feel than those in the exercise information group regardless of time. The imagery group did not significantly differ from the other two groups ( $M = 3.77$ ,  $SD = 1.36$ ). The interaction was not significant

## CHAPTER IV

### DISCUSSION

This study investigated the effect of an imagery intervention on exercise frequency and exercise self-efficacy beliefs, in an inactive college student population. Overall, the results have shed light on the effectiveness of the imagery intervention, on the characteristics of the imagery intervention, and the potential limitations of the imagery intervention. More specifically, due to the unexpected results found in this study the discussion focuses on what may have led to the specific results, and what potential changes can be made to imagery interventions in the future to make them a more effective tool for exercise behavior change.

The first hypothesis was that exercise frequency would increase over time in the imagery group, but not in the exercise information and the control groups. This hypothesis was partially supported. Those in the imagery group did show an increase in exercise frequency over time. The fact that the imagery intervention was effective indicates that a one time imagery intervention does in fact have the ability to increase exercise frequency. The increase of 10.59 minutes from Time 1 to Time 3 indicates that those in the imagery group were exercising significantly more statistically. It can be argued that an increase of over ten minutes in just 14 is also a clinically significant change. Although ten minutes of exercise a week doesn't meet the ACSM's recommendation of 150 minutes a week, it does move the participants' from the inactive group to the low activity group (activity beyond baseline but fewer than 150 minutes a week), which, it is a change in the right direction, and

when it comes to exercise any amount of increase in activity can have benefits for a person (Sparling, 2003).

This intervention employed a one time intervention design, meaning, participant's, increased their exercise 10 minutes over two weeks after simply participating in a one time, short imagery intervention (the intervention itself was less than five minutes). Although past research by Libby and colleagues (Libby & Eibach, 2002, Libby et al., 2005; Libby et al., 2007) has found a one time intervention to be effective, they often assess one time behaviors (e.g., over eating at thanksgiving, voting). It may be that when attempting to change a behavior over a longer period of time, a imagery intervention that is longer in duration and/or more frequent interventions may lead to an even greater result. Future research should investigate whether an increase in duration and/or frequency of the imagery would lead to an even greater increase in exercise frequency. This may be particularly true for people who are inactive, as behavior adoption may take more time than behavior maintenance.

Although the imagery group's results supported the hypothesis, it was only partially supported as those in the exercise information and control group also showed an increase over time which was not hypothesized, or expected. In fact, the group by time interaction for exercise frequency was statistically significant and showed that at Time 3 those in the exercise information group had increased their exercise significantly more than those in the imagery group. The control group was not significantly different from either group, however they did had a higher exercise frequency than the imagery group at both Time 2 and Time 3. Because both the control group and the exercise information group actually had larger increases in exercise frequency from Time 1 to Time 2 and from Time 2 to Time 3, the increase in exercise frequency in the imagery group should be interpreted with caution.

Those in the exercise information group were exercising an average of 83.61 minutes at Time 3. This amount of exercise moves those in the exercise information group into the low activity group (activity beyond baseline but fewer than 150 minutes a week), in just two weeks. When investigating why this occurred, there are numerous speculative reasons, first, it may be that the exercise information may have acted to motivate the participants' to exercise. Although the intent was not to encourage the participants' to engage in exercise via the information provided to them in the intervention, the exercise information may have worked to persuade the participants' to exercise. Giving information on the importance of exercise in an attempt to increase exercise frequency was done in studies by Calfas et al. (1997), Luszczynska et al. (2006), and Lewis et al., (2006). In all these studies the verbal persuasion was found to effectively increase exercise frequency. Although the type of verbal persuasion was different (see the literature review for more details on the content) it may be that just giving people who are inactive specific information on the importance of exercise, in a way that requires them to pay attention to each statement, (as this study did required by implementing a post intervention quiz), is an effective way to increase exercise frequency.

Secondly, the exercise information group may have showed the largest increase in exercise frequency, because the participants' in this study were all being asked to adopt a behavior they were not currently engaged in. According to Bandura's (1997) self efficacy theory when adopting a new behavior it is important that people believe it will lead to the desired results, and that they understand its effectiveness (1997). This assertion is supported by the transtheoretical model which states that the most effective way to encourage change in an inactive population is by raising their consciousness of the importance of the behavior change, or the dangers of their current behavior (c.f. Velicer, Prochaska, Fava, Norman, &

Redding, 1997). The exercise information intervention may have been the most effective as it gave participants' information about the benefits of increased exercise behavior.

