The Effect of self-efficacy manipulation on the efficiency, rate of perceived exertion, and affective state of runners

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THE EFFECT OF SELF-EFFICACY MANIPULATION ON THE EFFICIENCY,
RATE OF PERCEIVED EXERTION, AND AFFECTIVE STATE OF RUNNERS

by

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Bachelor of Arts
Butler University, Indianapolis
2008

A thesis submitted in partial fulfillment
of the requirements for the

Master of Science in Kinesiology
Department of Kinesiology and Nutritional Sciences
School of Allied Health Sciences
Division of Health Sciences

Graduate College
University of Nevada, Las Vegas
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We recommend the thesis prepared under our supervision by

**Isabelle Stoate**

entitled

**The Effect of Self-Efficacy Manipulation on the Efficiency, Rate of Perceived Exertion, and Affective State of Runners**

be accepted in partial fulfillment of the requirements for the degree of

**Master of Science in Kinesiology**

Kinesiology and Nutritional Sciences

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**August 2010**
ABSTRACT

The Effect of Self-Efficacy Manipulation on the Efficiency, Rate of Perceived Exertion, and Affective State of Runners

by

Isabelle Stoate

Dr. Gabriele Wulf, Examination Committee Chair
Professor of Kinesiology
University of Nevada, Las Vegas

Objectives: To determine the effect of self-efficacy manipulation on the movement efficiency, rate of perceived exertion (RPE), and affective state of runners while running on the treadmill at a constant submaximal pace.

Methods: 20 trained male and female runners were randomly assigned to experimental (self-efficacy manipulation) and control groups. Participants first filled out a pre self-efficacy questionnaire and the positive affect negative affect schedule (PANAS), and then completed a 20 minute run on the treadmill running at 75% of their peak treadmill running speed. After 10 minutes, their oxygen consumption (VO₂), heart rate (HR), and RPE was recorded. Participants (n=10) in the experimental group were then given motivational feedback in the form of verbal persuasion, which was recurrent every 2 minutes onwards. No feedback was given to the control participants. VO₂, HR, and RPE were recorded for all participants at 10, 12, 14, 16, 18, and 20 minutes. A post-test questionnaire measuring the participant’s level of self-efficacy and the PANAS was filled out.

Results: Successful manipulation if self-efficacy (p < .05) led to significant interaction between groups and measurement times in VO₂ (p < .001), with the control group
showing an almost significant \( (p = .027) \) increase and the experimental group a significant decrease \( (p < .01) \) in VO\(_2\) across times. No differences were found in HR or RPE \( (p > .05) \). Positive affect tended to increase and negative affect to decrease more from pre- to post-test in the experimental relative to the control group \( (p = .055) \).

Conclusions: Verbal persuasion is an effective measure of altering one’s self-efficacy which results in greater movement efficiency.
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CHAPTER 1

THE PROBLEM

Achieving peak performance is an athlete’s ultimate goal, and having the mental edge over an opponent has become a highly important factor in reaching success. Many athletes seek information from sports psychologist to help them get on top of their game. Anecdotally, when athletes describe their most successful sports performance they recall positive internal attributes such as feeling in control, relaxed, and confident. Whereas a bad performance results in responses such as ‘my head wasn’t in it’, or ‘I lost focus’.

Having self-confidence is regarded as a necessary quality for successful sports performance (Bandura, 1977). The more confident you feel, the more motivated you will be, and the more likely you will be to succeed. However, it is a situation-specific quality. Bandura (1977) labeled this type of specific self-confidence as self-efficacy. Self-efficacy is a term referring to the belief that we can perform adequately in a given situation. Bandura’s concept of self-efficacy addresses the notion of control being the central factor in human lives and establishing human functioning: “people’s level of motivation, affective states, and actions are based more on what they believe than on what is objectively true” (Bandura, 1997, p. 2). People are guided by what they believe and although this belief may not always match the outcome, their self-efficacy perceptions help determine the direction of their performance. Using a correlational design, Lee (1982) had 14 female gymnastic athletes report their expectations about how well they thought they could do in competition. The individual expectations were found to be a better predictor of their actual performance than their previous competition scores. This
supports that self-efficacy affects how well one expects to perform, which ultimately influences performance.

It’s not always necessary for the goal or the time on the clock to tell you how your performance is going. The feedback from the movements of your body (kinesthetic awareness) or feedback from teammates, coaches, and spectators can let the performer know how they are doing. Athletes can be uncertain at times and rely on this sensory feedback to keep them on track.

The theory of self-efficacy (Bandura, 1977) identifies four dimensions of experience affecting individual’s belief in their ability to perform a particular task: (a) performance accomplishments, (b) vicarious experiences, (c) verbal persuasion, and (d) emotional arousal. Experiences gained through performance accomplishments are said to have the greatest impact on establishing self-efficacy, and “techniques that enhance mastery experiences…both physical and verbal feedback, should be powerful tools for bringing about behavior change” (Turk, 2004, p. 4). If experiences are viewed as successful self-efficacy will be increased, but if experiences are viewed as failures self-efficacy will be decreased.

Observing and comparing oneself with others (vicarious experiences) can also affect a person’s efficacy levels (Bandura, 1977). People hold certain levels of expectation of themselves and their abilities to perform certain tasks. When matched with someone who is believed to be less skillful the performer will display a greater level of persistence to meet their own expectations and will have higher confidence levels beforehand than when matched with someone with greater skill levels than themselves (Weinberg, Gould, & Jackson, 1979).
Verbal persuasion is a technique widely used in attempts to influence human behavior and make people believe they can successfully cope with the task at hand. It is a simple and readily available technique. For the effect to take place it is important that the degree of verbal persuasion is believable and will also be more meaningful coming from someone who understands the task (Feltz, Short, & Sullivan, 2008, p. 187).

The final dimension of Bandura’s theory is emotional arousal which suggests that performers who are encouraged to perceive their physiological and psychological arousal before participation in a positive manner are more likely to develop high self-efficacy. It is important for coaches to recognize the concept of self-efficacy and seek efficacy-enhancing strategies to help assist their athletes grow in confidence and belief, and as a result improvements will be seen in performance level.

