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The Effects of Indoor Climbing Route Rating Manipulation on Participant Climbing Self-Efficacy

Phillip James Sandlin
San Jose State University

THE EFFECTS OF INDOOR CLIMBING ROUTE RATING MANIPULATION ON PARTICIPANT CLIMBING SELF-EFFICACY

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Phillip J. Sandlin

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Dr. Randy J. Virden	Department of Hospitality, Recreation, and Tourism Management
Dr. Andrew R. Fields	Central Washington University
Stephen Dowling	Department of Hospitality, Recreation, and Tourism Management

ABSTRACT

THE EFFECTS OF INDOOR CLIMBING ROUTE RATING MANIPULATION ON PARTICIPANT CLIMBING SELF-EFFICACY

by Phillip J. Sandlin

This quantitative study utilized a classical experiment design to explore the effects of manipulation of indoor climbing route ratings on the climbing self-efficacy of 90 indoor rock climbers. Controversy surrounding the accuracy of the assigned ratings of indoor climbing routes is commonplace at indoor climbing facilities. For indoor rock climbers to accurately assess their abilities, set appropriate goals, and monitor their progress, they must be able to choose climbs that accurately represent their desired level of challenge. Statistical analysis of the data did not support a relationship between manipulation of climbing route ratings and any changes in participant climbing self-efficacy. Additionally, participant perceptions of the accuracy of the stated climbing route ratings for the under and over-rated experimental groups were not found to be significantly different ($p < .05$) than that of the control group.

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Introduction

As commercial indoor rock climbing industry continues to grow and communities and universities continue to incorporate indoor climbing walls into their recreation facilities, the sport of rock climbing is becoming more accessible and more people are taking to the sport. The Outdoor Industry Association (2010) reported that of the 4,313,000 Americans age six and above represented in its outdoor recreation participation study, 24.4 % participated in either sport climbing, indoor climbing, or bouldering for the first time in 2009. Between 1998 and 2001 participation in the sport of climbing is reported to have grown by 57 % (Ewert, Attarian, Hollenhorst, Russell, & Voight, 2006). Stiehl and Ramsey (2005) attributed the growth of participation in climbing to the increased accessibility provided by indoor climbing walls. Outdoor Foundation research reported that participation in indoor climbing had surpassed that of outdoor climbing (as cited in NIRSA, 2009). Managers of indoor climbing facilities are eager to understand the motivations and desires of new and seasoned climbers, both indoors and outdoors, in order to understand what they can do to foster long-term satisfaction and involvement in the sport of climbing.

Participation in regular physical activity is associated with various psychological, physiological, and social benefits (Blair et al., 1985; Wankel & Berger, 1990; Berger, 1996; Chodzko-Zajko, 2000); however, the drop out rate for individuals starting up a sport or recreation program has been shown to be as high as 50 % within the first six months (Dishman, 2001). Mannell and Kleiber (1997) have attested that "successfully managing leisure settings and activities would be impossible without a good knowledge of the psychological state of the participants" (p. 347). Increasing desires for value-based outcomes from leisure services has put more emphasis on the need for a more theoretical approach to leisure service programming (Little, 1993). Feher, Meyers, and Skelly (1998) stated that there has been a relatively small amount of research conducted on rock climbers and the growing interest in the sport and that it is important that this group of athletes be better understood.

Sanchez, Lambert, Jones, and Llewellyn (2010) expressed that recent studies involving rock climbing have focused on various physiologically related aspects of climbing performance, whereas few studies have examined the potential influences of psychological factors. Social psychological constructs have been widely used to investigate individual experiences and behaviors associated with their chosen leisure activities (Mannell & Kleiber, 1997). Individual behaviors and experiences are viewed as an interplay between internal psychological dispositions and the various situational influences existing within social environments (Mannell & Kleiber).

Csikszentmihalyi (1975) described the optimal experience for individuals, the experience of flow, as occurring in a space where perceived challenge is matched by perceived capability. These flow experiences are best facilitated by structuring offerings to provide a clear set of challenges. Rock climbing offers constant discovery, skill development, problem solving, and interpersonal interaction creating a prime space for flow experiences (Csikszentmihalyi). Flow experiences rely on a balance between the perception of challenge and skill.

The construct of self-efficacy may offer an avenue to further understanding individuals' behaviors and satisfactions pertaining to leisure experiences. Bandura (1997a) defined perceived self-efficacy as "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (p. 3). There also exists a control aspect to perceived self-efficacy. As Bandura (1994) explained "perceived self-efficacy is concerned with people's abilities to exercise control over their own functioning and over events that affect their lives" (p. 80). Bandura (1977) also asserts that the more control one has over the level of challenge, the larger the increase in self-efficacy upon success. Furthermore, the setting and reaching of attainable goals and sub goals creates a history of mastery experience (Bandura, 1997b) which, in-turn, feeds motivation for continued participation in the activity (Llewellyn & Sanchez, 2008).

In both the indoor and outdoor climbing arena rating systems are used to differentiate climbs by level of difficulty. These ratings offer climbers a way to gauge ability, anticipate performance, set goals, and gauge improvement. Delignières, Famose, Thépaut-Mathieu, and Fleurance (1993) proposed that the climbing rating scales have come to describe "the level of competition, to express a climber's expertise or to announce the requirements of a competitive examination" (p. 2). The ratings of the climbs in indoor climbing facilities are generally assigned based on the subjective assessment of difficulty made by the route setting staff who have designed the climbs. The routes are then labeled with these ratings at their intended starting point.

There exists continuing controversy within indoor climbing facilities regarding the accuracy of climbing route ratings (Anderson, 2004). Delignières et al (1993) found that the accuracy of climbing route rating assessment increases as difficulty of the climbing route approaches the maximal ability level of the individual assessing the rating. Considering that the maximal climbing ability of route setters tends to be toward the upper limit of a climbing gyms population, thus it is conceivable that variation within the rating of climbs in indoor climbing facilities could result, especially within the middle to lower end of the rating scale occupied by a majority of a climbing gyms user base. Many facilities attempt to mitigate this inconsistency by having route setters regularly recalibrate to the scale (as Delignières et al., 1993, recommended), and/or by having the climbing routes tested for rating accuracy by other climbers with ability levels along the continuum of ratings.

Statement of the Problem

Within indoor climbing centers the difficulty ratings subjectively assigned to climbs, typically by the facility staff who have designed the climbs, are continually challenged by participants (Anderson, 2004). Regular conversations regarding a climbing route being easier or harder than its posted rating are commonplace and occasionally heated. For climbers to accurately monitor their climbing ability, set appropriate goals, and monitor their progress they must be able to accurately select climbs representative of their desired level of challenge. Weinberg (2002) stated that goals produce higher levels of task performance when they are both specific and measurable and are stated in behavioral terms. Additionally, Bandura (1977) determined that the more control one has over the level of challenge, the larger the increase in self-efficacy upon success. For the efficacious person challenges are approached not as threats but as opportunities for success, fostering “intrinsic interest and deep engrossment in activities” (Bandura, 1994). Intentional, theory-based programming agendas designed to help facilitate increases in the climbing self-efficacy of indoor climbers may offer programmers avenues to increasing user satisfaction and retention. The intentional facilitation of increases in the climbing self-efficacy of patrons may therefore be valuable to indoor climbing wall operators in their development of programming agenda’s to maximize climber satisfaction and retention. It is therefore important to examine the effects, if any, of manipulation of indoor climbing route ratings on the climbing self-efficacy of indoor climbers.

Purpose of Study

The purpose of this study was to examine the effect, if any, of manipulation of indoor climbing route ratings on the climbing self-efficacy of indoor rock climbers. This study will contribute to the body of research surrounding rock climbing and indoor rock climbing by offering additional insight into climbing route rating evaluation and the role of climbing self-efficacy within the sport of rock climbing.

Hypotheses

The purpose of this research study is to examine the effects, if any, of manipulation of indoor climbing route ratings on climbing self-efficacy.

H_1: There will be an effect on participants climbing self-efficacy based upon manipulation of the climbing route rating.

H_2: Participants in the over and under rated groups will perceive the manipulated climbing route ratings as being different from the control group.

Definitions

Indoor Rock Climbing. Traditionally the sport of rock climbing in its outdoor arena has been comprised of the disciplines of top-rope climbing, sport lead climbing, traditional lead climbing, free soloing, and bouldering (Llewellyn & Sanchez, 2008, &, Llewellyn, Sanchez, Asgar, & Jones, 2008). The development of indoor rock climbing facilities has brought the disciplines of top-rope climbing, sport lead climbing, and bouldering indoors. For the purposes of this study, participation in indoor rock climbing has been conceptualized as participation in top-roped climbing on artificially created climbing walls within an indoor arena.

Indoor Climbing Routes. Indoor climbing facilities offer climbing opportunities in the form of specified paths for climbing to the top of the wall commonly referred to as climbing routes. These climbing routes are delineated from one another by proximity, the use of specifically colored climbing holds, or by the use of colored tape to indicate which climbing holds or features on the particular section of climbing wall are considered to be a part of the specified climbing route. Anderson (2004) asserted that indoor climbing routes are the main product of indoor climbing gyms.