Whereas, the participants' in the imagery group were given a definition of imagery that explained how it worked, however, they were not told that imagery was an effective tool for behavior change. Instead they were asked to image as best they could the images, with no explanation of the intent of the image, or the imagery scripts potential impact on their behavior. Having those in the imagery intervention listen to an imagery definition and the script, without any other information about imagery was done in an attempt to make sure those in the imagery intervention group were not exposed to any other factor that may have made it impossible to attribute results to the use of imagery alone. However, this lack of direction may have led to the participants' not understanding the value of the imagery, and therefore not paying attention to the script while it played. Future research should investigate whether the effectiveness of an exercise information intervention is specific to those in the adoption stage behavior. Future research should also investigate whether giving information on the importance and effectiveness of imagery would increase the effectiveness of an imagery intervention.

The control group showing an increase from zero minutes at Time 1 to 34.17 minutes at Time 3 which moves them from the inactive to the low activity group as defined by ACSM. This finding may simply be due to their participation in the study. Specifically, labeling ones self a non-exerciser, as all participants' did to qualify for the study, along with completing the questionnaires may have made participants' think about their lack of exercise and want to change their behavior. Completing the EII-R and EII-R companion scales may have led the participants' to use exercise imagery. These two results may explain why those

in the control group showed an increase in exercise frequency. However, before any absolutes can be given as to why the control group increased their exercise frequency, future research needs to be done to assess the effect of both participation in a study, and the effect of being forced to acknowledge ones own inactivity level, in the effectiveness of exercise interventions.

Although the imagery script was effective, the findings that the exercise information intervention and the control group were more effective, makes it imperative that the imagery intervention is analyzed to assess how it could have been more effective, and therefore, how an imagery intervention could be more effective in the future. As previously discussed future research should investigate whether giving information on the importance and effectiveness of imagery would increase the effectiveness of an imagery intervention for exercise frequency. Another issue for future researchers to investigate via imagery intervention studies is the importance of making the script individual. Past research (e.g., Cumming, 2008; Kossert & Munroe-Chandler, 2007) has encouraged exercise interventions to be individualized, however, these suggestions were made based on correlational and descriptive studies opposed to studies using experimental methodologies, making the suggestion that imagery interventions for exercise frequency change be individualized something that still needs to be researched in the future. In this study the imagery script was not completely individualized. Participants' were asked to choose their own exercise, and image themselves doing that exercise in the way that they wanted to, however it was the same script that played for each individual in the imagery intervention group. This procedure was used because it was felt that as the first study to investigate the effectiveness of an imagery intervention in an exercise setting, that it would be best to have one script that encompassed the



recommendations for what types of imagery, (i.e., appearance/health and technique imagery) and what types of self-efficacy (i.e., coping and scheduling) should be used in an imagery script. Individualizing the type of exercise they imaged, may not have been enough individualization and may have led to the participants' not relating to the imagery script. The imagery script gave specific obstacles to overcome, for example, one statement in the script was "now, imagine you are having a busy day, instead of deciding you don't have time to exercise, you put on your workout clothes and complete your exercise." Those participants whose exercise frequency is not hindered by their busy days, and instead is hindered by a different obstacle (e.g., lack of motivation) may not have found the script effective. If a participant did not relate to the images given, it may have made it difficult for them, or led them to not attempt, to image the script. Future research should investigate to what level an imagery script should be individualized, specifically, should each person have a script made up based on their reasons for not exercising, or is it enough to use coping images, if they report a lack of confidence in their ability to cope with those things that keep them from exercising. Knowing exactly how imagery scripts should be designed should be a priority for those researching imagery and exercise frequency as the results would have both research and applied implications.

Hypothesis two was that those in the imagery condition would have significantly higher efficacy scores from Time 1 to Time 2, from Time 2 to Time 3, and from Time 1 to Time 3, while those in the exercise information and control conditions, would not show a significant difference across time. This hypothesis was not supported by the results. The results showed that there were not any differences among groups, across time, or by group by time for coping self-efficacy, or technique self-efficacy. There was however, a significant

difference in scheduling self-efficacy at Time 3 compared to Time 1. Specifically scheduling self-efficacy significantly increased from Time 1 to Time 3 regardless of group. At Time 1 coping self-efficacy scores were in the moderate range, while technique scores were moderately high, the scheduling self-efficacy scores on the other hand were fairly low. It may be that the coping and technique scores did not increase because the sample was already fairly efficacious in regards to these two types of self-efficacy, while the scheduling self-efficacy scores increased because they were so low to start.