Being able to complete a task with the least energy expenditure is a crucial characteristic in the performance of motor skills. In recent years research has focused on understanding the relationship between metabolic energy expenditure and motor learning and control (Sparrow & Newell, 1998). The concept of economy has often been used as the term for understanding everyday motor skills, however, for those tasks involving the measurement of metabolic energy expenditure the term efficiency would be suitable as “changes in metabolic energy expenditure are usually interpreted as reflecting changes in efficiency” (Sparrow & Newell, 1998, p. 175). The term efficiency will be used in this paper to make comparisons in terms of the rate of oxygen consumption while completing the physical task.
Statement of Problem

Limited research had been done that studies the effect self-efficacy manipulation has on the physiological factors of sport performance. Therefore, the problem directing this study was whether self-efficacy manipulation could have a positive effect on the affective state, RPE, and the overall efficiency of running. Gender was manipulated in the study and the testing took place across 20 minutes of time. The hope was to expand on the emerging research on the mental effects on movement efficiency, through the manipulation of self-efficacy, during a continued exercise bout.

Hypothesis

Null Hypotheses

H₀. After experimental self-efficacy manipulation, HR across groups remains constant and no differences are found in oxygen consumption across groups.

H₀. The RPE is no different in the experimental self-efficacy group and the control group after manipulation.

H₀. There are no differences in positive affect post test between the experimental self-efficacy group and the control group.

Research Hypotheses

H₁. After experimental self-efficacy manipulation, HR across groups remains constant but there are differences in oxygen consumption (reduced in self-efficacy group).

H₁. The experimental self-efficacy group reports a lower RPE than the control group after manipulation.

H₁. The experimental self-efficacy group displays a greater positive affect post test.
Definitions

Self-efficacy: “The belief in one’s capabilities to organize and execute the courses of action required to manage prospective situations” (Bandura, 1995).

Efficiency: “the ratio of mechanical work done to metabolic energy expended” (Sparrow & Newell, 1998).

HR: The number of heart beats per unit of time. Expressed as beats per minute (bpm).

VO₂: The amount of oxygen used by the body per minute. Measured in ml/kg/min.

RPE: The intensity or exertion of exercise that is felt or perceived by the individual exercising. A scale from 6 to 20, where 6 is “no exertion at all” and 20 is “maximal exertion” (Borg, 1985).

PANAS: A psychometric scale developed to measure the independent constructs of positive and negative affect.

VO₂ max: The maximum amount of oxygen that an individual can utilize during intense or maximal exercise.

Limitations

A possible limitation to this study was the reliability of the self-efficacy questionnaire. The questionnaire was self-created as there were no running-based self-efficacy questionnaires available. However, it was based on Bandura’s (2006b) guidelines, which states that self-efficacy scales should be task specific and have face validity (i.e., persistence, thought pattern, emotional responses, and performance attainments). Although no reliability checks were done on the questionnaire, I believe it was an effective measure and a good indicator of one’s level of self-efficacy.
CHAPTER 2
REVIEW OF LITERATURE

Major Concepts

The study of self-efficacy beliefs in sport started in the late 1970’s and 1980’s by researchers Weinberg and Feltz (Weinberg, Gould, & Jackson, 1979; Feltz, 1988). Through their research they were able to explore the concept of self-efficacy and discover that self-efficacy plays a significant part in performance. Since these early studies the actions used to measure self-efficacy have varied greatly as most are constructed for the specific task in question, although most have been developed in accordance with Bandura’s recommendations (Bandura, 1997, 2006b). In a meta-analysis based on 45 studies (102 correlations) examining the relationship between self-efficacy and performance in sport, Moritz, Feltz, Fahrbach, and Mack (2000) found the average correlation between self-efficacy and sport performance was .38. This is a meaningful result, given all the other factors that could contribute to performance.

Numerous studies have looked at self-efficacy through correlation and regression (Lee, 1982; Myers, Feltz, & Short, 2004) and self-efficacy as the dependent variable (Gernigon & Delloye, 2003), but few studies have studied the effect of self-efficacy on another variable (manipulating self-efficacy).

The following section reviews research findings of: (a) self-efficacy manipulation on affective state, (b) self-efficacy and other psychological and physiological factors, (c) self-efficacy manipulation and perceived effort, (d) self-efficacy manipulation and performance, and (e) running efficiency.
Self-Efficacy on Affective State

Self-efficacy has been successfully manipulated in an exercise context using false performance feedback depicting contrived normative data, and the effect on affective state analyzed (McAuley, Talbot, & Martinez, 1999). The results revealed that those participants in the high self-efficacy condition (receiving positive bogus feedback) reported significantly greater positive well-being and less psychological distress and fatigue both during and after the activity than low self-efficacy participants exercising at the same intensity (RPE 12-14).

In a similar way, Marquez, Jerome, McAuley, Snook and Canaklisova (2002) manipulated self-efficacy in low-active women using computer generated bogus feedback after a graded exercise test. Manipulation was successful and those given high self-efficacy (top 20\textsuperscript{th} percentile of peer group) reported significantly less anxiety after the graded exercise test and before and after a subsequent exercise bout (20 minutes of moderate to vigorous running) than the low self-efficacy group (bottom 20\textsuperscript{th} percentile of peer group). Although oxygen consumption was not measured in this study, all participants’ HR and RPE responses increased over time (measurements were made every 2 minutes), suggesting they were working at equivalent workloads. This research shows that it is possible to manipulate self-efficacy through feedback in an exercise setting and see an effect on affective state.

Self-Efficacy and Other Psychological and Physiological Factors

Burke and Jin (1996) studied self-efficacy in relation to other physiological (VO\textsubscript{2} max, adiposity, height, weight) and psychological variables (self-efficacy, motivation, sport confidence, cognitive and somatic anxiety) as well as history of performance
(performance accomplishments) in predicting overall performance based on finishing time in an ironman triathlon event. When all variables were included in the analysis, performance was predicted most accurately by self-efficacy, performance history, and weight.

**Self-Efficacy Manipulation and RPE**

Using a similar design to McAuley, Talbot, and Martinez (1999), Motl, Konopack, Hu, and McAuley (2006) manipulated self-efficacy beliefs via bogus feedback in low-moderately active women. Perception of leg muscle pain, work rate, and oxygen consumption were recorded during exercise. RPE was measured using Borg’s 6-20 scale. An initial relationship was found between baseline self-efficacy and pain rating during the maximal incremental exercise test, but there was no effect found on leg muscle pain intensity ratings during the 30-minute bout of moderate-intensity cycling. Self-efficacy was manipulated only after a maximum incremental exercise test and the effect of the manipulation was examined on leg muscle pain during a bout of submaximal physical activity at 60% VO$_2$ max, 2-3 days later. It is possible that any changes in self-efficacy might be short-lived, so the time frame in which the manipulation is given needs to be taken into consideration.