Climbing Route Ratings. There exist various rating systems throughout the world that have been developed to signify the difficulty levels of specific rock climbs. Delignières et al. (1993) asserted that scales like those used in rock climbing represent one of the most advanced ratings systems being administered for rating difficulty. In the United States the most common system used to rate the difficulty of climbing routes is the Yosemite Decimal System (YDS). The YDS denotes the difficulty level of a free climb with the number 5, followed by a decimal point and subsequent numerals used to delineate the difficulty of the free climb. These subsequent numerals currently range from 0 to 15. Further subdivisions are used from the grade 5.10 and upward and are denoted by the letters a, b, c, and d. With these subdivisions a 5.10a would be less difficult than a 5.10b and so forth. The current YDS range is from 5.0 (easiest) to 5.15c (most difficult). The majority of indoor climbing facilities within the United States utilize the YDS to rate the difficulty of their climbing routes. A separate system is generally used for rating the difficulty of bouldering routes.

Self-Efficacy. Bandura (1997a) defines perceived self-efficacy as "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments (p. 3)."

Climbing Self-Efficacy. Climbing self-efficacy refers to an individual's self-perceived beliefs in their "ability to perform actions necessary to produce a given effect in climbing" (Llewellyn et al., 2008, p. 77).

Social Psychology. "Social psychology is the scientific study of the behavior and experience of individuals in social situations" (Mannell & Kleiber, 1997, p. 25).

Social Psychology of Leisure. "The social psychology of leisure is the scientific study of the leisure behaviors and experiences of individuals in social situations" (Mannell & Kleiber, 1997, p. 25).

Structure of the Thesis

This thesis includes an introduction and background for the study, a review of relevant literature regarding key concepts and theories, the methods used, results of the study, and a discussion of the findings with recommendations for future research.

Chapter II

Review of Literature

The purpose of this study is to explore possible effects of manipulation of indoor climbing route ratings on the climbing self-efficacy of indoor rock climbers. This chapter will examine previous research regarding motivation, social cognitive theory, social learning theory, and self-efficacy theory.

Motivation

In order to evaluate the quality of leisure experiences, it is first necessary to understand the motivations involved. Beggs, Elkins, and Powers (2005) suggest that the quality of leisure experiences may be linked to initial motivations for the chosen activity. Motivation refers to "the dynamics of behavior, the process of initiating, sustaining, and directing activities of the organism" (Goldenson, 1970, p. 269). Theories of motivation have progressed from those focused on physiological or biological activators, to a more cognitive holistic approach. Progressive theories within the discipline of leisure studies, more specifically play, include stimulus-arousal theory and competence-effectiveness theory.

Maslow's hierarchy of needs. Maslow (1970), through the study of a selection of highly successful individuals, posited that individuals are motivated by the desire to satisfy a continuum of needs where lower level needs, like basic physical needs of food, shelter, and safety must be satisfied before higher level growth needs like social, esteem, and finally self-actualization can be addressed. This upper tier of self-actualization addresses the need to discover one's full potential through "intense activity and experience" (Csikszentmihalyi, 1990). Maslow's model was expanded in 1970 to include cognitive, aesthetic, and the new top tier of transcendence needs (Maslow, 1970). Though Maslow's hierarchy of needs has received much recognition, it has also received much criticism due to a lack of empirical support (Wahba & Bridwell, 1976).

Stimulus-arousal theory. Donald Hebb first proposed that regulation of behavior was linked to the need to maintain an optimal level of arousal (Zuckerman & Como, 1983). Pfaff (2006) describes arousal as the fuel behind behavior determining the activation, strength, and persistence of motivational behaviors. Arousal is "fundamental to all cognitive and emotional functions" (Pfaff, p. 3).

Level of arousal is also related to the perceived difficulty of a task (Pfaff, 2006). If the task is perceived as easy, arousal will decrease for the conservation of energy. If the task is perceived as difficult, arousal levels will increase in preparation. Yerkes-Dodson (Pfaff) proposed an inverted 'U' hypothesis stating that performance increases with arousal until the optimal level of arousal has been reached, beyond this optimal level, as arousal continues to increase, performance quickly begins to decrease.

Zuckerman (1983) remarks "There is great appeal in simple universal constructs like 'arousal,' but nature is rarely so kind as to make things simple for us" (p. 381). Zuckerman's (2004) sensation seeking theory posits that seeking high levels of arousal, such as those involved in high-risk activities, like rock climbing, is associated with a high sensation seeking personality trait. Llewellyn and Sanchez (2008) note that there is a large body of research confirming a relationship between risk taking behaviors and the sensation seeking personality trait; however, sensation seeking does not account for other motives for risk taking such as mastery and accomplishment. Studies have found motivation for participation in high-risk sports to be positively related to self-efficacy and mastery and accomplishment, rather than sensation seeking (Llewellyn & Sanchez, 2008; Slanger & Rudestan, 1997)

Competence-effectance theory. White (2011) proposed competence-effectance theory in reaction to the developing disfavor for biological or drive-based theories of motivation. White asserted that motivation stems from an intrinsic need to actively interact with the environment in a manner that gains more understanding and ultimately more control. This experimentation and exploration results in a developed competence. It is not the subsequent learning that motivates, but the sense of efficacy gained from the experience (White).

Competence mastery has been found to be the most important motivational factor for leisure activity participation amongst college students (Beggs, Elkin & Stitt, 2004, Beggs & Elkins, 2010). Ewert (1985) found that as climbers gain experience their motivations change from more extrinsic factors like social recognition, to the more intrinsic reasons of challenge, catharsis, locus of control, and creativity. The desire to develop mastery over one's environment through the cyclical process of acquisition and mastery of skills followed by the continuous challenging of one's capabilities leads us to the concept of flow, or optimal experience, as proposed by Csikszentmihalyi (1975).

Flow. Facilitating positive leisure experiences lies at the heart of the recreation industry. Csikszentmihalyi (1975) describes the optimal experience for individuals, the experience of flow, as one occurring when a perceived challenge is evenly matched by one's perceived capabilities. When capabilities are low and the challenge high, anxiety ensues. Alternatively, when the challenge is low and capabilities are high, one slips into boredom. Csikszentmihalyi emphasizes, "whether one is in flow or not depends entirely on one's perception of what the challenges or skill are" (p. 50) and the higher one is on the capability/challenge matrix, the deeper the flow experience.

In developing his concept of flow, Csikszentmihalyi (1975) studied rock climbers, dancers, chess players, and basketball players in an attempt to understand the motivations and experiences driving individuals to sacrifice so much time, energy, and expense with little or no foreseeable extrinsic rewards. What he discovered is that what is sought is the experience alone; thus, the experience itself becomes intrinsically rewarding. Csikszentmihalyi remarked that with the seemingly infinite potential for levels of challenge and skill development, rock climbing offers unlimited avenues for experiencing flow.

Social Cognitive Theory

Social cognitive theory is the evolution of Bandura's social learning theory, incorporating the additional elements of self-beliefs as well as emphasizing the importance of cognition in the regulation of human behavior (Pajares, 2002). Bandura (2001) asserts; "the capacity to exercise control over the nature and quality of one's life is the essence of humanness" (p. 1). Social cognitive theory posits that individuals are active, rather than passive agents in there own cognition, motivation, action, and emotions. Through cognitive representations, desired future outcomes can fuel motivation and action through goal formation. Bandura stresses; "Evaluative selfengagement through goal setting is affected by the characteristics of goals, namely their specificity, level of challenge and temporal proximity" (p. 8).

Bandura's (2001) social learning theory was rooted in the concept of triadic reciprocal determinism, where an individual's behaviors, environmental conditions, and personal factors interact not alone but in a reciprocal manner with one another to influence behavior. Social learning theory puts emphasis on three requirements for individuals to learn and model behavior that include attention and retention, reproduction, and motivation to actually want to adopt the behavior.

A key component of social cognitive theory is the concept of self-reflection. Bandura (2001) states, "Among the mechanisms of personal agency, none is more central or pervasive than people's beliefs in their capabilities to exercise control over their own functioning and over environmental events"(p. 10). These efficacy beliefs regulate motivation largely through personal goal setting (Bandura).

Self-Efficacy Theory

The theory of self-efficacy was developed by Albert Bandura and has been researched in regards to many disciplines including rock climbing. Bandura (1997a) defines self-efficacy as "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments (p. 3)." Perceived self-efficacy has been shown to be more reliable than past experience as an indicator of future success (Bandura, 1977). Self-efficacy beliefs affect individuals cognitive, motivational, affective, and selective processes (Bandura, 1994, 1997a, 1997b). Individuals with high-perceived self-efficacy tend to set more challenging goals for themselves, expend more effort trying to reach their goals, and will persist longer when the task proves to be difficult (Bandura, 1997a, 1997b). Challenges are approached not as threats but as opportunities for success, fostering "intrinsic interest and deep engrossment in activities" (Bandura, 1994: p. 71). These perceptions of self-efficacy are developed based upon previous mastery experiences, vicarious experience, verbal persuasion, and individuals' physical and psychological states (Bandura, 1977, 1997a).

