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The Effects of Self-Efficacy on Lower Body Power

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THE EFFECTS OF SELF-EFFICACY

ON LOWER BODY POWER

By

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ABSTRACT

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by

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The purpose of this study was to examine the effects of increased self-efficacy on three separate jump tests. Forty-seven students (18 females & 29 males) from Utah State University were randomly assigned to a treatment or control group. Participants performed a vertical jump test, a standing broad jump test, and a 30-s Bosco test on three separate days over a span of 1 week. The treatment group (n = 24) were given false, positive feedback about their performance while the control group (n = 23) were told their true results. Self-efficacy was measured pre and post using the Physical Self-Efficacy scale (PSE) and was found to increase more for the treatment group than the control group. A 3 x 2 ANOVA showed a significant improvement for the Bosco test but no significance for the other two tests, suggesting that self-efficacy has an effect on power endurance but not explosive power.

(64 pages)

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CONTENTS

Page

LIST OF TABLES

Table Page

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Measuring Anaerobic Power

Power is defined as the product of force (*F*) and velocity (*v*) (Enoka, 2002). Anaerobic power refers to the ability to perform high-intensity exercise from a fraction of a second to several minutes (Hoffman, 2006). Power is generally reported in watts (*W*) (Hoffman). Tests such as vertical jump are often used to assess this fitness component. The evaluation of such a task provides an index of whole body power (Enoka). Along with the vertical jump test, the standing broad jump is also used to assess anaerobic power. The standing broad jump is widely used by coaches and fitness professionals of all levels. Both tests are used to assess prospects in the National Football League (NFL) Combine.

The correlation between vertical and/or standing broad jump and athletic performance has been demonstrated in professional sports and can be generalized to all levels (McGee & Burkett, 2003). Those who excel in these tests are seen as more athletic and have the potential for more athletic success (Brodt, 2006). Vertical jump and standing broad jump are both used to determine peak power output. Peak power is the highest mechanical power output achieved at any stage of the test. Peak power output represents explosive capability (Hoffman, 2006). Power can also be measured as mean power output. Mean power output is the average power output over a long duration. Mean power output is used to assess the ability to maintain a high power output over a period of time (Hoffman).

To measure mean power output, experimenters often employ laboratory measures such as the Wingate Anaerobic test. Although the Wingate test is acknowledged as the gold standard for measuring anaerobic power, it has yet to gain wide spread support among coaches as a performance test for their athletes (Hoffman, 2006). The Wingate has long been accepted as a valid measure of anaerobic power output, but in recent years there is another test that has been gaining popularity. The Bosco test (Bosco, Luhtanen, & Komi, 1983) is a jumping test that may be a more sport-specific measure of anaerobic power and capacity among jump-trained athletes (Sands et al., 2004). The Bosco Anaerobic Test is a rebound-jumping test in which participants are required to give maximal effort in repeated jumps for 60 s. One of the reasons that the Bosco test is so attractive to coaches is due to the use of the stretch-shortening cycle (SSC), which is an important part of many athletic movements (Sands et al.).

Self-Efficacy Measurement

Self-efficacy is defined as the belief individuals have in the ability to successfully perform a specific activity (Bandura, 1977). In sports the effects of increased or decreased self-efficacy can translate into increased or decreased performance. Several studies have been conducted to examine the effects of self-efficacy on sports performance. Fitzsimmons, Landers, Thomas, and van der Mars (1991) found that increased self-efficacy could increase performance in skilled weightlifters. Other studies have been conducted to examine the effects of increased self-efficacy on a variety of sports including golfing (Bond, Biddle, & Ntoumanis, 2001) and track and field (Gernigon & Delloye, 2003). Self-efficacy is usually measured using a scale of some sort.

The problem with most scales is that they do not assess task specific self-efficacy. Ryckman, Robbins, Thornton, and Cantrell (1982) developed a scale that assessed physical self-efficacy, the Physical Self-Efficacy scale (PSE). This scale is the first of its kind to assess physical self-efficacy.

Self-Efficacy and Anaerobic Power

After reviewing the literature on the effects of self-efficacy on sports performance, one lingering question still remains. What is the effect of self-efficacy on anaerobic power output, and more specifically on jump performance? The intent of this study was to address this question. This was done by comparing the effects of increased self-efficacy (experimental group) versus unchanged self-efficacy (control group) on three jump tests. The anaerobic jump tests will look at the two components of anaerobic power: peak or explosive power and mean power or power endurance. Vertical jump for height and standing broad jump for distance will be performed to determine the explosive power component, and a vertical jump endurance test will be used to assess power endurance.

Purpose of the Study

The purpose of this study was to determine the effects of increased self-efficacy on jump performance.

Research Questions

1. Will self-efficacy change from pre to post test?

2. Will the performance variables change from pre to post test?

3. Will there be a difference in these variables between control and treatment groups?

Research Hypothesis

1. Scores on a self-efficacy test (PSE) will increase significantly from pre to post test for the treatment group but not the control group.

2. Scores on the anaerobic power performance tests will increase significantly from pre to post test for the treatment group but not the control group.

3. The treatment group will have a significantly greater increase in self-efficacy and anaerobic power test scores compared to the control group.

CHAPTER II

REVIEW OF LITERATURE

Introduction

Anaerobic power and athletic performance are directly related in the world of sport. Physical performance and self-efficacy beliefs are directly related in the world of psychology. When these worlds collide great advances can be made. Albert Bandura (1997) believed that there were four sources of information used to improve self-efficacy. These sources, listed in order of greatest to least influence on behavior, were (a) previous performance accomplishments or past enactive mastery experiences, (b) vicarious experiences, (c) verbal persuasion, and (d) physiological and emotional states. This review will first consider Bandura's theory of self-efficacy, its structure, and principle sources. Second, causal attribution and manipulated outcomes will be discussed. Third, applications of self-efficacy, causal attributions and performance in sport will be reviewed. Finally anaerobic power tests, their purpose and validity will be discussed.

Theory of Self-Efficacy

Self-efficacy is defined as the belief individuals have in the ability to successfully perform a specific activity (Bandura, 1977). The self-efficacy component of the social cognitive theory, developed by Bandura, discussed how self-efficacy governs thought, motivation, and action. The theory is based upon two independent mechanisms for obtaining behavioral change. The first mechanism relies on an individual's psychological belief in his/her ability to complete the task at hand. The second mechanism relies on previous performance experiences. Therefore, one's belief in his own competence in accomplishing a task will dictate whether or not he will attempt the task. Performance outcomes will then dictate changes in beliefs and behavior prior to the next performance attempt.

Self-Efficacy Theory Structure

Bandura believed that self-efficacy beliefs are stretched across three dimensions: level, generality, and strength (Bandura, 1997). The amount or level of self-efficacy can be changed as the tasks vary. As the context in which a task is attempted changes, self-efficacy can be altered. Generality refers to the domain of efficacious activities for each individual. The domain can be broad, as when demonstrating high efficacy in a variety of tasks, or can be considered narrow showing high efficacy in only a few tasks. The generality of individuals' efficacy beliefs will determine the activities around which those individuals will structure their lives. The most easily determined dimension of self-efficacy is that of strength. The strength of the efficacy belief will play a role in determining if a task will even be attempted. Although all three dimensions of self-efficacy for a particular activity will determine task initiation, effort expenditure, and length of perseverance given to the activity, it is the strength dimension that acts as the threshold for resultant behavior (Bandura, 1986).

In order to measure self-efficacy a scale must inquire about various activities under different levels of demands and circumstances (Bandura, 1997). Typically, self-efficacy scales are constructed using task items representing varying levels of task demands. Individuals are then asked to record the strength of their belief in their capabilities to complete a given task. The strength of belief is recorded on a 100-point scale ranging from 0 (cannot do), through intermediate beliefs 50 (moderate certainty), to 100 (complete certainty).

To examine an individual’s belief in certain sport settings, sport-specific scales are used. These scales are constructed of sport-specific questions designed to measure one’s belief based on the three dimensions. Initially it is important to distinguish the level of the task demand. A football player, for example, may find it easy to distinguish between a run and a pass. However, if asked to identify the type of blocking scheme used, the previously simple task may become a difficult one. For another football player, identifying run or pass may be difficult and distinguishing blocking schemes may be impossible. The scale should, therefore, consider varying degrees of challenge to define successful performance, and the amount of perceived efficacy an individual has should be based upon situational conditions.

Generality, the second dimension of self-efficacy belief refers to the spectrum of activities or domains of functioning in which each individual may or may not engage. Certain athletes may play a wide variety of sports throughout the year or may confine themselves to only one sport where they feel comfortable. Self-efficacy scales are used to link activity domains and situational contexts to degree of efficacy to determine patterning and degree of generality (Bandura, 1997). Sport-specific scales for example should include questions that target various aspects of sport that are typically performed within that activity, as well as various aspects of sport that may not be typically experienced within the domain of their preferred sport. This organization of the questionnaire would help to determine if athletes limit themselves to only the sport in which they are the most efficacious, which is considered their "safe" zone.