**Self-Efficacy Manipulation and Performance**

In an early study of self-efficacy on a competitive muscular endurance task, Weinberg, Gould, and Jackson (1979) manipulated participants’ efficacy expectations by having them observe their competitor (a confederate) who was either said to have a knee injury (high self-efficacy condition) or be a varsity track athlete (low self-efficacy condition). Interestingly, those who were competing against the injured competitor had
higher self-efficacy levels before competition and maintained a leg extension for longer on a second trial than those who competed against the track athlete. This is interesting as even though both groups were told they had lost the first trial to the confederate, those in the high self-efficacy condition persisted longer on the second trial, and a questionnaire confirmed that confidence was a major factor determining performance.

Hutchinson, Sherman, and Martinovic (2008) also confirmed the major role self-efficacy has in enhancing performance. Self-efficacy was manipulated through bogus feedback during a single exercise bout isometric hand grip task. Those who were told they were doing better than they actually were reported the task as less strenuous, more enjoyable, and had an overall better performance on the task. This greater sustained effort shows that, when given sufficient motivation to perform, the person’s self-efficacy beliefs are the determining factor as to whether the behavior will be initiated. As proposed by Bandura “efficacy expectations determine how much effort people will expend and how long they will persist” (Bandura, 1977, p.194). An important finding was that the feedback had to be forthcoming for this result to take place.

**Running Efficiency**

Oxygen consumption (VO₂) has often been used as a measure of efficiency for endurance sports (i.e., running and cycling). In recent research done on trained runners, differences in VO₂ (between different running conditions) have been reported while running at a constant submaximal pace (Baden, McLean, Tucker, Noakes, & St Clair Gibson, 2005; Schücker, Hagemann, Strauss, & Völker, 2009). Baden et al. (2005) had 16 trained runners start out running at 75% of their VO₂ max and found that while no change was made to the speed of the treadmill, neither heart rate nor stride frequency
showed any significant changes between running conditions, VO$_2$ was significantly lower (by approximately 2 ml/kg/min, $p < .05$) during the unknown condition than when the duration of the trial was known. At the same exercise intensity, a lower VO$_2$ suggests improved running economy and shows that the participants were more economical in their use of physiological resources in anticipation of greater physiological demand.

Research on motor control has frequently replicated the finding that an internal focus of attention is detrimental to performance of well-learned skills (Wulf, 2007). This effect also appears to hold true with physiological variables. Schücker et al. (2009) found that the focus of attention can impact VO$_2$. They had 24 trained runners run on the treadmill at 75% VO$_2$ max for three 10-minute trials. For each of the trials they were instructed to adopt a different focus of attention. There were two internal focus conditions: The running movement condition, where instructions were to concentrate on the running movement, especially on the movement of their feet, and a breathing condition, where instructions were to concentrate on their breathing. In the external focus condition the focus was on the surroundings, and a film clip was displayed on a monitor in front of them depicting an urban running course. Significant differences were found in VO$_2$ across focus conditions (within subjects), $p < .001$, even though no differences were found in HR. A limitation to this study is that there was no control group used, so inferences to a “normal baseline condition” could not be made.

If physiological differences can be found by altering one’s attentional focus at the same submaximal speed then these findings could also be found for other aspects related to motor control (i.e., altering self-efficacy). Self-efficacy is so interesting to study
because it has been shown that beliefs are modifiable. Strategies that strengthen beliefs should be adopted by coaches rather than predicting behavior based solely on personality.

Source of Review

My research was constructed through database searches Pubmed, Scopus, and PsychInfo and through reading published self-efficacy books (i.e., Feltz, 1994). Table 1 shows a breakdown of the research found on self-efficacy and running efficiency:

Table 1

<table>
<thead>
<tr>
<th>Type of research</th>
<th>Variables studied</th>
<th>Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-efficacy correlation and regression</td>
<td></td>
<td>Lee (1982); Meyers, Feltz, and Short (2004)</td>
</tr>
<tr>
<td>Self-efficacy as dependent variable</td>
<td></td>
<td>Gernigon and Delloye (2003)</td>
</tr>
<tr>
<td>Self-efficacy as independent variable</td>
<td>On affective state</td>
<td>McAuley, Talbot, and Martinez (1999); Marquez, Jerome, McAuley, Snook, and Canaklisova (2002)</td>
</tr>
<tr>
<td></td>
<td>On performance</td>
<td>Weinberg, Gould, and Jackson (1979); Hutchinson, Sherman, and Martinovic (2008)</td>
</tr>
<tr>
<td>Self-efficacy in relation to psychological and physiological factors</td>
<td></td>
<td>Burke and Jin (1996)</td>
</tr>
<tr>
<td>Running and changes in efficiency</td>
<td>During unknown running duration</td>
<td>Baden, McLean, Tucker, Noakes, and St Clair Gibson (2005)</td>
</tr>
<tr>
<td></td>
<td>Attentional focus</td>
<td>Schücker, Hagemann, Strauss, and Völker (2009)</td>
</tr>
</tbody>
</table>
Equipment and Measuring Techniques

Table 2 represents research found on the measuring techniques used in my study:

Table 2

<table>
<thead>
<tr>
<th>Measuring technique</th>
<th>Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPE</td>
<td>McAuley, Talbot, and Martinez (1999); Marquez, Jerome, McAuley, Snook, and Canaklisova (2002); Baden, McLean, Tucker, Noakes and St Clair Gibson (2005); Motl, Konopack, Hu, and McAuley (2006)</td>
</tr>
<tr>
<td>Bogus feedback as self-efficacy manipulation</td>
<td>McAuley, Talbot, and Martinez (1999); Marquez, Jerome, McAuley, Snook, and Canaklisova (2002); Motl, Konopack, Hu, and McAuley (2006); Hutchinson, Sherman, and Martinovic (2008)</td>
</tr>
<tr>
<td>PANAS</td>
<td>Treasure, Monson, and Lox (1996); Crawford and Henry (2004)</td>
</tr>
<tr>
<td>VO₂ as measure of efficiency</td>
<td>Baden, McLean, Tucker, Noakes and St Clair Gibson (2005); Motl, Konopack, Hu, and McAuley (2006); Schücker, Hagemann, Strauss, and Völker (2009)</td>
</tr>
</tbody>
</table>

**Borg RPE scale**

Perceptions of exertion were assessed with Borg’s (1985) RPE scale. The RPE scale gives a quantitative identification of the feeling of fatigue, and indicates a subjective sensation of effort. The format of the RPE scale required the participant to respond to the question “How hard are you working?” Individual responses can range from 6 to 20 with 7 = very, very light and 19 = very, very hard (see appendix, p. 38). Test-retest reliabilities of .80 and higher have been reported and it has repeatedly been demonstrated that the scale is valid for assessing perceived work intensity (Borg).
Self-Efficacy Manipulation

Verbal persuasion is an effective persuasive technique which has been used to influence athlete’s or team’s perceptions of efficacy (Vargas-Tonsing, Myers, & Feltz, 2004). Performers who receive encouragement about their abilities feel more confident about their actions of attempts. Informing athletes that they are successful is considered positive feedback. There are two types of evaluative feedback, a form of verbal persuasion often used by coaches to their athletes: Knowledge of performance (KP) and knowledge of results (KR). KP provides information about the movement characteristics (emphasis on technique and form) that led to performance outcomes, and KR refers to feedback externally presented about the outcome of performing a skill.