The fact that scheduling self-efficacy showed an increase in the imagery group is supported by past correlational research on the relationship between exercise imagery and exercise self-efficacy. Rodgers et al. (2002) found that scheduling self-efficacy may be an important type of self-efficacy when considering the role of self-efficacy in people's physical activity participation. They also found that scheduling self-efficacy predicted exercise behavior. Specifically, those with higher levels of scheduling self-efficacy exercised more than those with lower levels of scheduling self-efficacy. Cumming (2008) also suggested that scheduling self-efficacy is important to consider when attempting to increase exercise frequency via imagery. In the current study, the imagery script itself was heavily focused on scheduling efficacy as past research (Cumming, 2008; Rodgers & Sullivan, 2001; Rodgers et al., 2002) has shown scheduling efficacy to be important for the exercise frequency imagery relationship, and to be one of the main issues that hold people back from exercising (Cumming, 2008; Rodgers et al. 2002). The fact that scheduling self-efficacy also increased in the information group and the control group is surprising. It may be that the scheduling self-efficacy scores increased in all groups because the participants' were increasing their exercise frequency, which in turn proved to the participants' that they could fit exercise into

their schedules. The increase may have been greatest in the exercise information group, as their increase in exercise frequency was the largest. Future research should investigate whether giving exercise information is an effective way to increase scheduling self-efficacy, and whether it is in fact a more effective tool for increasing scheduling self-efficacy than imagery.

Because the exercise frequency results were unexpected supplemental analyses were done. Specifically, imagery frequency scores and imagery ability scores were assessed for all groups across time. The results indicated that all three groups showed an increase in their use of routine imagery over time, and in their ability to see technique and routine images. Those in the information group increased their ability to see appearance images significantly more than the control group, and increased their ability to see technique and routine images significantly more than the imagery group. Those in the control group perceived feeling images to be significantly harder than those in the exercise intervention group. None of these differences were related to time, in other words there were not any interactions found.

It is not known why routine imagery frequency increased or why the ability to see routine and technique images increased, as the control and exercise information group were not asked to use imagery and the imagery intervention group was given a script that did not focus on either of those imagery subscales. Speculatively, the findings regarding both imagery frequency and imagery ability may be a result of just completing the EII-R, the EII-R companion scale, and the exercise self-efficacy questionnaire. Doing so may have led to an increase in routine imagery frequency, and an increase in ability to image seeing technique and routine images over time. The questionnaires asked numerous questionnaires about imagery as the EII-R, and the EII-R companion scales were included in the questionnaires at

all three times. It may be that completing these questionnaires three times, led to the increase over time.

The differences in appearance imagery ability and the ability to feel images between the control group and the exercise information group, along with the findings that the imagery group had a significantly lower ability to see images for technique and routine imagery than the exercise information group is also surprising. This may be due to the exercise intervention group using imagery along with their own exercise information intervention. Although a quiz was given to those in the exercise intervention group to encourage the participants' to use other cognitive skills, instead of imagery, it may be that participants' used imagery, either while in the intervention, or other times during the two weeks post intervention. If those participants' were using imagery, they were in fact using two different techniques (imagery, and the verbal persuasion of the exercise information). The exercise information group spontaneously using imagery may explain why they had increases in imagery ability over time for appearance imagery, and why their imagery ability was higher than the imagery groups across time for technique and routine imagery. It may also be that their scores being higher at the beginning of the study led to them being more likely to increase their ability over time, once they were exposed to the different images listed in the EII-R, and the EII-R companion scale.

Like all studies there are limitations in this study that need to be addressed. First, ideally the imagery intervention would have been individualized, incorporating why the participants didn't exercise, if they wanted to increase their exercise, and exactly how they wanted to exercise in the future. Second, all the groups being exposed the exercise images when they completed the EII-R and the EII-R companion scales at Time 1, and two may have

led to those in the exercise information group, and the control group using imagery. Third, because of the homogeneity of the sample, the effect of gender, age, and imagery perspective on exercise frequency were not able to be analyzed, even though they are all listed as potential moderators of the self-efficacy, exercise frequency relationship in the exercise imagery model (Munroe-Chandler & Gammage, 2005). Future research that aims to investigate the effectiveness of an imagery intervention on exercise frequency and self-efficacy should assess the role of these variables on the relationship.