Strength of efficacy belief, the third dimension of self-efficacy belief, is the degree to which an individual believes success at a given task can be accomplished (Bandura, 1997). Individuals are presented with items portraying different tasks; in football for example, athletes may be asked to rate the strength of their belief in their ability to make a tackle or run a pass route correctly. The responses will be on a scale of 0-100 with 0 being "no confidence," and 100 being "absolute confidence."

Level, generality, and strength are dimensions of perceived efficacy beliefs that can be measured. Efficacy beliefs are based, however, upon four principal sources of information: previous experiences, vicarious experiences, verbal persuasion, and physiological and emotional states (Bandura, 1997). Bandura and others have investigated the impact of the four sources on an individual's self-efficacy and found them to be unequal (Feltz, 1988; McAuley, 1985). The impact on one's efficacy for each of the four sources is dependent on how important that source is to the individual.

Sources of Self-Efficacy

Although all four sources have a different impact on efficacy, it is important to understand each source. According to Feltz (1988), the strongest source of information about one's capabilities is based on previous performance accomplishments. Feltz, Landers, and Raeder (1979) investigated the effectiveness of participants with live and videotape modeling using college-aged females learning a back dive. The participant-modeling group was physically guided through the dive after a full explanation and demonstration of how to perform the dive was given by the instructor. The other two groups were verbally instructed on how to complete the dive correctly. The participants then viewed a live or videotaped demonstration by the instructor. No physical guidance was provided for these two groups, although the two groups experienced two different modes of vicarious learning, the videotaped or live demonstration. The results of the study demonstrated that participant modeling resulted in more successful dives and stronger expectations of personal perceived efficacy when compared to the other two groups who learned through the two modes of vicarious experience.

Performance accomplishments have been determined to strengthen personal efficacy, whereas, failure threatens it (Bandura, 1997). Unfortunately, not all successes come with an increase in efficacy, and not all failures threaten one’s belief in ability. Successes that come too easily often foster increased discouragement when future failures occur due to increased task difficulty. Conversely, early failures can often serve as positive learning experiences increasing one’s abilities to overcome future obstacles, as well as demonstrate perseverance during times of failure. However, serious consequences may arise when athletes experience failures. For example, if an athlete experiences an injurious accident while in the weight room, he/she may become afraid of future accidents and avoid the weight room all together. This type of failure outweighs many successful experiences (Bandura).

Personal accomplishments are not the only form of influence that shape self-efficacy beliefs. Authority figures, friends and family may also affect one’s beliefs. However, the amount of influence from others on an individual is limited to the credibility of the persuasive party (Feltz, 1988). For example, an athlete’s coach may have more of an influence on an athlete's off-season training than a parent or teammate due simply to the perceived authority of the coach, when in fact the parents may know the most beneficial program for their son/daughter. Verbal persuasion is considered to be a weaker influence on efficacy beliefs than that of performance accomplishments and is strictly dependent on the source (Bandura, 1986).

The amount of influence physiological and emotional states has on self-efficacy is the least influential of the four sources. It is limited to the extent, as well as the interpretation, of the physiological and emotional states. Various emotions will result in the same physiological responses. For example, various physiological responses such as increased heart rate, muscle tension, and perspiration can be interpreted as various emotions, such as excitement, anxiety, or fear. The individual's interpretations of physiological responses are key to the decision to attempt a certain task, how much effort is expended, and the amount of persistence given to the accomplishment of the task. All four principal sources of efficacy play unequal roles defining the level, generality, and strength of efficacy beliefs.

Causal Attribution and Manipulated Outcomes

Self-efficacy is one of the most investigated psychological processes in the behavioral sciences. Recent narrative (Feltz & Lirgg, 2001) and meta-analytic (Moritz, Feltz, Fahrbach, & Mack, 2001) reviews conducted in the domain of sport have shown clear evidence for a significant relationship between self-efficacy beliefs and performance (Gernigon & Delloye, 2003). Because of this relationship, it is important to understand the mental processes that take place from the perception of a specific sport outcome unto athletes' future efficacy beliefs. In order to better understand the processes that are involved researchers sometimes experimentally manipulate failure and success outcomes.

In a study conducted by Fitzsimmons et al. (1991), experienced weightlifters were told they had lifted more or less than they actually had. Weightlifters self-efficacy beliefs and future performances then appeared to be increased by the false positive feedback. The participants who received false positive feedback showed higher self-efficacy and performance than those who received false negative feedback. These findings support Bandura's theory that past performances can effectively influence self-efficacy.

The causes that are used by individuals to explain successes and failures in achievement contexts are also considered to be effective determinants of their expectations and future performances. According to Weiner's (1992) casual attribution theory, there are three main dimensions from which casual attributions are made: locus of causality, stability, and controllability. Locus of causality involves causes that are internal or external to the person (i.e., attribution to personal or situational factors). Stability refers to the extent that a cause is modifiable (i.e., stable or unstable). Controllability indicates whether or not the individual can modify a cause. Central to Weiner's theoretical framework is that casual dimensions that characterize the causes result from an individual's own attributional thinking. For example, ability can be either stable if thought of as a gift or unstable if thought of as improvable by learning.

How causes are attributed to a specific event depends on both personal and situational factors. One typical situational characteristic that influences behavior is outcome of the task, according to which individuals will adopt different attributional strategies. The strategies called “self-serving attributional bias” (Miller & Ross, 1975) are used to protect or enhance self-esteem and self-efficacy. For example, if a kicker misses an easy field goal, attributing the failed kick to external factors such as wind allows him to protect his self-efficacy beliefs. Conversely, it is preferred to attribute success to more internal and stable causes such as fixed ability because it is more gratifying and boosts self-efficacy. Empirical support of self-serving bias has been provided in sport settings. For example, McAuley and Gross (1983) found that winners of table tennis matches explained their outcomes with more internal, stable, and controllable attributions than those in losing situations. In 1991, Grove, Hanrahan, and McInman found that in basketball, winning situations entailed more internal stable attributions than losing situations.

According to Weiner (1992), the action of causal attribution is motivational, since causal dimensions influence choice, intensity, and persistence of behavior. Motivational effects of causal attributions on motor or sport performance have been observed. Results from many laboratory studies carried out in the domain of motor tasks showed that performance is enhanced when outcomes are attributed to unstable causes such as effort (Grove & Pargman, 1986) or when perceived failures are attributed to internal, unstable, and controllable causes (Rudisill & Singer, 1988). Orbach, Singer, and Murphey (1997) found that when adults trained themselves to attribute failures to unstable and controllable causes they actually made unstable and controllable changes and improved their performance in basketball dribbles, whereas adults who had not trained themselves did not make the changes or improve performance.

Links can be established between causal attribution theory and self-efficacy theory due to the fact that both theories are founded on self-referent thoughts involving personal beliefs about one's control over the environment (McAuley, 1992). Both of these theoretical constructs of human behavior emphasize the role of perception of control as a key determining factor in task completion (Skinner, 1996).

According to Skinner's (1996) classification of the different theoretical constructs of perceived control, causal attributions and their dimensions are involved in the "means-ends" relation of the control process. Obviously causal attributions can be viewed as one of the means leading to a particular end. On the other hand, self-efficacy expectations are perceptions of control that are involved in the "agent-means" relation of the process of control, because they refer to the personal belief that one can act or not on the means that is assumed to lead to the desired outcome (Skinner). Thus, causal attributions and self-efficacy are linked, since the causes perceived as explaining the outcome of a task ("means-ends") can then be used by the person to help predict future outcomes in similar situations ("agent-means").

A similar relationship has been made linking causal attribution, self-efficacy, and performance. This relationship is well documented by researchers in academics. For example, training to attribute arithmetic successes to internal and stable causes and failures to external, unstable, and changeable causes resulted in an increase in self-efficacy and arithmetic skills in learning disabled children (Schunk & Cox, 1986). However, McAuley (1992) points out that few investigations dealing with this relationship have been conducted in the area of motor skills, and even fewer in the context of competitive sport.

Self-efficacy, Causal Attribution, and Performance

In a recent study, researchers examined the relationship between self-efficacy, causal attribution, and performance in a series of gun-shooting tasks using junior high school students. Students were asked to complete self-efficacy and attributional scales prior to completing the task and then again after completing the task. Researchers found a positive correlation between high pre-task self-efficacy expectations and attribution scores and actual task performance as well as a positive correlation between low pre-task self-efficacy and attribution score and poor performance on the actual task (Gernigon, Fleurance, & Reine, 2000).

In another study performed by Gernigon and Delloye (2003) elite sprinters were led to believe that they had ran faster or slower than they really had in a 60-m sprint. Self-efficacy and causal attributions were measured pre- and post-race and were then analyzed according to future performance. Researchers found that increased and decreased times lowered and raised efficacy beliefs, respectively. Researchers also found that sprinters who perceived themselves as successful attributed their success to internal and stable causes while those who perceived themselves as failures attributed the results to external and unstable causes. Interestingly, researchers were also able to predict future outcomes using self-efficacy beliefs; the higher the self-efficacy the more successful the future outcomes.

