ABSTRACT

BARTON, K. A. The effect of mental imagery on sport climbing performance of college students. MS in Exercise and Sport Science-Pedagogy, August 1996, 85pp. (J. Steffen)

This study was designed to determine if mental imagery techniques with physical practice can aid the improvement of sport climbing performance. The sample included 47 male and female Ss (18-27 yr). Subjects were self-assigned into either a control (n = 22) or treatment (n = 27) group. Groups were determined via a coin toss. Subjects completed a sport climbing performance test before and after the training program. Treatment subjects participated in a total of 100 minutes of mental imagery techniques during the 10 day program. Results of the 2-way ANOVA indicated no significant (p > .05) interaction for gain score performance between the variables of gender and treatment, no significant (p > .05) difference for gain score performance between males and females by control and treatment groups, and no significant (p > .05) difference for gain score performance between the control and treatment groups. Pearson product-moment correlations indicated no significant (p > .05) correlations between the variables of age, height, weight, gender, and gain score performance.
THE EFFECT OF MENTAL IMAGERY
ON SPORT CLIMBING PERFORMANCE
OF COLLEGE STUDENTS

A THESIS PAPER PRESENTED
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MASTER OF SCIENCE DEGREE

BY
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We recommend acceptance of this thesis in partial fulfillment of this candidate's requirements for the degree:

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The candidate has successfully completed the thesis final oral defense.

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Finally, I would like to dedicate this thesis to my father, who I miss very much, but I know is with me daily. I would also like to dedicate this thesis to my dog, and best friend, Ozzy. Without him I do not know where I would be today.
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CHAPTER 1
INTRODUCTION

The focal point of learning and developing a physical skill for both athletics and recreational activities is physical practice. Pangrazi and Dauer (1992) stated, "During practice, the learner receives ongoing feedback, eliminates errors, and makes necessary adjustments" (p. 36). Physical practice and the neuromuscular changes that occur in the muscle during practice can influence improved performance. Other factors that could contribute to superior performance in athletics include: a) muscular strength and endurance, b) flexibility, c) cardiovascular endurance, d) limb length, and e) body mass or height-weight ratio.

Physical practice is usually emphasized when learning to rock climb. Wescott (1992) found that practicing rock climbing two times a week for seven weeks improved body composition, joint flexibility, and muscular strength. However, along with physically practicing for an activity, such as rock climbing, mental practice has been found to be effective in increasing the motor or sport performance of both novice and elite performers (Feltz & Landers, 1983).
Rock climbing as a recreational activity has challenged individuals for generations. Due to an increasing interest in this activity, classes of climbing difficulty were developed in the 1930's by the Sierra Club describing equipment and technique needed on a route (Loughman, 1981). With more rock climbers, the competitive nature inherent in humans turned this recreational activity into a competitive sport for many individuals. Competition climbing began in the mid 1970's in Soviet bloc countries (Darmi, 1992). Competitions were held on natural rock surfaces and judged by the speed it took a climber to reach the summit (Darmi, 1992).

In the 1980's modern sport climbing began (Skinner & McMullen, 1993). Sport climbing makes use of man made climbing walls that have permanent bolts placed for protection. Permanent bolts, such as carabiners, are equipment used to aid the climber while ascending a wall. These walls are used instead of natural rock surfaces which have no permanent bolts. Just like competition climbing on natural rock surfaces, sport climbing competitions began. These competitions were held on artificial climbing walls and use both speed and difficulty to determine a winner (Darmi, 1992).

Artificial climbing walls tend to be more physically demanding than real rock because they do not have positions at which one can rest (Long, 1994). Individuals who participate in sport climbing competitions need physical
and mental preparation because a climber is not only challenged against the rock, but climber against climber. Therefore, it is important for a climber to become familiarized with the skills and techniques needed for optimal performance.

Research has shown that the techniques used for mental imagery increase motor and sport performance (Corbin, 1967; Feltz & Landers, 1983; Grouios, 1992; Lejeune, Decker, & Sanchez, 1994; Meyers, Schleser, & Okwumabua, 1982; Weinberg, Chan, & Jackson, 1983; Wyatt & Ranero, 1993). Sport psychologists and researchers have paid much attention to this fact over the past 20 years. Thus, a new form of preparing for an activity has emerged.

Garfield and Bennett (1984) investigated why the Russians won so many gold medals during the 1976 Olympics. While working with Soviet researchers Garfield was subjected to the mental training Soviet athletes endured. Through his participation as a subject in a weight lifting experience, Garfield concluded that his performance improved considerably as a result of mental imagery.

To further support the notion that mental imagery can improve performance, Grouios (1992) reported that mental practice significantly affected diving performance in a positive manner. In one of the many studies concerning basketball, Weinberg et al. (1983) reported improvement in basketball free throw shooting.
With research that supports mental imagery as a psychological training technique which improves performance, many coaches and athletes use various training methods to improve mental imagery. One recent training method which incorporates many of the principles of mental imagery is a four step Mental Conditioning Program developed by Curtis (1991) and found in his book *The Mindset for Winning*.

The four step program involves relaxation, positive affirmation statements, mental recall, and mental rehearsal. The advantage of this program is that it is easily understood and not overly time consuming. Furthermore, due to its minimal time commitment, it can be beneficial for athletes in a classroom setting as a supplement to physical practice. The Mental Conditioning Program combines relaxation and mental imagery and is a way for athletes to use the mind's power in conjunction with physical training methods to achieve optimal performances.

Research also supports the notion that relaxation combined with mental imagery improves performance. The combination was found to improve a basketball defensive skill during game situations (Kendall, Hrycaiko, Martin, & Kendall, 1990). Relaxation and mental imagery was also found to influence the acquisition of the golf putt (Meaoci & Price, 1985). Therefore, for this study, sport climbers were taught relaxation techniques to learn to control their bodies' movements through awareness of the mind. Thus, a climber will not be as intimidated by the rock because the
climber will be able to completely focus on the task at hand, such as climbing to the summit of a route.

By slowing down the mind during the relaxation phase of the Mental Conditioning Program the climber can then use mental imagery to implant new images of success into the subconscious mind. In a study by Burhans, Richman, and Bergey (1988) runners were taught to imagine themselves crossing the finish line ahead of competitors. As a result, running speed improved.

With new images of success implanted into the subconscious mind of a sport climber, perceptions of the route to be climbed can possibly be enhanced. The climber's attitude about the climb may be positive and seen as successful. Thus, the climber will no longer focus on the limitations of performing the climb because the mind has already seen the climb as successful.

The relationship between mind and body is an area of current research in movement. For a climber to participate and desire improved sport climbing performance, the climber should use a training program that integrates mind and body. The researcher believed that the power of the mind is an important tool that a climber should not neglect when physically training for sport climbing.

**Need for Study**

Athletes at all levels of experience usually focus on practicing and developing the physical skills required for an activity. There is very little, if any, time spent on
the development of mental factors that can contribute to success. For most, there is a goal to improve performance. Within the last 20 years mental imagery has become a psychological training technique that can improve athletic performance when regularly practiced with physical skills.

Sport climbing has become an extremely popular activity within the last 15 years. While participating in this sport, a climber competes against the rock alone or against a competitor. Mental imagery may be a technique for sport climbers to use for improved performance.

While the use of mental imagery has shown an increase in athletic performance in certain activities, the researcher was unable to find any studies to date concerning an increase in one's sport climbing performance.

**Purpose**

The primary purpose of this study was to measure sport climbing improvement as a result of mental imagery techniques with physical practice of male and female University of Wisconsin-La Crosse students. A secondary purpose was to examine the relationship between age, weight, height, and gender with sport climbing performance.

**Hypotheses**

The following hypotheses were tested in this study:

1. There will be no significant difference in sport climbing performance between the control and experimental groups when comparing pre- and posttest values.
2. There will be no significant differences in sport climbing performance between males and females when comparing pre- and posttest values.

3. There will be no relationship between sport climbing performance when compared to the variables of age, weight, height, and gender.

Assumptions

This study made the following assumptions:

1. The instructor had adequate experience in eliciting a mental imagery strategy.

2. Subjects in the treatment group were able to properly activate an imagery strategy.

3. Mental imaging practice sessions were of adequate length.

4. During pre- and posttesting subjects climbed to the best of their ability.

6. Subjects were not color blind.

7. The researcher accurately scored a climb.

8. Subjects practiced the mental imagery techniques as instructed.

9. The mental imagery techniques taught were valid methods at eliciting imagery.

10. The instructor taught both classes the same physical techniques required to rock climb.

Delimitations

This study had the following delimitations:

1. Subjects were male and female undergraduate students from the University of Wisconsin-La Crosse.
2. The size of the treatment and control groups was held to 49 undergraduate students.
3. The highest point touched on a route was the only measurement used to determine performance of a climb.
4. Subjects were not told the true purpose of the study until testing was completed.

**Limitations**

1. Subjects self-assigned themselves into each class.
2. Subjects received 10 mental imagery training sessions.
3. Motivation from fellow subjects and onlookers could not be completely controlled.
4. Muscle fatigue from previous climbing sessions may have hindered performance.
5. Rest, health, activity level, and daily habits were not monitored.
6. The study was 7 weeks in duration.
7. Motivation levels of subjects could not be controlled.

**Definition of Terms**

Aid Climbing - when a climber uses equipment to directly ascend a rock face (Skinner & McMullen, 1993).