Bogus feedback as a means of verbal persuasion has been used as a way of manipulating self-efficacy beliefs, so the performer believes they are achieving success, and this has been found to increases participants self-efficacy levels. In maximum-strength performance studies, where external cues indicating the amount of resistance did not accurately reflect true resistance, there was an increase in strength performance when the resistance was set higher than the participants believed (Ness & Patton, 1979; Hutchinson et al., 2008). This indicates that “expected” resistance rather than actual resistance was a determining factor in maximum-performance lifting, as the participants attempted to remain consistent with self-expectations based upon environmental cues.

Of course, for this procedure to show an effect the degree of the persuasive information has to be believable (Bandura, 1986). Actual performance gains are much more achievable when the person is convinced they have what it takes to succeed, and with these factors considered, providing bogus feedback is an effective way of altering
efficacy beliefs (Bandura, 1997). Bandura observed that although “verbal persuasion also may be limited in its power to create enduring increases in self-efficacy…it can bolster self-change if the positive appraisal is within realistic bounds” (Bandura, 1997, p. 101). Verbal persuasion will have the greatest effect on those who believe they can be successful. In the current study, runners would expect to have a greater level of running efficiency than average, so stating that they are in the top 10th percentile for their age group was within the realistic boundaries. It is often difficult for a participant in a study to evaluate their own progress, so having a credible observer provide feedback plays an influential role on developing confidence beliefs (Feltz, 1994).

The bogus feedback given to participants has often been given after a maximal incremental exercise test, and the effects on a subsequent exercise bout observed (Marquez et al., 2002; Motl et al., 2006). However, even though self-efficacy beliefs were successfully manipulated, differences in HR and RPE across self-efficacy conditions were not always observed in subsequent trials (Marquez et al., 2002; Motl et al., 2006). This could well be due to the fact that feedback was just being given once, and in order to observe difference in RPE the feedback should be forthcoming, as suggested by Hutchinson et al. (2008).

For the current study, feedback given to the participants was provided after VO2 and HR readings were taken and before RPE rating recorded every time in the manipulation phase of the study (10 min, 12 min, 14 min, 16 min and 18 min). Providing individuals with normative information is a basis for evaluation of personal performance. In motor skill learning, where performers were led to believe their performance was 20% higher than the “average” score during practice, their balance on a stabilometer in retention was
more effective during retention (Lewthwaite & Wulf, 2010). If normative comparisons are favorable for the individual, increased self-efficacy, positive self-reactions, lower RPE, and greater tolerance for sustained effort can result (Hutchinson et al., 2008).

Providing external feedback has also been found to be more effective in improving efficiency, especially when more feedback is given (Wulf, McConnel, Gartner, & Schwarz, 2002), and when expert (trained) performers are being studied (Wulf, 2007). Therefore, for this study the dialog was constructed in a way as to not direct the participants’ attention to internal cues i.e., breathing or leg movements, but rather provide them with KR. As executed in Hutchinson et al. (2008) study, the participants in the high self-efficacy condition were informed that their performance placed them in the top 10th percentile for endurance, based on the norms constructed for individuals of similar age and gender. A manipulation check was done on the feedback.

**PANAS**

The PANAS was developed by Watson, Clark, and Tellegen (1988) and has since been used as a popular measure for assessing emotional states in sport. It was developed and tested to be a reliable, valid, and efficient means for measuring the positive and negative dimensions of mood. The schedule consists of two 10-item subscales that assess positive affect (i.e., excited, strong, inspired, active) and negative affect (i.e., distressed, scared, irritable, afraid). “Positive affect (PA) reflects the extent to which a person feels enthusiastic, active and alert…Negative affect (NA) is a general dimension of subjective distress and unpleasurable engagement” (Watson, Clark, & Tellegen, 1988, p. 1063). The participants rate how they are feeling for each adjective on a 5-point Likert scale (1=very slightly or not at all; 5=extremely).
Crawford and Henry (2004), using a large, general adult population sample, evaluated the reliability and validity of the PANAS. A Cronbach’s $\alpha$ of .89 for PA and .85 for NA, indicates that the scale can be regarded as providing very accurate estimates of the internal consistency of the PANAS and possessing adequate reliability.

Treasure, Monson, and Lox (1996) examined the relationship between self-efficacy, wrestling performance, and affect prior to competition. Self-efficacy was found to be positively associated with PA and negatively associated with NA. Importance of assessing both PA and NA of sport performance rather than just the traditional method of assessing only negative states which may be ignoring potential useful information. As a result, I chose to use the PANAS to assess the participant’s emotional state prior to testing for both the control and experimental group.
CHAPTER 3

METHODS

Design Statement

This study used an experimental quantitative design. The independent variables (self-efficacy and gender) had two levels. Half of the participants (n = 10) had their self-efficacy manipulated (through bogus positive feedback) whereas the other half (n = 10) did not receive any manipulation and thus served as the control group. There were equal numbers of males and females in each of the four groups. The participants were assigned to either the manipulation or control group based on when they came into the lab. The first male and female who came in were assigned to the experimental condition and the next male and female to the control condition, until there were 10 in the experimental group (5 males, 5 females) and 10 in the control group (5 males, 5 females).

Variables

Independent Variables

- Self-efficacy manipulation via motivational performance bogus feedback, or no feedback (experimental vs. control group)
- Gender (male vs. female)
- Time (repeated measures factor)

Dependent Variables

- HR
- VO₂
- RPE
• PANAS Score
• Self-efficacy score

Control Variables

• Running Duration (20 minutes)
• Relative Speed (75% VO₂ max)

Manipulation Checks

Manipulation checks were given for both self-efficacy and feedback. A pre and post self-efficacy questionnaire specific to the activity (running) was given to the participants. The pre questionnaire was comprised of 12 items representing the participants’ confidence in being able to successfully complete 20 minutes of running at 75% VO₂ max. The participants responded on a 10 point scale, with 0 = not confident and 10 = very confident. The post questionnaire was comprised of 12 items representing the participants’ confidence in their performance. The participants responded on a 10 point scale, with 0 = not at all how I felt, and 10 = very much how I felt. Efficacy scores were determined by summing the ratings and dividing by the number of items on the scale resulting in a possible maximum efficacy score of 10. The post test feedback question administrated to the experimental group stated “did you believe your performance was in the top 10th percentile for your age and gender?”