Bond et al. (2001) examined the relationships between causal attribution and pre- and post-competition self-efficacy among experienced female golfers. Researchers manipulated outcomes and found that under perceived success conditions, more attributions made to more stable causes were found to predict post-competition self-efficacy. Golfers who made more internal and stable attributions saw a greater increase in self-efficacy than golfers who made more external and unstable attributions.

These studies illustrate the fact that increased self-efficacy and internal and stable attributions lend themselves to future success in athletic competitions. Manipulated outcomes, as discussed by Gernigon and Delloye (2003), are useful in increasing self-efficacy and encouraging more internal and stable attributions. However, this increase in desirable outcomes can also be trained as discussed by Schunk and Cox (1986). Both methods, training and manipulating outcomes, produce measurable increases in future performances that are the goal of every competitive athlete. Utilizing both tactics may elicit even greater improvements. If athletes can undergo a training regimen where manipulated success outcomes are trained to be attributed to internal and stable causes, and failures are trained to be attributed to external, unstable, and controllable causes then it is reasonable to hypothesize that those athletes would experience much greater increases in self-efficacy and ultimately perform better in future tasks. Each of these studies dealt with self-efficacy in the physical sense. However, not all self-efficacy scales are relevant to this type of research.

It was not until 1982 that a self-efficacy scale was developed to assess physical self-efficacy. Ryckman et al. (1982) developed a scale that measured physical self-efficacy. The scale was developed out of neccessity, as there were no other scales that adequately measured self-efficacy as it pertained to physical tasks. Since its development it has been shown to have good convergent validity and has been found to be highly correlated with the Tennessee Physical Self-Concept scale (Ryckman et al.) and has been found to be applicable to different training situations (Duda & Tappe, 1988; Duncan & McAuley, 1987). Test-retest reliability for the PSE has been reported as r = .80 (Ryckman et al.).

Anaerobic Power Tests: Purpose and Validity

Power is defined as the product of force (*F*) and velocity (*v*) (Enoka, 2002). Power in athletes is the product of the strength of the muscles and the velocity of the movements being executed, and is a key component for most athletic events (Enoka). Anaerobic power refers to the ability to perform high-intensity exercise from a fraction of a second to several minutes (Hoffman, 2006). Typically, tests of maximal effort in cycling, running, and jumping are used to assess this energy system (Hoffman). Tests vary widely in both style and sophistication and include both lab and field methods. However, many athletic teams and individual health professionals lack an exercise physiology laboratory and must rely heavily on the use of field methods. Due to a lack of facilities and equipment, lab methods such as the Wingate anaerobic power test often are not implemented.

Although the Wingate anaerobic power test performed on a cycle ergometer is considered the gold standard of laboratory anaerobic power assessments, it is not widely accepted among coaches as a performance test for their athletes (Hoffman, 2006). This could be due to questions concerning the specificity for muscle and activity patterns (Hoffman). Field methods such as the vertical jump appear to be more sport specific and thus have more wide spread acceptance (Hoffman). Due to the aforementioned reluctance to employ laboratory methods to assess their athletes, coaches and clinicians often turn to field methods to gather their data.

Tests such as the vertical jump and standing broad jump are both field methods that are frequently implemented. The vertical jump is perhaps the most popular field test used to assess anaerobic power in athletic populations. Countermovement vertical jump has reported very good reliability (Cronbach's α= .98) as well as good validity (r = .78) (Markovic, Dizdar, Jukic, & Cardinale, 2004; Miller, 1994). The vertical jump uses very little equipment, is relatively easy to perform, and provides a measurement of power that is specific to sports that include jumping (Hoffman, 2006). The vertical jump is typically used to measure only jump height. However, using a multiple regression equation, vertical jump can be used to determine peak and mean power output. Standing broad jump is another widely used test of anaerobic power. The standing broad jump is commonly used by coaches and physical educators to assess leg power (Hoffman). The main advantage of using the standing broad jump is that it is easy to administer and requires minimal space. The test is also easy to perform and non-invasive. The standing broad jump has also been widely used in addition to the vertical jump to assess explosive leg power. The standing broad jump has good face validity and reliability coefficients between .83 and .99 (Miller).

While the vertical jump and broad jump tests are well known and widely accepted, they are limited in that they only measure explosive power also known as peak anaerobic power. To gain a better picture of an athlete's ability, it may be necessary to use a test that measures power endurance or mean anaerobic power. The Bosco jump test is a very good test for measuring power endurance (Bosco et al., 1983). The reliability of the Bosco test has been reported as $r = .95$, and test-retest reliability of $\alpha = .87$ (Bosco et al.). The Bosco jump test is a repeated or rebound jumping test. The participants are required to jump repeatedly giving their maximal effort each time for a predetermined length of time, generally 60 s. Due to the fact that jumping is a more sports-specific task than bicycle riding for the majority of scholastic and collegiate sports, the Bosco jump test, rather than the Wingate cycle ergometer test, will be used to assess the participants of this study.

To measure the Bosco jump test the researcher must be able to measure the time spent in the air or on the ground accurately. The Optojump is an optical acquisition system that uses optical sensors to measure the time spent in the air or on the ground. The Optojump system can be used to compute vertical jump height and power output along with time in the air or on the ground. The Optojump system consists of two bars that can be placed any distance apart and will record any action taking place between the two bars via laptop computer. Essentially, the Optojump is a switch mat that records contact and flight times to within $1/1000^{th}$ s.

As the research suggests, self-efficacy and athletic performance are intertwined. It is the degree to which they are intertwined and the effect of one on the other that needs to be examined closer. It is believed that this study will begin to shed some light on the questions that remain.

CHAPTER III

METHODS

This chapter outlines how the experimental process was conducted, including statistical analysis. There are four sections: (a) participants, (b) pre-testing procedures, (c) testing procedures (d) instruments and (e) statistical analyses. The first section describes the sample that was studied and inclusion and exclusion criteria for participation. The second section discusses how testing conditions were assigned, how baseline self-efficacy data was obtained, and describes the dynamic warm-up. The third describes the actual details of how the experiment was executed and data recorded. The fourth section lists the instruments that were used in the gathering of self-efficacy information and the devices used to measure anaerobic power output. The fifth and final section discusses the statistical analyses used.

Participants

The participants (N = 47) for the study were a sample of convenience and included physically active males (n = 29) and females (n = 18) currently enrolled in physical education classes at Utah State University (USU). Average age for participants was 21.5 years with a range of 18-24 years. Subjects were recruited by word of mouth as well as announcements from their physical education instructors (Appendix A). The number of subjects was selected after conducting power analysis using R statistical software and is assuming an effect size of .6, power of .8, and a .05 alpha level.

Participants were screened, and if there was any recent history of injury or pregnancy they were excluded from the study because maximal effort jumping was required for the experiment. Also any potential participants who were currently collegiate athletes were excluded to try and control for outliers. Participants who were cognitively impaired were also excluded due to the possibility of confusion and liability issues with the informed consent. Participants who passed the initial screening were asked to sign an informed consent form (Appendix B) in accordance with the requirements of the Institutional Review Board at USU.

Pretesting Procedures

In order to ensure randomization to groups, participants blindly selected a slip of paper with a number from 1-48 printed on it. Even numbered slips (n = 23) were assigned to the control group while odd numbered slips (n = 24) were assigned to the experimental group. The experimental group had false results reported to them after the second trial to experimentally increase their self-efficacy. The control group had their true results reported to them after each trial. The researcher queried participants as to their age, and height and weight values were obtained for each individual participant (Appendix C) using a wall-mounted stadiometer (Seca, Hamberg, Germany) and a digital scale (Detecto Scales, Inc., Brooklyn, NY), respectively. Gender was also recorded. Once the researcher obtained the above information, each participant was asked to complete the Physical Self-Efficacy scale (PSE) (Ryckman et al., 1982) according to the directions printed on the cover page (see Appendix D). Participants who were in the presence of other participants while filling out the PSE were asked to find a private area away from other participants to ensure privacy and to encourage truthful answers.

After completing the PSE the participants performed a dynamic warm-up that mimicked the different components of running. The warm-up involved performing jumping jacks for 30 sec. Participants then performed 10 walking lunges, 10 reverse lunges, 10 single-leg Romanian dead swings (five each leg), 10 toy soldiers (five each leg), a high knee run over a distance of 10 yards, and a reverse high knee run over a distance of 10 yards. Each participant was instructed on proper technique before performing the warm-up exercises, and the researcher demonstrated each movement before the participants engaged in the movements.

Following the dynamic warm-up, each participant had their double-reach measured on the Vertec (Sports Imports, Columbus, OH) apparatus. This was the same instrument used to measure vertical jump heights during the actual experiment. Participants fully extended both arms overhead, hands overlapping, with their chin parallel to the floor and walked through the Vertec’s vanes. The Vanes are equally spaced out in half-inch intervals. The participants’ double-arm reach was determined to the nearest half inch by the highest vane touched after two trials. The researcher assisted in this process by placing his hands on the participant’s elbows to ensure full extension of the arms overhead.