Artificial Aids - using the protection bolts as holds, grabbing slings or biners, taking tension on the rope (Darmi, 1992).

ASCF - abbreviation for the American Sport Climbers Federation (Darmi, 1992).
Belaying - the act of managing a climbing rope which is attached to a climber and safeguarding the climber (Skinner & McMullen, 1993).

Belayer - the person who is managing the rope and protecting the climber with it (Skinner & McMullen, 1993).

Free Climbing - when a climber depends entirely upon his footwork, ability, skill, and physical strength to pull themself up the rock face (Skinner & McMullen, 1993).

Mental Practice - the symbolic rehearsal of a physical activity in the absence of any gross muscular movements (Richardson, 1967).

Neutral Zone - unclimbed area (without holds) out of bounds to climbers (Darmi, 1992).

Positive Affirmation Statements - short sentences and/or statements which implant in your subconscious mind ideas which are designed to enhance self-image, achieve a positive mental attitude, or help lead one toward a specific goal (Curtis, 1991).

Relaxation - a temporary withdrawal from activity which has the potential of enabling the individual to recharge and make full use of one's physical, mental, and emotional energy (Syer & Connolly, 1984).

Rock Climbing - bolt protected face climbing (Skinner & McMullen, 1993).

Route - an established or selected path of climbing on rock (Loughman, 1981).
Sport Climbing - climbing with the protection points, usually bolts, already in place (Darmi, 1992).

UIAA - abbreviation for the Union Internationale Des Association D'Alpinisme, the international governing body for climbing competitions (Darmi, 1992).
CHAPTER II
REVIEW OF RELATED LITERATURE

Introduction

The purpose of this chapter is to review related literature pertaining to rock climbing and mental imagery. However, since the merging of these topics has yet to reveal scientific research, this chapter is presented in two sections: a) research related to adventure and adventure activities, and b) research related to mental imagery.

The following topics concerning adventure and adventure activities will be discussed: a) adventure, b) Outward Bound, c) rock climbing, d) sport climbing, e) artificial climbing walls, f) variables associated with recreational rock climbers, g) fitness benefits of rock climbing, h) stress and rock climbing, i) anthropometric profiles of rock climbers, j) artificial climbing wall injuries, and k) maximal oxygen consumption and rock climbing.

The following topics concerning mental imagery will be discussed: a) reviews of literature, b) motor and sport task performance as a result of mental imagery, c) muscular responses during imagery, d) physiological activity during imagery, and e) imagery use between novice and elite athletes.
Adventures

Adventure programs are fairly new and a widely expanding means of enjoyment. But, beyond their value for fun and excitement, the benefits of adventure programs offer an awareness of positive changes through a physically active atmosphere. Adventure education is a process based on adventurous activities which use natural or artificial environments to identify individual and group intrapersonal or interpersonal strengths and weaknesses (Priest, 1990). Priest stated, "The product of adventure education is personal growth and development" (p. 114).

Adventure based activities involved in promoting a positive personal growth which have evolved from Outward Bound include: a) icebreakers, b) initiates, c) trust activities, and d) high elements such as a ropes/challenge course or rock climbing wall. Other activities promoted by Outward Bound include: a) rock climbing, b) white water rafting, c) wilderness canoeing, d) mountaineering, and e) rappelling.

Ewert (1983) conducted a study on 27 Outward Bound participants with the purpose of determining which outdoor adventure activity the participants considered most important. The activities considered for this study included: a) peak climb, b) rock climbing, c) expedition, d) solo, e) rappelling, f) final expedition, g) marathon, and h) closing ceremonies. Of these eight activities, peak climbing and rock climbing were found to be most important.
In the early 1970's, Project Adventure was funded under a Federal Office of Education grant. Project Adventure was developed for a Hamilton, Massachusetts high school based upon the philosophy of Outward Bound. According to Rohnke (1986), the learning goals of Project Adventure are: a) to increase the participant's sense of personal confidence, b) to increase mutual support within a group, c) to develop an increased agility and physical coordination, and d) to develop an increased joy in one's physical self and in being with others.

**Outward Bound**

Outward Bound developed from the philosophy of Kurt Hahn in Wales in 1941. Hahn developed this program in order to train British seaman to endure the hazards of naval warfare. As an educator, Hahn's initial program was designed to allow young men to realize their potential and to develop a stronger character and will to survive (Marsh, Richards, & Barnes, 1986). This program is both physically and mentally challenging. But, beyond the physical challenge it was Hahn's desire to create an educational program which would stimulate students to develop a passion for life and growth, and would cultivate social vision (Smith, Roland, Havens, & Hoyt, 1992).

Outward Bound experiences generate from a group setting. While in these groups, members participate in activities that require group building and organization, and cooperation among the individuals. Members also participate
in physical conditioning, goal setting, and ropes courses. Experiences then shift towards more personal challenges such as rock climbing, rappelling, backpacking, and solo journeys into the backcountry. These activities tend to be vigorous and physical. However, it is also the goal of Outward Bound to improve awareness of self, self-confidence, initiative and self-reliance, cooperation, awareness of others, taking responsibility for self, and the mastery of stressful situations (Marsh et al., 1986). Richards (1977) explained that physical activities are an effective medium for "the person to recognize his own weaknesses, strengths, and resources and thus find himself the wherewithal to master the difficult and unfamiliar" (p. 69). Thus, an Outward Bound program will allow participants to recognize that they are capable of much more than they had previously thought.

Rock Climbing

With the help of programs like Outward Bound, rock climbing has become quite popular and a fast growing outdoor adventure activity. The definition of modern rock climbing is both easy and difficult to explain. If rock climbers are regarded as a group then "modern" rock climbing can be defined as bolt protected face climbing (Skinner & McMullen, 1993). Bolt protected requires the use of equipment to directly aid the climber in ascending the rock face. However, if a rock climber is looked at as an individual, a climber may choose to free climb a rock face. Free climbing requires a climber to depend entirely on
footwork, ability, skill, and physical strength without the use of equipment to ascend a rock face (Skinner & McMullen, 1993). Thus, "modern" rock climbing can have two methods of ascending a rock face: a) free climbing and b) aid climbing.

**Sport Climbing**

While original climbers were passionate about climbing and interested in the adventure of climbing or the art and spirituality of it, it was not considered a sport. Within the last 15 years, rock climbing has been described as a "sport" (Darmi, 1992). Thus, the term sport climbing has emerged. Skinner and McMullen (1993) defined "sport" climbing as indoor climbing, for fun or competition, in a controlled atmosphere. Skinner and McMullen noted that routes used for sport climbing have permanent bolts placed for protection. Originally, climbing competitions were held outdoors on natural rock surfaces. These competitions were difficult to hold due to inclimate weather, environmental damage due to crowds, and the problem of creating routes in successive years (Darmi, 1992). Holds had to be chiseled into the rock, which damaged the rock. The emergence of indoor and outdoor artificial climbing walls have solved the problems encountered in holding competitions on natural rock surfaces.

Sport climbing competitions vary in organization, but must be Union Internationale Des Associations D'Alpinisme (UIAA) sanctioned to be considered world class (Skinner & McMullen, 1993). In the U.S. anyone can compete in a
sanctioned event, but in order for a climber's points to be included in the national ranking system, the climber must be a member of American Sport Climbers Federation (ASCF). ASCF is also responsible for the approval of sport climbing competitions in the U.S. Points earned during sanctioned events held in the U.S. allow a climber to qualify for the U.S. Climbing Team.

There are two main formats for sport climbing competitions: a) difficulty climbing, and b) speed climbing (Darmi, 1992). A difficulty climbing competition places a climber on a route which has never been seen before by any of the contestants. The climber who touches the highest point on the course is considered the winner (Skinner & McMullen, 1993). Speed climbing competitions place competitors head to head for speed to determine the winner (Darmi, 1992).

Artificial Climbing Walls

Artificial climbing walls have emerged throughout the U.S. in such places as climbing gyms, universities, schools, and camps. Fesko (1992) estimated that there are 1,000 to 1,500 indoor climbing areas open to the public across America. These walls enable the beginner a safe and enjoyable introduction to rock climbing. The advanced climber benefits as well because the climber can practice inside without the distractions of weather, loose holds, and route finding (Long, 1994).
Walls vary in height. A 40 foot wall is considered tall (Long, 1994). The structure of climbing walls also vary. While some are only vertical, others are more sophisticated with inset pockets, sweeping angles, and overhangs (Long, 1994). Climbing artificial climbing walls is essentially the same as on real rock in terms of the basic pulling motion the body uses to ascend.

**Variables Associated with Recreational Rock Climbers**

Ewert (1989) defined adventure recreation as, "A variety of self-initiated activities utilizing an interaction with the natural environment, that contain elements of real or apparent danger, in which the outcome, while uncertain, can be influenced by the participant and circumstance" (p. 6). Ewert and Hollenhorst (1994) conducted a study on the variables associated with rock climbing and white water boating using the specialization theory. Specialization theory suggests that as levels of specialization increase: a) individuals will spend more money and participate more frequently, b) increase the level of centrality, and c) increase the dependency on the specific type of resource (Ditton, Loomis, & Choi, 1992).

Ewert and Hollenhorst's (1994) study looked at the following attributes: a) experience use history, b) skill level, c) locus of control, d) involvement, e) naturalness, f) social orientation, g) equipment, and h) level and type of risk. A sample of 586 adventure recreationists were given a 31 item questionnaire to determine the relationship
among the variables. Results for this study supported the specialization theory. However, one implication found was that subjects did not become more involved with rock climbing or white water boating over time.