Participants

20 participants (10 male and 10 female) were recruited for this study from local running clubs. A flyer (see appendix, p.33) was posted in local running stores to recruit participants. An inclusion criterion included training as part of a running team for
competition and aged between 18 and 34. Human subjects rights were protected and IRB approval was given (see appendix 2).

Equipment
ORCA Cardiopulmonary Test System, ORCA Diagnostics Co., Santa Barbara, CA.
Treadmill Control, Quinton Instruments Co., Seattle, WA.
Polar T31 Heart Rate monitor, Polar Electro Oy, Professorintie 5, FIN- 90440 Kempele.

Task and Procedure
The 20 participants who volunteered to participate in the study were asked to come into the exercise physiology lab at University of Nevada, Las Vegas, individually, on two separate occasions. On the first occasion they were asked to sign an informed consent form for a study looking at the relationship between running and oxygen consumption and fill out a short demographic questionnaire (see appendix, p. 34). They then ran a graded exercise test on the treadmill and 75% of their VO₂ max was determined. The technique used to determine VO₂ max and thus 75% VO₂ max was the University of Nevada, Las Vegas VO₂ max protocol. Expired gases were analyzed by a metabolic cart (ORCA Cardiopulmonary Test System, Santa Barbara, CA). Participants stood still for one minute while baseline gases were collected to insure proper functioning of the metabolic cart. Participants then walked at 3 mph for 3 minutes. The pace was then increased to a slow jogging pace (4.5mph) for 3 minutes. At the 6 minute point the participants started running at a pace they reported as their general steady running pace. They remained at this pace for the remainder of the test and every 3 minutes the grade of
the treadmill was increased by 3% until the participant could no longer keep running. At this point the test was stopped. Participants were said to have reached VO$_2$ max if the respiratory exchange ratios were greater than 1.0 or the oxygen consumption data demonstrated a plateau rather than a peak value.

On the second occasion the participants were asked to fill out the pre self-efficacy questionnaire (see appendix, p. 35) and the PANAS (see appendix, p. 37). After a minute warm up walk on the treadmill at 3 mph the speed was increased to 75% of the participants VO$_2$ max. The speed was adjusted to get as close as possible to the participants submaximal pace, and remained constant from the 6 minute mark onwards at 0% grade. All recordings at 10 minutes were ± 5 ml/kg/min of the participant’s 75% submaximal pace. After 10 minutes the participants HR, VO$_2$, and RPE were measured, and at this point those participants assigned to the high self-efficacy group (n = 10) were given motivational feedback in the form of verbal persuasion (see appendix, p. 39), which was recurrent every 2 minutes onwards. No feedback was given to the control group. HR, VO$_2$, and RPE was recorded for all participants (n = 20) at 12, 14, 16, 18, and 20 minutes. VO$_2$ readings are based on an average of 15 seconds around the minute mark, so the 10 minute VO$_2$ baseline reading is an average of the participants VO$_2$ reading at 9:55, 10:00, and 10:05, and so on. As the machine (ORCA test system, Santa Barbara, CA) gives a continuous reading every 2 – 3 seconds this was possible to do. The test was stopped after 20 minutes and a post test questionnaire measuring the participant’s level of self-efficacy (see appendix, p. 36) was filled out, as well as the PANAS.
At the end of the experiment, the participants were informed that the purpose of the study was to examine whether motivational feedback resulted in greater movement efficiency compared to a control condition. Any questions were answered.

Statistical Analysis

The effect of the self-efficacy manipulation was analyzed using a 2 (group: experimental condition vs. control condition) x 2 (gender: male vs. female) x 2 (time: pre- vs. post-self-efficacy manipulation) mixed model factorial ANOVA, with repeated measures on the last factor.

The statistical analyses used to analyze the results in this study for VO₂, HR, and RPE was a mixed model factorial 2 (group: experimental condition vs. control condition) x 2 (gender: male vs. female) x 6 (time: 10 min, 12 min, 14 min, 16 min, 18 min, 20 min) analysis of variance (ANOVA), with repeated measures on the last factor.

The affective state of the participants was analyzed using a 2 (group: experimental condition vs. control condition) x 2 (gender: male vs. female) x 2 (affect: positive vs. negative) x 2 (time: pre- vs. post-self-efficacy manipulation) factorial ANOVA.
CHAPTER 4

RESULTS

Analysis of Data

Demographic Data

All participants completed the exercise trial and were included in the statistical analysis. Sample means and standard deviations (SD) for the participants demographic information is listed in Table 3.

Table 3

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>26.2</td>
<td>5.9</td>
</tr>
<tr>
<td>Height (ft/in)</td>
<td>5'8&quot;</td>
<td>3.0</td>
</tr>
<tr>
<td>Weight (lbs)</td>
<td>143.4</td>
<td>22.3</td>
</tr>
<tr>
<td>Number of years running</td>
<td>7.8</td>
<td>5.8</td>
</tr>
<tr>
<td>Weekly running mileage (miles)</td>
<td>33.4</td>
<td>21.8</td>
</tr>
<tr>
<td>Number of times run per week</td>
<td>5.4</td>
<td>1.8</td>
</tr>
<tr>
<td>Average running pace (mph)</td>
<td>7.0</td>
<td>1.1</td>
</tr>
<tr>
<td>VO$_2$ max (ml/kg/min)</td>
<td>47.7</td>
<td>6.6</td>
</tr>
</tbody>
</table>

Manipulation Checks

Feedback manipulation check

All 10 participants in the experimental group reported believing the bogus feedback that was given to them during the test. The feedback was successfully administrated.
Self-efficacy manipulation check

Self-efficacy scores on the pre- and post-tests for both groups are illustrated in Figure 1. While the score increased in both groups, there was a greater increase for the experimental group. The main effect of time (pre vs. post manipulation) was significant, $F(1, 16) = 8.16, p < .05$. Also, the interaction of group and time was significant, $F(1, 16) = 3.54, p < .05$. Post-hoc tests indicated that the experimental group’s self-efficacy increased significantly from pre to post test, $F(1, 9) = 14.51, p < .01$, whereas the control group’s self-efficacy remained the same, $F(1, 9) < 1$. The main effects of group and gender, and the Group x Gender interaction were not significant, all $F$s $(1, 16) < 1$.