Testing Procedures

Once pretesting procedures were completed for both groups, each participant was briefed on the testing procedures. Participants were tested wearing athletic shorts or pants such as warm-ups, t-shirt, and tennis shoes. Each group engaged in the exact same testing protocols and only the reporting of results varied. Testing of each participant occurred over a span of three separate days with a minimum of 48 hr and a maximum of 72 hr between tests. Participants performed three separate tests on all 3 days of testing.

Testing procedures were as follows.

Vertical Jump

Participants performed a counter movement jump from a stationary stance to achieve maximum height. Each participant stood directly under the vanes of the Vertec apparatus with their feet directly under their frame and weight evenly distributed. Participants raised their hands overhead and stood upright with legs fully extended. Participants then lowered their arms while lowering their center of mass. Participants then explosively extended their arms upward while jumping vertically to achieve maximum height. At the vertical apex of the jump the participant reached with a single arm and tried to move the highest vane possible. Participants were given approximately 20 s to regain their composure before attempting to improve on the previous performance. Participants repeated the vertical jump process three times. The best of the three trials was used for subsequent analysis.

Once maximum vertical jump height was achieved the researcher recorded the results by subtracting the double-arm reach height from the maximum jump height, as per the Vertec manufacturer’s suggestion. For example if the double-arm reach height is 12 inches and the maximum jump height is 38 inches than the maximum vertical jump height will be recorded as 26 inches.

Reliability coefficients of .98 and validity coefficients of .78 have been reported for the vertical jump (Markovic et al., 2004; Miller, 1994).

Standing Broad Jump

Participants performed a countermovement jump for maximum horizontal distance. Participants stood behind a pre-marked starting line with weight evenly distributed on feet spread approximately shoulder width apart straddling a 12 foot length of white athletic tape. Participants performed a countermovement by swinging their arms downward and backwards while bending at their hips and knees to lower their center of mass. While performing the countermovement, participants were instructed to produce a positive forward lean to help direct their momentum in a forward direction. Participants then explosively jumped forward attempting to achieve maximum distance. Participants performed three measured jumps for maximum distance. After each attempt the researcher marked the distance from the area of the body that is nearest the starting line. Measurements were then made using a tape measure from the starting line to the furthest mark on the tape, and this distance was recorded to the nearest quarter inch. The best of three trials were used for subsequent analysis. Standing broad jump has reported reliability coefficients ranging from .83 to .99, and has good face validity (Miller, 1994).

Bosco Jump Test

Participants were required to make repeated maximal vertical jumps over a span of 30-s. Although the original Bosco jump test (Bosco et al., 1983) is 60-s, the 30-s time period was used because the Wingate test, which is considered by many to be the gold standard in muscular endurance tests, is also a 30-s test. Participants were placed between two, meter long bars of an Optojump (Microgate, Bolzano, Italy) optical acquisition system. Participants bent their knees to approximately 90° of flexion. Participants then explosively jumped vertically before returning to the starting position. Participants jumped repeatedly, trying to maximize jump height while minimizing time on the ground. Participants received verbal encouragement as well as information pertaining to time left in the test. Time in the air was the outcome variable for subsequent analysis. Reliability of the Bosco jump test has been reported with a coefficient of .95 and a test-retest reliability of .87 (Bosco et al., 1983)

Participants were given 1-2 min between the different jumping protocols and were encouraged to keep moving to ensure that they did not become stiff. Testing was completed in the order that it appears above to control for any fatigue that may have been experienced during the Bosco test. This protocol is also supported by the National Strength and Conditioning Association, which suggests completing all power movements before endurance movements (Baechle & Earle, 2000).

Once all three tests were completed the data were collected and entered into an Excel file. Participants were notified of their values upon reporting for the second day of testing.

During the second day of testing participants repeated the procedures as reported above, but the researcher manipulated the outcomes for the experimental group by reporting a vertical jump value that was 2 inches higher than the true outcome. The 2-inch increment was chosen because the researcher felt that this would be a significant, but believable, increase for both trained and untrained participants. Results for the standing broad jump were altered by simply increasing the measured distance reported, by 2 inches. Again the 2-inch increment was chosen because the researcher felt that a 2-inch increase would be both significant and believable in both trained and untrained participants. Results from the Bosco jump test were altered by reporting a two second time in air increase to the participants. All three manipulated outcomes were made to try and increase self-efficacy by reporting a perceived success. An impartial research assistant who was also blind to the true nature of the experiment reported these manipulated outcomes to the participants. The research assistant was used to eliminate any effects and bias that the researcher may have had on the outcomes when talking to the participants. When reporting the results the assistant gave predetermined verbal reinforcement to each participant depending on the amount of increase of each test. For example if a participant saw a change of ± .5 inches on the vertical jump they were given neutral verbal reinforcement; however, if an increase of 2 or more inches was observed they were given positive verbal reinforcement. This was done to try and increase the self-efficacy of the experimental group.

On the third and final day of testing, participants were asked to complete the PSE again to assess change in their self-efficacy. After the PSE was administered the participants repeated the testing procedures trying to improve on their last performances on all three tests. Results were then analyzed to assess the effect of increased self-efficacy on the three anaerobic power measures.

Debriefing

Because this study had to employ deception in order to try and increase self-efficacy, participants did not immediately know the true nature of the study. Once the study was completed on the third day of testing, the researcher explained the true nature of the study. The researcher used the same debriefing statement (Appendix D) for all participants to avoid confusion and to give each participant a chance to ask questions and have them answered.

Instruments

The dynamic warm-up was performed on the gym floor in the Health, Physical Education and Recreation (HPER) building on the USU campus. The gym floor was clearly marked with athletic tape at 10-yard increments. The HPER gym was also used to administer all three tests. The Vertec apparatus was used to measure vertical jump height. The Vertec is an adjustable apparatus that can be raised or lowered to accommodate each participant based on his or her double-arm reach height. The standing broad jump used a 2-foot piece of athletic tape to designate the starting position. A 15-foot length of athletic tape was placed perpendicular to the starting line and served as a method to mark the jump distance. A regular carpenter's tape measure was used to actually measure the distance traveled. The Bosco jump test was administered using the 1-meter Optojump optical acquisition system. The Optojump utilizes two bars, each 1-meter in length. The bars can be set any distance apart and transmit information pertaining to time on the ground and time in the air during a series of jumps.

Statistical Analyses

A 3 x 2 mixed factor ANOVA with the within factor being testing done over three sessions and the between factor being the experimental group was conducted to assess the effects of self-efficacy on vertical jump, broad jump, and the Bosco jump test. Level of statistical significance was set at $p < 0.05$, and statistical computation was performed using SPSS 14.0 software.

CHAPTER IV

RESULTS

Participants (N = 47) completed all three tests on three separate occasions. For ease of analysis, testing days are referred to in the ANOVA tables as testing time.

Vertical Jump

The 3 x 2 ANOVA for vertical jump (see Table 1) showed that there was a significant main effect for within-subjects effects, F (1,46) = 8.191, p = .001, partial η^2 =.154. However, the interaction effect between the experimental groups and the testing time was not significant, F (1,46) = .049, p = .943, partial η^2 = .001, suggesting that groups did not differ in the amount of improvement from day one to day three. A test of between-subject effects showed a significant main effect between the groups, F (1,46) = 5.581, p = .023, partial η^2 = .11, suggesting that the groups differed significantly in overall performance. Means for vertical jump can be seen in Figure 1.

Broad Jump

The ANOVA showed no significant main effect in the test of within-subjects effects for broad jump improvement from day one to day three, F (1.927, 86.699) = .988, p = .374, partial η^2 = .021, nor was there a significant difference in the within-subjects group improvement, F (1.927, 86.699) = .033, p = .964, partial η^2 = .001. Broad jump distance did not change significantly across trials regardless of experimental group. A test of between-subjects effects also showed no significant difference between groups, F

(1,45) = 3.411, *p* = .071, partial η^2 = .07. See Table 2. Means for broad jump can be seen in Figure 2.