**Fitness Benefits of Rock Climbing**

Wescott (1992) conducted a study to assess fitness benefits as a result of rock climbing on a revolving rock wall called a Treadwall. Subjects were placed in either a climbing group or nonclimbing control group. Members of the climbing group climbed twice a week for a period of 7 weeks.

Wescott (1992) tested each subject before and after the 7 week climbing program. The fitness tests assessed the following characteristics: a) bodyweight, b) percent fat, c) fat weight, d) lean weight, e) flexibility, f) leg strength, and g) arm strength. Results indicated that climbing subjects made significant improvements in body composition, joint flexibility, and muscular strength.

Subjects were also tested for climbing proficiency on the third and seventh week. Climbing subjects improved in climbing proficiency by significantly improving climbing level, climbing time, and climbing distance. Wescott (1992) also noted a relatively high heart rate response to the climbing sessions. This finding resulted in a second study.

Wescott's (1992) second study assessed cardiovascular fitness as a result of climbing two times a week for 8 weeks on a revolving rock wall called Treadwall. Ten subjects were given maximum oxygen consumption tests before and after
the 8 week climbing program. Results indicated statistically significant improvements in cardiovascular performance.

**Stress and Rock Climbing**

Bunting, Little, Tolson, and Jessup (1986) conducted a study on 12 low-fit and high-fit individuals measuring beneficial stress (eustress) as a result of four rock climbing/rappelling sessions. Stress was quantified by levels of catecholamines, epinephrine, and norepinephrine found in the subject's urine. Bunting et al. (1986) chose rock climbing/rappelling because these situations are designed to promote eustress. Results indicated that low-fit subjects had higher levels of stress during activity. Bunting et al. indicated that further research is needed to determine the implications of eustress because the Yerkes-Dodson Law has indicated stress is beneficial up to a certain point.

**Anthropometric Profiles of Rock Climbers**

Watts, Martin, and Durtschi (1993) investigated the anthropometric profiles of 39 world class rock climbers who participated in the 1989 World Cup rock climbing competition. Of the 39 semifinalists, 7 males and 6 females advanced to the finals. The major event for this study was the "On Site Difficulty" which had competitors attempting to reach the highest point on an extremely difficult climbing route. The variables measured for this study were: a) age, b) years of climbing experience, c) height, d) body mass,
e) height-weight ratio, f) sum of seven skinfolds,  
g) percent body fat, h) fat-free mass, i) hand and arm  
volumes, j) average of right and left grip strengths,  
k) grip strength to body mass ratio, and l) climbing  
ability.

Results of this study indicated that elite sport rock  
climbers are lean and small in stature possessing very low  
percent body fat, moderate grip strength, and high strength  
to body mass ratio. Climbing ability was also found to be  
predictable from strength to body mass ratio and percent  
body fat.

**Artificial Climbing Wall Injuries**

Limb (1995) conducted a survey concerning the incidence  
and nature of injuries requiring emergency treatment on  
climbing walls in England, Scotland, and Wales. This study  
lasted 2 years with a total of 1.021 million visits by  
climbers. There were 55 significant injuries reported.  
Variables considered for this study included: a) wall  
height, b) solo climbing, c) climbing with ropes, d) fixed  
safety mats at the base of the wall, e) moveable mats at the  
base of the wall, f) no mat, and g) mat size.

The most frequently occurring injury was ankle  
fractures. Nineteen were reported. There were 14 ankle  
sprains, and 6 shoulder dislocations. Various other  
dislocations, sprains, and fractures were reported. This  
study found that the two most common reason why injuries  
occurred were because: a) a mat got moved without the
climber knowing it, and b) a climber landed with one foot on
the mat and the other foot off the mat.

**Maximal Oxygen Consumption and Rock Climbing**

A second study conducted as a result of the 1989 World Cup rock climbing competitions was by Billat, Palleja, Charlaix, Rizzardo, and Janel (1995). These researchers tested four competitive rock climbers for the extent to which oxidative metabolism is utilized during climbing with regard to the climber's maximal oxygen consumption. Results indicated that rock climbing does not insinuate oxidative metabolism. It was also found that oxygen uptake during climbing only represents a small fraction of the climbers' maximal oxygen consumption due to a rather large percent of static time when climbing.

**Mental Imagery**

While mental imagery is the focus of this study, it is a term investigated under plethora of names. Terms used interchangeably with mental imagery include: mental practice (Corbin, 1972; Feltz & Landers, 1983; Grouios, 1992; Hird, Landers, Thomas, & Horan, 1991; Richardson, 1967), mental rehearsal (Lejeune, Decker, & Sanchez, 1994; Yamamoto & Inomata, 1982), guided visual imagery (Gough, 1989), imagery rehearsal (Hecker & Kaczor, 1988; Kendall, Hrycaiko, Martin, & Kendall, 1990), and psyching up (Lee, 1990; Weinberg et al., 1983).
According to Singer (1972), "There is growing evidence that the learning and performance of motor skills can be greatly enhanced through the use of mental practice, particularly when such practice is used in conjunction with overt practice" (p. 185). To improve athletic performance, mental practice is a suggested technique (Richardson, 1967). Feltz and Landers (1983) also reported that mental practice can be effective in improving motor or sport performance of both novice and experienced performers.

Sport psychologists over the last 20 years have come to recognize the importance of the cognitive process of mental imagery. While some researchers have provided information on improved performance, other researchers have looked at what occurs in the brain during mental imagery. Hecker and Kaczor (1988) stated, "Imagery involves activation of a network of propositionally coded information stored in long-term memory" (p. 363). Lang (1979) suggested that mental images can be understood as products of the brain's information processing capacity.

Reviews

The first major review of literature concerning mental imagery was conducted by Richardson (1967). For his review, mental practice was used to describe mental imagery. Richardson stated, "Mental practice refers to the symbolic rehearsal of a physical activity in the absence of any gross muscular movements" (p. 95). As a result of his review, Richardson addressed three issues: a) that mental practice
aids in the facilitation of the initial acquisition of a perceptual motor skill, b) that mental practice aids the continued retention of such a skill, c) and that mental practice improves the immediate performance of a skill.

In his review, Richardson (1967) found 11 studies to support the hypothesis that mental practice was associated with improved performance of a task. Seven other studies showed a positive trend in improved performance. Three studies reported negative findings.

Feltz and Landers (1983) conducted a more comprehensive review of existing research using a metaanalytic strategy. In their critique of Richardson's review (1967), the effects of mental practice may have been distorted. Feltz and Landers (1983) stated, "only a subset of possible studies was included, leaving open the possibility that the bias on the reviewers' part may have influenced him to include studies that support his position, while excluding those that may have contradicted his beliefs" (p. 27).

Feltz and Landers (1983) reviewed 60 studies. To statistically analyze the data, the studies' characteristics were coded and placed into the following categories:

a) subject characteristics, b) task-type characteristics, c) design characteristics, and d) published or unpublished studies. The variables investigated in these categories included: a) sex, b) age, c) previous experience with task, d) motor, e) strength, f) cognitive, g) self paced, h) reactive, i) attentional control, j) simple control,
k) pre/post only design, l) immediate posttest, m) delayed posttest, n) number of practice sessions, and o) length of practice sessions.

Feltz and Landers (1983) found an overall effect size of .48. With this effect size finding, Feltz and Landers concluded, as did Richardson (1967), that "mentally practicing a motor skill influences performance somewhat better than no practice at all" (p. 41). It was also suggested that mentally practicing the motor skill with physical practice helps improve performance to a moderate extent above and beyond physical practice without mental practice.

Wand Juggling Performance

Corbin (1967) conducted a study on wand juggling that required all subjects to physically practice the task under controlled conditions before mentally practicing it. Subjects were randomly assigned to three groups: a) control, b) mental practice, or c) physical practice. The control group physically practiced the skill for 5 days then were subjected to no practice of any kind for 13 days. The mental practice group physically practiced for 5 days and then mentally for 13 days. The physical practice group practiced the skill physically for 18 days.

Results indicated that the physical practice group outperformed the control and mental practice groups. However, Corbin concluded that mental practice is effective in facilitating wand juggling performance. He suggested
that previous physical practice of a task with mental practice can improve performance of a complex motor skill.

Swimming/Diving Performance

Grouios (1992) investigated the effect of mental practice on the diving performance of 30 subjects. Grouios stated that, "mental practice is used to signify the rehearsal of a skill in imagination rather than by overt physical activity" (p. 60). Subjects were randomly placed in three groups: a) physical practice, b) mental practice, or c) no practice. As with the results found in Corbin's study (1967), the physical practice group outperformed the control and mental practice groups. Nevertheless, the results of this study support Grouios' hypothesis that mental practice can positively affect diving performance.

Yamamoto and Inomata (1982) conducted a study on the effect of mental rehearsal with part and whole demonstration models on acquisition of backstroke swimming skills. This study used a movie, which is a different approach in facilitating mental practice. Subjects were randomly assigned to three groups: a) mental rehearsal with a whole model demonstration, b) mental rehearsal with a progressive part model demonstration, and c) control.

The whole model demonstration group learned the entire back crawl stroke at the same time, while the progressive part model demonstration group learned the back crawl piece by piece. Subjects in the progressive part model
demonstration group learned the pull, kick, body position, and breathing progressively from part to whole. The control group only received physical practice.