Furthermore, there were no significant interactions of test and gender, $F(1, 16) = 1.86, p > .05$, or test, gender, and group, $F(1, 16) = 4.38, p > .05$.

![Figure 1. Self-efficacy scores pre- and post-tests for both the experimental and control group](image)

**Oxygen Consumption**

$VO_2$ for both groups across times are shown in Figure 2. As can be seen, the control group had generally higher $VO_2$ values than the experimental group. More importantly,
those values tended to increase in the control group, but decreased in the experimental group. The group main effect was significant, with $F(1, 16) = 11.32, p < .001$. Also, the interaction of group and time was significant, $F(5, 80) = 6.20, p < .001$. Post-hoc tests indicated that control group’s increase in VO$_2$ across measurement times reached borderline significance ($p = .027$), and the experimental group’s decrease in VO$_2$ was significant ($p = .003$). Because the control and experimental groups differed in VO$_2$ max (50.4 versus 45.2 ml/kg/min), VO$_2$ max was included as a covariate in a subsequent analysis. Importantly, the interaction of group and time was still significant, $F(1, 15) = 5.50, p < .05$, indicating that the differential effect of self-efficacy feedback on changes in VO$_2$ was not dependent on the group difference in VO$_2$ max.

![Figure 2. VO$_2$ for both groups and changes in VO$_2$ across measurement times](image)

Men had generally higher VO$_2$ values than women (see Figure 3). The main effect of gender was significant, with $F(1, 16) = 19.23, p < .001$. Furthermore, the group difference between control and experimental groups was larger in the male compared to
the female group, as indicated by an interaction of group and gender, $F(1, 16) = 4.5, p = .05$.

Figure 3. VO$_2$ for both groups and changes in VO$_2$ across measurement times, by gender

**HR**

HR for both groups across times are shown in Figure 4. As can be seen, both groups had similar HRs, and HR generally increased over time. The main effect of time was significant, with $F(5, 80) = 14.78, p < .001$. The main effects of group and gender, and the Group x Gender interaction were not significant, all $F$s (1, 16), $p > .05$.

Figure 4. HR for both groups and changes in HR across measurement times
**RPE**

RPE for both groups and changes in RPE across measurement times are shown in Figure 5. As can be seen, both groups had very similar values, and these increased over time. The main effect of time was significant, with $F(5, 80) = 11.77, p < .001$. The main effects of group and gender, and the Group x Gender interaction were not significant, all $Fs(1, 16) p > .05$. Also, none of the other interactions were significant.

![Figure 5. RPE for both groups and changes in RPE across measurement times](image)

**Affective State**

Positive and negative affect scores for both groups and changes in positive and negative affect pre- and post-tests are shown in Figure 6. Positive affect was generally greater than negative affect. This was confirmed by a significant main effect of affect, $F(1, 16) = 104.40, p < .001$. Also, positive affect increased from pre to post test, whereas negative affect decreased. The interaction of affect and time was significant, $F(1, 16) = 11.81, p < .01$. Importantly, the experimental group tended to show greater positive affect than the control group, particularly on the post test. The main effect of group was
significant, $F(1, 16) = 7.88$, $p < .05$, and the interaction of group, affect, and time reached borderline significance, $F(1, 16) = 4.30$, $p = .055$. None of the other main or interaction effects were significant.

![Figure 6. Positive and negative affect scores for both groups and changes in positive and negative affect pre- and post-tests](image)

**Figure 6. Positive and negative affect scores for both groups and changes in positive and negative affect pre- and post-tests**

### Statistical Analysis of Research Questions

**Hypotheses 1**

The null hypothesis is rejected and research hypothesis accepted. As a result of successful self-efficacy manipulation oxygen consumption was reduced while HR across groups remained constant.

**Hypotheses 2**

The null hypothesis is accepted and research hypothesis rejected. RPE increased in both groups over time but there were no significant difference between groups.

**Hypotheses 3**

The null hypothesis is rejected and research hypothesis accepted. The experimental self-efficacy group displayed greater positive affect post-test.
CHAPTER 5

DISCUSSION

Discussion of Results

The present study was designed to assess the role of self-efficacy manipulation on the movement efficiency, RPE, and affective state of runners. The results indicate that verbal persuasion is an effective way of increasing self-efficacy which is consistent with previous findings (McAuley, Talbot, & Martinez, 1999; Marquez et al., 2002; Motl et al., 2006; Hutchinson, Sherman, & Martinovic, 2008). Participants assigned to the experimental group displayed greater movement efficiency, and reported more positive affect and less negative affect post test than those assigned to the control condition. This latter finding is consistent with McAuley et al’s. (1999) and Hutchinson et al’s. (2008) findings. A significant increase in self-efficacy post test and an increase in positive affective state provides support for Bandura's (1986) self-efficacy theory which states that the relationship between efficacy cognitions and affect is reciprocal. No differences were found in RPE. The RPE of both groups, along with HR increased over the course of the test suggesting both groups were working at equivalent workloads. Correlations have often been found between RPE and physiological measures (e.g., HR) (Chen, Fan, & Foe, 2002).

According to the Rejeski model “cognitive variables should be expected to influence RPE most when the sport/physical task in question is performed at, or has physiological demands on a submaximal nature” (Rejeski, 1981, p.314). This model has been supported by Hall, Ekkekakis, and Petruzzello (2005) in which significant negative correlations were found between self-efficacy and RPE at lower but not higher intensities. Although it
was reasonable to expect increased efficacy during exercise to reduce perceptions of effort, the manipulation may have been needed prior to the test, in order to see any significance. Rudolph and McAuley (1996) found pre-exercise efficacy was associated with lower RPE during the last minute of a challenging exercise, where the task demands were at their greatest. It is possible that the duration of the task was not long enough in the present study to see an effect.

The successful self-efficacy manipulation led to significant differences in VO$_2$ between the experimental group and the control group running submaximally. Even though HR is typically correlated with % VO$_2$ (Hall et al., 1998), no differences in HR between groups were found. The reduction in oxygen consumption (% VO$_2$ max the individual is running at) without a concomitant reduction in HR in the experimental group suggests that overall movement efficiency was enhanced by the manipulation of self-efficacy. The increase versus decrease in VO$_2$ over time as a function of group was still significant when VO$_2$ max was used as a covariate. Nevertheless, suggestion for future studies would be to stratify based on VO$_2$ max. Ratings of perceived exertion seem to be much more individualized, and as previous research has found, the same level of ratings are given at markedly different levels of VO$_2$, HR, and % VO$_2$max, both in trained and untrained men and women (Demello et al., 1987).