Table 1

ANOVA Summary Table for Vertical Jump Test

Within-Subjects Effects

Source	*SS*	*df*	*MS*	*F*	*p*	η^2
TestingTime	8.619	1.861	4.633	8.191	0.001	0.154
TestingTime * GRP	0.052	1.861	0.028	0.049	0.943	0.001
Error(TestingTime)	47.349	83.723	0.566			

Between-Subjects Effects

Source	*SS*	*df*	*MS*	*F*	*p*	η^2
Intercept	62127	1	62127	928.7	<.001	0.954
GRP	373.34	1	373.3	5.581	0.023	0.11
Error	3010.2	45	66.89			

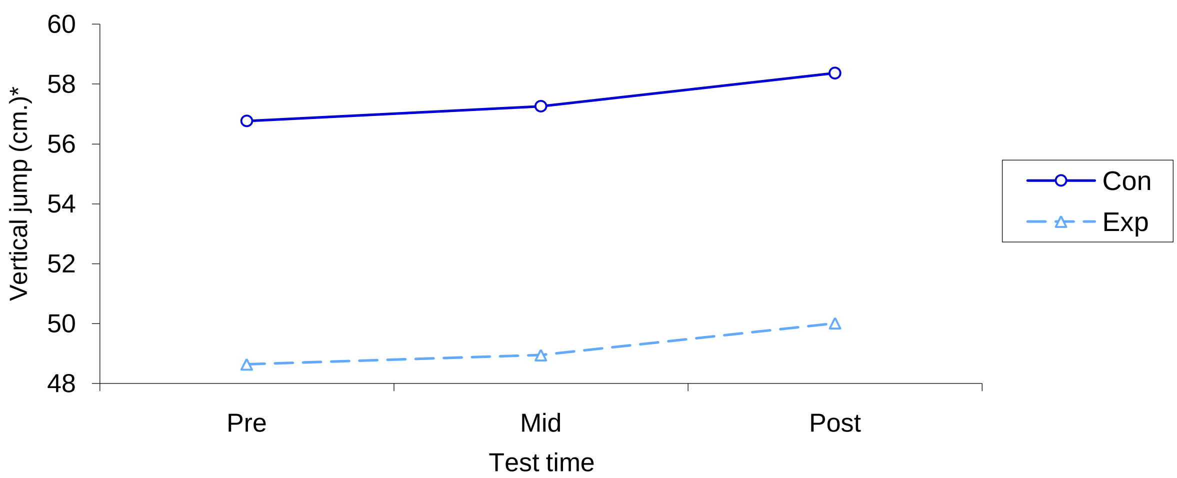

Figure 1. Means for vertical jump as a function of testing time. Testing days 1, 2, and 3 are coded pre, mid and post respectively. * Vertical jump measured using Vertec device, which uses English system of measurement (in).

Table 2

ANOVA Summary Table for Broad Jump Test

Within-Subjects Effects

Source	*SS*	*df*	*MS*	*F*	*p*	η^2
TestingTime	16.732	1.927	8.684	0.988	0.374	0.021
TestingTime * GRP	0.561	1.927	0.291	0.033	0.964	0.001
Error(TestingTime)	761.9	86.70	8.788			

Between-Subjects Effects

Source	*SS*	*df*	*MS*	*F*	*p*	η^2
Intercept	1018464.584	1.000	1018464.584	1558.538	0.000	0.972
GRP	2229.265	1.000	2229.265	3.411	0.071	0.070
Error	29406.353	45.000	653.475			

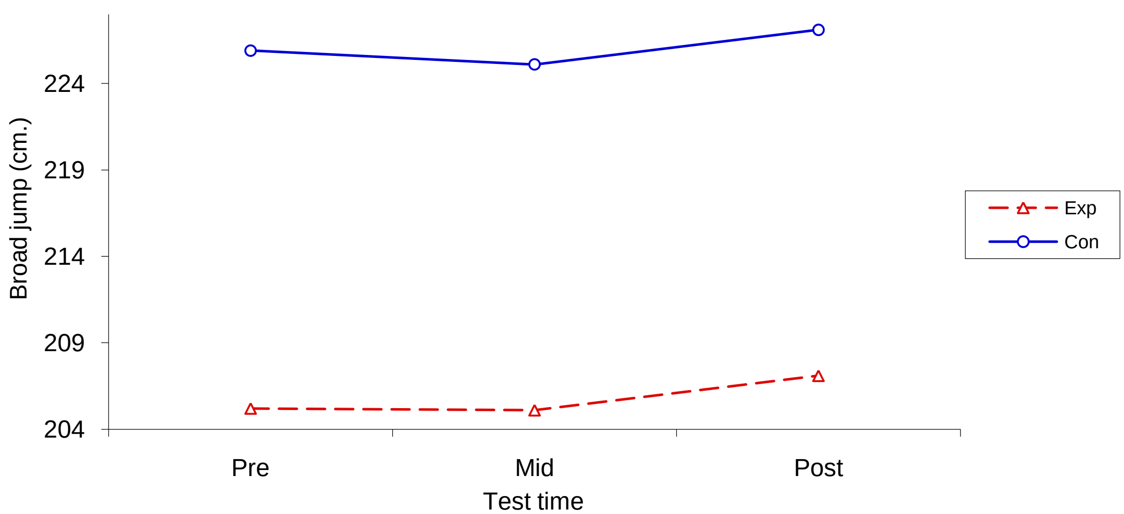

Figure 2. Means for broad jump as a function of testing time. Testing days 1, 2, and 3 are coded pre, mid and post, respectively.

Bosco Jump Test

The ANOVA showed a significant main effect for within-subject effects, *F* (1.444, 64.977) = 27.579, *p* = <.001, partial η^2 = .38, indicating a significant improvement from day one to day three for the sample (see Table 3). Also, there was a significant difference in the amount of improvement for each group, *F* (1.444, 64.977) = 5.358, *p* = .014, partial η^2 = .106, suggesting that the groups (control vs. experiment) improved by different amounts. This difference is depicted in Figure 3 which shows the mean values for the Bosco test. A test of between-subjects effects found that there was no significant difference between the groups for the Bosco test, *F* (1,45) = 2.882, *p* = .096, partial η^2 = .06.

Table 3

ANOVA Summary Table for Bosco Jump Test

Within-Subjects Effects

Source	*SS*	*df*	*MS*	*F*	*p*	η^2
TestingTime	37.189	1.444	25.755	27.579	0.000	0.380
TestingTime * GRP	7.225	1.444	5.004	5.358	0.014	0.106
Error(TestingTime)	60.681	64.977	0.934			

Between-Subjects Effects

Source	*SS*	*df*	*MS*	*F*	*p*	η^2
Intercept	53010.135	1.000	53010.135	5233.997	0.000	0.991
GRP	29.187	1.000	29.187	2.882	0.096	0.060
Error	455.762	45.000	10.128			

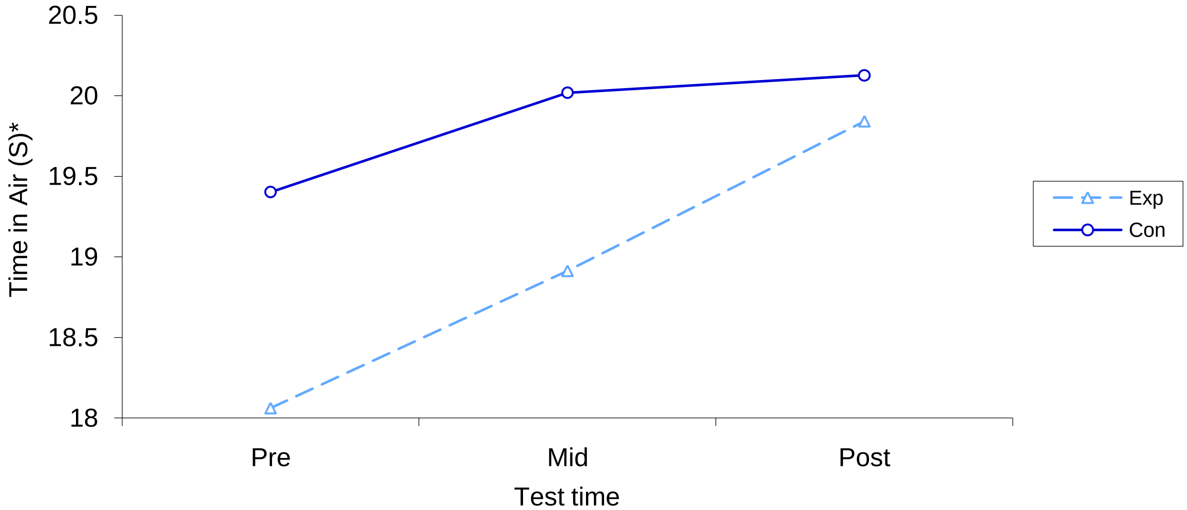

Figure 3. Means for Bosco jump test as a function of testing day. Testing days 1, 2, and 3 are coded pre, mid and post, respectively,*Time in Air refers to time spent in the air over a 30-sec. period.

Physical Self-Efficacy Scale

Self-efficacy, as measured by the Physical Self-Efficacy Scale (PSE), was measured for each participant prior to the first and third day of testing. Means and percentage differences were calculated to assess change for each group from day one to day three. Mean PSE scores for each group can be seen in Figure 4. Means, standard deviations, and percent change, calculated as $M_2 – M_1 / M_1$ for each group, can be viewed in Table 4.