Subjects who received mental rehearsal were first shown a film of the back crawl. Part and whole skill models of the film were respectively shown. After the film, subjects were instructed to mentally rehearse what they had just seen for 5 minutes. After mentally rehearsing the film, subjects were instructed to mentally rehearse a self-image of the back crawl.

The researchers in this study judged performance of the back crawl by speed and distance. No differential effects of the two modeling procedures on motor performance were statistically significant.

Running Performance

Burhans et al. (1988) conducted a study on running speed performance. Mental imagery was examined from an external perspective. Two imagery strategies were used in this study: imaging various movements associated with running (skills), or imaging oneself crossing the finish line ahead of all other competitors (results). Subjects were randomly placed in four groups: a) visual imagery of specific skills, b) visual imagery of the end result, c) visual imagery of both specific skills and the end result, or d) lecture control. All four groups showed the same level of improvement by the end of the 12 weeks of training.
Van Gyn, Wenger, and Gaul (1990) investigated the effect of imagery in conjunction with nonspecific training on the transfer of the training to performance. A cycle ergometer test for peak power was used for nonspecific training for performance in the 40m sprint. In this study, subjects trained for the 40m sprint through the use of mental imagery while physically practicing for the task on the cycle ergometer.

Subjects for this study were placed into four groups: a) imagery training, b) imagery training and physical training, c) physical training, and d) control. Results indicated that imagery practice of the sprint with nonspecific training on the cycle ergometer can significantly improve 40m sprint performance. Thus, Van Gyn et al. (1990) suggested that imagery can produce the transfer of physiological training to performance.

**Basketball Performance**

Kendall et al. (1990) investigated the effects of an imagery rehearsal, relaxation, and self-talk package on a specific defensive skill performance of four female intercollegiate varsity basketball players. A single-subject design was utilized. Data were collected by videotape during actual game situations.

Kendall et al. suggested that relaxation enhances the clarity of the athlete's imaging while self-talk can help the athlete focus on the correct cues during imagery. The
skill investigated by the researchers was an athlete's ability to cut off the baseline. This defensive skill is used by the defender in the defensive zone when the offensive player attempts to dribble toward the basket. Results indicated that the combination of imagery rehearsal, relaxation, and self-talk were effective in enhancing the performance of cutting off the baseline during a basketball game performance.

Lamirand and Rainey (1994) conducted a study on the accuracy of basketball free throw shooting as a result of mental imagery and relaxation. Eighteen NCAA Division III female basketball players were assigned to two training groups: a) imagery, or b) relaxation. Subjects received 30 foul shot attempts as a pre- and posttest. The relaxation group improved from 65 to 74% while the imagery group decreased from 71 to 70%.

Weinberg et al. (1983) investigated whether combining two mental preparation strategies would be more effective in enhancing basketball free throw shooting performance than a single strategy. For this study, the researchers referred to relaxation and imagery as a psyching up technique.

Subjects were randomly assigned to one of four groups: a) imagery, b) relaxation, c) relaxation plus imagery, and d) control. Weinberg et al. chose these strategies because Clark (1960) demonstrated that imagery could improve basketball free throw shooting performance.
The results for this study did not indicate that two mental strategies versus a single strategy would be better in improving basketball free throw shooting performance. The results did indicate that the imagery group made the highest percentage of free throws.

Another study using imagery and relaxation to improve basketball free throw shooting performance was conducted by Suedfeld and Bruno (1990). This study was designed to see if Restricted Environmental Stimulation Technique (REST), a relaxation technique, with imagery can improve athletic performance.

Three treatment groups were used in this study. All three received imagery training, but each was given a different relaxation treatment. Results indicated that basketball free throwing can be significantly improved after flotation REST and imagery.

Meyers et al. (1982) conducted a case study on imagery techniques intervention for improving competitive performance in basketball free throw shooting and field goal shooting. Two women intercollegiate basketball players were chosen for this study. The imagery techniques involved had visual, auditory, and kinesthetic components. An internal imagery approach was used.

The results of this case study indicated that imagery techniques can be associated with improvements in the competitive performance in basketball players. However,
when the intervention ceased for the free throw shooter, performance diminished in competitive situations.

**Table Tennis Performance**

Lejeune et al. (1994) examined the effects of mental training on table tennis performance. Two table tennis skills were assessed: a) counterattack forehand and b) counterattack backhand. Subjects were placed in one of four groups: a) no practice, b) physical practice, c) physical practice and observational learning, and d) physical practice, observational learning, and mental practice.

Mental practice for this study consisted of relaxation and mental rehearsal. Relaxation consisted of laying flat on a bed while becoming aware of the muscular tensions present in different parts of the body. Mental rehearsal consisted of visualizing oneself playing table tennis in a relaxed state. While visualizing the counterattack forehand and counterattack backhand subjects were asked to feel minimal muscular tensions associated with the two skills.

The significant finding of this study was that the physical practice, observational learning, and mental practice group was the only group to improve its performance of the counterattack forehand and counterattack backhand.

**Baseball Performance**

Wyatt and Ranero (1993) conducted a case study on the effect of imagery on the athletic performance of a baseball pitcher. The subject was a player from the Appalachian
State University baseball team who had high levels of stress and anxiety, and low coping skills.

Tutko and Tosi's sports psyching program was used to facilitate imagery in this study. As a result of this program, the researchers concluded that the subject showed considerable improvement in pitching ability. The subject's earned run average (ERA) dropped from 10.80 to 3.86 while his win/loss record improved from 1 and 4 to 3 and 4.

Gough (1989) conducted a study on improving batting skills performance as a result of guided visual imagery. The subjects in this study were three nonscholarship members of a small college baseball team. The three subjects represented three different levels of experience and ability.

The entire baseball team went through the same physical training and 10 minutes of guided visual imagery prior to practice. Two types of imagery were used in this study: a) external, and b) internal. External imagery consisted of seeing oneself hitting the baseball as if viewing a movie. Internal imagery consisted of identifying the actual feelings associated with hitting the baseball. Prior to imaging, subjects entered a relaxed state and then visualized oneself hitting a baseball.

Performance was measured by the number of quality contact swings compared to the total number of pitches. Quality contact swings were all hits that were not foul tips, dribblers, or pop-ups. Interobserver agreement was
found to be 84%. All three subjects showed improvement in batting performance. The one subject who was rated as the least experienced with the lowest ability showed the most improvement.

**Cricket Performance**

Gordon, Weinberg, and Jackson (1994) conducted a study to determine the effectiveness of an internal versus an external imagery training program on cricket performance. Internal imagery is associated with an individual seeing themselves perform a task as if they were physically doing the skill at that time. External Imagery occurs when an individual takes a third person perspective and views themselves as if they were watching a movie. Smith (1987) suggested that internal imagery is more effective in enhancing sport performance than external imagery.

Subjects for Gordon's et al. (1994) study were randomly assigned to one of three groups: a) internal imagery, b) external imagery, or c) control. The task measured was the outswing bowling technique used in the game of cricket. Results from this study revealed that there were no significant performance differences between imagery groups.

**Peg Board/Pursuit Rotor Performance**

Hird et al. (1991) investigated the effects of varying ratios of physical practice to mental practice on cognitive (pegboard) and motor (pursuit rotor) task performance. Subjects were randomly placed in one of six groups which
received different amounts of combined mental and physical practice.

Results from this study indicated that all groups, except for the pegboard control group, showed significant improvement from pre- to posttest scores. However, physical practice was found to be much more effective than mental practice in improving pegboard and pursuit rotor performance.

The study by Hird et al. (1991) supported the notion that physical practice combined with mental practice can improve performance. However, just mental practicing as compared to no practice at all was also found improve performance. This result led Hird et al. to suggest that mental practice can be effective when physical practice is limited.

**Golf Performance**

Menocci and Price (1985) conducted a study on the acquisition and retention of golf putting as a result of relaxation, visualization, and body rehearsal. Subjects were placed in one of four groups: a) relaxation, visualization, and body rehearsal, b) physical practice, c) combination of relaxation, visualization, and body rehearsal with physical practice, and d) control.

Results of this study demonstrated two significant findings. The first finding was that relaxation, visualization, body rehearsal, and physical practice as compared to the other groups resulted in superior golf
putting acquisition from the first to third testing sessions. The second finding was that superior learning retention levels after 58 to 60 days were demonstrated by the relaxation, visualization, body rehearsal, and physical practice group.

Sit-up Performance

Lee (1990) used the term psych-up strategy for the use of mental imagery. In her study of sit-up performance subjects were given different psych-up strategies. Groups consisted of: a) positive task relevant, b) positive task irrelevant, and c) distraction control. It was found that subjects who performed positive task relevant imagery were most effective in improving sit-up performance. Lee (1990) suggested that psyching-up using positive task relevant imagery serves to prepare one specifically for a particular task.

In a follow-up study, Lee (1990) used the same treatments in her first study, but had subjects complete a Profile of Mood States (POMS) questionnaire immediately after imagery techniques. Lee wanted to determine if psych-up techniques effected mood.

The follow-up study replicated the findings of the first study in that positive task relevant imagery was most effective in improving sit-up performance. However, POMS scores did not correlate in any way with sit-up performance.
Muscle Response

Jowdy and Harris (1990) conducted a study to examine the magnitude of muscular responses during imagery between high and low skilled jugglers. Corbin (1972) stated, "The innervation of the muscles involved in the skill being imagined may well be capable of providing kinesthetic feedback necessary to make adjustments in future trials, thus improving skilled motor performance" (p. 102).