Conclusions and Recommendations for Further Study

According to the Fick equation, where VO$_2$ = HR x SV x a-v O$_2$ difference (arterial-venous oxygen content), if significant differences in VO$_2$ can occur with no changes in HR then the changes must be the result of a change in SV or the oxygen content of the
blood. It is possible that biomechanical factors (e.g., stride length) may play a role but previous studies have ruled this out (Baden et al., 2005). Future studies should involve taking blood samples to analyze any changes in oxygen content.

Personality types were not taken into consideration and would be useful in future research. Different personality factors can play a role on the RPE (De Meersman, 1988) and in the relationship between RPE and HR (Hassmen, Ståhl, & Borg, 1993). When comparing personality types Carver, Coleman, and Glass (1976) found that type A individuals not only reported lower levels of fatigue compared to type B’s while working at equivalent levels, but type A’s also exercised on a treadmill considerably longer than type B individuals. Many studies fail to include personality factors as a factor effecting self-efficacy (McAuley et al., 1999; Marquez et al., 2002). In the present study baseline recordings of RPE were taken at 10 minutes and therefore personality factors should not have affected the results, however, it would be interesting to know the individuals personality type to compare to RPE, and how much the individual’s RPE changes throughout the test. However there are inconsistencies in the research as personality doesn’t necessarily predict RPE at either low or high intensities (Dishman et al. 1991; Hardy, McMurray & Roberts 1989).

Future research should also include studying the effects at different exercise intensities, and at different exercise durations. Also, no efficacy recording were taken prior to or post VO\textsubscript{2} max test. A maximal test is a strenuous task which is likely to alter efficacy levels. Although the task is the same for everyone, it would be interesting to know the efficacy and affective state of the participants before and after the maximal test as well as before and after the submaximal test.
Many runners prefer to run outside and do not often run on the treadmill. In the present study 10 people reported that they run on the treadmill but only an average of two times per week (the average number of running times per week for all participants was 5 times). Whether the same effect could be found in a more familiar setting (outdoor / competition) is questionable.

Overall results of the present study were in line with the finding found in Baden et al.’s (2005) study. When participants were told to run for 20 minutes, VO$_2$ increased between 10 minutes and 20 minutes by approximately 1 ml/kg/min. This is very similar to the control group in the present study where VO$_2$ was found to increase by 1.6 ml/kg/min. However, when the participant’s in Baden et al.’s study were told to run for 10 minutes and then at 10 minutes were told to run for another 10 minutes their VO$_2$ decreased by approximately 0.5 ml/kg/min between 10 min and 20 minutes. This result is similar to the experimental group, who were spoken to at 10 minutes, and VO$_2$ decreased by 1.5 ml/kg/min between 10 minutes and 20 minutes. The greater effect would be expected with the continuous feedback every 2 minutes. It is possible that something as simple as being acknowledged by being spoken to could change overall movement efficiency, and people perform better under these social conditions.

Acknowledgement allows the participant to be distracted taking their attention away from their bodily movements and breathing. At the same running intensity changes in VO$_2$ have been found by as much as 3.7 ml/kg/min between focus conditions, with the external focus condition being the lowest and internal (breathing) being the highest (Schücker et al., 2009). It would make sense for the participants to be focusing on their breathing while knowing their oxygen consumption is being recorded. In future research
participants should be asked post test where their attention was directed during the run to see whether the information provided is external or internal under experimental and control conditions.

No study is ever perfectly designed, but the information here should be used to expand on the current knowledge and provide insight into further areas to explore in research. From this study, verbal encouragement should be regarded as a successful measure of increasing confidence and overall enjoyment, in specific situations, while working more efficiently. This is useful information for coaches who need to keep their athletes motivated to perform well.
PARTICIPANTS WANTED FOR A RUNNING STUDY!!

Come and be part of an exciting research study at UNLV measuring the oxygen consumption of runners during maximal and submaximal runs. You need to be available to come into the exercise physiology lab on two separate occasions (within a two week period but at least 3 days apart) for around 30 minutes each.

You will perform a graded exercise test on the treadmill. You will receive information about your 75% VO$_2$ capacity.

Inclusion criteria:
Between the ages of 18-34, healthy, and training as part of a running team for competition.

All interested participants should contact Isabelle Stoate at stoatei@unlv.nevada.edu or (702)234-3731 or Dr. Gabriele Wulf (PI) at gabriele.wulf@unlv.edu or (702)895-0938 for more information and to set up a testing time.
Dear Participant,

Thank you for participating in the study!

We would greatly appreciate if you could answer the following questions for us.

1. What is your age? ________
2. What is your height? ________
3. What is your weight? ________
4. What is your gender? male____ female ___
5. How many years have you been running? ________
6. How many miles do you run per week? ________
7. How many times do you run per week? ________
8. What is your average running pace? ________
9. Do you ever run on the treadmill? Yes ____ No ____
10. If so, how often? ________

Thank you very much!
Pre Run Self-Efficacy Questionnaire

Using the scale below, where 0 is “Not Confident” and 10 is “Very Confident”, how confident are you right now about the following aspects of running on the treadmill for 20 minutes at 75% of your VO2 max.

<table>
<thead>
<tr>
<th>Item</th>
<th>Not Confident</th>
<th>Very Confident</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I will enjoy running on the treadmill</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>2. I will be able to complete the task easily</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>3. I could run for longer than 20 minutes</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>4. The task will not be strenuous</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>5. I will not be tired after 20 minutes</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>6. I will not feel nervous about running</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>7. The task will not be stressful</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>8. I will not be depressed after running</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>9. I will not embarrass myself with my performance</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>10. I will be able to run with ease</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>11. 20 minutes will go by quickly</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>12. I will be happy running</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
</tbody>
</table>
Post Run Self-Efficacy Questionnaire

Using the scale below, where 0 is “Not at All How I Felt” and 10 is “Very Much How I Felt,” how did you feel about your performance?