Figure 4 and Table 4 indicate a slight increase in self-efficacy for both groups, with a larger increase for the experimental group. While, the group interaction was not significant after a 2 X 2 ANOVA was conducted, it is practically relevant when compared to previous research using the PSE (Ryckman et al., 1982)

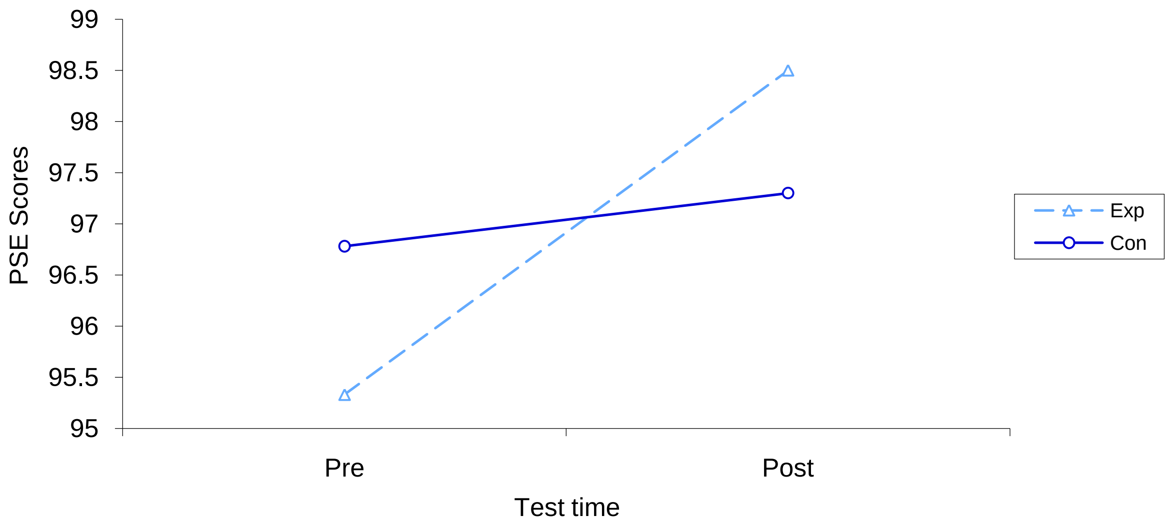

Figure 4. Means for PSE as a function of time. Testing days 1 and 3 are labeled pre and post, respectively.

Table 4

(PSE) Mean, Standard Deviation and Percent Change Values

Group	M_1	M_2	SD_1	SD_2	% Change
Experimental	95.33	98.5	11.224	11.413	3.32%
Control	96.78	97.3	12.817	12.086	.054%

CHAPTER V

DISCUSSION

The purpose of this study was to determine the effects of increased self-efficacy on jump performance which is often used as an indicator of anaerobic power. Two types of anaerobic power were considered: explosive and endurance. First, peak or explosive power was evaluated by having participants perform a vertical jump test as well as a standing broad jump test. These tests involved a single maximal effort lasting only a fraction of a second. Second, mean or power endurance was examined by having participants complete a Bosco jump test in which participants performed a series of maximal vertical jumps over a period of 30 s. Participants (N = 47) were required to perform all three tests on three separate occasions.

Participants were assigned to either a control group (n = 23) or a treatment group (n = 24). Participants in the treatment group had false (better) results reported to them on day three for their tests performed on day two.

Self-efficacy was also measured to assess change from day one to day three. The Physical Self-Efficacy Scale (PSE) was administered prior to participation on day one and was administered on day three after results were reported for day two.

It is important to note that all participants were novices with respect to the three jumping tests as well as the PSE; no previous training was given prior to the first day of testing. Because of this, a slight learning curve effect was noticed for all three jump tests from day one to day two; however, this did not interfere with the most significant effects which occurred from day one to day three.

Research Hypotheses

Three separate hypotheses were tested during this study and are as follows:

1. Scores on a self-efficacy test (PSE) will increase significantly from pre to post test for the treatment group but not the control group.
2. Scores on the anaerobic power performance tests (jump tests) will increase significantly from pre to post test for the treatment group but not the control group.
3. The treatment group will have a significantly greater increase in self-efficacy and anaerobic power test scores compared to the control group.

Hypothesis 1

Scores for the PSE increased by a larger amount for the treatment group than the control group. The treatment group saw an average increase of 3.17 points from pre- to posttest, an overall increase of 3.32%, while the control group remained nearly unchanged with a slight increase of 0.52 points from pre- to posttest, an overall increase of 0.054%. Previous research conducted by Ryckman et al. (1982) reported average test-retest scores decreased 1.5%. This suggests that the 3.32% increase experienced by the treatment group is a meaningful increase in self-efficacy.

Hypothesis 2

Vertical Jump and Standing Broad Jump Tests. Scores for the vertical jump test showed a significant increase for both groups from day one to day three. However, no significant difference was found in the amount of improvement between the control and experimental group. The increase from day one to day three can be attributed to the learning curve effect discussed earlier. Analysis also showed a significant difference in the overall performance of each group, meaning one group, the control group, was much better overall on the vertical jump to start with. This difference can be explained if the gender makeup of each group is considered. The control group (n = 23) was made up of 17 males and 6 females while the treatment group (n = 24) was made up of 12 males and 12 females. The difference in the number of males in the control group versus the number of males in the treatment group might explain the difference in overall performance between the two groups.

Analysis of the standing broad jump showed that neither group improved significantly from day one to day three. Group performance was also found to be insignificant meaning no difference in overall performance was found.

These findings for the vertical jump and standing broad jump tests suggest that increased self-efficacy has no effect on lower-body explosive power. These findings contradict the findings of Fitzsimmons et al. (1991) who studied the effects of self-efficacy on weightlifters. Fitzsimmons et al. found that increased self-efficacy led to increased anaerobic power output (explosive power) on upper-body weightlifting exercises.

One plausible theory for why there is a discrepancy between the findings of this study and the Fitzsimmons study is that in the Fitzsimmons study, participants were blind to their performance. What this means is that participants did not know the amount of weight being lifted on each trial and thus could not visually tell if the weight they were attempting was in fact more than they had attempted prior. Because the participants did not know how much they were lifting they could not mentally limit their performance.

During the vertical and broad jump trials in the present study, participants could visualize their previous performance by seeing the highest vane they had touched, or by figuring out the height of the past days' jumps. This could have limited their true potential by giving them an idea of their vertical jump limit, instead of them not knowing how high they could jump. Future research could employ the use of an overhead target that is higher than their previous best performance to see if there is a "target effect".
No previous research has been conducted to examine the effects of self-efficacy on lower-body explosive power. Based solely on this study, it can be theorized that self-efficacy has no effect on lower body explosive power. However, this relationship between self-efficacy and lower-body explosive power should be examined more closely with a longer, more intensive study to establish the effects of self-efficacy on lower-body explosive power.

Bosco Jump Test. Unlike the vertical jump and standing broad jump tests, analysis of the Bosco jump test showed that not only was there a significant improvement from day one to day three but also there was a significant difference in the amount of improvement between groups from day one to day three. Just like the vertical jump test, both groups improved from day one to day two by a similar amount; however, from day two to day three (after giving falsely high scores to the treatment group in an attempt to bolster their self-efficacy) the treatment group saw a much greater improvement compared to the control group. It is expedient then to believe that the treatment did in fact affect the performance of the treatment group on the Bosco jump test.

This finding, that increased self-efficacy resulted in an increase in power endurance performance, is supported by a study conducted by Gernigon and Delloye

(2003). In their study, Gernigon and Delloye found that when elite sprinters had their 60m sprint times experimentally decreased (made faster) that their resulting self-efficacy increased, and thus their future 60 m sprint times decreased. Although the duration of these two tests are different (60 m sprint vs. 30-s. Bosco test), they can both be thought of as tests of power endurance because each requires a sustained maximal effort over a prolonged period of time, unlike the vertical jump or standing broad jump tests which only last a fraction of a second. The findings from the Bosco test match up perfectly with the findings from Gernigon and Delloye. Thus, it is possible to state that increased self-efficacy can increase power endurance performance.

Hypothesis 3

After considering all analyses, it is evident that the scores for self-efficacy as well as the scores for the anaerobic power tests increased more for the treatment group than the control group. The control group saw no significant increases when compared to the treatment group while the treatment group saw a significant increase in self-efficacy as well as a significant increase for the 30-s. Bosco test. Neither group saw a significant increase in the vertical jump or the standing broad jump tests. These findings make it reasonable to believe that increased self-efficacy can significantly affect lower-body power endurance but not lower-body explosive power.

A plausible explanation of why self-efficacy affects lower-body power endurance but not explosive power relates to the theory stated previously. During a sprint as in the Gernigon and Delloye (2003) study, or the 30-s Bosco test, participants cannot accurately assess their performance. Participants can not visualize or measure the amount of time they spend in the air, nor can they measure the exact amount of time it takes them to complete a sprint. Because of this inability to measure performance it is possible to elicit small unperceivable performance improvements, which, over a period of time add up to a significant improvement. However, in tests such as the vertical and broad jumps which occur over a fraction of a second, it is indeed possible to visualize or measure past and current performances and thus much harder to elicit those small changes in performance.