### *Conclusion*

Although the findings of this study were unexpected, they still add valuable information to the discussion on imagery, self-efficacy, and exercise. Specifically, because this is the first study to assess the above relationship through intervention based research, the findings have highlighted potential limitations for imagery interventions, but more importantly the findings have indicated what future research should focus on including imagery intervention frequency and length, individualization of the scripts, and matching the intervention to the persons current behavior level (e.g., adoption versus maintenance). Along with the information this study contributes to the imagery literature, it also has implications for research on exercise interventions in general. Specifically, it appears that exercise information, even given in a brief one time intervention setting, may be extremely effective in changing the exercise patterns of people who are currently inactive. In the end the results of this study were informative, and hopefully will help future researchers better understand the imagery intervention, exercise frequency, and self-efficacy relationship.

APPENDICES

Appendix A  
Background Information & Exercise Background Questionnaire

**Background Information**

What is your sex \_\_\_\_\_

What is your age \_\_\_\_\_

The following questions deal with your imagery use. Imagery is “an experience that mimics real experience. We can be aware of 'seeing' an image, feeling movements as an image, or experiencing an image of smell, tastes or sounds without actually experiencing the real thing”.

**Please circle the appropriate response**

Have you ever had any formal imagery training      Yes                  No

When you image how do you see yourself?

OWN EYES (1<sup>ST</sup> PERSON)                  ON TELEVISION (3<sup>RD</sup> PERSON)                  BOTH

How easy or hard is it for you to see an image (1= *very easy*, 7= *very hard*).  
1      2      3      4      5      6      7

How easy or hard is it for you to feel an image (1= *very easy*, 7= *very hard*).  
1      2      3      4      5      6      7

**Exercise Background Questionnaire**

Please list all times you exercised in the past week. Exercise is an activity requiring moderate to strenuous effort that is sustained long enough to cause one to break a sweat or to breathe heavily.”

Did you exercise 1 day ago? Yes      No  
If yes how many minutes did you exercise \_\_\_\_\_

Did you exercise 2 days ago? Yes      No  
If yes how many minutes did you exercise \_\_\_\_\_

Did you exercise 3 days ago? Yes      No

If yes how many minutes did you exercise \_\_\_\_\_

Did you exercise 4 days ago? Yes No  
If yes how many minutes did you exercise \_\_\_\_\_

Did you exercise 5 days ago? Yes No  
If yes how many minutes did you exercise \_\_\_\_\_

Did you exercise 6 days ago? Yes No  
If yes how many minutes did you exercise \_\_\_\_\_

Did you exercise 7 days ago? Yes No  
If yes how many minutes did you exercise \_\_\_\_\_

What are your primary exercise activities? (List all activities)

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Appendix B  
Exercise Self-Efficacy Questionnaire

Think about your own typical activities and answer the questions below using the 10 point rating scale. Circle the number that best represents your confidence level for each of the 10 questions.

**1 = No Confidence    10 = Complete Confidence**

	Circle the number that best represents your confidence level for each question. 1 = no confidence    10 = complete confidence
<b>Rate how confident you are that you can...</b>	
1. exercise when you are in a bad mood	1 2 3 4 5 6 7 8 9 10
2. exercise when you feel you don't have time	1 2 3 4 5 6 7 8 9 10
3. exercise when you feel you don't feel well	1 2 3 4 5 6 7 8 9 10
4. exercise when you feel discomfort	1 2 3 4 5 6 7 8 9 10
5. exercise when you lack energy	1 2 3 4 5 6 7 8 9 10
<b>The next questions are about exercise itself. Assuming you were able to get to the place you exercise and that you have all the necessary equipment, how confident are you that you can</b>	
6. complete exercise using proper technique	1 2 3 4 5 6 7 8 9 10
7. follow directions to complete exercise	1 2 3 4 5 6 7 8 9 10
8. perform all of the required movements	1 2 3 4 5 6 7 8 9 10
9. work at an appropriate intensity to receive benefits from exercise	1 2 3 4 5 6 7 8 9 10
10. pace yourself to avoid over-exertion	1 2 3 4 5 6 7 8 9 10
<b>The next questions are about scheduling time for exercise. How confident are you that you can</b>	
11. arrange your schedule to exercise regularly no matter what	1 2 3 4 5 6 7 8 9 10
12. overcome obstacles that prevent you from participating regularly	1 2 3 4 5 6 7 8 9 10
13. make up times when you missed	1 2 3 4 5 6 7 8 9 10
14. consistently exercise three times per week	1 2 3 4 5 6 7 8 9 10
15. include exercise in your daily routine	1 2 3 4 5 6 7 8 9 10