<table>
<thead>
<tr>
<th></th>
<th>I enjoyed running on the treadmill</th>
<th>0 1 2 3 4 5 6 7 8 9 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>I was able to complete the task easily</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>3</td>
<td>I could have run for longer</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>4</td>
<td>The task was not strenuous</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>5</td>
<td>I am not tired</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>6</td>
<td>I felt relaxed running</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>7</td>
<td>The task was not stressful</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>8</td>
<td>I do not feel depressed</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>9</td>
<td>I do not feel embarrassed with my performance</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>10</td>
<td>I was able to run with ease</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>11</td>
<td>20 minutes went by quickly</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>12</td>
<td>I felt happy running</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
</tbody>
</table>
PANAS

This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you feel this way right now, that is, at the present moment. Use the following scale to record your answers.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>very slightly</td>
<td>a little</td>
<td>moderately</td>
<td>quite a bit</td>
<td>extremely</td>
</tr>
</tbody>
</table>

______ interested
______ distressed
______ excited
______ upset
______ strong
______ guilty
______ scared
______ hostile
______ enthusiastic
______ proud
______ irritable
______ alert
______ ashamed
______ inspired
______ nervous
______ determined
______ attentive
______ jittery
______ active
______ afraid
RPE Scale

6
7 very, very light exertion
8
9 very light exertion
10
11 fairly light exertion
12
13 somewhat hard exertion
14
15 hard exertion
16
17 very hard exertion
18
19 very, very hard exertion
20
Feedback Dialog

10min – You’re doing great. Your oxygen consumption is in the top 10th percentile for your age and gender.

12min – You look very relaxed. You are a very efficient runner.

14min – You’re doing really well. Your oxygen consumption is still in the top 10th percentile for your age and gender.

16min – You still look very relaxed. You are a very efficient runner.

18min – Your oxygen consumption is still in the top 10th percentile for your age and gender.
APPENDIX 2

IRB APPROVALS

Biomedical IRB – Expedited Review
Approval Notice

NOTICE TO ALL RESEARCHERS:
Please be aware that a protocol violation (e.g., failure to submit a modification for any change) of an
IRB approved protocol may result in mandatory remedial education, additional audits, re-consenting
subjects, researcher probation, suspension of any research protocol at issue, suspension of additional
existing research protocols, invalidation of all research conducted under the research protocol at
issue, and further appropriate consequences as determined by the IRB and the Institutional Officer.

DATE: April 2, 2010
TO: Dr. Gabriele Wulf, Kinesiology
FROM: Office of Research Integrity - Human Subjects
RE: Notification of IRB Action by Dr. Charles Rasmussen, Co-Chair
Protocol Title: Oxygen Consumption and Rate of Perceived Exertion in Trained
Runners During Maximal and Sub-maximal Runs
Protocol #: 1003-3408M

This memorandum is notification that the project referenced above has been reviewed by the UNLV
Biomedical Institutional Review Board (IRB) as indicated in regulatory statutes 45 CFR 46. The
protocol has been reviewed and approved.

The protocol is approved for a period of one year from the date of IRB approval. The expiration date
of this protocol is March 25, 2011. Work on the project may begin as soon as you receive written
notification from the Office of Research Integrity - Human Subjects (ORI – Human Subjects).

PLEASE NOTE:
Attached to this approval notice is the official Informed Consent/Assent (IC/A) Form for this study.
The IC/A contains an official approval stamp. Only copies of this official IC/A form may be used
when obtaining consent. Please keep the original for your records.

Should there be any change to the protocol, it will be necessary to submit a Modification Form
through ORI – Human Subjects. No changes may be made to the existing protocol until modifications
have been approved by the IRB.

Should the use of human subjects described in this protocol continue beyond March 25, 2011 it would
be necessary to submit a Continuing Review Request Form 60 days before the expiration date.

If you have questions or require any assistance, please contact the Office of Research Integrity –
Human Subjects at IRB@unlv.edu or call 895-2794.

Office of Research Integrity – Human Subjects
4505 Maryland Parkway • Box 451047 • Las Vegas, Nevada 89154-1047

40
INFORMED CONSENT
Department of Kinesiology and Nutrition Sciences

TITLE OF STUDY: Oxygen Consumption and Rate of Perceived Exertion in Trained Runners During Maximal and Sub-maximal Runs
INVESTIGATOR(S): Gabriele Wulf, Ph.D., and Isabelle Stoate
CONTACT PHONE NUMBER: 702-895-0938 (Wulf) or 702-234-3731 (Stoate)

Purpose of the Study
You are invited to participate in a research study. The purpose of this study is to evaluate the oxygen consumption of trained runners during a graded exercise test, and again during a constant submaximal pace.

Participants
You are being asked to participate in the study because you are between the ages of 18 and 34, you are healthy, and you are training as part of a running team for competition.

Procedures
If you volunteer to participate in this study, you will be asked to come into the Exercise Physiology Laboratory on two occasions. On the first occasion you will be asked to run a graded exercise test on the treadmill while your oxygen consumption is being measured. On the second occasion you will be asked to run for 20 minutes at 75% VO2 max while your oxygen consumption is being measured. At certain points during the run I will ask you to indicate your rate of perceived exertion, which you can do so by pointing at the corresponding number on the scale.

Benefits of Participation
There may not be direct benefits to you as a participant in this study. However, we hope to learn more about oxygen consumption of trained runners during maximal and sub-maximal runs.

Risks of Participation
There are risks involved in all research studies. You may experience some minor discomfort after running the graded exercise test.

Cost /Compensation
There will not be financial cost to you to participate in this study. The study will take 30 minutes of your time on two separate occasions. You will not be compensated for your time.

Participant Initials _____
1 of 2
TITLE OF STUDY: Oxygen Consumption and Rate of Perceived Exertion in Trained Runners During Maximal and Sub-maximal Runs

Contact Information
If you have any questions or concerns about the study, you may contact Dr. Gabriele Wulf at 702-895-0938 (or gabriele.wulf@unlv.edu) or Isabelle Stoate at 701-234-3731 (or stoatei@unlv.nevada.edu). For questions regarding the rights of research subjects, any complaints or comments regarding the manner in which the study is being conducted you may contact the UNLV Office for the Protection of Research Subjects at 702-895-2794.

Voluntary Participation
Your participation in this study is voluntary. You may refuse to participate in this study or in any part of this study. You may withdraw at any time without prejudice to your relations with the university. You are encouraged to ask questions about this study at the beginning or any time during the research study.

Confidentiality
All information gathered in this study will be kept completely confidential. No reference will be made in written or oral materials that could link you to this study. All records will be stored in a locked facility at UNLV for 3 years after completion of the study. After the storage time the information gathered will be destroyed.

Participant Consent:
I have read the above information and agree to participate in this study. I am at least 18 years of age. A copy of this form has been given to me.

__________________________________________    ____________________
Signature of Participant                        Date

____________________________________________
Participant Name (Please Print)

Participant Note: Please do not sign this document if the Approval Stamp is missing or is expired.
REFERENCES


VITA

Graduate College
University of Nevada, Las Vegas

Isabelle Stoate

Degrees:

Bachelor of Science, Psychology, 2008
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Thesis Title: The effect of self-efficacy manipulation on the efficiency, rate of perceived exertion, and affective state of runners

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