Limitations

There were five main limitations observed during the experiment process. These limitations are a follows.

1. The sample size for this experiment was $N = 47$. While this sample was indeed large enough to obtain the proper statistical power it was not large enough to confidently generalize the results to the general population. A larger sample size could also help lower the chance of outliers affecting the data.
2. The Physical self-efficacy scale could be viewed as a limitation because the scale was not developed with this particular use in mind; therefore, theoretically there could be a better scale that could be used to measure self-efficacy as it pertains to this specific experiment.
3. The study was conducted over a 1-week period. This is a limitation in that self-efficacy manipulation was too quick and more subtle approaches must be used in order to attain the desired effects. If a longer study was conducted a slower more subtle and possibly more permanent change in self-efficacy could take place, and thus may alter the results.

4. This study involved only novice athletes; elite athletes were excluded from this study to try and control for outliers. If a study were conducted that was more inclusive, it would be much more applicable to athletics than is the current study. Without the testing of elite athletes, generalizing to the athletic world can be nothing more than speculation.
5. The gender difference between the treatment and control groups. The groups could have been matched or equalized for gender

Future Research

After conducting this study there are a few suggestions that could be used to improve future research in this area, these suggestions are listed below.

1. A larger more inclusive sample is needed to assess the differences among the population. This study used a sample of N = 47 which did not include elite athletes. A larger more inclusive sample could help determine what, if any, impact self-efficacy has on people of different athletic abilities. Also, a larger sample size can help decrease the risk for errors and help control for any outliers that might skew the data.
2. A more longitudinal study is needed to assess the change to self-efficacy. This study was conducted over a one week time period which limited the amount of treatment that could be given and could have affected the results. A more longitudinal study conducted over a period of many weeks or months could allow researchers to manipulate self-efficacy in a slower and more subtle way. The slower and more subtle manipulation could result in a more significant increase in

self-efficacy because it would be easier for the participant to attribute the perceived successes to more internal stable causes, and thus the change in self-efficacy could be more permanent resulting in greater increases in performance.

3. As discussed earlier, it is hypothesized that because participants could visualize their results from each of the vertical and broad jump tests that a visual limiting effect could have been a factor in why participants did not see a significant increase in performance for these two tests. This limiting effect could be controlled for by keeping the participants blind in regard to their results. This could be done for the vertical jump by using a switch mat to measure time in the air. With this information as well as the participants' height and weight data, vertical jump height could be derived. As for the broad jump, simply having participants jump on an unmarked surface could eliminate any visual targets from which the participants could gauge their jump distance.

Conclusion

The fact that increased self-efficacy can significantly effect power endurance should be taken into consideration when training athletes to perform in power endurance sports such as football, basketball, volleyball, etc. Better performance may not be determined by weights lifted but rather by self-efficacy beliefs about the task at hand. This claim is substantiated by Bandura's beliefs regarding past enactive mastery experiences and supported by Weiner's causal attribution theory (Bandura, 1997; Weiner, 1992). Bandura believed that if a person had previous experiences involving a specific task that the person would subconsciously judge his or her likelihood of being successful on the next attempt. If the previous attempt was successful and they attributed that success to internal stable causes, meaning that they believed they were solely responsible for that outcome and that they are skilled in that area, then the future outcomes are likely to be better and more successful. Conversely, if they viewed the previous attempt as unsuccessful, future attempts would likely be unsuccessful as well. These findings

REFERENCES

Baechle, T.R., & Earle, R.W. (2000). *Essentials of strength training and conditioning* (2nd ed.). Champaign, IL: Human Kinetics.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory.* Englewood Cliffs, NJ: Prentice Hall.

Bandura, A. (1997). *Self-efficacy: The exercise of control.* New York: Freeman.

Bond, K.A., Biddle, S.J.H., & Ntoumanis, N. (2001). Self-efficacy and causal attribution in female golfers. *International Journal of Sport Psychology, 31,* 243-256.

Bosco, C., Luhtanen, P., & Komi, P.V. (1983). A simple method for measurement of mechanical power in jumping. *European Journal of Applied Physiology and Occupational Physiology*, *50*, 273-282.

Brodt, V. (2006). *Comparison of vertical jump with and without drop-step in male college athletes.* Unpublished master's thesis, Utah State University, Logan.

Duda, J.L., & Tappe, M.K. (1988). Predictors of personal investment in physical activity among middle-aged and older adults. *Perceptual and Motor Skills, 66,* 543-549.

Duncan, T., & McAuley, E. (1987). Efficacy expectations and perceptions of causality in motor performance. *Journal of Sport Psychology, 9,* 385-393.

Enoka, R.M. (2002). *Neuromechanics of human movement* (3rd ed.). Champaign, IL: Human Kinetics.

Feltz, D.L. (1988). Self-confidence and sports performance. *Exercise and Sport Science Reviews, 16,* 423-457.

Feltz, D.L., Landers, D.M., & Raeder, U. (1979). Enhancing self-efficacy in high avoidance motor tasks: A comparison of modeling techniques. *Journal of Sport Psychology, 1,* 112-122.

Feltz, D.L., & Lirgg, C.D. (2001). Self-efficacy beliefs of athletes, teams, and coaches. In R.N. Singer, H.A. Hausenblas, & C.M. Janelle (Eds.), *Handbook of sport psychology* (2nd ed., pp. 340-361). New York: Wiley.

Fitzsimmons, P. A., Landers, D. M., Thomas, J. R., & van der Mars, H. (1991). Does self-efficacy predict performance in experienced weightlifters? *Research Quarterly for Exercise and Sport, 62,* 424-431.

Gernigon, C., & Delloye, J. B. (2003). Self-efficacy, causal attribution, and track athletic performance following unexpected success or failure among elite sprinters. *The Sport Psychologist, 17,* 55-76.

Gernigon, C., Fleurance, P., & Reine, B. (2000). Effects of uncontrollability and failure on the development of learned helplessness in perceptual-motor tasks. *Research Quarterly for Exercise and Sport, 71,* 44-54.

Grove, J.R., Hanrahan, S.J., & McInman, A. (1991). Success/failure bias in attributions across involvement categories in sport. *Personality and Social Psychology Bulletin, 17,* 93-97.

Grove, J.R., & Pargman, D. (1986). Attributions and performances during competition. *Journal of Sport Psychology, 8,* 129-134.

Hoffman, J. (2006). *Norms for fitness, performance, and health.* Champaign, IL: Human Kinetics.

Markovic, G., Dizdar, D., Jukic, I., & Cardinale, M. (2004). Reliability and factorial validity of squat and countermovement jump tests. *Journal of Strength and Conditioning Research, 18*, 551-555.

McAuley, E. (1985). Success and causality in sport: The influence of perception. *Journal of Sport Psychology, 7,* 13-22.

McAuley, E. (1992). Self-referent thought in sport and physical activity. In T.S. Horn (Ed.), *Advances in sport psychology* (pp. 101-118). Champaign, IL: Human Kinetics.

McAuley, E., & Gross, J. B. (1983). Perceptions of causality is sport: An application of the causal dimension scale (CDSII). *Personality and Social Psychology Bulletin, 18,* 566-573.

McGee, K.J., & Burkett, L.N. (2003). The National Football League Combine: A reliable predictor of draft status? *Journal of Strength and Conditioning Research, 17,* 6-11.

Miller, D. K. (1994). *Measurement* (2nd ed.). Dubuque, IA: Brown & Benchmark.

Miller, D. T., & Ross, M. (1975). Self-serving biases is the attribution of causality: Fact or Fiction? *Psychological Bulletin, 82*, 213-225.

Moritz, S. E., Feltz, D. L., Fahrbach, K. R., & Mack, D. E. (2001). The relation of self-efficacy measures to sport performance: A meta-analytic review. *Research Quarterly for Exercise and Sport, 71,* 280-294.

Orbach, I., Singer, R. N., & Murphey, M. (1997). Changing attributions with an attribution training technique related to basketball dribbling. *The Sport Psychologist, 11,* 294-304.

Rudisill, M. E., & Singer, R. N. (1988). Influence of causal dimension orientation on persistence, performance and expectations of performance during perceived failure. *Research Quarterly for Exercise and Sport, 60,* 166-175.

Ryckman, R. M., Robbins, M. A., Thornton, B., & Cantrell, P. (1982). Development and validation of a physical self-efficacy scale. *Journal of Personality and Social Psychology*, 42, 891-900.

Sands, W. A., McNeal, J. R., Ochi, M. T., Urbanek, T. L., Jemni, M., & Stone, M. H. (2004). Comparison of the Wingate and Bosco anaerobic tests. *Journal of Strength and Conditioning Research*, 18, 810-814.

Schunk, D. H., & Cox, P. D. (1986). Strategy training attributional feedback with learning disabled students. *Journal of Educational Psychology, 78,* 201-209.

Skinner, E. A. (1996). A guide to constructs of control. *Journal of Personality and Social Psychology*, *71*, 549-570.