There also exists a control aspect to perceived self-efficacy. Bandura (1994) explained, "perceived self-efficacy is concerned with people's abilities to exercise control over their own functioning and over events that affect their lives" (p. 80). Bandura (1977) determined that the more control one has over the level of challenge, the larger the increase in self-efficacy upon success. Through the setting and reaching of attainable goals and sub goals, a history of mastery experiences develops leading to subsequent increases in self-efficacy (Bandura, 1997b).

Sources of self-efficacy. Bandura (1994, 1997a, 1997b) explained that an individual's perceived self-efficacy can be derived from four main sources. The first and most substantial source influencing individuals perceptions of self-efficacy is enactive mastery experiences; followed by the sources of social modeling, social persuasion, and lastly one's physical and emotional states.

Increases in self-efficacy through enactive mastery experiences involve individuals having experiences of success despite difficulties (Bandura, 1997b). These experiences of success serve as indicators of individual capabilities. Bandura further explained that an individual's perceived self-efficacy could be raised, lowered, or remain unaffected by the same performance successes depending upon how individuals interpret various situational and personal contributors to the success. Increases in self-efficacy are greater when an individual's perception of self-efficacy is high toward the given challenge, and they proceed to perform tasks successfully under challenging circumstances (Bandura). Witnessing the successes of others can also provide information for self-appraisal.

These vicarious experiences provide information about potential personal capabilities through the modeling of others (Bandura, 1997b). Increases of perceived self-efficacy can be obtained through witnessing the successes of others viewed as similar to oneself. In the absence of clear measures of challenge, individuals must rely on self-evaluation based upon the attainments of these models (Bandura). Furthermore, Bandura explained that performing better than others raises efficacy beliefs. Witnessing others perform above one's current ability can also provide evidence that one is capable of raising one's performance to similar levels. These increases in perceived self-efficacy can be further enhanced through models instruction in skills for improving performance and strategies for coping with subsequent failures and setbacks (Bandura, 1986 cited in Bandura, 1997b).

Modeled performances can also have a negative effect on an individuals' perceived self-efficacy. Modeled failures can lower the observer's perception of self-efficacy when observers evaluate themselves as having similar capabilities to the model (Bandura, 1997a). Additionally, being out performed can also potentially decrease efficacy beliefs when observers evaluate themselves as having similar capabilities to the model (Bandura, 1977b).

There exists an additional way in which other individuals influence the self-efficacy beliefs of individuals. The social persuasion of others through positive motivation and experience design can facilitate increases in self-efficacy (Bandura, 1994, 1997a). Bandura (1997a) stated, “People who are persuaded verbally that they have the capabilities to master given tasks are likely to mobilize greater effort and sustain it than if they harbor self-doubts and dwell on personal deficiencies when difficulties arise” (p. 101). However, providing unrealistic feedback of capabilities can alternatively produce failures that “discredit the persuader and further undermine the recipients’ beliefs in their capabilities” (p. 101).

The fourth area that can influence the efficacy beliefs of individuals, especially with regards to perceived self-efficacy in athletic endeavors, involves their physiological and affective states (Bandura, 1997a). Bandura described these physical and emotional states to include physical accomplishments, physical and mental health, and various coping mechanisms. During physical activities, indications of strength, stamina, and discomfort affect efficacy beliefs based upon cognitive evaluations of circumstances involved (Bandura).

An individual’s perceived self-efficacy can be built and it can also be dissolved. Within these sources for increasing perceived self-efficacy lie inverse sources that can be destructive to an individuals perceived self-efficacy. Individuals with low perceived self-efficacy tend to avoid difficult situations, have weak commitment to there goals, revel in self-doubts, and blame there own inadequacies as the reason for failure (Bandura, 1997a). Understanding the affects of the various sources of self-efficacy beliefs may offer modes for evaluation of program experiences. Future programs can then be optimized to assist in facilitating the development of participant self-efficacy.

Climbing self-efficacy. Climbing self-efficacy refers to an individual's self-perceptions of their "ability to perform actions necessary to produce a given effect in climbing" (Llewellyn et al., 2008, p. 77). The construct of self-efficacy has been researched in regards to rock climbing in several ways.

Rock climbers have been categorized into sub-groups based upon level of risk-taking. Slanger and Rudestan (1997) separated rock climbers into either "high-risk taker" or "extreme risk takers" based upon whether they climbed with ropes and other protective equipment (lead climbing) or without ropes or other protective equipment (soloing). Llewellyn and Sanchez described top-roped climbing as being low risk in relation to lead climbing (medium to high risk) and soloing (extreme risk). Bandura (1997b) has proposed that one of the reasons that individuals take risks is that they believe they will be able to cope with the situation, thus exhibiting aspects of self-efficacy. Bandura (1986) also mentioned that studies of athletes have shown a negative relationship between perceived self-efficacy and the amount of fear and anxiety experienced during an activity. Llewellyn and Sanchez (2008) found self-efficacy to be positively associated with risk-taking, supporting Slanger and Rudestam's (1997) conclusion that "the factor most responsible for the disinhibition associated with risk taking appears to be the precepts of self-efficacy" (p. 366). Additionally, the aspects of mastery and accomplishment were found by to be key motivating factors in risk taking (Slanger & Rudestan).

Outside the realm of risk taking, self-efficacy has also been found to be positively related to frequency of climbing and difficulty of climbs attempted (Llewellyn & Sanchez, 2008; Slanger & Rudestam, 1997), and as a predictor of superior performance (Judge & Bono, 2001). The majority of previous research has focused on how self-efficacy affects aspects of performance. Feltz, Short, and Sullivan (2008) remarked that in self-efficacy-performance research regarding sports, athlete's perceptions of their performance have mostly been assumed. There currently exists a gap in climbing self-efficacy research regarding how indoor rock climber's perceptions of their performance affect their climbing self-efficacy.

Summary

The ratings assigned to rock climbs represent a measurement tool by which climbers can gauge skill level, evaluate improvement, set goals, and compare their performance with other climbers. Individuals set appropriate goals based upon their efficacy beliefs, which intern regulates their motivation for action (Bandura, 2001). Bandura (1997b) stated that "the same level of performance success may raise, leave unaffected, or lower perceived self-efficacy depending on how various personal and situational contributors are interpreted and weighed" (p. 81). Applied to indoor climbing, theory would suggest that successful or unsuccessful performance on a specific climbing route may raise, may not affect, or may lower the perceived climbing self-efficacy of the climber having climbed the route based upon the climbers interpretations of the experience. This interpretation may, at least partially be based upon available information such as the difficulty ratings assigned to indoor climbing routes. It is therefore important to explore the effect, if any, of manipulation of climbing route ratings on the climbing self-efficacy of indoor rock climbers.

Chapter III

Method

The purpose of this study was to explore the effects, if any, of manipulation of climbing route ratings on climbing self-efficacy. This chapter provides an overview of the research design including the study's research methodology, sampling design, variable operationalization, and measuring instruments to be used for data collection. The first section contains a discussion of the sampling design including the study area, study population, and sampling procedures. This is followed by a description of how the variables of climbing route rating and climbing self-efficacy are operationalized for this study. Lastly, the data collection methods utilized for this study are discussed.

Research Design

This study utilized a classical experiment design (Figure 1) to investigate possible effects of manipulation of climbing route ratings on the climbing self-efficacy of indoor rock climbers and to investigate whether the manipulated ratings were viewed by participants as different from the true rating (Babbie, 2007). First, the independent variable of climbing self-efficacy was tested against the dependent variable of the indoor climbing route rating. Second, the independent variable of indoor climbing route rating was tested against the dependent variable of perceived rating accuracy. The study utilized a pretest and posttest on a control group and two experimental groups. The control group was told the true rating of the climb while one experimental group was told a rating one level above that of the control group, and the other experimental group told a rating one level below that of the control group in order to increase the validity of the findings (Babbie).