To measure muscle activity during imagery sessions four Beckman standard silver-silver chloride electrodes were used on two groups of high and low skilled jugglers. Imagery consisted of relaxation and internal and external perspectives. Results indicated that there was no difference in magnitude of muscular activity between high and low skilled jugglers. However, there was a significant increase in muscle activity during imagery that provides support for the occurrence of slight muscular contractions during imagery.

Physiological Activity During Imagery

Hecker and Kaczor (1988) conducted a study to determine the physiological activity associated with imagery of four scenes. Subjects were 19 members of a varsity NCAA Division I-AA women's softball team. They were initially given relaxation instructions so heart rate would reach a stable base-line. Four scenes to be internally imagined were then read. The four scenes were as follows: a) neutral (sitting on a porch relaxing), b) action (doing bench presses in the
weight room, c) athletic anxiety (batting at a critical point in the game), and d) fear (being in a plane that is tumbling toward the ground).

Results indicated that heart rates increased significantly when subjects had some familiarity with the task and when the task involved physiological activation. This lends support to bioinformational theory which contends that response propositions during imagery rehearsal must be activated to provide a prototype for an overt motor act.

Rowing and Imagery Use

Barr and Hall (1992) examined the differences in imagery use between novice and elite rowers. This study dealt with a concern that skill level relates to a performer's ability to effectively use mental imagery. Hall, Rodgers, and Barr (1990) reported that elite athletes use imagery to a greater extent in training and during their event than nonelite athletes.

The Imagery Use Questionnaire (IUQ) was used in this study to determine the habits and practices of imagery by rowers. The researchers found that "elite athletes have more structure and regularity to their imagery sessions than novices" (p. 258). Another finding of this study was that elite rowers were able to feel the actions of rowing to a greater extent than nonelite rowers.

Summary

Sport climbing is a fast growing outdoor adventure activity which promotes positive personal growth. As the
number of sport climbers continues to grow, so has
competitive sport climbing competitions. With more climbers
climbing and more competitions being held, climbers need to
train to improve performance.

A form of training that has been often studied with
athletes is mental imagery. Mental imagery is a cognitive
function which studies have shown to be an effective
technique for athletes to achieve improved performance.
However, no published studies are currently available on
mental imagery and its effect on sport climbing performance.

With the available literature, there seems to be a
relationship between adventure activities, such as sport
climbing, and mental imagery. Both seem to provide an
individual with positive personal growth. The link between
sport climbing and mental imagery could include personal
growth in the following areas: a) an increase in a
participant's sense of personal confidence, b) an increase
in a participant's agility and physical coordination, and
c) improved sport climbing performance.
CHAPTER III
METHODS AND PROCEDURES

Introduction

The primary purpose of this study was to measure sport climbing improvement as a result of 5 weeks of mental imagery techniques with physical practice of male and female college students. Subjects received a four step Mental Conditioning Program and climbing techniques to develop skills required to rock climb. This chapter will present information concerning: a) subjects, b) instruction, c) the indoor climbing wall, d) testing procedures, e) scoring, f) instrumentation, g) the Mental Conditioning Program, and h) statistical treatment of data.

Subjects

A total of 25 male and 24 female volunteer University of Wisconsin-La Crosse (UW-L) students between the ages of 18 and 27 years participated in this study during the spring semester of 1996. Subjects qualified for the study as a result of enrolling in one of two indoor sport climbing courses (ESS 100) held at UW-L. Control and treatment groups were randomly chosen via a coin toss.

The control group consisting of 8 males and 14 females met from January 22 to March 8 on Monday and Wednesday from
7:45 to 9:45 a.m. The control group met for a total of 1,680 minutes on 14 class days. The treatment group consisting of 17 males and 10 females met from March 18 to May 7 on Tuesday and Thursday from 7:45 to 9:40 a.m. The treatment group met for a total of 1,725 minutes on 15 class days.

**Instruction**

Both classes were taught by the same instructor and received the same content concerning the techniques associated with indoor sport climbing (see Appendix A). However, to begin class, the control group participated in 100 minutes of physical games, while the treatment group received 100 minutes of mental imagery techniques. Thus, the control group participated in 1,580 minutes of sport climbing and the treatment group participated in 1,625 minutes of sport climbing.

The researcher met with the treatment group for 15 minutes on the first day of the course to explain mental imagery and the techniques that would be taught to aid sport climbing performance. Once the students were informed about mental imagery and sport climbing, volunteers were solicited to participate in the mental imagery program and asked to sign the Informed Consent Form (see Appendix B). All procedures were thoroughly explained and questions were answered.

**Indoor Climbing Wall**

The indoor climbing wall located in Mitchell Hall at UW-L is 33 feet tall and consists of 12 different climbing
routes. Each route is identified by the same colored hand and foot holds. Holds are of different sizes and shapes which are bolted to the rock's surface.

All climbing routes were set with varying degrees of climbing difficulty. Variables which determined the difficulty rating of a climb included: a) the angle of the rock, b) size and shape of holds, d) placement of holds, and e) an overhang. The researcher and committee chair determined each route's climbing difficulty and numbered them from 1 to 12 with 1 being the least difficult and 12 being the most difficult. See Appendix C for the difficulty rating of all routes.

**Testing Procedures**

This study used a pre- and posttest randomized-groups design. Groups were randomly formed due to subject's self-enrollment into each class. Both groups were given identical pre- and posttests.

Testing for control and treatment groups occurred during the second and final weeks of class in the Mitchell Hall field house at UW-L. Subjects were instructed to dress appropriately for exercise. Upon arrival of the participants at the indoor climbing wall each subject was fitted with a harness and climbing shoes.

Subjects were then instructed to attempt a climbing route that would be challenging. Subjects randomly placed
themselves at a belay station where volunteer belayers from the UW-L climbing wall staff were stationed.

Once hooked onto a belay system, subjects attempted to climb the route to its final hold. If the route was successfully completed to its final hold without falling, using the belay rope, or touching a hold from another route the subject was placed at a route with a more difficult rating. Subject performance was judged until a fall or infraction occurred, as is done during American Sport Climbers Federation (ASCF) sport climbing competitions (Darmi, 1992). After a fall or infraction occurred on that route, the subject was given credit for the highest hold touched and all holds on routes with easier difficulty ratings.

If a fall or infraction occurred on the initial route attempted, the subject was placed at the next easier route. If that route was completed to the last hold performance was determined by the height reached on the previous climb. Subjects who could not successfully complete route number one were given credit for the highest hold touched on that route. See Appendix D for a description of climbing rules.

Scoring

The climbing wall at UW-L consists of 12 climbing routes. Routes varied in total number of holds with a range from 19 to 31 (see Appendix C). On each route, the closest hold to the ground had a value of 1 point and each
successive hold had an ascending value with the largest value being 31 points. As routes increased in difficulty rating, holds on each route were added together and increased in value. For example, hold number 1 on route 1 was given the value of 1 point and hold number 30 on route 12 was given the value of 281 points.

Subjects were given credit for a hold as soon as it was touched. The total number of points a subject could amass was 281 if route 12 was successfully completed to its last hold. If a subject fell touching hold number 14 on route number 6, credit was given for those 14 holds and the total number of holds on routes 1 through 5. Therefore, the subject’s score would be 123 points.

Instrumentation

The scoring card used to evaluate a climb in this study was a remodeled version of a scoring card used in all major competitions that are ASCF sanctioned (see Appendix E). This card was used to keep track of the results of each climber’s performance. Information on the card included: a) social security number, b) gender, c) age, d) weight, e) height, f) the number of the highest hold touched on a route in which a fall or infraction occurred following a successful climb, and g) route number where a fall or infraction occurred to end the test.
Mental Conditioning Program

To supplement physical training, subjects in the sport climbing treatment group were taught mental imagery techniques. The techniques taught came from *The Mindset for Winning* (Curtis, 1991), which includes the Mental Conditioning Program. To help facilitate the program, *The Mindset for Winning Athlete's Log* was given to each subject.

At the onset of each class, daily goals were written into the log book by each subject. The instructor then provided mental imagery instruction for 10 minutes. Subjects were exposed to a total of 100 minutes of the program. Thus, instruction was given for ten days. The following components of the program were covered by the instructor: a) relaxation, b) positive affirmation statements, c) mental recall, and d) mental rehearsal. See Appendix F for an outline of the mental imagery program.

Relaxation was the first step which entailed breathing normally while observing the breathing cycle. The observation of the breathing cycle included disregarding one's inhalations while focusing on exhaling. The goal of relaxation is to shut down the rational mind. While this happens the subconscious mind is free to accept new images of sport climbing achievement. Curtis (1991) identified the key sensations of exhaling as: a) feelings of sinking down,
b) slowing down, c) heaviness, and d) an overall letting go or feeling of relaxation.

For the first 2 days of the program, subjects were asked to lay flat on the ground without crossing arms or legs to begin class. While in this comfortable position with eyes closed, subjects breathed normally while observing the air enter and leave one's nose. The researcher slowly mentioned the word relax coupled with asking them to focus on the exhalation phase of the breathing cycle. Subjects were asked to feel the heart beat slowing down and to feel a sense of patience. After 5 minutes of relaxation, subjects were asked to take a deep breath before opening one's eyes. Subjects were instructed to practice the relaxation phase of the program three times a day for 3 to 5 minutes.