Weiner, B. (1992). *Human motivation: Metaphors, theories, and research* (2nd ed.). Thousand Oaks, CA: Sage.

APPENDICES

Appendix A

Participant recruiting announcement

Activity Class Instructors Please Announce To You Students.

PARTICIPANTS NEEDED!!!

Dr. Dale Wagner and Justin Jackson are conducting a study to validate three separate anaerobic tests. They need approximately 48 participants, male and female. All participants will be required to be between 18 and 24 years of age, current collegiate athletes, those who are pregnant, and those who are cognitively impaired may not participate. Also if you have had a joint injury within the past 6 months you may not participate.

All participants will be asked to participate in three separate jumping tests, vertical jump, standing broad jump and a rebound jumping test. Participants will be informed of all of their results and will be informed of their power output as measured by the rebound-jumping test.

If you are interested please contact Justin Jackson at 435 213 0135 or drop by his office HPER 161.

Thanks!

Appendix B

Informed Consent
Cross Validation of Anaerobic Measures

Introduction: Dr. Dale Wagner in the Health, Physical Education, and Recreation Department at Utah State University and Justin Jackson, a graduate student are conducting a research study in which three separate anaerobic power measures will be used to create validation data for each of the three tests. Anaerobic power output is an important part of physical activity, and vertical jump, standing broad jump, and Bosco jump test are commonly used to assess this power. However, very little data exists validating these tests. By validating these tests against one another we will be able to create empirical data to show that these test are indeed valid.

Procedures: Once you have read and signed this informed consent form, you will be asked to draw a participant number out of a hat which will be the only identification info taken by the researchers. Next, researchers will gather your weight, height, age, and gender data. Once this is completed you will be asked to complete a survey that will ask questions about your personal values as they pertain to exercise. This is simply to assess your attitudes towards the tasks at hand, and you are encouraged to answer openly and honestly. Once the survey is completed you will hand it to the researcher and he will ensure that your data is not viewed by anyone beside himself. Following the survey you will be directed through a dynamic warm-up by the researcher and will then have each of the three tests explained to you in detail until you are comfortable in executing the test. Each test will take approximately 6 minutes to complete, with a 2-minute break given between each separate test. You are required to repeat the actual tests 3 separate times on three separate days. Upon arrival on your second and third day your results from the previous test will be reported to you.

New Findings: During the course of the study, you will be informed of any significant new findings, such as changes in the risks or benefits resulting from your participation in the study, or new alternatives to participation, which may cause you to change your mind about participating in this study. If new information is provided to you, including a change in the purpose of the study, at any point before during or after your participation your consent to continue participating or use previously recorded data in the study will be obtained again.

Risks and Discomfort; There are no anticipated risks in participating in this study. However, there are a few unlikely potential sources of risk including but not limited to; Injury during landing after one of the jumps, cardiac problems resulting from over exertion. If you have any medical questions or concerns please inform the researcher prior to participating.

Care if Harmed: In the event you sustain an injury from your participation in this research study, Utah State University can reimburse you for emergency and temporary medical treatment not otherwise covered by your own insurance. If you believe that have sustained an injury as a result of your participation in this research study, please contact the Institutional Review Board Office at (435) 797-1821**.**

Benefits: This study will help to identify valid measures of anaerobic power and will help to create a standard protocol in measuring anaerobic power. For you individually it will inform you as to your own anaerobic power output numbers. Upon request I will provide a summary of your results as well as the results of the study.

Explanation & Offer to Answer Questions: Justin Jackson has explained this study to you and has given you time to ask questions and has provided answers to the best of his ability. If you have other research-related questions you may reach Justin in his office HPER 161 MWF 12:30pm – 1:30pm.

Confidentiality: Research records will be kept confidential to be consistent with state and federal regulations. Only the researcher will have access to the data and it will be kept in a locked desk drawer in a secure room. Your name will be replaced with the participation number you draw at the beginning of the study and no names will be recorded to minimize risk. The results of the study may be presented at professional meeting and in professional journal as quantified data only.

Voluntary Nature of Participation and Right to Withdraw: Participation in this research study is completely voluntary. You may refuse to participate or withdraw at any time without consequences or loss of benefits. You may be withdrawn form this study at anytime without your consent by the researcher under the following circumstances:

1. In the event that a physical injury should occur that is perceived by the researcher as a risk to the participant or the validity of the study.
2. If you fail to follow research procedures
3. If you do not participate in all three days of testing.

IRB Approval Statement: The Institutional Review Board (IRB) for the protection of human subjects at Utah State University has reviewed and approved this research project. If you have any questions about your rights or concerns regarding this study you may contact the IRB Office at (435) 797-1821.

Copy of Consent: You have been given two copies of this Informed Consent. Please sign both copies and retain one for your files.

Researcher Statement: “I certify that the research study has been explained to the individual whose signature appears below, by me or my research staff, and that the individual understands the nature and purpose of the study as describe above as well as the risks and benefits associated with taking part in this study. Any questions that have been raised have been answered”.

______________________________ ______________

Dale Wagner, Ph.D. Date
Principal Investigator
(435) 797-8253

______________________________ ______________

Justin Jackson, CSCS Date
Research Assistant

Signature of Participant: By signing below I agree to participate.

______________________________ ______________

Signature of Participant Date

Appendix C

Data Collection sheet

Participant # ________________ Group________________

Consent form: Y / N

Height: _______inches ________cm

Weight: _______lbs ________kg

Age: _____yrs

Sex: M / F

PSE: Y / N

Double arm reach: ________inches

Vertical Jump:
Trial 1 _________inches

Trial 2 _________inches

Trial 3 _________inches

Broad Jump:
Trial 1 ___________inches

Trial 2 ___________inches

Trial 3 ___________inches

Bosco Jump Test:

Time in air ___________seconds

Mean power ___________Watts

APPENDIX D

Physical Self-Efficacy Scale

PERSONAL VALUE SURVEY

This questionnaire is a series of attitude statements about you. We are interested in the extent to which you agree or disagree with them.

Please read each statement carefully. Then indicate the extent to which you agree or disagree with each statement by putting a number from 1 to 6 in the blank space to the right of the statement. The numbers and their meanings are indicated below:

If you agree strongly -1
If you agree somewhat -2
If you agree slightly -3
If you disagree slightly -4
If you disagree somewhat -5
If you disagree strongly -6

If you find that the numbers to be used in answering do not adequately indicate your opinion, please use the one which is closest to the way you feel.

Please turn the page and begin.

If you agree strongly -1
If you agree somewhat -2
If you agree slightly -3
If you disagree slightly -4
If you disagree somewhat -5
If you disagree strongly -6

1. I have excellent reflexes.
2. I am not agile and graceful.
3. I am rarely embarrassed by my voice.
4. My physique is rather strong.
5. Sometimes I don't hold up well under stress.
6. I can't run fast.
7. I have physical defects that sometimes bother me.
8. I don't feel in control when I take tests involving physical dexterity.
9. I am never intimidated by the thought of a sexual encounter.
10. People think negative things about me because of my posture.
11. I am not hesitant about disagreeing with people bigger than me.
12. I have poor muscle tone.
13. I take little pride in my ability in sports.
14. Athletic people usually do not receive more attention than me.
15. I am sometimes envious of those better looking than myself.
16. Sometimes my laugh embarrasses me.
17. I am not concerned with the impression my physique makes on others.
18. Sometimes I feel uncomfortable shaking hands because my hands are clammy.
19. My speed has helped me out of some tight spots.
20. I find that I am not accident prone.
21. I have a strong grip.
22. Because of my agility I have been able to do things which many others could not do.

Appendix E

Debriefing Statement

Thank you for participating in this study. You have been under the belief that this study was validating three anaerobic measures, however in truth this has been an experimental study assessing the effects of self-efficacy on anaerobic measures. During this study you were randomly assigned to one of two groups either an experimental group or a control group. If you drew an even numbered slip, your experimental I.D., then you were placed in the control group; if you drew an odd numbered slip you were in the experimental group.

Control Group

If you were in the control group your participation in this study was just as it seemed. Your results of your jump tests were not altered in any way when they were reported to you. The personal belief questionnaire that you filled out was actually a Physical Self-efficacy scale developed by Ryckman et. al. Your data were used to compare/contrast to the experimental group.

Experimental Group

If you were in the experimental group your participation in this study involved deception. Deception had to be used in this study to try and increase self-efficacy without your knowledge. Your results from the second day of testing, reported to you on the final day of testing were altered. Your results were inflated by two inches on the vertical jump and standing broad jump, and by 2 seconds on the Bosco jump test. The falsifying of your results was done in an attempt to increase your self-efficacy. Your self-efficacy was experimentally increased to assess if the increase would have any effect on your physical performance on the three jump tests.

Questions

If you have any questions about the study, what group you were assigned to, your true results for the second day or if you would like to see the results of this study feel free to contact Justin Jackson at 435-213-0135 or Dr. Wagner at 435-797-8253.