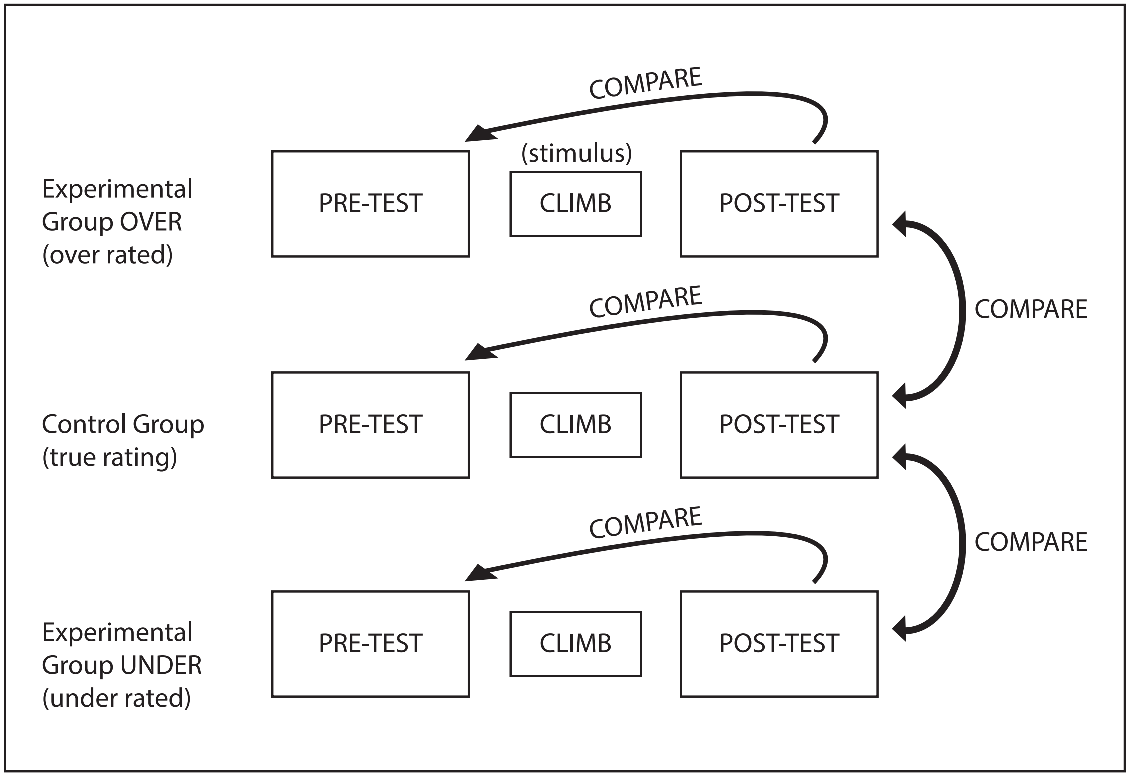

Figure 1. Flow chart of classical experiment design.

An indoor climbing gym in northern California was selected as the site for the research experiment. The 16,000 square foot indoor climbing wall consisted of 60 top-rope climbing stations offering an average of 120 top rope climbing routes and 50 sport lead climbs ranging in difficulty rating from 5.4 to 5.13a. The facility also featured an average of 100 boulder problems. The indoor climbing gym was open to the public via day pass or monthly membership. All participants were required to sign a release of liability as required by the facility. Facility protocols were followed regarding safety procedures for indoor top-roped climbing.

Three climbing routes were created for the experiment on the morning that the experiment began so that none of the participants had prior experience on their assigned climbing route. The individual routes were checked for both rating accuracy and accessibility for various heights of climbers by both the researcher and the facility manager, both of whom regularly assess the climbing routes at the facility. The assessed actual ratings for each of the three routes were 5.8, 5.10a, and 5.11a, respectively. These ratings were desired to be representative of beginner, intermediate, and advanced categories of climbers. The routes were distinguished from one another via the use of a specific color of tape marking each of the climbing holds that make up each climbing route. One route was marked with white tape, one with black tape, and the third with red tape. The climbing routes were not labeled with ratings.

All three of the designated routes reached peak height of 30 feet. To mitigate the potential risk of participant injury from falling during the experiment, participants were tied into a top-rope safety system while climbing, which was managed by the researcher who was certified for its use in the facility when the research was conducted. This top-rope safety system involved the participant being tied to one end of a climbing rope using a figure-eight-follow-through knot, then being threaded through an anchor at the top of the climb with the other end of the rope coming back down to the researcher, who is attached to this end via an aperture style belay device and locking carabiner used to manage slack in the rope, hold the climber in the event of a fall, and then lower the climber in a controlled fashion back to the ground once they are finished climbing.

Study participants were members or guest of the indoor climbing facility who were at least 18 years of age at the time of the study. The sample size for this study was 90 participants, 30 participants per each of the two experimental groups and the control group. Stevens (1992) offers that "Generally about 15 subjects per predictor are needed for a reliable regression equation in the social sciences, that is, an equation that will cross validate well" (p. 125). Participation in the study was voluntary and participant identities were kept confidential by the researcher. An incentive for participation in the study was offered in the form of a free guest pass to the facility.

Sampling Selection and Methodology

Voluntary participation was solicited using a systematic sampling method where every fourth member, age 18 or over, after checking into the facility was solicited for participation in the study. A solicitation script was followed and a consent form was provided to all participants informing them of their rights as study participants. Potential participants were asked if they were able to climb at least a 5.8 level climbing route, and if so, would they be willing to participate in a graduate research project regarding climbing route perceptions that would require them to climb one route rated within their ability level and provide feedback regarding the experience. Participants were also informed that as compensation they would receive a free guest pass to the facility in exchange for participating in the study and that they are only allowed to participate once. Other members of the systematically selected participants party were also invited to participate. The exact title of the research project was not mentioned to participants to prevent contamination of the results.

Participants were systematically placed into either the control group or one of the two experimental groups by order of their participation. This method involved the first participant being placed in the experimental group OVER, the second participant was then placed in the control group, and the third participant was placed in the experimental group UNDER. This method of group placement was repeated until the study goal of 90 participants was reached. The study spanned over seven consecutive days, until on the seventh day the goal of 90 participants was reached and the study was concluded. Due to the length of the study, a few participants were systematically chosen more than once. When this occurred they were skipped over and the next member checking into the facility was solicited for participation in the study.

Climbing routes were assigned to participants based upon that routes true rating being as close to the participants self-stated capability limit as possible without exceeding it. Participants with a self-stated capability level between 5.8 and 5.10a were placed on the climbing route with a true rating of 5.8. Those with a self-stated capability level between 5.10b and 5.10d were placed on the climbing route with a true rating of 5.10b. Participants with a self-stated capability level of 5.11a or higher were placed on the climbing route with a true rating of 5.11a.

Participants were not required to complete the entire climbing route. In the event of a fall, participants were allowed to get back on their climbing route and continue if they would like. Once starting their climb, there was no limit to the number of times a participants could fall and continue to attempt their climb. However, participants were not allowed to retry the entire route restarting from the ground. Participants were administered the posttest regardless of whether or not they were able to complete the climb they had attempted.

Survey participants were tracked through the experiment through sequentially numbered pretest and posttests. When a participant completed a pretest, it was collected and the number was written on their hand. After administration of the experiment, participants were administered a posttest with a number matching that of their pretest. Completed pretest and posttests were later matched for analysis.

Variable Operationalization

The variables of climbing self-efficacy and climbing route rating were operationalized for the study. The variable of climbing self-efficacy was operationalized through the use of the Climbing Self-Efficacy Scale (CSES) developed by Llewellyn et al (2008). The variable of climbing route rating is operationalized using the Yosemite Decimal System for the rating of the indoor climbing routes used in the study.

The CSES was be used to measure the self-efficacy of individuals related to the specific domain of rock climbing (Llewellyn et al., 2008). The CSES measures individuals' confidence on ten variables congruent with self-efficacy theory as recommended by Bandura (1997a). Participants were asked to indicate their degree of confidence with regards to their climbing abilities at that moment on a scale ranging from 0 percent (not at all confident), through 50 percent (moderately confident), to 100 percent (extremely confident). All ten CSES item scores totaled provide a measure of an individual's perception of their ability to perform the necessary actions to produce a given effect in climbing (Llewellyn et al., 2008). The CSES was found to have high ($\propto$ = 0.88) internal consistency (Llewellyn et al., 2008; Young, 2010).

The variable of climbing route rating was operationalized through the use of the Yosemite Decimal System (YDS) for the rating of a climbing routes difficulty. The YDS is commonly used in the United States. Delignières et al. (1993) asserted that rock climbing rating scales represent some of the most advanced ratings systems being administered for the rating difficulty. The YDS denotes the difficulty level of a free climb with the number 5, followed by a decimal point and subsequent numerals used to delineate the difficulty of the climb. These subsequent numerals currently range from 5.0 to 5.15. Further subdivisions used from the grade 5.10 and upward are denoted by the letters a, b, c, and d. With these subdivisions a 5.10a would be less difficult than a 5.10b and so forth. The current YDS range is from 5.0 (easiest) to 5.15c (most difficult). The majority of indoor climbing facilities within the United States utilize the YDS to rate the difficulty of their climbing routes.

All subjects were asked to climb one of the study routes, chosen by the researcher to be as close to their self-stated capability level as possible without exceeding it. Participants were told a rating for the route they are asked to climb. The rating that they were told depended on what route they were assigned and whether they had been systematically placed in the control group or in one of the two experimental groups. For participants in the control group the stated rating was the true rating of the route. The participants in the experiment groups were told a manipulated rating. Participants in the experimental group UNDER were told a rating one level below that of the control group, while participants in experimental group OVER were told a rating one level above that of the control group. Subjects were given one attempt at climbing the route and instructed to simply do there best and that should they fall during the attempt they may get back on the route and continue if they wish in order for them to have experience with the entire route. Immediately following their attempt on their assigned climbing route, subjects were asked to complete the posttest survey. In the posttest survey, subjects were asked to complete the CSES once again, to report their perceptions of the accuracy of the stated rating, and what they believed an accurate rating for the climb to be. Collected data was then entered into the statistical analysis program SPSS for analysis.

Data Collection Method

The pretest (Appendix A) was administered to participants immediately after consent to participate in the study was received. Upon completing and submitting the pretest, participants were asked to take approximately 10 minutes to warm up after which they reported to the designated study area to climb a route consistent with their self-reported climbing ability level.