The second step introduced positive affirmation statements. Curtis (1991) defined these statements as, "...short sentences and/or statements which implant in your subconscious mind ideas which are designed to enhance self-image, achieve a positive mental attitude, or help lead one toward a specific goal" (p. 49). To begin this step, subjects were read the guidelines for developing positive affirmation statements (see Appendix G), then completed the positive affirmations worksheet found in the log book (see Appendix H). The researcher explained that the statements should be worded so they are positive in nature, brief,
vivid, and in the present tense. An example of a positive affirmation statement given by the researcher to the subjects was, "I will climb to the top of route number 6."

For the next 2 days of the program subjects were instructed to enter a relaxed state and repeat their positive affirmation statements 5 to 20 times to begin class. These statements should be repeated during the exhalation phase of the breathing cycle. Subjects were instructed to practice this step of the program two additional times in the day, once while waking up in the morning and a second time just prior to falling asleep.

Mental recall was the third step of the program which was introduced after subjects had climbed on numerous occasions. Mental recall entailed reliving a past climb that was performed perfectly. For example, when a difficult climb was successfully completed to the top without a fall or infraction. Curtis (1991) explained that this step is designed to improve confidence. To aid mental recall, subjects were read the mental recall worksheet (see Appendix I), then completed a shortened version of it in the log book. This worksheet was used to aid subjects to envision a climb as thorough as possible. Some of the items on the worksheet included: a) emotional feelings, b) level of confidence, c) temperature, d) smell, e) sound, and f) kinesthetic feelings.

During the following 3 days of the program subjects practiced the two previous steps followed by a mental
recall experience to begin class. This experience was instructed to be performed from inside the body, using proper speed, and carrying the experience through to completion. Subjects were asked to perform this phase of the program several times a day while in a relaxed state.

The final step of the Mental Conditioning Program was mental rehearsal which tied each step of the program together. It is similar to mental recall, but now the subject visualizes a future climb of perfection instead of a past climb of perfection.

During the last 3 days of the program subjects entered a relaxed state to begin class and were instructed to visualize a perfect performance where the climbing goal, listed during positive affirmation statements, was accomplished. It should be done in detail using all the body senses, at proper speed, and carried through to completion. Subjects were asked to practice mental rehearsal three times a day.

**Statistical Treatment of Data**

Standard descriptive techniques were computed for subject biographical characteristics and sport climbing performance results. Independent t-tests were used for initial differences of pretest performance scores. A two-way ANOVA was used to detect significant differences for gain score performance of gender by group. Pearson product-moment correlations were performed on the following
variables: a) age, b) height, c) weight, d) gain score, and e) gender. The .05 level of significance was used for all analyses.
CHAPTER IV

RESULTS AND DISCUSSION

Introduction

This study examined sport climbing improvement as a result of mental imagery techniques with physical practice of male and female University of Wisconsin-La Crosse (UW-L) students. This chapter presents the results and discussion of the following data: a) biographical characteristics of the subjects, b) sport climbing performance results for the control and treatment groups, c) t-test results for initial differences of pretesting performance, d) ANOVA results for gain score performance of gender by group, and e) correlation matrix of variables. The .05 level of significance was used for all statistical calculations.

Biographical Characteristics

Biographical characteristics of all subjects who completed the study are presented in Table 1. Forty-nine subjects between the ages of 18 and 27 years participated as either control or treatment group subjects. Subjects in the control group had a mean age of 22 years, while subjects of the treatment group had a mean age of 21.30 years.

Both control and treatment subjects were volunteers from two indoor sport climbing courses (ESS 100) held at
Table 1. Biographical characteristics of the subjects
(N = 49)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control (n = 22)</th>
<th>Treatment (n = 27)</th>
<th>Male (n = 25)</th>
<th>Female (n = 24)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>22*</td>
<td>21.30</td>
<td>21.88</td>
<td>21.33</td>
</tr>
<tr>
<td></td>
<td>2.11**</td>
<td>1.54</td>
<td>2</td>
<td>1.62</td>
</tr>
<tr>
<td>Height (in)</td>
<td>67.36</td>
<td>67.67</td>
<td>70.40</td>
<td>64.54</td>
</tr>
<tr>
<td></td>
<td>4.09</td>
<td>3.67</td>
<td>3.07</td>
<td>1.78</td>
</tr>
<tr>
<td>Weight (lbs)</td>
<td>144.68</td>
<td>157.70</td>
<td>172.64</td>
<td>130.21</td>
</tr>
<tr>
<td></td>
<td>29.93</td>
<td>26.37</td>
<td>23.57</td>
<td>13.83</td>
</tr>
</tbody>
</table>

* = Mean  ** = Standard Deviation

UW-L during the 1995-1996 academic year. Control subjects met during the first section of the spring semester, while treatment subjects met during the second section of the spring semester.

The control group originally consisted of 23 subjects. One subject withdrew from the class, thus 22 subjects were used in the control group's final analyses. The mean height of participants in this group was 67.36 in. and mean weight of participants was 144.68 lbs.

The treatment group originally consisted of 29 subjects. Two subjects withdrew from the class. Therefore, 27 subjects were used in the treatment group's final analyses. The mean height of participants in this group was 67.67 in. and mean weight of participants was 157.70 lbs.

Performance Scores

Pretest, posttest, and gain score performance results of subjects who completed the study are presented by group
and gender in Table 2. Both control and treatment subjects were given a pre- and posttest to determine sport climbing performance. To determine the extent of a subject's improvement, pretest scores were subtracted from posttest scores which resulted in a gain score.

Table 2. Sport climbing performance results for the control group (n = 22) and the treatment group (n = 27)

<table>
<thead>
<tr>
<th>Group</th>
<th>Pretest</th>
<th>Posttest</th>
<th>Gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>male</td>
<td>87.50*</td>
<td>137.13</td>
<td>49.63</td>
</tr>
<tr>
<td></td>
<td>36.47**</td>
<td>70.74</td>
<td>40.29</td>
</tr>
<tr>
<td>female</td>
<td>50.14</td>
<td>86.07</td>
<td>35.93</td>
</tr>
<tr>
<td></td>
<td>32.55</td>
<td>46.62</td>
<td>27.78</td>
</tr>
<tr>
<td>combined</td>
<td>63.73</td>
<td>104.64</td>
<td>40.91</td>
</tr>
<tr>
<td></td>
<td>37.91</td>
<td>60.38</td>
<td>32.63</td>
</tr>
<tr>
<td>Treatment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>male</td>
<td>78.94</td>
<td>136.82</td>
<td>57.88</td>
</tr>
<tr>
<td></td>
<td>29.18</td>
<td>37.62</td>
<td>23.19</td>
</tr>
<tr>
<td>female</td>
<td>40.90</td>
<td>98.40</td>
<td>57.50</td>
</tr>
<tr>
<td></td>
<td>24.62</td>
<td>38.14</td>
<td>28.92</td>
</tr>
<tr>
<td>combined</td>
<td>64.85</td>
<td>122.59</td>
<td>57.74</td>
</tr>
<tr>
<td></td>
<td>32.93</td>
<td>41.62</td>
<td>24.91</td>
</tr>
</tbody>
</table>

* = Mean  ** = Standard Deviation

Pretest

T-test results for initial differences of pretesting performance are presented in Table 3. T-tests were used to determine significant differences between males for pretesting performance by group. T-tests were used to determine significant differences between females for pretesting performance by group. T-tests were used to determine significant differences between males and females.
Table 3. T-test results for male, female, and male vs. female pretest performance

<table>
<thead>
<tr>
<th>Gender</th>
<th>t-value</th>
<th>df</th>
<th>p-value</th>
<th>95% C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>-.63</td>
<td>23</td>
<td>.534</td>
<td>-36.57, 19.45</td>
</tr>
<tr>
<td>Females</td>
<td>-.76</td>
<td>22</td>
<td>.458</td>
<td>-34.63, 16.14</td>
</tr>
<tr>
<td>Male vs. Female</td>
<td>4.09</td>
<td>47</td>
<td>.000*</td>
<td>17.99, 52.79</td>
</tr>
</tbody>
</table>

* Indicates a significant difference between groups (p < .05)

for pretesting performance. No significant (p > .05) difference was found between males for pretesting performance. No significant (p > .05) difference was found between females for pretesting performance. A significant (p < .05) difference was found between males and females for pretesting performance.

Mean pretest score for the control group was 63.73 points. Mean pretest score for the treatment group was 64.85 points. Mean posttest scores for the control group was 104.64 points. Mean posttest score for the treatment group was 122.59 points. Mean gain score for the control group was 40.91 points. Mean gain score for the treatment group was 57.74 points.