## Appendix C

### The Exercise Imagery Inventory

The following questions deal with imagery and exercise participation. *Imagery* involves “mentally” seeing yourself exercising. The image in your mind should approximate the actual physical activity as closely as possible. Imagery may include sensations like hearing sounds and feeling yourself move through the exercises. Imagery can also be associated with emotions (e.g., getting psyched up or energized), staying focused or not being distracted, setting exercise plans/goals (e.g., imaging achieving goal of losing weight), etc. There are no right or wrong answers so please answer as accurately as possible.

**Please answer the following questions with regard to how often you use mental imagery (Never to Often) and how easy or hard it is to see or feel the imagery (Very Hard to Very Easy).**

	Rate the frequency with which you use this image 1 = Never 7 = Often	Rate how easy or hard it is for you to see the image (“picture in your mind”) 1 = Very Hard 7 = Very Easy	Rate how easy or hard it is for you feel the image (“feel what it would be like in real life”) 1 = Very Hard 7 = Very Easy
1. I imagine a “fitter-me” from exercising	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
2. I imagine my typical exercise routines	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
3. I imagine completing my workout	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
4. When I think about exercising, I imagine the perfect technique	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
5. I imagine being more relaxed from exercising	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
6. I imagine a “leaner-me” from exercising	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
7. I imagine having the confidence to exercise	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
8. When I think about exercising, I imagine my form and body position	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
9. I imagine my entire	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7

workout routine			
10. I imagine how I will feel after I exercise	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
11. I imagine being toned from exercising	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
12. I imagine having the confidence to complete my workout	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
13. I imagine being healthier from exercising	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
14. I imagine losing weight from exercising	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
15. When I think about exercising, I imagine doing the required movements	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
16. I imagine the order I perform my exercise activities	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
17. I imagine becoming more fit	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
18. I imagine the perfect exercise technique	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
19. I imagine getting in better shape	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
20. I imagine reducing my stress from exercising	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
21. I imagine a "firmer-me" from exercising	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7
22. I imagine feelings associated with exercising	1 2 3 4 5 6 7	1 2 3 4 5 6 7	1 2 3 4 5 6 7

## Appendix D

### Imagery Script

Image you are going to exercise. Take a moment to decide what you want your main exercise to be (Pause tape). Now that you have decided what exercise you are going to take part in imagine yourself finding time in your schedule to do the exercise you want to do. Now, image you are having a busy day, instead of deciding you don't have time to exercise, you put on your workout clothes and complete your exercise. See and feel yourself having the confidence to complete the exercise. Image yourself having the confidence to exercise regardless of the situation. See yourself doing the required movements for your particular exercise, image yourself doing the technique properly, feel your form and body position to be exactly how it is suppose to be. Now image what it looks like, and how it feels to correctly complete your exercise program even though you had to rearrange your schedule to make it happen. Image how confident you are now that you have overcome the obstacles in your way, and completed your exercise. Now, image yourself after exercising, you are feeling and looking toned. You feel healthier than you did before, you have proven to yourself that you can exercise in any situation.

## Appendix E

### Exercise Information Intervention

Physical exercise is any bodily activity that enhances or maintains physical fitness and overall health. Physical exercise is important for maintaining physical fitness and can contribute positively to maintaining a healthy weight, building and maintaining healthy bone density, muscle strength, and joint mobility, it can promote physiological well-being, reduce surgical risks, and strengthen the immune system. Frequent and regular aerobic exercise has been shown to help prevent or treat serious and life-threatening chronic conditions such as high blood pressure, obesity, heart disease, Type 2 diabetes, insomnia, and depression. Strength training appears to have continuous energy-burning effects that persist for about 24 hours after the training, though they do not offer the same cardiovascular benefits as aerobic exercises do. Exercise is therefore important for a healthy lifestyle.

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