The posttest (Appendix B) was administered immediately following the experiment as recommended by Feltz and Lirgg (2001) such that other experiences do not intervene (Bandura, 1997a). Subjects were asked not to speak to anyone about the climbs ratings or any other details of the experiment until after the full experiment had been completed in order to limit contamination of any of the groups (Babbie, 2007). Once collected the data was statistically analyzed for similarity or difference amongst groups in order to prove or disprove the hypotheses.

Data Analysis

The first hypothesis for this study stated that there will be a change in self-efficacy related to climbing route ratings. Means scores on the CSES were compared for similarity or difference across experiment and control groups using an ANOVA. The significance level was set at the .05 level. A significance level of .05 is the most widely used level (Hair et al., 2010) and represents "the likelihood of its (relationship) being only a function of sampling error" (Babbie, 2007, p. 465).

The second hypothesis stated that participants in the over and under rated experimental groups will perceive the manipulated climbing route ratings as being different from the control group. Mean scores for perceived accuracy of the ratings were compared for similarity or difference across groups using an ANOVA with the significance level set at the .05 level.

Chapter IV

Results

The purpose of this study was to explore the potential effects of the manipulation of indoor climbing route ratings on the climbing self-efficacy of indoor rock climbers. Initially, quantitative results of participant demographic characteristics across groups will be presented. This will be followed by results pertaining to the two study hypotheses. First, results regarding the possible effects of manipulations of the climbing route ratings on climbing self-efficacy will be presented. Next, results regarding participant perceptions of the accuracy of the stated climbing route ratings will be reported.

Descriptive Data

This study investigated the climbing self-efficacy of ninety (N = 90) indoor rock climbers. Study participants were randomly assigned to experimental group OVER, the control group, or the experimental group UNDER by order of their participation. Participants in the experimental group OVER were told an overstated rating for the climbing route that they were asked to climb. Participants in the experimental group UNDER were told a understated rating for the climbing route they were asked to climbed. Participants in the control group were told the true rating of the climbing route they were asked to climb. The first participant in the experiment was randomly assigned to experimental group OVER, the second participant was assigned to the control group, and the third was assigned to experimental group UNDER. This order of group assignment was repeated continuously until the study goal of 90 participants was reached. Each of the three groups were thus comprised of 30 test subjects. A total of 95 candidates were approached using a systematic sampling method where every fourth member checking into the facility was solicited for participation. Two candidates were unable to participate in the study due to their climbing abilities being below the minimum required to participate, and an additional three candidates chose not to participate in the study. The response rate for this study was ninety-five percent.

Demographic Information

Study participants. The demographic characteristics of study participants are displayed in Table 1. Study participants were 71 % male and 29 % female. Over half of the participants (54%) were between the ages of 18 years and 27 years old. An additional 14 % were between the ages of 28 years and 32 years of age, with the remaining 32 % being above the age of 32 years. Nearly half (48%) of study participants were between 5-foot-5-inches tall and 5-foot-9-inches tall, with 19 % being 5-foot-4-inches tall or below, 28 % being between 5-foot-10-inches and 6-foot-2-inches tall, and the remaining 6 % being 6-foot-2 inches or taller.

Participants climbing experience varied between less than six months experience to over six years of experience. Frequency of indoor climbing varied from 18 % of participants having climbed one to three times within the 30 day prior to participation in the study, to 19 % having climbed 13 or more times indoors within the same time span. Just over half of the study participants also climb outdoors. Of these, 57 % had climbed outdoors five of fewer times over the past year, while 24 % had climbed outdoors between six and ten times, with the remaining 20 % having climbed outdoors more than 10 times over the past year.

Table 1

Demographic Characteristics of Study Participants

Variable	*f*	Percent
Gender (*n*=90)		
Male	64	71.1
Female	26	28.9
Age (*n*=90)		
18-22	20	22.2
23-27	32	35.6
28-32	13	14.4
33-37	7	7.8
38-42	6	6.7
43-47	2	2.2
48-52	6	6.7
53-57	2	2.2
58 or older	2	2.2
Height (*n*=90)		
Under 5 ft.	1	1.1
5’0” – 5’4”	16	17.8
5’5” – 5’9”	43	47.8
5’10” = 6’2”	25	27.8
Over 6’2”	5	5.6
Length of Climbing Experience (*n*=90)		
0-6 months	21	23.3
6-12 months	16	17.8
1-2 years	20	22.2
3-5 years	15	16.7
6+ years	18	20.0
Indoor Climbing Frequency Last 30 Days (*n*=90)		
1-3 times	16	17.8
4-6 times	22	24.4
7-9 times	18	20.0
10-12 times	17	18.9
13+ times	17	18.9
Climb Outdoors (*n*=89)		
Yes	49	55.1
No	40	44.9
Outdoor Climbing Frequency Past Year (*n*=51)		
1-5 times	29	56.9
6-10 times	12	23.5
11-15 times	3	5.9

16-20 times	2	3.9
21+ times	5	9.8

Note: f= frequency

Experimental and control groups. This study utilized a classical experiment design with two experimental groups and a control group. Experimental group OVER was told and overstated rating, while experimental group UNDER was told and understated rating for the climbing route they were asked to climb. The control group was told the true rating of the climbing route they were asked to climb. The demographic characteristics for the two experimental groups and the control group are shown in Table 2.

Table 2

Demographic Characteristics within Experimental and Control Groups

	Group					
	OVER		Control		UNDER	
Variable	*f*	Percent	*f*	Percent	*f*	Percent
Gender						
Male	21	70.0	23	76.7	20	66.7
Female	9	30.0	7	23.3	10	33.3
Age						
18-22	7	23.3	5	16.7	8	26.7
23-27	9	30.0	13	43.3	10	33.3
28-32	7	23.3	3	10.0	3	10.0
33-37	1	3.3	3	10.0	3	10.0
38-42	3	10.0	2	6.7	1	3.3
43-47	0	0.0	1	3.3	1	3.3
48-52	2	6.7	2	6.7	2	6.7
53-57	0	0.0	1	3.3	1	3.3
58 or older	1	3.3	0	0.0	1	3.3
Height						
Under 5 ft.	1	3.3	0	0.0	0	0.0
5’0” – 5’4”	5	16.7	5	16.7	6	2.0.
5’5” – 5’9”	12	40.0	13	43.3	18	60.0

5’10” - 6’2”	10	33.3	10	33.3	5	16.7
Over 6’2”	2	6.7	2	6.7	1	3.3
Length of Climbing Experience						
0-6 months	6	20.0	6	20.0	9	30.0
6-12 months	9	30.0	2	6.7	5	16.7
1-2 years	5	16.7	10	33.3	5	16.7
3-5 years	5	16.7	4	13.3	6	20.0
6+ years	5	16.7	8	26.7	5	16.7
Indoor Climbing Frequency (last 30 days)						
1-3 times	7	23.3	5	16.7	4	13.3
4-6 times	9	30.0	5	16.7	8	26.7
7-9 times	4	13.3	9	30.0	5	16.7
10-12 times	7	23.3	6	20.0	4	13.3
13+ times	3	10.0	5	16.7	9	30.0
Climb Outdoors (n=89)						
Yes	16	53.3	15	50.0	18	62.1
No	14	46.7	15	50.0	11	37.9
Outdoor Climbing Frequency (past year) (n=51)						
1-3 times	8	50.0	9	56.3	12	63.2
4-6 times	5	31.3	4	25.0	3	15.8
7-9 times	2	12.5	0	0.0	1	5.3
10-12 times	0	0.0	1	6.3	1	5.3
13+ times	1	6.3	2	12.5	2	10.5

Note: f=frequency

A One-way ANOVA was performed to investigate demographic differences between experiment groups and the control group (Table 3). The results from the One-way ANOVA showed no significant difference between the three groups based upon participant gender (F = .369, p = .692), age (F = .018, p = .982), height (F = .829, p = .440), length of climbing experience (p = .440), indoor climbing frequency (F = .1.167, p = .316), climbing level (F = 1.839, p = .165), hardest climb completed in the last 30 days

(F = .057, p = .954), outdoor climbing experience (F = .450, p = .639), or outdoor climbing frequency (F = .039, p = .961).   It can be concluded that there were no significant differences found between the three groups on the descriptive study variables.

Table 3

One-way ANOVA Results for Difference in Demographic Characteristics Between Groups

Demographic Characteristic	Source	*SS*	*df*	*MS*	*F*	*p*
Gender	Between Groups	.156	2	.078	.369	.692
	Within Groups	18.333	87	.211		
	Total	18.489	89			
Age	Between Groups	.156	2	.078	.018	.982
	Within Groups	378.833	87	4.354		
	Total	378.989	89			
Height	Between Groups	1.156	2	.578	.829	.440
	Within Groups	60.633	87	.697		
	Total	61.789	89			
Length of Climbing Experience	Between Groups	3.489	2	1.744	.829	.440
	Within Groups	182.967	87	2.103		
	Total	186.456	89			
Indoor Climbing Frequency (Past 30 Days)	Between Groups	4.467	2	2.233	1.167	.316
	Within Groups	166.433	87	1.913		
	Total	170.900	89			
Climbing Level	Between Groups	23.359	2	11.679	1.839	.165
	Within Groups	546.282	86	6.352		
	Total	569.640	88			
Hardest Climb (Past 30 days)	Between Groups	.950	2	.475	.057	.945
	Within Groups	702.452	84	8.363		
	Total	703.402	86			
Climb Outdoors	Between Groups	.228	2	.114	.450	.639
	Within Groups	21.794	86	.253		
	Total	22.022	88			
Outdoor Climbing Frequency	Between Groups	.138	2	.069	.039	.961
	Within Groups	83.901	48	1.748		
	Total	84.039	50			

Notes: SS=Sum off Squares, df= Degrees of Freedom, MS=Mean Square

Hypothesis Test Results

The purpose of this study was to examine the effects of manipulation of indoor climbing route ratings on the climbing self-efficacy of indoor rock climbers. The study investigated two hypotheses. One instrument with a pretest and a posttest was utilized to investigate the study hypotheses.

H_1: There will be an effect on participants climbing self-efficacy based upon manipulation of the climbing route rating.

H_2: Participants in the over and under rated groups will perceive the manipulated climbing route ratings as being different from the control group.

The instrument utilized in this study to investigate the first hypothesis was the Climbing Self-Efficacy Scale (CSES) developed by Llewellyn et al. (2008). The CSES was administered to subjects as part of the pre-test, and again as part of the posttest following their experience climbing a specified indoor climbing route within their self-stated ability level.

Participants were asked to climb one of three available climbing routes. A climbing route was assigned to a participant based upon the climbing route ratings proximity to the participants' self-stated ability level. The climbs were assigned in a manner that the stated rating fell as close to the participants' self-stated maximal limit as possible without exceeding it. This method of climb assignment was important based upon Delignières et al. (1993) findings that the accuracy of the assessment of a climbing route rating increases as the difficulty of the climbing route approaches the maximal limit of the climber. The rating stated to the participant for their assigned route depended upon which of the three groups the participant had been randomly assigned to. Experimental group OVER were told a rating one increment higher than the control group, the control group were told the true rating of the climbing route, or experimental group UNDER were told a rating one increment below the control group. The results of these tests will now be discussed.

Hypothesis 1. To test the first hypothesis regarding a possible effect on participants climbing self-efficacy based upon manipulation of the climbing route rating, first the scores for each of the ten CSES subscales for each participant were added together to provide a total Climbing Self-efficacy (CSE) score, as recommended by Llewellyn et al. (2008). Mean pre test and posttest CSE scores for each group were then tabulated (Table 4). Upon examination of this data, the mean posttest CSE scores were found to be greater than the mean pre test CSE scores across all three groups.

Pre test and posttest CSE scores were then analyzed using a paired samples t-test to test for significant difference between pre test and post test CSE scores within each of the two experiment groups and the control group (Table 4). Within the paired samples t-test, pre test scores were subtracted from posttest scores to represent a change in CSE. Results of the paired samples t-test revealed that there was a significant difference ($p < 0.05$) between the pre test and posttest CSE scores for all groups.

Table 4

Climbing Self-Efficacy T-Test Results

Paired Samples T-Test								
				95% CI				
Group	*M*	*SD*	*SEM*	*LL*	*UL*	*t*	*df*	*Sig. (2-tailed)*
OVER								
Pre Test	675.07							
Post Test	737.23	73.175	13.360	34.843	89.491	4.653	29	.000
Control								
Pre Test	735.50							
Post Test	768.30	60.604	11.065	10.170	55.430	4.653	29	.006
UNDER								
Pre Test	721.00							
Post Test	768.00	92.340	16.859	12.520	81.480	2.788	29	.009

Note: df=Degrees of Freedom

In order investigate whether the change in CSE score could be related to the manipulation of the climbing route ratings, a One-way ANOVA was performed to test for mean difference in pre test and post test CSE scores between the two experimental groups and the control group related to the manipulation of the climbing route ratings (Table 5). The results show a difference in the change of CSE score from pre test to post test between the experimental; groups and the control group, however, the difference was not found to be significant at the 0.05 level. Any change in CSE scores was not related to the manipulation of the climbing route ratings. The first hypothesis was therefore rejected.

Next the individual subscales of the Climbing Self-Efficacy Scale (CSES) were examined for possible relationships between changes in CSES subscale score and manipulation of the climbing route ratings. A paired samples t-test was used to test for significant difference between pre test and posttest scores on each of the ten CSES subscales (Table 6). Test results showed a significant difference ($p < .05$) between pre test and posttest scores for all ten CSES subscales.

Table 5

One-way ANOVA Results for Change in CSE Scores Between Groups

Source	*SS*	*df*	*MS*	*F*	*p*
Between Groups	12940.689	2	6470.344	1.106	.36
Within Groups	509070.967	87	5851.390		
Total	522011.656	89			

Notes: SS=Sum off Squares, df= Degrees of Freedom, MS=Mean Square

Table 6

Individual CSE Subscale T-Test Results

Paired Samples T-Test								
				95% CI				
CSE Subscale	*M*	*SD*	*SEM*	*LL*	*UL*	*t*	*df*	*Sig. (2-tailed)*
Deal w/ Unexpected Events								
Pre Test	63.78							
Post Test	71.72	13.173	1.389	5.185	10.704	5.721	89	.000
Maintain My Concentration								
Pre Test	77.47							
Post Test	80.76	12.664	1.335	.636	5.941	2.464	89	.016
Manage Risks								
Pre Test	71.71							
Post Test	76.44	11.442	1.206	2.337	7.130	3.925	89	.000
Manage Fear/Anxiety								
Pre Test	74.47							
Post Test	79.08	13.583	1.432	1.766	7.456	3.221	89	.002
Prepare Physically for Demanding Routes								

Pre Test	66.86							
Post Test	70.40	13.406	1.413	.737	6.352	2.508	89	.014
Perform Well								
Pre Test	71.12							
Post Test	75.81	13.100	1.381	1.945	7.433	3.396	89	.001
Avoid Making Mistakes								
Pre Test	64.11							
Post Test	70.48	15.763	1.662	3.065	9.668	3.823	89	.000
Prepare Mentally for Demanding Routes								
Pre Test	70.24							
Post Test	74.49	14.968	1.578	1.110	7.379	3.934	89	.009
Accomplish What You Set Out To Do								
Pre Test	77.96							
Post Test	83.01	12.192	1.285	2.502	7.609	3.934	89	.000
Use Appropriate Climbing Techniques								
Pre Test	72.81							
Post Test	75.66	12.021	1.267	.327	5.362	2.245	89	.027

Note: df=Degrees of Freedom

In order to test for possible relationship between change in CSES subscale score and manipulation of the climbing route rating, a One-way ANOVA was performed (Table 7). Analysis did not find the changes in CSES subscales from pre test to post test to be related to the manipulation of the climbing route rating. However, the subscales ability to deal with unexpected events (F = 3.035, p = .053), and manage risks effectively (F = 2.638, p = .077) came very close. Possible explanations for these results will be addresses in Chapter 5.

Table 7

One-way ANOVA Results for Change Within CSE Sub Scales Between Groups

CSE Sub Scale	Source	*SS*	*df*	*MS*	*F*	*p*
Deal w/ Unexpected Events	Between Groups	1007.222	2	503.611	3.035	.053
	Within Groups	14437.500	87	165.948		
	Total	15444.722	89			
Maintain My Concentration	Between Groups	130.756	2	65.378	.402	.670
	Within Groups	14143.733	87	162.572		
	Total	14274.489	89			
Manage Risks	Between Groups	566.200	2	333.100	2.638	.077
	Within Groups	10985.400	87	126.269		
	Total	11651.600	89			
Manage Fear/Anxiety	Between Groups	320.556	2	160.278	.866	.424
	Within Groups	16098.833	87	185.044		
	Total	16419.389	89			
Prepare Physically for Demanding Routes	Between Groups	666.822	2	333.411	1.892	.157
	Within Groups	15327.500	87	176.178		
	Total	15994.322	89			
Perform Well	Between Groups	400.689	2	200.344	1.172	.315
	Within Groups	14872.600	87	170.949		
	Total	15273.289	89			
Avoid Making Mistakes	Between Groups	97.267	2	48.633	.192	.826
	Within Groups	22015.633	87	253.053		
	Total	22112.900	89			
Prepare Mentally for Demanding Routes	Between Groups	198.956	2	99.478	.438	.646
	Within Groups	19739.667	87	226.893		
	Total	19938.622	89			
Accomplish What You Set Out To Do	Between Groups	286.289	2	143.144	.962	.386
	Within Groups	12942.433	87	148.764		
	Total	13228.722	89			
Use Appropriate Climbing Techniques	Between Groups	398.956	2	199.478	1.393	.254
	Within Groups	1246.867	87	143.251		
	Total	12861.822	89			

Notes: SS=Sum off Squares, df= Degrees of Freedom, MS=Mean Square

Hypothesis 2. The second hypothesis stated that participants in the over and under rated groups would perceive the manipulated ratings as being different than the control group. Participants responded within the post test regarding to what degree the route they attempted felt easier or harder to them compared to the rating stated by the researcher or whether the stated rating felt accurate. Mean results for participant perceptions of the accuracy of the stated climbing route rating were tabulated across all three groups (Table 8).

Table 8

Perceived Rating Accuracy Descriptive Statistics

Descriptive Statistics							
						95% CI	
Group	Stated Rating	*n*	*M*	*SD*	*SEM*	*LL*	*UL*
OVER	Harder	30	5.23[c]	.935	.171	4.88	5.58
Control	Accurate	30	4.63	1.351	.247	4.13	5.14
UNDER	Easier	30	4.40[a]	.932	.170	4.05	4.75

Note: A perception of the stated rating as being accurate would produce a mean score of 4.00, with a mean score of 5.00 reporting a description of the route seaming slightly easier than the stated rating, a mean score of 6.00 reporting that the climb felt easier than rated, and finally a mean score of 7.00 reporting a feeling that the route felt much easier than rated.

It is important to note that the mean scores for all groups indicated that all three groups felt that the climbs were easier than the ratings stated by the researcher, regardless of the direction of the manipulation. A perception of the stated rating as being accurate would produce a score of 4.00, with a score of 5.00 reporting a description of the route seaming slightly easier than the stated rating, a score of 6.00 reporting that the climb felt easier than rated, and finally a score of 7.00 reporting a feeling that the route felt much easier than rated. A score of less than 4.00 would report a perception of the climbing route as feeling harder than the rating stated by the researcher. Experimental group

OVER, who were told a rating deemed one grade higher than the true rating of the climb showed a mean of 5.23 (slightly easier), while the control group, who were told a rating deemed accurate for their climb, returned a mean of 4.63 (very slightly easier), and lastly, experimental group UNDER, who were told a rating deemed one grade lower than the true rating for the climb reported a mean of 4.40 (very slightly easier). Though means for all groups show a consensus for the route being easer than the stated difficulty, the results are still tiered in line with the experiments manipulation.

The second hypothesis was then tested using a One-way ANOVA in order to test for mean significant difference between the two experiment groups and control group regarding participant perceptions of the manipulated climbing route ratings as being inaccurate (Table 9). The One-way ANOVA test reported that there was a significant difference between groups based upon perception of the accuracy of the stated rating of the route they climbed (F = 4.659, p = 0.012).

Table 9

One-way ANOVA Results for Perceived Rating Accuracy

Source	*SS*	*df*	*MS*	*F*	*p*
Between Groups	11.089	2	5.544	4.659	.012
Within Groups	103.533	87	1.190		
Total	114.622	89			

Notes: SS=Sum off Squares, df= Degrees of Freedom, MS=Mean Square

Post-hoc analysis using the Scheffe test was performed to determine between which groups the significant difference exists (Table 10). The analysis showed that the OVER and UNDER experimental groups perceptions of the accuracy of the stated climbing route ratings were significantly different from one another at the .05 level.

However, no significant difference was revealed between the control group and either experimental group OVER or UNDER. Therefore participants in experiment group OVER and experimental group UNDER perceived the manipulated ratings as being different from each other, but not different from the control group. The second hypothesis is thus rejected. Possible explanations for these results will be addressed in the Discussion section of this paper.

Table 10

Mean Difference in Perceived Rating Accuracy by Group

Comparison	*Mean Difference*	*s.e*	*95% CI*
OVER vs. Control	.006	.282	-.10, 1.30
OVER vs. UNDER	.833*	.282	.13, 1.53
Control vs. UNDER	.233	.282	-.47, .93

**p<.05, where p-values are adjusted using Scheffe method*

Conclusion

The purpose of this study was to examine the possible effects of manipulation of indoor climbing route ratings on the climbing self-efficacy of indoor rock climbers. The first hypothesis stated that there would be a change in climbing self-efficacy related to a manipulation of the climbing route ratings. The second hypothesis stated that participants in the experimental groups OVER and UNDER would perceive the ratings of the climbing routes as being different than the control group.

The results showed an increase in climbing self-efficacy for both of the experiment groups, as well as for the control group. The amount of change was different between groups, however not different enough to be statistically significant at the .05

level. Any change in CSE was not related to a manipulation of the climbing route ratings. The first hypothesis was therefore rejected.

Results showed that there were significant differences ($F = 4.659$, $p = 0.012$) between the perception of the accuracy of the climbing route ratings between experimental groups OVER and UNDER. However, no differences were found between the control group's perceptions of the accuracy of the climbing route ratings and those of either experimental group OVER or experimental group UNDER. The second hypothesis was therefore rejected. Further discussion of the results and possible implications will follow in Chapter 5.

Chapter V

Discussion

The purpose of this study was to explore the effects of manipulation of indoor climbing route ratings on the climbing self-efficacy of indoor rock climbers. This research added to current research on participant experiences while indoor rock climbing. Indoor climbing centers can benefit from a greater understanding of participant perceptions of their product offerings and the possible implications of inconsistencies in the ratings of the indoor climbing routes they provide.

This chapter will begin with a review of the conceptual framework for this study. A discussion of the limitations of the study will follow. Lastly, possible implications for indoor climbing centers and recommendations for future research will be presented.

Conceptual Review

Facilitation of experiences is at the heart of the recreation industry. Csikszentmihalyi (1990) describes the optimal experience, the experience of flow, as occurring in a space where perceived challenge is matched by an individual's perceived capabilities, with the sport of rock climbing offering an excellent venue for these experiences. These flow experiences tend to be best facilitated through activities structured to provide a clear set of challenges. Should contradictions between an individual's perception of the level of challenge and their perceived capabilities arise, flow can be compromised (Csikszentmihalyi, 1975).

In rock climbing, both indoors and outdoors, level of challenge is communicated with the use of a standardized difficulty rating scale. At indoor climbing centers these ratings are typically assigned by consensus of the staff who create the indoor climbing routes. Indoor climbers are then able to search out a climb consistent with their desired level of challenge. Anderson (2004) reported that there regularly exists controversy surrounding the ratings assigned to climbs in indoor climbing gyms. The existence of these disagreements regarding what an indoor climb is rated suggests that there may exist some dissonance surrounding participants perceptions of the accuracy of indoor climbing route ratings and their perceptions of their own capabilities with regards to climbing.

An individual's perception of their capabilities towards a specific task is what Bandura (1977) refers to as an individual's perceived self-efficacy. These perceptions of self-efficacy are derived from four main sources, the most influential being past successes or mastery experiences. Studying recreational experiences and their effect of participant self-efficacy can benefit recreation professionals. Research such as this can offer insights into how participant experiences can be optimized and evaluated. It was thus important to investigate whether or not manipulation of the difficulty ratings of indoor climbing routes affects participants climbing self-efficacy.

Discussion of Study Results

The first hypothesis stated that there would be a change in participants climbing self-efficacy related to manipulation of the climbing route ratings. The second hypothesis sated that participants in the over and under rated groups will perceive the manipulated ratings as being inaccurate. The results of the study will now be discussed.

Hypothesis 1. Results showed a significant increase in climbing self-efficacy from pretest to posttest across both experiment groups and the control group, however, there was not found to be a significant relationship ($p < .05$) between the manipulation of the indoor climbing route ratings and this change in climbing self-efficacy. The first hypothesis was therefore rejected.

The lack of significance in the results for the first hypothesis can be explained by several factors. First, participants were asked to climb a climbing route with a true rating that was as close to there self-stated capability level as was available, without exceeding it. The rating that they were told for there respective climb, whether manipulated or not, also did not exceed there self-stated capability level. By the climbs being accessible to their capability level, all participants were placed within the range of a potential mastery experience, possibly explaining why all groups experienced a mean increase in climbing self-efficacy. Had one of the experiment groups been placed on a climbing route with a true rating above there perceived capability level, yet been told a manipulated rating that was within there perceived level of capability, the results of the study may have been different.

Secondly, only three indoor climbing routes, one considered to be representative of a beginner level, another representative of an intermediate level, and the third an advanced level were available for the study. This resulted in some of the participants climbing a route up to several grades below their maximal limit. This was an error in the study design. The study could have benefited from having routes available across the continuum of participant capabilities, offering the opportunity for participants to be more precisely challenged at their perceived maximal limit.

Thirdly, the manipulation of the ratings only went one rating increment above and one below the true rating of the respective climbs. Had the study utilized a wider manipulation increment, perhaps the results may have been different.

Hypothesis 2. Results did show a significant difference ($F = 4.659$, $p = 0.012$) between the two experimental groups OVER and UNDER based upon their perceptions of the accuracy of the climbing route rating stated to them by the researcher. Results however did not show significant difference between the experimental groups OVER and UNDER's perceptions of the accuracy of the climbing route ratings and that of the control group. Thus the second hypothesis was rejected.

Interestingly, all groups showed a mean perception of the climbing routes that they attempted as feeling to some degree easier than the rating stated to them, regardless of direction of the manipulation or lack of manipulation. This phenomenon could be explained by Delignières et al. (1993) findings that "representation of one's upper limit introduces a context effect (p. 9)" where climbers become apprehensive when performing near their limit of assigning a climb an upper rating. The degree that participants felt that the climbs were easier than the ratings stated was still tiered inline with the experiments manipulations showing that indoor climbers are fairly sensitive to variations in the ratings of indoor rock climbs.

Another explanation for participants in all groups reporting that the climbs felt easier than the sated ratings could be that the evaluated true ratings for the climbs utilized in this study were initially inaccurately assessed. The routes therefore could have in reality deserved a true rating that was easier than the true ratings assigned to them. Since only the researcher and the gym manager were available to confirm the initial grade assessment prior to administration of the study, the possibility of error in this regard is higher than if the climbing routes had been initially tested by a larger group of climbers with varying capability levels.

Study Limitations

There existed several limitations to this study. These limitations include facets of the studies design and logistics surrounding facility space.

The study could have benefited from the expansion of sample demographics to include youth climbers as well as lower level beginner climbers. The inclusion of youth climbers poses a challenge as many youth members tend not to be accompanied by their parents, so acquiring the necessary consent could prove difficult. As these demographics represent those new to the sport, it would be beneficial to understand how their experiences are being shaped and how these experiences can be optimized to increase their perceptions of their competence at climbing.

The small number of indoor climbing routes available for the study was an additional limitation. As mentioned previously, this study could have benefited from having climbing routes available across the continuum of participant ability levels making it easier to place participants on routes closest to there perceived maximal limit. With the study being conducted over a weeks time during regular business hours, closing off the necessary space to allow for such a large number of routes to be utilized for the study would be difficult as it would have a greater impact on the gyms daily operations.

Implications for Indoor Climbing Centers

Indoor climbing centers are interested in better understanding how their patron's experiences can be optimized in order to foster continued participation in the sport of indoor climbing, as well as continued patronage of their facilities. Managers of these facilities could benefit from more research into participant behaviors, motivations, and satisfactions. The more understanding climbing facility managers have of their participant needs and desires, the higher the quality of climbing experiences they can provide. With indoor rock climbing offering a seemingly endless variety of puzzles to unlock, a clear difficulty scale describing the level of challenge, and a supportive social environment, facility managers need to intentionally optimize there offerings to continuously facilitate optimal experiences for their climbers.

Indoor Climbing Center managers should make efforts to have the ratings of there indoor climbing routes verified by several climbers of varying capability levels and adjust the posted ratings as necessary, taking care not to under or over represent the level of difficulty of any of the climbing routes. Since a participants interpretation of the level of challenge and how this lines up with their perceptions of their own capabilities can have such an effect on their experience, the closer the stated ratings are to the level of perceived challenge experienced by participants, the higher the chance of optimal experiences. With this in mind it may also be beneficial to have participants involved in the rating assessment process.

Recommendations for Future Research

The sport of indoor climbing is gaining popularity and more and more dedicated indoor climbing centers continue to open around the world. Little research however has focused on the indoor rock climber. With participation in indoor climbing having exceeded that of outdoor climbing (NIRSA, 2009), it is important to better understand the similarities and possible differences between participant motivations and activity preferences for indoor and outdoor rock climbers. Better understanding the motivations and preferences of indoor rock climbers would offer indoor rock climbing facilities key insights into how to optimize there programming efforts and marketing strategies to most effectively attract new participants and increase participant retention.

One important area of attention for future research should be on better understanding how indoor climbing program attributes effect the climbing self-efficacy of indoor rock climbers and how program attributes can be optimized to facilitate increases in climbing self-efficacy. For the efficacious person challenges are approached not as threats but as opportunities for success, fostering "intrinsic interest and deep engrossment in activities" (Bandura, 1994). Increased climbing self-efficacy has been linked to more frequent participation in the sport of climbing (Gomez, 2007).

This study should be repeated with climbs available across the continuum of participant capabilities in order to more accurately administer the manipulations at each participant's perceived maximal limit, with one experiment group being place on a climb with a with a true rating that is above their maximal limit but be told a manipulated rating within their perceived maximum capability level. Additionally, it could be valuable to increase the manipulation increment beyond a single rating above and below the true rating of the climbs. Widening the demographics of the study to include indoor climbers under the age of 18 would also be valuable as more and more youth are participating in indoor rock climbing.

Finally, including a qualitative methodology could offer insight into how to better study experiences related to indoor and outdoor climbing route ratings. As many indoor climbers do not climb outdoors as well, there may exist differing experience preferences between indoor climbing sub groups. With regards to ratings especially, indoor climbers without the reference to outdoor climb ratings and the possible inconsistencies that may exist there as well may internalize indoor climbing route rating inconsistencies differently than climbers who do participate in outdoor climbing.

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Appendix A

Pretest

Part 1

Thanks you so much for agreeing to be part of this research project.
Please complete the following survey regarding your experience rock climbing. Your responses will be confidential so please be frank.

CLIMBING CONFIDENCE SCALE

Instructions:

Please rate how confident you feel about your climbing abilities at the moment. In each case rate your degree of confidence from 0% (Not at all confident) to 100% (Extremely confident) using the scale below:

0	10	20	30	40	50	60	70	80	90	100
Not at all confident					Moderately confident					Extremely confident

My confidence in my ability to:

1. Deal with unexpected events _____%
2. Maintain my concentration _____%
3. Manage risks effectively _____%
4. Manage my fears and anxieties _____%
5. Prepare physically for demanding routes _____%
6. Perform well _____%
7. Avoid making mistakes _____%
8. Prepare mentally for demanding routes _____%
9. Accomplish what you set out to do _____%
10. Use appropriate climbing techniques _____%

Climbing Demographic Data

1. How long have you been climbing? (circle one)

   0-6 months 6-12 months 1-2 years 3-5 years 6+ years

2. How many times have you climbed indoors in the last 30 days: (circle one)

   1-3 times 4-6 times 7-9 times 10-12 times 13+ times

3. Age: (circle one)

   18-22 23-27 28-32 33-37 38-42 43-47

   48-52 53-57 58 or older

4. Gender: (check one) ____Male ____Female

5. Your Height: (circle one)

   Under 5ft 5'0" – 5'4" 5'5" – 5'9" 5'10" – 6'2" Over 6'2"

6. What is the highest rating you are currently able to successfully climb on top-rope on a regular basis: (circle one)

   5.4 5.5 5.6 5.7 5.8 5.9 5.10a 5.10b 5.10c 5.10d

   5.11a 5.11b 5.11c 5.11d 5.12a 5.12b 5.12c 5.12d 5.13a

   5.13b 5.13c 5.13d 5.14a

7. What is the highest rating you have climbed on top-rope without falling in the past 30 days: (circle one)

5.4 5.5 5.6 5.7 5.8 5.9 5.10a 5.10b 5.10c 5.10d

5.11a 5.11b 5.11c 5.11d 5.12a 5.12b 5.12c 5.12d 5.13a

5.13b 5.13c 5.13d 5.14a

8. Approximately what percentage of the time do you spend participating in the following types of indoor rock climbing? (total of all three types should equal 100)

____% top-rope climbing

____% sport lead climbing

____% bouldering

9. Do you also climb outdoors?

_____ yes

_____ no

10. If yes, approximately how many times have you climbed outdoors in the past year? (circle one)

1-5 6-10 11-15 16-20 21+

Appendix B

Posttest

Part 2

Thank you again for being a part of this research project.
Please complete the following survey about your experience climbing the assigned route.
Once again your response will be confidential so please be frank.

CLIMBING CONFIDENCE SCALE

Instructions:

Please rate how confident you feel about your climbing abilities at the moment. In each case rate your degree of confidence from 0% (Not at all confident) to 100% (Extremely confident) using the scale below:

0 10 20 30 40 50 60 70 80 90 100

Not at all confident — Moderately confident — Extremely confident

My confidence in my ability to:

1. Deal with unexpected events _____%
2. Maintain my concentration _____%
3. Manage risks effectively _____%
4. Manage my fears and anxieties _____%
5. Prepare physically for demanding routes _____%
6. Perform well _____%
7. Avoid making mistakes _____%
8. Prepare mentally for demanding routes _____%
9. Accomplish what you set out to do _____%
10. Use appropriate climbing techniques _____%

Route Perceptions

1. What was the stated rating of the route you just climbed? (circle one)

   5.4 5.5 5.6 5.7 5.8 5.9 5.10a 5.10b 5.10c 5.10d

   5.11a 5.11b 5.11c 5.11d 5.12a 5.12b 5.12c 5.12d 5.13a

   5.13b 5.13c 5.13d 5.14a

2. How do you feel about the difficulty of the route you just climbed? (check one)

   ___ route felt much harder than rated
   ___ route felt harder than rated
   ___ route felt slightly harder than rated
   ___ route felt accurately rated
   ___ route felt slightly easier than rated
   ___ route felt easier than rated
   ___ route felt much easier than rated

3. What would you consider an accurate rating for the route you just climbed? (circle one)

   5.4 5.5 5.6 5.7 5.8 5.9 5.10a 5.10b 5.10c 5.10d

   5.11a 5.11b 5.11c 5.11d 5.12a 5.12b 5.12c 5.12d 5.13a

   5.13b 5.13c 5.13d 5.14a

4. Do you feel the route was accessible for your height? (check one)

    ___ Strongly Agree

    ___ Agree

    ___ Slightly Agree

    ___ Slightly Disagree

    ___ Disagree

    ___ Strongly Disagree

5. What would you consider the quality level of the route you just climbed?

    ___ much higher than average

    ___ higher than average

    ___ slightly higher than average

    ___ average

    ___ slightly lower than average

    ___ lower than average

    ___ much lower than average