Gain Score Performance by Gender by Group

Two-way ANOVA results for gain score performance of gender by group are presented in Table 4. A two-way ANOVA
Table 4. ANOVA summary table of gain scores by gender for the control group (n = 22) and the treatment group (n = 27)

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Squares</th>
<th>F</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Effects</td>
<td>3975.90</td>
<td>2</td>
<td>1987.95</td>
<td>2.38</td>
<td>.104</td>
</tr>
<tr>
<td>Gender</td>
<td>557.95</td>
<td>1</td>
<td>557.95</td>
<td>.67</td>
<td>.418</td>
</tr>
<tr>
<td>Treatment</td>
<td>2504.58</td>
<td>1</td>
<td>2504.58</td>
<td>3.00</td>
<td>.090</td>
</tr>
<tr>
<td>2-Way Interactions</td>
<td>498.983</td>
<td>1</td>
<td>498.983</td>
<td>.598</td>
<td>.443</td>
</tr>
<tr>
<td>Explained</td>
<td>4390.28</td>
<td>3</td>
<td>1463.42</td>
<td>1.76</td>
<td>.169</td>
</tr>
<tr>
<td>Residual</td>
<td>37527.07</td>
<td>45</td>
<td>833.94</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>41917.35</td>
<td>48</td>
<td>873.28</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Indicates a significant difference between groups (p < .05)

was used to indicate the interaction among the variables of gender and treatment. A two-way ANOVA was used to determine significant differences between males and females by control and treatment groups on gain score performance. A two-way ANOVA was used to determine significant differences between the control and treatment groups on gain score performance.

The results of the two-way ANOVA indicated no significant (p > .05) interaction for gain score performance among the variables of gender and treatment. No significant (p > .05) difference was found for gain score performance between males and females by control and treatment groups. No significant (p > .05) difference was found for gain score performance between control and treatment groups.
Pre- and posttest mean performance scores for males and females by control and treatment groups depicting the extent and direction of improved performance are in Figure 1.

![Performance Test Graph]

Figure 1. Mean performance scores for males and females by control and treatment groups

Correlation Coefficients

The correlation coefficients for the independent variables of age, height, weight, and gender, along with gain scores are presented in Table 5. When age, height, weight, gender, and gain scores were analyzed, there were several variables with significant correlations. However, no independent variables showed a significant correlation with gain score performance.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Age</th>
<th>Height</th>
<th>Weight</th>
<th>Gain Score</th>
<th>Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>--</td>
<td>.2685*</td>
<td>.2430</td>
<td>.1386</td>
<td>.1477</td>
</tr>
<tr>
<td></td>
<td></td>
<td>.031**</td>
<td>.046***</td>
<td>.171</td>
<td>.156</td>
</tr>
<tr>
<td>Height</td>
<td>--</td>
<td></td>
<td>.7862</td>
<td>.0369</td>
<td>-.7576</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>.000***</td>
<td>.401</td>
<td>.000***</td>
</tr>
<tr>
<td>Weight</td>
<td>--</td>
<td>-.1594</td>
<td></td>
<td>-.7375</td>
<td>.000***</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>.137</td>
<td></td>
<td>.113</td>
</tr>
<tr>
<td>Gain Score</td>
<td></td>
<td></td>
<td></td>
<td>-.1764</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* = Coefficient  ** = Significance  
*** Indicates a significant correlation between variables  
(p < .05)

**Discussion**

Upon examining the statistical analyses for this experiment on indoor sport climbing performance, both control and treatment groups were not statistically different after pretest performance. As a result of the indoor sport climbing course, both control and treatment groups improved performance as indicated by posttest performance. While mean gain scores for the treatment group were greater than the control group, it was not statistically significant. Thus, there was no significant difference for the control and treatment groups on mean gain score improvement.
Therefore, the first null hypothesis that there would be no significant differences in improved sport climbing performance between the control and treatment groups when comparing gain score values failed to be rejected. No significant difference lends itself to the conclusion that under the conditions in this study, using the sample of subjects from UW-L, mental imagery techniques with physical practice did not improve sport climbing performance greater than physical practice alone. In other words, both methods are equally effective for teaching indoor sport climbing.

When looking at the independent variable of gender, male and female subjects also improved in sport climbing performance as indicated by posttest scores. Results indicated that males and females from the control and treatment groups were not statistically different on gain score performance. Hence, male and female subjects had similar mean gain score improvement.

Therefore, the second null hypothesis of this study that there would be no significant difference in improved sport climbing performance when comparing males and females on gain score performance failed to be rejected. This indicates that gender was not a limiting factor to performance. Unfortunately, this fact could not be compared with World Cup championships because these competitions have male and female climbers ascend different routes (Watts et al., 1993).
Another factor that was analyzed for this study was the interaction between gender and treatment. Results indicated no significant interaction among these variables. Male mean gain score improvement was similar whether one was in the control or treatment group, and female mean gain score improvement was similar whether one was in the control or treatment group. Therefore, group did not influence mean gain score improvement for both males and females.

Results from this study concerning improved sport climbing performance after receiving mental imagery techniques are not congruent with results found in both of the major literature reviews concerning mental imagery and motor tasks. In the first review by Richardson (1967), 11 studies support the hypothesis that mental imagery was associated with improved performance of a task. The aforementioned finding of this study also rejects what was implied in a second review by Feltz and Landers (1983). Feltz and Landers suggested that mentally practicing the motor skill with physical practice helps improve performance to a moderate extent above and beyond physical practice without mental practice.

Improved performance in this study does not agree with those of Meacci and Price (1985) who found that the acquisition and retention of golf putting was superior using relaxation, visualization, body rehearsal, and physical practice. The study by Meacci and Price (1985) was much
like this study in that the subjects being used were
beginners at the task with little, if any, experience.

Pearson product-moment correlations were performed with
the intention of finding out the relationship between age,
height, weight, and gender is to gain score performance. The
results indicate that there were no significant correlations
among these variables. Thus, participants of this study
were not limited by these physical factors nor were they
beneficial. It should be noted that Watts et al. (1993)
found that elite competitive sport climbers are extremely
lean athletes of small stature.
CHAPTER V
SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The primary purpose of this study was to measure sport climbing improvement as a result of mental imagery techniques with physical practice of male and female University of Wisconsin-La Crosse students. A secondary purpose was to examine the relationship between age, weight, height, and gender with sport climbing performance. Forty-nine subjects between the ages of 18 and 27 completed the study. The control group, consisting of 22 subjects, received instructional techniques for indoor sport climbing. The treatment group, consisting of 27 subjects, received the same techniques associated with indoor sport climbing and mental imagery techniques.

Each subject completed pre- and posttesting evaluations consisting of a score which measured their ability to climb the routes on the indoor climbing wall. At the beginning of the mental conditioning program, log books were given to the subjects to set goals and evaluate the positive things that occurred during each day's climbing experience.

Pre- and posttest data from the control and treatment groups were collected and statistically analyzed to
determine if significant improvement occurred in response to the mental imaging techniques. Results of the two-way ANOVA indicated: no significant ($p > .05$) interaction for gain score performance among the variables of gender and treatment; no significant ($p > .05$) difference for gain score performance between males and females by control and treatment groups; no significant ($p > .05$) difference for gain score performance between control and treatment groups. Pearson product-moment correlations indicated no significant ($p > .05$) correlations between the variables of age, height, weight, gender, and gain scores.

**Conclusions**

Based on the results of this study, the following null hypotheses failed to be rejected or were rejected:

1. There will be no significant difference in sport climbing performance between the control and experimental groups when comparing pre- and posttest values. The null hypotheses failed to be rejected.

2. There will be no significant differences in sport climbing performance between males and females when comparing pre- and posttest values. The null hypotheses failed to be rejected.

3. There will be no relationship between sport climbing performances when compared to the variables of age, weight, height, and gender. The null hypotheses failed to be rejected.
Recommendations

Based on the results of this study, the following recommendations are presented:

1. It is recommended that future studies be done with an increased number of subjects and equal number of subjects in each group.

2. It is recommended that future studies be done with equal members of gender in each group.

3. It is recommended that future studies be done using a three or four group design.

4. It is recommended that future studies be done with a motivational strategy.

5. It is recommended that future studies be done with a self-efficacy questionnaire.

6. It is recommended that future studies be done with fitness pre- and posttesting.

7. It is recommended that future studies be done with experienced rock climbers.

8. It is recommended that future studies be done with more than one criteria of judging a climb, such as the speed it takes a climber to complete a route.

9. It is recommended that future studies be done with pre-, mid-, and posttests.
REFERENCES


APPENDIX A

INDOOR SPORT CLIMBING COURSE OUTLINE
INDOOR SPORT CLIMBING COURSE OUTLINE

I. Course Description:
This course presents the content, methods, and safety of indoor sport climbing. Students will learn to use and implement a wide variety of climbing equipment and knots. Emphasis will be placed on the acquisition of basic climbing skills and techniques for improving performance in climbing indoor walls.

II. Student Objectives:
Upon completion of this course, the student will be able to:

1. Identify proper safety procedures.
2. Identify knowledge and skills in knot-tying and rope management.
3. Utilize skills needed for climbing indoor walls.
4. To become proficient in specific technical skills of belaying, knot-tying, and harnesses.

III. Course Content:
1. Preconditioning activities, physical warm-up, and psychological preparation.
2. Safety, spotting, and belaying techniques.
4. Materials and equipment necessary for indoor rock climbing.
5. Elements of climbing techniques and conditioning.

IV. Course Evaluation:
50% Participation
50% Following safety procedures

Attendance policy: You are allowed 3 absences, more than 3 and you fail the class.

V. Resources:
The Basic Essentials of Rock Climbing, Mike Strassman
APPENDIX B

INFORMED CONSENT FORM
INFORMED CONSENT FORM

University of Wisconsin-La Crosse
La Crosse, Wisconsin 54601

Project Title: The effect of mental imagery on sport climbing performance of college students

Principal Investigator: Keith Barton

Principal investigator will read aloud along with the subjects the narrative accompanying points 1-6.

1. Procedures to be followed: I, ____________________________, volunteer to participate in the training enhancement, relaxation, and mental imagery series of lectures during the spring 1996 indoor rock climbing course. I will apply the techniques I have learned during these lectures towards my participation in the physical aspect of indoor rock climbing. The purpose of this study is to determine whether or not using mental imagery techniques coupled with physical practice will elicit greater rock climbing performance than physical practice only.

2. Potential discomforts or risks to be expected by the subjects: There are no risks involved with learning mental imaging techniques.

3. Potential benefits to the subject and others: Mental imagery has the potential to improve all aspects of one's life if practiced regularly. Examples of improvement may include one's physical performance in athletics, schoolwork, sleeping, etc.

4. Alternative procedures which might be advantageous for the subject (if any): Not applicable.

5. The researcher will meet all voluntary participants independently. The researcher will have a score card for each subject. Subjects will be identified using the last four digits of their social security number. Only the researcher and committee members will have access to the score card.

6. The Principal Investigator will answer any and all inquiries concerning procedures, risks, or benefits. Keith Barton can be reached at 2823 Hamilton St., La Crosse, Wisconsin. His phone number is (608) 781-0682. Dr. Jeffrey Steffen will be the faculty research advisor. He can be
reached at (608) 785-6535. Dr. Jeffrey Steffen's office is located on the second floor in Mitchell Hall.

1. I, ______________________, being of sound mind and ___
(Signature of Subject)
years of age, do hereby consent to, authorize and request
the person named above (and co-workers, agents, and
employees) to undertake and perform on me the proposed
procedure, treatment, research or investigation (herein
called "Procedure").

2. I have read the above document, and I have been fully
advised of the nature of the Procedure and the possible
risks and complications involved in it, all of which risks
and complications I hereby assume voluntarily.

3. I hereby acknowledge that no representations, warranties,
guarantees or assurances of any kind pertaining to the
Procedure have been made to me by the University of
Wisconsin-La Crosse, the officers, administration, employees
or by anyone acting on behalf of any of them.

4. I understand that I may withdraw from the program at any
time without penalty of any kind.

Signed at __________ this ___ day of __________, 1996,
in the presence of the witnesses whose signatures appear
below opposite my signature.

WITNESSED BY:

_________________________  ____________________________
(Subject)
APPENDIX C

CLIMBING WALL CHARACTERISTICS
CLIMBING WALL CHARACTERISTICS

Routes were numbered from 1-12, with 1 being the least difficult and 12 being the most difficult. Viewing the wall from left to right the following difficulty ratings were assigned to each route by the researcher and committee chair. Also listed are the number of possible holds and the scoring range of each route:

Brown/White - # 11
- Possible Holds - 31
- Scoring Range - 221-251

Purple - # 6
- Possible Holds - 22
- Scoring Range - 110-131

Black/White - # 8
- Possible Holds - 24
- Scoring Range - 151-174

Brown/White - # 4
- Possible Holds - 19
- Scoring Range - 66-84

Black/White - # 10
- Possible Holds - 24
- Scoring Range - 197-220

Red - # 5
- Possible Holds - 25
- Scoring Range - 85-109

Blue/White - # 3
- Possible Holds - 25
- Scoring Range - 41-65

Royal Blue - # 12
- Possible Holds - 30
- Scoring Range - 252-281

Green - # 7
- Possible Holds - 19
- Scoring Range - 132-150
Red - # 1
- Possible Holds - 20
- Scoring Range - 1-20

White/Red - # 2
- Possible Holds - 20
- Scoring Range - 21-40

Royal Blue - # 9
- Possible Holds - 22
- Scoring Range - 175-196
CLIMBING RULES

The following is a reprint of current Union Internationale Des Association D'Alpinisme (Darmi, 1992) regulations governing climbing competitions which will be used to assess a subject's climb during pre- and posttesting.

1. Neutral Zone: unclimbed area (without holds) out of bounds to climbers.

2. A route shall be considered successfully completed if it is climbed without a fall and without the use of artificial aids. Successfully completed means completion of the route to the last hold.

3. A climber may climb downwards at any time, but without returning to the ground.

4. Each climber may use whatever technical equipment and materials he/she chooses (climbing shoes, harness, helmet).

6. In the event of a fall or ordered stop, the route judge shall measure the highest point held. An ordered stop will entail crossing over the boundaries of the route, use of artificial aid, and returning to the ground.

7. If a climber firmly takes a specified hold, he/she is given the measurement of that hold.
APPENDIX E

SCORING CARD
SCORING CARD

Date:
Name of Researcher: Keith Barton

<table>
<thead>
<tr>
<th>SS#</th>
<th>GENDER</th>
<th>AGE</th>
<th>WEIGHT</th>
<th>HEIGHT</th>
<th>ROUTE#</th>
<th>HOLD#</th>
<th>REACHED</th>
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</tbody>
</table>
APPENDIX F

MENTAL IMAGERY PROGRAM OUTLINE
MENTAL IMAGERY PROGRAM OUTLINE

<table>
<thead>
<tr>
<th>DAY</th>
<th>PROGRAM STEP</th>
<th>TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1:</td>
<td>Relaxation</td>
<td>10 Minutes</td>
</tr>
<tr>
<td>Day 2:</td>
<td>Relaxation</td>
<td>10 Minutes</td>
</tr>
<tr>
<td>Day 3:</td>
<td>Positive Affirmation Statements</td>
<td>10 Minutes</td>
</tr>
<tr>
<td>Day 4:</td>
<td>Positive Affirmation Statements</td>
<td>10 Minutes</td>
</tr>
<tr>
<td>Day 5:</td>
<td>Mental Recall</td>
<td>10 Minutes</td>
</tr>
<tr>
<td>Day 6:</td>
<td>Mental Recall</td>
<td>10 Minutes</td>
</tr>
<tr>
<td>Day 7:</td>
<td>Mental Recall</td>
<td>10 Minutes</td>
</tr>
<tr>
<td>Day 8:</td>
<td>Mental Rehearsal</td>
<td>10 Minutes</td>
</tr>
<tr>
<td>Day 9:</td>
<td>Mental Rehearsal</td>
<td>10 Minutes</td>
</tr>
<tr>
<td>Day 10:</td>
<td>Mental Rehearsal</td>
<td>10 Minutes</td>
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</tbody>
</table>
APPENDIX G

GUIDELINES FOR DEVELOPING

POSITIVE AFFIRMATION STATEMENTS
GUIDELINES FOR DEVELOPING
POSITIVE AFFIRMATION STATEMENTS

1. Word the positive affirmation statements so that they are positive in nature. Focus the statement on what you will be doing - not on what you will not be doing. For example, state "I am relaxed" rather than "I am not tense" or, "I will sink the putt" rather than "I will not miss the putt." Remember, the mind focuses subconsciously on the behavior you are suggesting.

2. Make the positive affirmation statements as brief as possible. Focus the statements on precisely what you would like to achieve, the exact goal. There is no sense in creating a fog around the goal, disguising it with unnecessary words.

3. Select vivid words for your positive affirmation statements. The way you state or verbalize something can influence your mood and feelings, so be precise as well as vivid in selecting the statement. Each time you repeat the affirmation, you want to reinforce the emotional feeling that accompanies the action it describes.

4. Use the present tense whenever possible in your positive affirmation statements. This makes the visualization as well as the emotions evoked more vivid and more believable.

Samples:
"Every day in every way, I am better and better."
"I am filled with loving kindness."
"I am at peace with nature - and myself."
"I am a success."
APPENDIX H

POSITIVE AFFIRMATIONS WORKSHEET
POSITIVE AFFIRMATIONS WORKSHEET

List 3 of your major goals below:

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1.</td>
<td>Write 3 affirmation statements for each goal.</td>
</tr>
<tr>
<td>1a</td>
<td></td>
</tr>
<tr>
<td>1b</td>
<td></td>
</tr>
<tr>
<td>1c</td>
<td></td>
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<p>| | |</p>
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<tbody>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>2a</td>
<td></td>
</tr>
<tr>
<td>2b</td>
<td></td>
</tr>
<tr>
<td>2c</td>
<td></td>
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</tbody>
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<p>| | |</p>
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<tbody>
<tr>
<td>3.</td>
<td></td>
</tr>
<tr>
<td>3a</td>
<td></td>
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<tr>
<td>3b</td>
<td></td>
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<td>3c</td>
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Directions: From the affirmation statements above, select the best affirmation related to your most important goal. Rewrite it below. Be sure to follow the guidelines for affirmations that were discussed.

BEST AFFIRMATION STATEMENT: ____________________________________________________________

__________________________________________________________

__________________________________________________________
APPENDIX I

MENTAL RECALL WORKSHEET
MENTAL RECALL WORKSHEET

DESCRIBE THE CLIMB YOU WILL BE RECALLING:

EXPERIENCES AND SENSATIONS FELT PRIOR TO THE CLIMB
Emotional Feelings
Level of Confidence
Energy/Stress Levels
Temperature
Smell
Sound
Thoughts? Expectations? Goals

WHAT YOU EXPERIENCED AT VARIOUS STAGES OF THE CLIMB
Emotional Feelings
Smell
Sound
Kinesthetic Feelings
Taste
Temperature
Confidence
What You Saw from Your Own Eyes

COMPLETION OF EVENT
Emotional Feelings
Thoughts
Level of Confidence
Level of Stress
What You Saw

ADDITIONAL COMMENTS/OBSERVATIONS ABOUT THE RECALL EXPERIENCE: