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A TRAINING MODEL: THE EFFECTS OF MENTAL REHEARSAL ON THE  
PERFORMANCE OF ELITE COLLEGIATE NORDIC SKIERS

BY

JENNIFER LYNN CONANT

B.A., University of New Hampshire, 2003

THESIS

Submitted to the University of New Hampshire

in Partial Fulfillment of

the Requirements for the Degree of

Masters of Arts

in

Counseling

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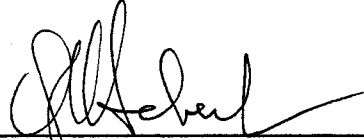
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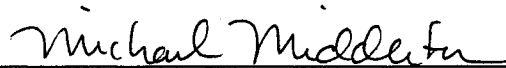
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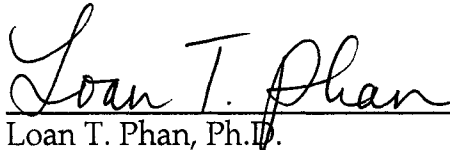
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## ABSTRACT

### A TRAINING MODEL OF THE EFFECTS OF MENTAL REHEARSAL ON THE PERFORMANCE OF ELITE COLLEGIATE NORDIC SKIERS

by

Jennifer Conant

University of New Hampshire, September, 2006

In today's competitive athletic world, the one common goal all athletes share is to win. The pressure to carry out this goal is staggering and as a result, athletes are training harder for longer hours and ultimately burning out. While there are numerous books that attempt to teach an athlete how to train physically for their sport, very few training programs teach them how to train mentally for their sport. A training program that does not include both a physical and mental aspect will fail.

This model introduces a training program where interested Nordic ski coaches can implement the training model, whereby elite collegiate Nordic skiers are introduced to a specific mental rehearsal technique. Specifically, this writer asserts that implementing a structured training program that focuses on introducing a mental rehearsal technique to elite collegiate Nordic skiers will not only increase their technique and skill development, concentration and relaxation and decrease anxiety levels, but will improve their overall skiing performance.

## **Purpose of Study**

What if there was another method that athletes could utilize to gain an upper hand on the competition? What if mental rehearsal is that answer? After all, many sports not only require physical skills, but a strong mental game as well. Most coaches preach the line that sports are 90% mental and only 10% physical. In Nordic skiing where hundredths of a second or tenths of an inch can separate the champions from the mediocre athletes, an extra edge can be extremely crucial.

Another advantage of mental rehearsal is the factor of time. The NCAA regulations state that Division I and Division II schools cannot have their athletes practice more than twenty hours per week. Many coaches do not have their team members meet with a sport psychologist to learn methods that might help enhance their performance because it would cut into their physical practice time. While the twenty hours does not include travel time, it would include any psychological skills sessions, making coaches not too eager to give up their time as many think that the given twenty hours is not enough. Mental rehearsal is a skill that can be done on the athlete's own time and convenience. Mental rehearsal would allow athletes to gain the benefits of possibly enhancing their performance without compromising their physical practice time.

The connection between mental rehearsal and its effect upon motor skill performance has been of interest to researchers for a long time. It is estimated that over 200 studies have examined the relationship between mental imagery and sport performance (Martin, Moritz, & Hall, 1999). Throughout these numerous studies, mental imagery has shown to have a positive influence on specific areas of sport such as self-confidence, concentration, performance anxiety, and motivation.

Most of this research, while showing a positive effect, has not been performed in actual field context but in a controlled environment. The purpose of this proposed training model would be to enhance the overall performance of elite athletes, specifically Nordic skiers, during their competitive season using mental rehearsal exercises. By using mental imagery as a part of their athletic preparation, athletes would get to see the possible benefits first hand, making them more likely to turn to imagery as a performance enhancer rather than steroids or other illegal substances.

### **Definition of Terms and Concepts**

The following terms are defined for the proper understanding of their use in this study.

High imager – a person who is able to produce an accurate image easily.

Imagery ability – a performers' ability to form vivid images and also to control their images (Gould, Hardy, & Jones, 1996).

Imagery perspective – the basic distinction between internal and external imagery use (Gould, Hardy, & Jones, 1996).

Imagery type – how a person is experiencing imagery; the distinction between kinesthetic imagery, temporal imagery, and visual imagery.

Low imager – a person who has difficulty producing an accurate image.

Mental imagery: “a covert activity whereby a person experiences sensory-motor sensations that reintegrate reality experiences” (Straub & Williams, 1984).

Mental rehearsal – refers to training in the use of imagery and is a skill whereby the individual gains control over the experience (Straub & Williams, 1984).

Performance: the amount of time it takes a subject to complete a set course.

Somatic features of Imagery – “any skeletal, proprioceptive, sensory experience and/or kinesthetic motoric sensation of internal body functions such as a heartbeat” (Taktek, 2004, p. 96).

Visuomotor Behavior Rehearsal – an imagery method developed by Suinn (1980) which uses a combination of relaxation plus the use of imagery for practicing athletic skills.

### **Proposed Training Model**

The model presents a step-by-step manual that could be utilized by collegiate Nordic ski coaches. It will outline how to implement a mental rehearsal training program in the collegiate setting. It will also describe in detail the importance of including mental preparation in a Nordic ski training program, how to train athletes to use specific mental rehearsal techniques, and how to recruit athletes to take part in the training program.

The potential benefits of implementing the proposed training model at the collegiate level include the following: (1) faster race times or improved overall performance; (2) increased levels of concentration and relaxation; (3) improved technique and skill development; and (4) decreased levels of anxiety.

### **Summary**

This training program was designed to introduce collegiate athletes to a specific mental rehearsal technique and stress the importance of implementing a mental preparation program along with a physical training program at the collegiate level.

The related literature revealed that with certain sports, implementing a mental rehearsal technique, specifically visuomotor behavior rehearsal, into an athletes weekly training regimen may help enhance his or her overall performance and skill development.

The proposed training program will help determine if this is true for elite collegiate Nordic skiers.

## CHAPTER II

### REVIEW OF THE LITERATURE

The drive to be the best at one's sport has existed since the beginning of human history. Competitiveness was observed by the ancient Greeks as a gift. The fastest and the strongest were crowned and treated as gods. Many aspired to be like them, while they carried the reputation of the perfect human being. While a godlike status has been acquired, the question remains, how does one get to this level of performance? This chapter will examine how one might improve one's athletic status to that of an elite athlete using the psychological technique known as visuomotor behavior rehearsal (VMBR). This chapter describes literature relevant to the research purposes of this thesis. It is organized into four sections: (1) psychological techniques and athletics, (2) mental rehearsal as a technique, (3) conceptualizations of imagery, and (4) imagery and sports. Each of these sections will discuss the relevance of the literature to the proposed research study.

#### **Psychological Techniques and Athletics**

The drive to be the best at whatever we do seems to be engrained into the development of the human being. This is especially true in the world of sports. Think about the World Series or the Super Bowl. There are probably very few individuals who do not know what these two events are. Millions of people tune in to watch big events



like these, not because they necessarily like the sport, but because the best athletes in the world are about to be crowned as such.

There is a lot of pressure to become the best athlete in your respective sport and getting there can either make you or break you. Some athletes feel the need to achieve champion status faster than their training program allows and they turn toward illegal substances, such as steroids, which will allow them to immediately enhance their performance. Not only are steroids and other performance-enhancing drugs illegal, their effects are short-lived. The more patient athletes turn toward psychological techniques such as goal setting, self-talk, and mental rehearsal to enhance their athletic performances.

“Goal-setting is an extremely important strategy employed in sport and it has been a prominent topic in the popular applied sport psychology literature” (Gould, Hardy, & Jones, 1997, p. 26). Goals have generally been viewed in very simple terms as “what an individual is trying to accomplish; it is the object or aim of an action” (Locke, Shaw, Saari, & Lantham, 1981, p. 126). There are three types of goals athletes can set for themselves: outcome goals, performance goals, and process goals. “Outcome goals focus upon the outcomes of particular events and usually (but not always) involve interpersonal comparison of some kind; for example, finishing a 400-meter hurdles race in first place” (Gould et al., 1997, p. 24). Performance goals have been identified as goals which “specify an end product of performance that will be achieved by the performers; for example, running a race in a certain time” (Gould et al., 1997, p. 25). Finally, process goals “specify the processes in which the performer will engage during the performance; for example, maintaining a good lead leg technique over each hurdle” (Gould et al., 1997,

p. 25). Athletes are encouraged to set goals for themselves which identify specific “targets that lie within their control, that they are committed to, and that they perceive to be realistic and worthwhile” (Gould et al., 1997, p. 26). If athletes feel they are not going to be able to reach their goal they are going to give up. Research indicates that athletes are much more successful throughout the goal-setting process when they break down long-term goals into short-term goals (Murphy & Jowdy, 1992). By breaking down a long-term goal into many short-term goals, the outcome appears to be more achievable by an athlete and he or she is more likely to achieve the goal. While many athletes are able to reap the positive benefits of goal-setting, when used improperly, goals can be “dysfunctional and a major source of stress” (Gould et al., 1997).

Self-talk is considered by some to be the “key to cognitive control” (Bunker, Williams, & Zinsser, 1993, p. 226). Hackfort and Schwenkmezger (1993) have interpreted self-talk as “an internal dialogue, in which the individual interprets feelings and perceptions, regulates and changes evaluations and convictions, and gives him/herself instructions and reinforcement” (p. 355). Several researchers have shown that thought content and self-statements are important predictors of sport success (Avenier & Mahoney, 1977; Orlick & Partington, 1988; Weinberg, Smith, Jackson, & Gould, 1984). Mahoney and Avenier’s study found that the best discriminator of qualifiers and non-qualifiers for the US Olympic gymnastics team was the nature and content of their self-talk just prior to competition. The qualifying gymnasts employed positive self-talk while the non-qualifying gymnasts exhibited negative self-talk (Avenier & Mahoney, 1977).

While there have been many studies showing the positive effects self-talk has had on athletic performance, there are some studies that have contradicted these findings.

Rotella, Gansneder, Ojala, and Billing (1980) found that the content of more successful elite skiers' self-talk did not differ from less successful ones. Also, Highlen and Bennett (1983) reported that elite divers as using less positive self-talk than their non-elite counterparts.

Mental rehearsal is another type of psychological technique athletes may use to try to enhance their performance. Mental rehearsal is a skill where athletes have the ability to “mimic sensory or perceptual experiences while remaining consciously aware of what they are imaging” (Richardson, 1969, p. 3). While mental rehearsal is similar to imagery, the two processes are very different. Imagery is defined in the literature as a mental process (Murphy & Jowdy, 1992) or a mode of thought (Heil, 1985). Mental rehearsal, on the other hand, is defined as “the employment if imagery to mentally practice an act” (Gould et al., 1997, p. 28). Therefore, mental rehearsal is a technique as opposed to a mental process (Gould et at., 1997). Throughout the 1980s a great deal of attention was given to the idea of mental rehearsal and this literature (Feltz & Landers, 1983; Weinberg, 1981) suggests three major findings: (1) mental rehearsal is better than no practice at all; (2) mental rehearsal combined with physical practice is more effective than either alone; and (3) the effects of mental rehearsal are greater for cognitive than for motor tasks. Corbin (1972) conducted a study in which figure skaters took part in a structured imagery regime along with their physical practices over the course of sixteen weeks. He found that the skaters that took part in the imagery regime were more successful at passing the Certified Figure Skater Assessment (CAFA) than those who chose not to partake in it. Therefore, he argues that a combination of mental and physical practice can be better than physical practice alone. He is not alone in his findings. Mental

imagery in combination with physical practice or other cognitive techniques has proven to be effective in the performance of hockey players (Davis, 1990), ski racers (Suinn, 1972), basketball players (Meyers, Schleser, & Okwumabua, 1982), gymnasts (Start & Richardson, 1964; Ward, 1992), tennis players (Daw & Burton, 1994), and golfers (McCaffrey & Orlick, 1989). These patterns suggest a positive relationship between the use of mental imagery and more successful athletic performance (Jones & Stuth, 1997).

Through techniques such as goal setting, self-talk, and imagery, an athlete will be able to enhance their performance in a legal manner. Famous athletes such as alpine skier and gold medal winner, Jean Claude Killy, and golf champion, Jack Nicklaus, admit to using mental imagery before some of their best performances (Sheikh, 1983). This thesis will look specifically at the effects mental rehearsal has on Nordic skiers.

### **Mental Rehearsal as a Technique**

#### **What is Mental Rehearsal?**

Imagery or mental rehearsal is defined in this research as a “covert activity whereby a person experiences sensory-motor sensations that reintegrate reality experiences” (Straub & Williams, 1984, p. 256). Mental rehearsal is also known as visuomotor behavioral rehearsal (VMBR) and can be divided into three steps: relaxation, the practice of imagery, and the use of imagery for strengthening psychological or motor skills (Suinn, 1980). Mental rehearsal refers to training in the use of imagery and is a skill whereby the individual gains control over the experience (Sheikh, 1983). This means that the individual will have control over what images are produced and what actions occur within each image (Suinn, 1980).

Imagery is more than visual. It is also tactile, auditory, emotional and muscular (Sheikh, 1983, p. 512). Many athletes will feel their muscles move as they rehearse their sport. Others will be able to hear the crowd cheering for them as they run by, smell the fresh cut grass as they prepare to putt, or taste the dryness of their mouth as they wait at the starting line for the gun to go off. Imagery is a total retrieval of experience that is fully dimensional in sensation (Sheikh, 1983).

In order for mental rehearsal to be effective, there are three factors that need to be controlled. These include imagery ability, imagery perspective, and the type of imagery being used.

Imagery Ability. Over the years that imagery has been studied, it has been suggested that imagery is more of a personal ability rather than a trait (Straub & Williams, 1984).

Due to this suggestion, it seems reasonable to assume that if individuals are poor imagers, imagery will not be very effective in helping them perform or learn a motor task. Good imagers, by contrast, should be able to use imagery very effectively (Munroe, Giacobbi, Hall, & Weinberg, 2000, p. 122).

Good imagery ability has been defined by two primary characteristics: vividness and controllability of the image (Murphy, 1994). The vividness of an image is made up of the clarity in which the image is being “seen,” and the accuracy to which the imagined task is being rehearsed. If athletes are visualizing themselves making a free throw, can they see themselves clearly and is the imagined free throw being correctly executed? According to the literature, if they are not able to see themselves correctly executing a free throw, they will not be able to correctly execute a free throw in reality (Munroe, Giacobbi, Hall, & Weinberg, 2000).

Controllability is an “individual’s ability to influence the content of the image” (Murphy, 1994, p. 489). If individuals are trying to visualize themselves swimming a personal best in the 100 meter butterfly, and every time they jump into the pool they see themselves sinking to the bottom, they do not have control over what they are imaging. While vividness and controllability both affect imagery ability, they do not directly affect one another. For example, a figure skater might be able to create a perfectly vivid picture of herself performing a triple salco, yet may not be able to control it, so that she imagines herself falling each time. If an individual cannot get a clear and accurate image of the task he or she wants to rehearse, the ability to complete this task accurately is going to be affected. Imagery ability has been found to influence the effects of mental rehearsal upon performance (Fishburne, Buckolz, Goss, & Hall, 1986; Housner, 1984; Ryan & Simons, 1982; Start & Richardson, 1964).

Imagery Perspective. Interest in the imagery perspective adopted by athletes was first prompted by an exploratory study done by Avener and Mahoney in 1977. Avener and Mahoney (1977) identified two different perspectives that an athlete could take when performing imagery: an external or an internal perspective. External imagery is described as, “imagery in which a person views him or herself from the perspective of an external observer” (Avener & Mahoney, 1977, p. 137). A people watch themselves as they would watch a film or a video of a past performance (Cummings & Ste-Marie, 2001). On the other hand, internal imagery “requires an approximation of the real life phenomenology such that the person actually imagines being inside his or her body” and “requires an approximation of the real life phenomenology such that the person actually imagines

being inside his or her body and experiencing those sensations which might be expected in the actual situation” (Avener & Mahoney, 1977, p. 137).

A common question that has been asked in many studies is “which perspective of imagery works better?” (Avener & Mahoney, 1977; Rotella, Gansneder, Ojala, & Billing, 1980; Hale, 1982). Avener and Mahoney (1977) conducted a study using a sample of elite gymnasts from the American Olympic Team. When asked which perspective of imagery they preferred to use, the more successful athletes were found to depend more on internal imagery while the less successful athletes relied on external imagery. Rotella et al. (1980) reached similar conclusions when examining the cognitive strategies of successful and non-successful elite skiers. Through his study, Hale (1982) reported that external imagery does not “invoke” the feelings of muscle action, as is the case with internal imagery. Hardy (1997) has suggested that skills depending on technical form for their successful completion would benefit most from an external perspective. In comparison, he also suggests that skills depending on perceptual information are well learned, not complex, and do not depend on technical form would benefit more from an internal perspective.

Most of the research that has been reviewed so far suggests that elite athletes use an internal imagery perspective more than an external imagery perspective for enhancing performance (Hall, Haslam, & Salmon, 1994). However, there have been some studies that have failed to demonstrate this preference of the internal imagery perspective. One such study conducted by Hall and Mumford (1985) investigated the effects of internal and external imagery on figure skating performance and found no difference in the use of internal and external perspectives.

While the debate over which perspective of imagery works better continues to be a heated one in the world of sport psychology, the topic that has sparked a new discussion is centered around which types of athletes benefit most from the use of imagery? There are two main types of athletes, the elite athlete and the non-elite athlete. One of the major questions the literature kept addressing was whether an athlete's status, or how much experience they had with their respective sport, affected their ability to use imagery. It has been suggested that the more experience athletes have in their sport, the more accurate their image is going to be, and therefore they might get more out of using imagery than novice athletes (Barr & Hall, 1992). Novice athletes seem to profit more from physical practice, whereas varsity athletes are better able to use mental practice effectively (Straub & Williams, 1984). Hall, Barr, and Rodgers (1990) suggest that elite and non-elite performers can be distinguished by their imagery use. Their study looked at the differences of imagery perspective in elite and non-elite (novice) rowers. The results showed that the elite rowers used an internal imagery perspective more often than the novice rowers. Avener and Mahoney (1977) in their study of elite gymnasts found that the more successful gymnasts used internal imagery while the less successful gymnasts used external imagery. These results suggest that elite athletes could be distinguished from non-elite athletes by their tendency to use an internal perspective of imagery (Hall, Haslam, & Salmon, 1994).

Types of Imagery. There are three major types of imagery that have been defined in the literature. These types include temporal imagery, visual imagery, and kinesthetic imagery. Temporal imagery is when one anticipates the effect of an action, such as a football player imagining what it is going to be like when he gets tackled during the next



play. Visual imagery is when an individual is imitating somebody's movements, and permits the representation of spatial components (Taktek, 2004). Visual imagery is composed of the vividness of that image (Munroe et al., 1994). Kinesthetic imagery is the feeling of one's bodily sensations (Taktek, 2004) while taking part in an imagery exercise. Kinesthetic imagery can also be described as imagining the feel of one's bodily movements while performing an action (Munroe et al., 1994). Two other forms of imagery mentioned in the literature were olfactory imagery, or the smells associated with sport, and auditory imagery, or the sounds associated with sport. While these two types of imagery are not to be ignored, they are not specific to this study.

While these types of imagery are important on their own, they have mostly been studied in conjunction with imagery perspective. The literature suggests that visual imagery is more closely related to an external perspective while kinesthetic imagery relates more to an internal perspective. Hardy and White (1995) found that participants imaging from an external perspective showed better learning and performance of a task that required participants to perform precise body movements (such as a gymnastic routine), as compared to those who had used internal imagery. Conversely, in the same study, participants who had used internal imagery executed a canoe slalom task with fewer mistakes than those who used external imagery.

When performing the gymnastic type routine, participants imaging from an external imagery perspective were able to 'see' the precise positions and movements that were required for performing the skill. During the canoe slalom task, participants imaging from an internal perspective were provided with perceptual information that was not available through an external perspective (Hardy & White, 1995, p. 175).

While more athletes are practicing the internal perspective of imagery, research has shown that it might be the type of sport that should determine from which perspective one could benefit most. Callow and Hardy (1999), who replicated Hardy and White's 1995 findings, recommend that athletes consider the characteristics of the skill being imaged when selecting the imagery perspective that will most benefit performance.

Where, When and Why? Mental imagery is used by athletes for a number of reasons, but its two primary purposes seem to be to prime the athlete for peak performance and to enhance skill learning (Hall, Rodgers, & Barr, 1990). In a study using elite rowers, Barr and Hall (1992) studied the use of imagery through the administration of a questionnaire. They found that most of the rowers had been exposed to and used other mental training techniques besides imagery, yet "the rowers who used other mental training techniques used imagery more than those who did not use other techniques" (Hall & Barr, 1992, p. 255). Results showed that "elite rowers used imagery more after practice, before a race, in competition and during breaks during the day than novice rowers" (Hall & Barr, 1992, p. 250). Other studies have reported athletes using imagery more in conjunction with competition than in training or practice (Munroe et al., 2000; Hall, Haslam, & Salmon, 1994). This suggests athletes are using imagery more for performance enhancement or execution than for skill learning (Munroe et al., 2000). Most athletes report using imagery more just before competing in their respective sports, rather than during or immediately after a competition (Giacobbi et al., 2000). In general, athletes report using mental imagery more in conjunction with competition than with training, more during practice than before or after practice, and more before a game than during or after a game (Hall, Haslam, & Salmon, 1994).

At this point, one might be asking why an athlete would use imagery. Imagery can help athletes in three main ways. First, imagery can help athletes improve their performance of a particular skill or facilitate learning. Tim Caldwell, an Olympic cross-country skier, was having a hard time being consistent with his results and technique. The harder he tried, the worse he performed, and the Olympics were drawing near. Suinn (1972) instructed Caldwell to ski the course exerting the same kind of effort he would as if he were racing. Then Suinn told Caldwell to imagine himself racing against his Olympic competitors. Soon after this regimen, Caldwell skied the relay event in the third fastest time for his lap helping prove that imagery can help one improve their skills.

Second, athletes could use imagery to psych themselves up for an important competition. Imagery has been thought to have a motivational function (Paivio, 1985) and imagining a crowd cheering you on as you stand on the winner's podium may enhance your performance through increased self-confidence and motivation (Gould et al., 1997).

Finally, imagery may help athletes stay focused on a specific task (Munroe et al., 2000). If a diver is about to perform in front of a cheering crowd, he or she might imagine blocking out everything but breathing before approaching the platform. Focusing on breathing through imaging will allow that diver to more easily perform that specific task while about to dive in reality.

### **Conceptualizations of Imagery**

#### **Paivio's Dual Code Model of Imagery**

Paivio (1985) proposed an analytic framework that would address a problem in a way so that one might be able to specify how imagery operates to affect different kinds of motor performance, and what might realistically be achieved through imagery rehearsal.

Paivio broke down his framework into three aspects. The first aspect deals with the functional roles through which imagery can affect performance. Paivio suggests that there are two functional roles of imagery: the cognitive role and the motivational role. The cognitive functional role of imagery can potentially affect general behavioral strategies or specific responses involved in motor skills (Paivio, 1985). This cognitive side of Paivio's suggested framework is "concerned with the effects that are attributable directly to covert practice of behavioral skills during imagery rehearsal, rather than effects that are indirectly mediated by motivational changes produced by imagery" (Paivio, 1985, p. 24S). The cognitive function focuses specifically on either general strategies or the rehearsal of specific skills (Paivio, 1985).

On the other hand, the motivational function of imagery involves imaging goals and the activities and arousal level needed to achieve these goals (Hall, Haslam, & Salmon, 1994). The motivational role of imagery allows one to "imagine goals that we like or dislike, and imagine the activities related to the attainment or non-attainment of those goals as well as the consequences that follow such successes or failures" (Paivio, 1985, p. 23S). Paivio (1985) related the motivational function of imagery to the Freudian concept of primary process thinking by stating, "The basic drives that are manifested in images relate directly to wish fulfillment, or images whose meanings or intention is only indirectly revealed in a symbolic form" (p. 23S). The motivational function focuses generally on arousal and affect, and focuses specifically on goal-oriented responses (Paivio, 1985).

The second aspect includes dealing with specific characteristics of the task. These characteristics include: one's knowledge of the task, or how experienced they are with the

task at hand; whether or not a target is involved; if the target is a non-reactive or reactive perceptual motor; and if the task requires complex or precise motor skills that do not require the performer to react to a specific target (Paivio, 1985). Tasks that have a non-reactive target would be sports such as archery, golf, or baseball. In archery and golf, both the target and the performer are stationary. In baseball, the target is moving, yet the performer is still stationary. Tasks that have a reactive target include sports where both the performer and the target are moving such as in boxing and tennis. Finally, those tasks that do not require the performer to react to a specific target yet do involve complex or precise motor skills would be sports such as diving, gymnastics, and figure skating.

The third and final aspect of his proposed framework addressed the roles of memory and verbal processes in imagery effects (Paivio, 1985). Imagery rehearsal depends on memory. “Imagery that is used in mental rehearsal could be based on memory for a specific performance episode, or on one’s general knowledge of performance skills in appropriate situations” (Paivio, 1985, p. 26S). Paivio suggests that the usefulness of imagery rehearsal depends on how accurately it represents performance skills, which in turn depends on specific experiences where performance has been optimal. This memory base is continually expanding and improving through direct practice under coaching and through observing the performance of experts (Paivio, 1985).

Language provides the retrieval cues for memories expressed as images. Without language, there is no efficient or accurate way to activate the desired imagery content (Paivio, 1985).

### Paivio's Types of Images

According to Paivio (1985), imagery is made up of both a motivational and a cognitive function. These functions operate at either a specific or general level (Munroe et al., 2000). Using the three aspects of his framework, Paivio (1985) identified five types of images one might generate in the course of using imagery. These five types include: (1) cognitive general, (2) cognitive specific, (3) motivational general-mastery, (4) motivational general-arousal, and (5) motivational specific (Martin, Moritz, Hall, & Vadocz, 1996). Cognitive general imagery is the imagery one might use to rehearse game plans, strategies, and specific routines. In contrast, cognitive specific imagery facilitates learning and performance of motor skills (Munroe et al., 2000). This type of imagery would be best used if one had to rehearse a specific sport skill such as a triple toe loop in the sport of ice-skating. Cognitive specific imagery is the most studied form of imagery today (Moritz et al., 1996; Munroe et al., 2000).

Motivational general imagery includes images that relate to general physiological arousal and effects (Munroe et al., 2000). In his framework, Paivio (1985) divided motivational general imagery into two components including motivational general-mastery (MG-M) and motivational general-arousal (MG-A). Specifically, motivational general-mastery is associated with being in control, mentally tough, and self-confident while motivational general-arousal is associated with arousal and stress (Munroe et al., 2000). Finally, motivational specific imagery involves imagining goals, the activities necessary to achieve these goals and the outcome of that goal (Moritz et al., 1994; Munroe et al., 2000).

### Ahsen's Triple Code Model (ISM) of Imagery

Ahsen (1984) proposed that imagery had three parts as opposed to Paivio's proposed two parts. He suggested that imagery was made up of the image (I), the somatic response (S), and the meaning of that image (M). Ahsen (2001) thinks of his model as one in which "the image contains not only the visual detail but also the emotional and physiological components and the verbal and interpretive relationship" (p. 8). Ahsen describes the image as possessing all the attributes of a sensation but is internal. "This image represents the outside world and its objects with a degree of sensory realism which enables us to interact with the image as if we were interacting with a real world" (Ahsen, 2001, p. 34).

The somatic response is linked to the "neurophysiological changes in the body" (Ahsen, 2001) such as one's heartbeat or the tensing of one's muscles as they perform imagery. The somatic response, along with its necessary dynamic role, plays a central function of joining the image and the meaning of the real-world experience of events (Taktek, 2004). A person has the ability to "see" the image and to make meaning out of it, but without somatic response one will not be able to "feel" the physiological or emotional changes that image is causing.

The third and final prong of Ahsen's Triple Code Model is the meaning of the image. Every image provides the individual with a very specific meaning or significance of its relevance. "Through meaning, the organism interprets its relationship with the visual image or with the world" (Ahsen, 1984, p. 34).

In the literature, Ahsen's Triple Code Model (1984) has been compared to Paivio's Dual Code Model (1971). The literature suggests that Paivio's model only

considers the image in relation to its structure and meaning, completely ignoring physiology as an important factor in mental imagery (Taktek, 2004). By including the physiological effects imagery might have on a person within an imagery model, that model becomes applicable to more people. By neglecting the somatic response in the middle, an important bridge between image and meaning, Paivio prevented his theory from being useful to a wide field of imagery application (Ahsen, 1984). Alvoeiro (1997) concluded that Ahsen's Triple Code Model is the "only framework that provides the most complete explanation as to why the use of mental imagery can affect the acquisition of motor skills and performance" (p. 214).

### Limitations of Imagery

While there have been many great findings from the research surrounding imagery, there have been many inconsistencies within this research. Some factors that have contributed to these inconsistencies include: definitions of what is being studied, the education process of imagery, and imagery ability.

Many studies have failed to describe accurately the imagery interventions that are to be used (Murphy, 1990). Current empirical studies examine the relationship between imagery use and performance enhancement, but they lack consistent operational definitions of treatment (Jones & Stuth, 1997) such as what type of imagery is to be used (kinesthetic, visual, or temporal), and from which perspective (internal or external). This lack of consistent definitions is contributing to the inconsistent findings within the research on mental imagery.

Further contributing to this inconsistency is the lack of a standard approach to educating and training athletes in the process of imaging (Jones & Stuth, 1997). While



some researchers are using imagery scripts to train subjects (Isaac, 1992), others only supplied general guidelines for what subjects were supposed to image (Ainscoe & Hardy, 1978). This lack of a standard education process allows subjects to reach an image in other ways than what is being studied. Therefore, it is “difficult to tell whether the reported improvements in performance are actually due to imagery-induced changes in arousal levels, or some specific behavior that accompanies a change in arousal” (Paivio, 1985, p. 24S).

Imagery ability is a third contributor to the inconsistencies that have been found within research on mental imagery. Very few studies attempt to assess subjects’ pre-intervention imagery abilities (Jones & Stuth, 1997). There are individual differences in imagery and these differences may influence the results of a study. If the subjects in an experimental condition are asked to use an imagery strategy and these subjects are all low imagers, it is likely that no effect or only a small effect of imagery will be found (Hall & Mumford, 1985).

“Mental practice is not a homogenous, distinct intervention” (Murphy, 1994, p. 491). To say that an athlete is mentally practicing can mean several activities are going on. Mentally practicing a tennis serve could involve thinking about serving, talking yourself through the steps in a serve, imagining hitting a perfect serve, or visualizing a perfect serve you once hit (Suinn, 1983). There are no two studies of mental practice that are actually studying the same thing (Murphy, 1994). Due to the fact that there are no two studies one can compare, the inconsistencies found within the research are going to be extensive.

## Imagery and Sports

### Sports Studied

There have been many studies that have looked at whether imagery made a difference in athletic performance. Specific sports that have been studied include rowing (Barr & Hall, 1992), basketball (Savoy & Beitel, 1996), figure skating (Hall, Buckolz, & Rodgers, 1991), swimming (Casby & Moran, 1998), soccer (Hall & Salmon, 1994), cross-country skiing (Suinn, 1980), gymnastics (Avener & Mahoney, (1977), and roller-skating (Hall et al., 1996).

### Visuomotor Behavior Rehearsal (VMBR)

Visuomotor behavior rehearsal was developed by Suinn (1980) as a combination of relaxation plus the use of imagery for practicing athletic skills. This method can be divided into three steps: relaxation, the practice of imagery, and the use of imagery for strengthening psychological or motor skills (Suinn, 1980). Suinn predicted that the quality of imagery would improve the more relaxed an athlete was. After the athlete is taught how to relax, they are instructed to practice their athletic skills by using mental imagery. This type of imagery is more than visual. It is also tactile, auditory, emotional and muscular (Suinn, 1980). For example, an athlete may experience the same “irritability” they experience during races when they mentally practice. During VMBR, athletes will experience their muscles in action, or tensing as they rehearse their sport (Suinn, 1980). Visuomotor behavior rehearsal appears to be so real that it has been compared to dreams.

The imagery of visuomotor behavior rehearsal is apparently more than sheer imagination. It is a well-controlled copy of experience, a sort of body-thinking similar to the powerful illusion of certain dreams at night. The major difference between dreams and VMBR is that the imagery rehearsal is subject to conscious control” (Suinn, 1980, p. 308).

The final stage in VMBR is to practice a specific skill through imagery. The more one practices their VMBR skills, the easier it will be to use them come competition day.

There are four benefits which can be obtained through using VMBR training. These include relaxation and anxiety reduction, error correction, concentration, and skill development (Suinn, 1980). The increased ability to relax and increased ability to concentrate on the goal to be attained or the skill to be performed have been the most general benefits athletes using VMBR have reported (Lane, 1977). VMBR can also be used to identify errors in motor performance to practice correction. Imaging a situation where an athlete feels he or she did not demonstrate optimal performance allows that athlete to “see” what he or she did wrong, imagine it correctly, and then physically practice it correctly. Lane (1977) demonstrated this part of VMBR with a baseball player who could not hit the ball. Through imagery, this baseball player was able to see that he was reacting too soon toward the pitch. He visualized himself consciously waiting for the correct moment to react to the pitch and in the next game tied his schools home run record (Lane, 1977).

Lane (1977) stated that the increased ability to concentrate is the most important benefit athletes derive from VMBR training. Specific behavior rehearsal scenes can be created to aid the development of concentration. Lane (1977) was able to do this with a basketball player who was distracted, while imaging making fouls shots, by images of spectators and the other players around him. Through VMBR, this basketball player

found that imaging the existence of high walls lining the key as they attempted to make foul shots eliminated these distractions.

The most problematic benefit of VMBR is skill development (Lane, 1977). Beginning athletes do not have the same amount of knowledge of the sport they are in as their experienced counterparts. This lack of knowledge about the technical aspects of undeveloped skills makes it hard for beginning athletes to try to improve on one specific skill. Athletes who have a lower level of skill development may benefit more from imagery that is triggered by specific instructions that emphasize the basic elements of skill (Lane, 1977). On the other hand, athletes who have a higher level of skill, such as elite athletes, may be able to indicate which element of the skill is most important and create an appropriate image for themselves (Lane, 1977).

Suinn (1976) was able to help the alpine ski team at Colorado State decrease their skiing errors through the use of VMBR. They envisioned themselves repeating the correct actions and by doing so, became more aggressive. VMBR worked so well in this case that the research study itself flopped as the coach raced the skiers who were part of the VMBR training group rather than those from the control group (Suinn, 1976).

### Summary

Many elite athletes have been trying for years to improve their performance. Some think they are not getting faster because they are not training hard and end up over-training. Others turn towards illegal substances that are short-acting and can ruin careers, yet give the immediate need of a faster performance. Both of these not-so-great solutions are leaving one of the biggest factors of sport out...the mental part of sport.

Those athletes who have taken part in psychological techniques such as goal-setting, self-talk and mental rehearsal have the chance to improve their performance without hurting their bodies. These methods are less straining on the physical self and the effects will last longer than performance enhancers or over-training. Like its illegal counterpart, mental rehearsal has been proven to help enhance athletic performance and motor skills.

Visuomotor behavior rehearsal has been used to study many sports including cross-country skiing. It has been supported through research that the use of imagery, especially VMBR, has a positive effect on a significant amount of athletes who try it (Lane, 1977; Suinn, 1976). The results of carrying out the proposed training model have the potential to be valuable to already existing literature on mental imagery through extending previous training programs and research by focusing on performance rather than elimination. While Gavel (1980) was interested in using VMBR as a mechanism to eliminate incorrect responses, I am interested in seeing if using the VMBR technique will help enhance an athlete's performance. While VMBR has been proven to help athletes decrease technical errors (Lane, 1977; Suinn, 1976), it has not been studied in terms of performance or time. The proposed training model will allow athletes and coaches to see the impact visuomotor behavior rehearsal techniques will help to improve the performance of an elite collegiate Nordic skier.

## CHAPTER III

### INTRODUCTION OF ATHLETES TO THE TRAINING PROGRAM

#### **Introduction to the Training Program**

Most athletes that participate in this training program are going to have the knowledge of how to train physically for collegiate skiing. While the physical part of training will provide athletes with strength and skill, the mental part of training gives them that extra edge needed to win. It is imperative that athletes understand the importance of including mental preparation into their physical training programs. Mental preparation is not something an athlete can gain immediately, and for this reason can be a difficult and frustrating process for those expecting immediate changes, yet the potential benefits far outweigh these frustrations. For this reason, it is important that the coaching staff prepare and stress to their athletes that this program is an ongoing process and that once they agree to participate, their commitment is imperative to the success of the program.

#### **Initial Training and Briefing of the Training Program**

It is important that participating athletes understand the details of this training program to help improve the probability of its success. It is suggested by this author that a briefing be held with interested athletes before the implementation of this training program so questions or concerns can be addressed and the athletes know to what they are possibly committing. It is imperative for athletes to understand that they potentially have

something to gain by following through with this program. This is why a briefing session is a vital part of this program, not only to introduce the athletes to the details of the program, but to help them realize that they stand to gain a greater overall performance level. At this time, a packet should be handed out to all interested athletes that includes:

1. Informed Consent Form (Appendix A)
2. Confidentiality Contract (Appendix B)
3. Audio Time Log (Appendix C)
4. Movement Imagery Questionnaire (Appendix D)
5. Sport Imagery Questionnaire (Appendix E)
6. Performance Likert Scale (Appendix F)
7. Contact information of the supervisor of the program.

All members of the coaching staff should receive a packet that includes:

1. Informed Consent Form (Appendix A)
2. Confidentiality Contract (Appendix B)
3. Revised Likert Scale (Appendix G)
4. Contact information of the supervisor of the program.

At the time athletes and coaches receive their packets, the consent letter and the confidentiality contract need to be read aloud by the supervisor and any questions answered. All athletes and coaches who decide to participate need to sign the consent letter and confidentiality contract at this time. The supervisor will collect and hold them until the end of the program. It is recommended that the Movement Imagery Questionnaire (Appendix D) be taken at this time by all interested athletes. Athletes should be split up into groups of eight or smaller to complete the MIQ. It is suggested

that the questions be read out loud by a member of the coaching staff familiar with the questionnaire so the athletes can concentrate on the tasks they will be asked to do, rather than focusing on the correctness of the item. The sooner the coaching staff knows an athlete's imagery ability, the sooner he or she knows whether it will be beneficial or not for that athlete to participate in the program.

The details that need to be stressed during this briefing session include:

- Time commitment to training program each week and throughout the competitive season.
- Weekly evaluations including the Sport Imagery Questionnaire, Likert Scale, and Revised Likert Scale (for the coaching staff).
- The completion of as many races as possible throughout the competition season.

It is recommended that all scripts, including the Edmund Jacobson Progressive Muscle Relaxation Script (Appendix H), and the Visuomotor Behavior Rehearsal Scripts (Appendices I and J), be read through and explained to all participating athletes to avoid confusion during the implementation of the program. A weekly schedule of the program should be described to the athletes so they know what they expect throughout the implementation of this training program.

The following outline will take place during the briefing session held before the implementation of this training program.

#### Briefing Session

Focus: Orientation, introduction to visuomotor behavior rehearsal (VMBR) and to the importance of including a mental rehearsal technique in one's training program.



Objective #1: Introduction to mental rehearsal techniques.

Exercise 1: “Visualization of a Past Ski Race”

Goal: To help athletes understand what imagery is and to explore what mental rehearsal skills have been used in the past by participating athletes.

Procedure:

The coaching staff introduces the exercise by explaining the importance of being properly mentally prepared for competition.

1. One member of the coaching staff starts by closing his/her eyes and visualizing a race he or she has done in the past. He/she then shares what was “seen” or even “felt” to the group.
2. All athletes are then asked to close their eyes and visualize a race they have done in the past for approximately two to three minutes. One at a time they share their experience with the group.
3. The coaching staff explains that they have just completed an imagery exercise and asks the athletes to describe how this technique may help them prepare for a race.
4. Open up the floor to discuss other methods of mental preparations volunteered by the athletes.

Briefing: Acquaint the athletes with the format of the training program.

1. State the goals of the training program: To develop a skill that will assist you, as skiers, to improve your overall skiing performance. We will focus on the following areas of improvement:

- Decreased race times
- Increased concentration and relaxation levels

- Improved technique and skill development
- Decreased levels of anxiety

2. Address where, when, and how

- How often will they practice the given mental rehearsal technique
- Where they will practice it
- How long the training sessions/program will run
- Approximately how many sessions there will be

3. Coaches Expectations: Stress commitment, as it is the backbone of the success of this training program. Ask athletes to be honest in filling out evaluations and in reporting when they practiced VMBR. Use the analogy of waxing skies. If an athlete waxes the race skies with the wrong wax, their chance of doing well in the race is small. If an athlete “makes up” doing a practice session or incorrectly fills out an evaluation, their chances to improve will be small. Evaluations will be collected weekly by the coaching staff. It is suggested that the supervisor gather a team contact list with each athlete’s phone number and e-mail address as means of communication to remind them when evaluations are due. Finally, confidentiality between athletes needs to be stressed.

4. Outline the Training Program: Distribute the training packet described earlier to each athlete and member of the coaching staff. Give everyone a few minutes to look through the packet contents and read the introduction letter.

5. Discussion: Discuss any concerns or questions that may arise, and allow time for the athletes and coaching staff to process the information.

Objective #2: Informed Consent

Goal: To receive consent to participate in this training program from all interested athletes and coaches.

Procedure:

1. Hand out Appendix A: Informed Consent Form.
2. Supervisor will read out loud the contents of the Informed Consent Form.
3. Answer any questions or concerns.
4. All participating athletes and coaches sign and date the form.
5. Informed Consent Form is collected from all individuals by the supervisor.

Objective #3: Confidentiality Contract

Goal: Stress no talking between athletes, and to inform athletes that any evaluations or communications regarding this program will be kept between coach and athlete.

Procedure:

1. Hand out Appendix B: Confidentiality Contract.
2. Supervisor will read out loud the contents of the confidentiality contract.
3. Answer any questions or concerns.
4. All participating athletes and coaches sign and date the form.
5. Confidentiality Contract is collected from all individuals by the supervisor.

Objective #4: Edmund Jacobson Progressive Muscle Relaxation Technique

Goal: To familiarize athletes with this specific relaxation technique which they will be utilizing throughout the training program.

Procedure:

1. Hand out Appendix H: Edmund Jacobson Progressive Relaxation Script.
2. Supervisor will read the script out loud in its entirety asking each athlete to listen only.
3. Supervisor will read the script out loud a second time. This time, athletes should physically participate and follow the directions.
4. Answer any questions or concerns.

Objective #5: Visuomotor Behavior Rehearsal Script

Goal: To familiarize participating athletes with this specific mental rehearsal technique that will be utilized throughout the training program.

Procedure:

1. Hand out Appendices IX and X: Visuomotor Behavior Rehearsal Scripts.
2. Supervisor will read both scripts out loud in their entirety asking each athlete to listen only.
3. Supervisor will read both scripts out loud a second time. This time athletes should physically participate and follow the directions.
4. Answer any questions or concerns.

Objective #6: Movement Imagery Questionnaire (MIQ)

Reference: Hall, C.R., & Pongrac, J. (1983). *Movement imagery questionnaire*. London, Ontario: University of Western Ontario.

Goal: To acquire imagery ability scores for participating athletes.

Procedure:

1. Depending on team size, split the team up into groups of eight or less.
2. Hand out Appendix D: Movement Imagery Questionnaire.
3. Explain the difference between visual and kinesthetic imagery (i.e., visual imagery is how well you visually see yourself doing an activity; kinesthetic imagery is how well you can feel the motion of an activity in you mind during visualization).
4. Go over the rating scales of the MIQ.
5. Remind athletes that each item will be read twice. The first time it is read, they will be carrying out the action physically and will record their score based on the visual scale. The second time, they will be carrying out the action mentally and will record their score based on the kinesthetic scale.
6. The coach will read the first item on the MIQ out loud while the athletes physically attempt the task.
7. Athletes will write down their score from the visual imagery scale (7 = very easy to see; and 1 = very hard to see).
8. All athletes will move to a relaxed seated position with their eyes closed.
9. The coach will read the first item on the MIQ out loud while the athletes attempt to mentally “feel” themselves completing the task.
10. Athletes will write down their score from the kinesthetic imagery scale (7 = very easy to feel; and 1 = very hard to feel).
11. Steps 6-10 should be repeated until all items have been completed.

12. Coach collects the questionnaires and scores each one – all visual scores are added up to get a total number; all kinesthetic scores are added up to get a total number. The higher total number represents at what type of imagery the athlete is better.

How many total sessions there are will depend on the length of the athletes' competitive season. Most collegiate skiers will have two races per week and will have to travel to get to them. It is recommended that skiers complete the required two sessions of mental rehearsal training on days where they are neither racing nor traveling. It is also recommended that they have a day in between sessions.

## CHAPTER IV

### PROPOSED TRAINING MODEL

The following is an outline of the proposed training model. This outline will serve as a guide for interested collegiate Nordic skiing coaches in implementing a training model whereby interested, healthy, motivated collegiate Nordic skiers are introduced to a method of training known as Visuomotor behavior rehearsal. The following information is provided in a guidebook format. It is intended for the use of understanding the importance and potential benefits of Visuomotor behavior rehearsal, and for the implementation of this specific training program within an elite collegiate setting.

#### **Visuomotor Behavior Rehearsal Training Manual**

##### Introduction

In today's world of competitive collegiate sports, the common goal is to win. Every athlete at some point in their collegiate career will ask the question, "What can I do to get faster?" The pressure from society and themselves to be the best in their respective sport may drive an athlete to seek out harmful methods of performance enhancement such as steroid use or blood doping. While most sports require strong physical skills, many also require a strong mental game. Unfortunately, many athletes today, including Nordic skiers, are focusing exclusively on the physical part of their training program and forgetting about the mental aspect. For a sport such as Nordic skiing, practicing a training program that includes mental preparation is vital to the success of these athletes. Whether

an athlete wins or loses a race depends on how mentally prepared he or she is for that race. Following a training program that includes mental preparation, specifically a visuomotor mental behavior rehearsal program, may discourage an athlete from seeking out illegal methods of enhancing their performance.

Mental rehearsal training programs, specifically those that include visuomotor behavior rehearsal, have been shown through research to have a positive effect on a significant amount of athletes who try it (Lane, 1977; Suinn, 1976). Although VMBR techniques have been shown to enhance an athlete's performance, many coaches are reluctant to include mental preparation as a part of their training program. Collegiate athletes can only attend practice for a total of twenty hours per week. For many Nordic ski coaches, this means splitting up their valuable time between studying technique videos, lifting, daily physical workouts, and during the competition season, racing two times a week. Including a mental aspect to their weekly training program would mean taking away from something else. What many coaches may not think of is that once learned, many mental rehearsal techniques, including VMBR can be done on athletes' own time and at their personal convenience. Introducing mental rehearsal techniques into a skier's weekly training program would allow him or her to gain the potential benefits of enhancing performance without compromising physical practice time.

The aim of this training program is to introduce visuomotor behavior rehearsal to elite collegiate Nordic skiers, which in turn may increase performance, concentration, relaxation, improve technique and skill development, and decrease levels of anxiety. Including VMBR techniques into a weekly training program may help discourage the use



of illegal performance enhancers and increase an athlete's ability to deal with societal and individual pressures to be the best.

### What is Visuomotor Behavior Rehearsal (VMBR)?

Visuomotor behavior rehearsal is a mental rehearsal technique that involves three steps including relaxation, the practice of imagery, and the use of imagery for strengthening psychological or motor skills (Suinn, 1980). Suinn predicted that the quality of imagery would improve the more relaxed an athlete was. After the athletes are taught how to relax, they are instructed to practice their athletic skills by using mental imagery. When most athletes are asked to describe what mental imagery is, a typical response may be, "It is when you can 'see' or visualize a picture or situation in your head." While this is true, VMBR allows the athlete to experience much more than just a visual picture. It allows one to experience the tactile, auditory, emotional, and muscular responses to what one is visualizing (Suinn, 1980). For example, while practicing VMBR, an athlete may experience his or her muscles in action, or tensing as he or she rehearses the sport (Suinn, 1980). They may also be able to hear the crowd cheering for them, or experience the relief of crossing the finish line. The more one practices their VMBR skills, the easier it will be to use them.

### Factors of Visuomotor Behavior Rehearsal

As discussed earlier in the literature review, there are three factors that need to be present in order for VMBR to occur. These factors include imagery ability, imagery perspective, and the type of imagery being used. Good imagery ability has been defined by two primary characteristics: vividness and controllability of the image (Murphy, 1994). Imagery ability has been found to influence the effects of mental rehearsal upon

performance (Gross, Hall, Bucholz & Fishburne, Fishburne, 1986; Housner, 1984; Ryan & Simons, 1982; Start & Richardson, 1964). If an athlete is unable to accurately rehearse or properly influence the content of the image he or she is seeing, that athlete is said to not have good imagery ability and will struggle with properly conducting VMBR.

Imagery perspective is the angle from which athletes 'see' themselves in their image. Avener and Mahoney (1977) identified two different perspectives that an athlete could take when practicing VMBR: an external or an internal perspective. External imagery is the type of imagery where athletes watch themselves as they would watch a film or a video of a past performance (Cummings & Ste-Marie, 2001). They are observers rather than participants. Internal imagery is the opposite. This is where a person actually imagines being inside his or her body and experiences those situations which might be expected in the actual situation (Avener & Mahoney, 1977). While the debate of which perspective of imagery is more effective continues to be a heated topic, most research suggests that elite athletes use an internal imagery perspective more than an external imagery perspective for enhancing performance (Hall, Haslam, & Salmon, 1994).

The final factor of visuomotor behavior rehearsal is imagery type. There are three major types of imagery that have been defined in the literature. These include temporal imagery, visual imagery, and kinesthetic imagery. Temporal imagery is when one anticipates the effects of an action, such as an alpine skier anticipating what it is going to be like if he or she falls during their next run. Visual imagery is when an individual is imitating somebody's movements, and permits the representation of spatial components (Taktek, 2004). How good an individual is at visual imagery depends on their imagery

ability. The third and final type of imagery is kinesthetic imagery which is described as imagining the feel of one's bodily movements while performing an action (Munroe et al., 1994). The type of imagery an athlete uses to practice VMBR will determine what type of imagery experience they have.

### Why is Visuomotor Behavior Rehearsal Important?

Today's athletes face many pressures both from themselves as well as society to be the best at their sport. Athletes not performing where they are expected to be, or where they feel they should be, may become desperate and turn to self-harming behaviors such as over-training or using illegal performance enhancing drugs. These perceived solutions may increase anxiety levels, raise the risk for developing a depression or eating disorder, and increase the probability of dropping out of the sport entirely. Visuomotor behavior rehearsal is a legal technique that has been proven to positively affect an athlete's performance and can be practiced outside of scheduled practice times at an athlete's own convenience. VMBR provides some variety in training which may prevent boredom and enhance motivation. Once learned, VMBR is an invaluable skill to have. It allows an athlete to "train" without physical exertion, and can be applied to other aspects of an athlete's life such as with schoolwork or social relationships. By practicing VMBR, athletes learn how to relax their body properly, which may come in handy when they are stressed about a big test coming up or trying to fall asleep after having a disagreement with their significant other.

Given the numerous benefits that visuomotor behavior rehearsal can provide athletes and the number of athletes who want to enhance their performance, it is clear that the implementation of a mental rehearsal training program is important and valuable for

collegiate Nordic skiers. Furthermore, through a mental rehearsal training program, Nordic skiers are taught the skills and given the opportunity to become a more motivated and skilled athlete, which makes for a future of more “well-rounded” athletes.

#### Benefits of a Mental Rehearsal Training Program

As mentioned earlier, visuomotor behavior rehearsal can have significant positive effects on collegiate Nordic skiers. There are four benefits which can be obtained through using VMBR training including: relaxation and anxiety reduction, error correction, concentration, and skill development. The most general benefit athletes have reported with using VMBR is the increased ability to relax, and increased ability to concentrate on the goal to be attained or the skill to be performed (Lane, 1977). In addition, VMBR can be used to identify errors in motor performance to practice correction. Imaging a situation where athletes feel they did not demonstrate optimal performance allows them to “see” what they did wrong, imagine it correctly, and then physically practice it correctly. Athletes who practice VMBR potentially stand to gain an increase in overall performance (faster race times), improved technique and skill development, and decreased levels of anxiety.

Mental rehearsal training programs are not only beneficial for the athletes, but for their coaching staff as well. Coaches whose athletes partake in VMBR training may see more team cohesion which is vital to a team’s success. Team members who do not support each other or work well together will negatively affect the performance of the team as a whole. Coaches may also see more motivated and competitive athletes. Athletes who are motivated and want to be out on the race course will out-perform indifferent athletes every time.

This mental rehearsal training program would be implemented with athletes at the collegiate level by the coaching staff. Yet with slight modification, this training program could be implemented at the middle or high school level as well. While no research has been done with these age groups, this author believes that the earlier athletes learn how to properly mentally train for their respective sport, the greater the potential benefits will be.

#### Aim of Mental Rehearsal Training Program

The aim of this mental rehearsal training program is to introduce visuomotor behavior rehearsal to interested elite collegiate Nordic skiers in an effort to increase their overall competitive performance and technical skills throughout their competitive season. This mental rehearsal training program will potentially help Nordic skiers become more aware of what they are competitively capable of while increasing their technical skills, confidence, and overall performance and decreasing anxiety levels. This will be done through a trusting relationship built on honesty, respect, and acceptance between coach and athlete. It is assumed that skiers who are not satisfied with how they are competing have greater levels of anxiety, lower levels of confidence, and possibly struggle with technical skills more than those individuals who are satisfied with their competitive level. It can be inferred that collegiate skiers who have successfully increased their performance have increased levels of confidence and have the tools to better handle the pressures of competing at the collegiate level.

#### Confidentiality

Throughout the process of this training program, participants will be asked not to communicate with each other about the training program in any way, shape or form. This is to allow the participating skiers to focus on themselves and their personal

performances rather than how their team mates are doing compared to them. All athletes will be required to complete a Confidentiality Form (Appendix B), before beginning this training program. All completed questionnaires and test score results obtained throughout this training program should remain confidential between an athlete and coaching staff. While any communication regarding mental rehearsal training should remain confidential between an athlete and the coaching staff, there is one important exception to this general rule: (1) Stated or implied threats to the personal safety or well being of the athlete, coaching staff, team mates, or others.

It is extremely important that the guidelines of confidentiality are thoroughly explained to the participating athletes and coaching staff during the beginning stages of program implementation. All coaching staff should be briefed on confidentiality prior to implementing this training program and agree to tell the head coach if any part of the confidentiality exception is divulged or if teammates are heard talking to each other regarding this training program.

#### Supervision

Supervision of this training program will be implemented by the coaching staff. The supervision of this program encompasses two areas: (1) overall responsibility for the operation of the program, and (2) providing guidance, support, and assistance to the athletes. The amount of time for supervision will depend upon the number of athletes participating in the program; however, the minimum supervision should consist of weekly check-ins with each athlete.

Major goals of supervision include the following:

1. Enable coaching staff to monitor training program related activities such as VMBR practice, and the evaluation of weekly questionnaires.
2. Enhance the overall performance gain from the mental rehearsal training program.
3. Encourage athletes to “stick with the program,” and support each other throughout the training process.

#### Steps in Implementing a Mental Rehearsal Training Program at the Collegiate Level

There are six steps in implementing a mental rehearsal training program at the collegiate level including:

1. Chain of command
2. Recruiting athletes
3. Selecting athletes
4. Training athletes to relax
5. Training athletes to use Visuomotor behavior rehearsal (VMBR)
6. Evaluating the effectiveness of training program

Each of these steps will now be discussed.

Step 1: Chain of Command. It is important for any coach to contact the athletic director at their respective institution before attempting to implement this training program. It is crucial to the success of this program that a relationship is built between the coaching staff and the director of their athletic department. By having the institutions athletic director “on board” with this training program, it will make the program a more succinct and effective process.

Step 2: Recruiting Athletes. Recruiting athletes involves having a team meeting to explain the process of the training program as well as the potential benefits they stand to gain from participating. It will be up to the discretion of the coaching staff as to which athletes will be involved in the program. Ideally the entire team would volunteer to participate in the training program. It is important that all interested athletes understand to what they are committing themselves before agreeing to participate. It is recommended that a letter be sent out to all interested athletes explaining the objective of the training program, the potential benefits of participating, and the time commitments they will be expected to follow through with. Those athletes who commit to this program will be required to sign an Informed Consent Form (Appendix A). Athletes under the age of eighteen will require parental consent. In this situation, it is recommended that a copy of the above letter be sent to their parent or guardian as well as to the athlete. It is crucial to the success of this program that interested athletes are fully informed of what is expected of them, as well as the potential benefits of the program. This may be done through an informal meeting where these specific details are explained:

- Explain why they have been chosen to participate and why the coaching staff feels they would benefit from mental rehearsal.
- Ensure athletes understand the time commitment needed to gain the potential benefits of this program.
- Explain what imagery is – not all athletes will have an understanding of this.

Step 3: Selecting Athletes. This program is meant to be implemented with a complete team of collegiate Nordic skiers. However, no athlete should be required to participate in the program if he or she does not want to or is unable to. It is important to



have the participation of motivated athletes during the implementation of this study. Non-motivated athletes may not follow through with the entire program and may negatively influence their teammates. As stated earlier, any athlete under the age of eighteen will be required to have parental consent to participate in the program. Therefore, if parental consent is not given for those athletes, they will be unable to participate in the training program.

Selection criteria should be designed to include as many athletes as possible. All athletes on the team should be encouraged to participate. Those who choose to participate will be asked to complete the Movement Imagery Questionnaire (MIQ; Appendix D), which will evaluate which type of imagery (visual or kinesthetic) they tend to use more frequently. It has been suggested through research that more novice athletes tend to use visual imagery while more advanced athletes tend to use kinesthetic imagery (Hardy & White, 1995). Athletes who score too low on the MIQ may not have the ability to perform the mental rehearsal techniques required to complete this program. While the benefits of the low scoring athletes may be compromised by their lack of imagery ability, they should not be discouraged from participating. The selection process should be guided by the following criteria:

1. Participants need to be between 17-22 years of age.
2. Current member of a collegiate Nordic ski team.
3. Completed the Movement Imagery Questionnaire, ideally with a high imagery ability.
4. Evidence of physical health.

5. Evidence of emotional security/stability.
6. Commitment to and motivation toward performance and self-improvement.

It is discouraged that athletes with emotional or physical problems participate in this training program. This training program will require weekly races in which athletes are expected to perform at their peak performance level. Athletes with chronic physical illnesses or injuries will be unable to fulfill these requirements and may cause themselves greater harm by participating. Likewise, those athletes struggling with emotional problems may have difficulties handling the stress of weekly races which may impair their visualization abilities. The aim of this program is to help athletes enhance their overall performance. Therefore, participating athletes need to exhibit the motivational behaviors and attitudes needed to positively affect their skiing performance.

Athletes should be fully informed of their responsibilities and the potential benefits of the training program before agreeing to participate. A simple induction would cover the following points:

“What’s in it for me?” Some of the potential benefits of this training program include:

- An opportunity to increase overall performance.
- Increased concentration and relaxation.
- An opportunity to improve technique and skill development.
- A chance to decrease anxiety levels.

When selecting athletes for mental rehearsal training, it may be helpful to collaborate as a coaching staff and work together to determine who will or will not participate in the

training program. Ultimately, it is up to the coaching staff and other possible supervisors who will and will not be involved.

Step 4: Training Athletes to Relax. One of the key components of this training program is learning how to relax one's body. Being able to relax the body is crucial to the success of this training program. Appendix H: Edmund Jacobson's Progressive Relaxation Technique describes a very specific method of relaxation that will be implemented during this training program. This method of relaxation will be practiced prior to any mental rehearsal exercises for the duration of the training program. It is inferred that the more relaxed an athlete is, the better ability he or she will have to use imagery (Suinn, 1980). While relaxation can be done in a group setting, it is not suggested for this training program as there are numerous possibilities for distraction and/or interruption when in a group setting. For these reasons, this relaxation technique should be done individually and in a space the athlete views as non-distracting and safe.

This relaxation technique will be practiced two times per week throughout the athlete's competitive season and will take approximately five minutes per session. Prior to starting the training program, the coaching staff should read through Edmund Jacobson's progressive relaxation script with the participating athletes and answer any questions they may have about the relaxation process. Ultimately, the coach or coaching staff supervising the implementation of this program should familiarize themselves with this technique so they can be there to support the participating athletes through weekly supervision and check-ins.

Before beginning this relaxation technique, athletes need to follow a few guidelines in order to implement relaxation correctly and for the amount of time suggested. These guidelines include:

- Wear loose or comfortable clothing – the body should not feel physically restricted in any way.
- Find a “secret” space or a quiet, non-distracting area where there will be no interruptions.

#### Step 5: Training Athletes to Use Visuomotor Behavior Rehearsal (VMBR)

The second key component of this training program is a specific imagery technique known as visuomotor behavior rehearsal. This intervention will implement relaxation through the Edmund Jacobson progressive relaxation technique, the practice of specific Nordic skiing techniques, and the use of imagery for strengthening psychological or motor skills. This technique will provide a visual, tactile, auditory, emotional, and muscular response to an image, and the opportunity to obtain relaxation and anxiety reduction, error correction, concentration, and skill development (Suinn, 1980). If an athlete is not able to utilize this imagery technique, he or she will not benefit from this program. Appendix I: Visuomotor Behavior Rehearsal Script – Day 1 and Appendix J: Visuomotor Behavior Rehearsal Script – Day 2 describe the specific imagery scripts that will be implemented in this training program. This imagery technique, in conjunction with Appendix H: Edmund Jacobson’s Progressive Relaxation Technique will be practiced two times per week throughout the athlete’s competitive season and will take approximately ten to fifteen minutes per session.

This imagery exercise will be done individually as each athlete will have his or her own auditory script to follow. While imagery exercises can be done in a group setting, it is not recommended for this training program as visuomotor behavior rehearsal takes one's complete concentration to be performed properly.

The coach or coaching staff supervising the implementation of this training program should familiarize themselves with the Visuomotor Behavior Rehearsal Script (Appendixes I and J) before introducing this program to their athletes so they can answer any questions athletes might have and be there to support them through supervision and check-in meetings.

In order to receive the full potential benefits of this program, athletes need to be aware of how to properly practice the visuomotor behavior rehearsal technique including:

- Wear loose or comfortable clothing – there should be no physical restriction of the body.
- Find a space where you will not be interrupted or distracted for at least twenty minutes.
- Know in which bodily position you are most relaxed (i.e., sitting, lying down) – this is the position you will get into when practicing VMBR throughout this program.
- Clear your head of all distracting thoughts other than the task of practicing VMBR – if athletes are thinking about what they are going to have for dinner that night or how they are going to get their homework done while practicing VMBR, they cannot expect to benefit from this training program.

## Step 6: Evaluating the Effectiveness of Training Program

Evaluation is an important component in assessing the effectiveness of training programs. According to research, there are four benefits which can be obtained through visuomotor behavior rehearsal training. These include increased relaxation and anxiety reduction, error correction, increased concentration, and improved skill development (Suinn, 1980). It is inferred that athletes who present with lower levels of anxiety and increased levels of concentration will produce faster overall performances or race times, improved technique and skill development, and have a more positive self-concept. Evaluation of these topics can be done in several ways and takes careful planning to be effective.

To evaluate changes in the athlete's use of imagery as a result of this training program, this author suggests using a questionnaire such as the Sport Imagery Questionnaire (SIQ; Hall, Mack, Paivio, & Housenblas. 1998) (see Appendix E). This questionnaire would be filled out individually by athletes following the completion of each race, and would assess how an athlete's use of imagery had changed (if at all) throughout the training program. This questionnaire looks at whether imagery use is getting easier or harder for the athlete, as well as what imagery type he or she is using the most.

It would also be important to evaluate the participating athletes' self-concepts in terms of how well they feel they are performing technically as well as how fast they feel they are racing. Those athletes who do not think they are improving technically or getting faster throughout the duration of the training program may not be implementing it correctly which needs to be addressed by the supervisor. This author suggests that

athletes use a Likert scale such as the Performance Likert Scale (see Appendix F) to evaluate how they feel they are performing technically and whether or not they are getting faster. This evaluation consists of two Likert scales which would be completed by athletes following the completion of each race. The first scale asks athletes to rank (1 = poor and 5 = excellent) how they thought they performed technically in that race. The second scale asks athletes to rank (1 = poor and 5 = excellent) how fast they thought they skied.

While an athlete's view of technical skills should not be ignored, ultimately the coach and coaching staff are the said experts on technique. Athletes may be able to verbalize that they are doing something wrong technically, but their coach will be able to point out specifically what they are doing wrong and help them to correct it. One of the potential benefits of this training program is improved technique and skill development. To help evaluate whether an athlete is improving technically, this writer suggests using a Revised Likert Scale (see Appendix G). This evaluation is filled out by the coach or coaching staff for each athlete following the completion of each race throughout the competitive season. It asks the coaches to rank (1 = poor and 5 = excellent) how each athlete performed technically during each race. Those athletes who do not appear to be improving technically may not be receiving the full potential benefits of this training program.

The last potential benefit of the athlete that needs to be evaluated is whether they are getting faster or improving their overall performance as a result of this training program. Before beginning this training program, the athlete will be required to complete two time trials on two separate days. These time trials will represent an athlete's base

performance rate and will allow the coach/coaching staff to compare performance before and after implementing the training program. One time trial should represent the skating technique, while the other time trial should represent the classic technique. This way it can be seen if one technique is improving more or faster than the other. The lengths of these time trials will be dictated by the supervisor of the program. This author suggests that the distance of these time trials be the most common distance skiers will race throughout their respective competitive season. For example, most collegiate men will race ten and twenty kilometer races while the women will race five and fifteen kilometer races. Every two years, the National Collegiate Athletic Association (NCAA) switches which technique will be represented by the longer race. It is suggested that when carrying out these time trials that the time trial distance correspond with the appropriate technique for that competitive season.

To calculate whether an athlete is getting faster, this writer suggests using a specific formula known as the Percentage Back Formula (see Appendix K). This formula allows one to calculate what percentage an athlete is back from the average of the top three places in any given race. As an athlete's percentage decreases, it can be inferred that he or she is racing faster and increasing his or her overall performance.



## CHAPTER V

### SAMPLE BI-WEEKLY VISUOMOTOR BEHAVIOR REHEARSAL TRAINING SESSIONS

The following is an example of the bi-weekly visuomotor behavior rehearsal training sessions that will last throughout the duration of the training program (the assigned days may be changed to accommodate any team's schedule):

#### **Sunday**

Objective #1: Rest Day – no racing or visualization practice.

#### **Monday**

Objective #1: Practice progressive muscle relaxation and visuomotor behavior rehearsal technique.

Exercise: Listen to provided VMBR audio recording (approximately 15 minutes).

Goal: To help athletes achieve a state of relaxation so they can focus on skill development and visualization skills.

#### Procedure:

1. Athlete changes into loose and comfortable clothing.
2. Athlete finds a quiet spot where they feel safe and will not be distracted or interrupted.
3. Athlete records on their Time Log (Appendix C) what time they started this session.

- Athletes will follow the first set of instructions on their respective audio recording which will last approximately 15 minutes.
- Athlete records on their Time Log (Appendix C) what time they ended this session.

### **Tuesday**

Objective #1: Rest Day – no visualization practice.

### **Wednesday**

Objective #1: Practice progressive muscle relaxation and visuomotor behavior rehearsal technique.

Exercise: Listen to provided VMBR audio recording (approximately 15 minutes)

Goal: To help athletes achieve a state of relaxation so they can focus on skill development and visualization skills.

Procedure:

- Athlete changes into loose and comfortable clothing.
- Athlete finds a quiet spot where they feel safe and will not be distracted or interrupted.
- Athlete records on their Time Log (Appendix C) what time they started this session.
- Athletes will follow the first set of instructions on their respective audio recording which will last approximately 15 minutes.
- Athlete records on their Time Log (Appendix C) what time they ended this session.

### **Thursday**

Objective #1: Travel Day – no visualization practice.

## **Friday**

### Athlete

Objective #1: Race, complete the sport imagery questionnaire, complete the performance Likert scale.

Goal: For athletes to race their best while utilizing the mental rehearsal skills they have been practicing.

### Procedure:

1. Complete race.
2. Focusing only on this race, complete the Sport Imagery Questionnaire (Appendix E).
3. Focusing only on this race, complete the Performance Likert Scale (Appendix F).

### Coaching Staff

Objective #1: Complete the revised Likert scale.

Goal: To evaluate whether athletes are improving technically.

Procedure: Following completion of the race, complete the Revised Likert Scale (Appendix G) for each athlete that is participating in the training program. Base your score off of this race only.

## **Saturday**

### Athlete

Objective #1: Race, complete the sport imagery questionnaire, complete the performance Likert scale.

Goal: For athletes to race their best while utilizing the mental rehearsal skills they have been practicing.

Procedure:

1. Complete race.
2. Focusing only on this race, complete the Sport Imagery Questionnaire (Appendix E).

Coaching Staff

Objective #1: Complete the revised Likert scale.

Goal: To evaluate whether athletes are improving technically.

Procedure: Following completion of the race, complete the Revised Likert Scale (Appendix G) for each athlete that is participating in the training program. Base your score off of this race only.

Following the completion of each weekly cycle, all evaluations filled out by athletes and coaching staff should be turned into the supervisor.

**Summary**

This study has introduced a training program model implemented by coaches for collegiate Nordic skiers, integrating relaxation with visuomotor behavior rehearsal (VMBR), a specific mental rehearsal technique. Research has shown that the use of imagery, specifically VMBR is an effective way to positively affect an athletes' performance (Lane, 1977; Suinn, 1976). This author believes that an athlete's technique, skill development, and overall performance can be enhanced through the implementation of this training program.

The last chapter of this thesis introduces a research design for the assessment of the effectiveness of the training program described earlier.

## CHAPTER VI

### SUGGESTED RESEARCH DESIGN, SUMMARY AND CONCLUSIONS

In order to properly measure the effectiveness of this mental rehearsal training model on athletes involved in the training program, one would need to conduct an experimental research project. The following subsections introduce a potential research design that, if implemented, would provide the opportunity to evaluate the proposed training model and its effect on the overall performance of collegiate Nordic skiers.

#### **Design**

Experimental research is fundamentally defined by the “direct manipulation of an independent variable” (Mertens, 2005, p. 121). This study would be conducted using an experimental pretest-post-test design strategy. The dependent variable in the current study is the performance of the participants, or the amount of time it takes them to complete a set course. The independent variable is the visuomotor behavior rehearsal intervention to be used with the experimental group. This study would last for a period of six weeks, with baseline measures of performance taken one week before the intervention is presented to the treatment group.

#### **Participants**

This study would draw its sample from 17- to 22-year-old male and female current members of a university Nordic ski team. Participants will have passed the Movement Imagery Questionnaire (Hall & Pongrac, 1983), indicating that they possess

one or both visual and kinesthetic imagery ability, and will qualify for the study through their baseline performance. Individuals who qualify will be asked to volunteer for the study. The participants will be randomly assigned to experimental or control groups. Participants would be asked to sign a confidentiality statement that they will not talk to fellow team members about what their assigned group is doing. The sample size will depend on the number of Nordic ski team members at the institution. Even numbers should be assigned to both the control and experimental group. The sample will be stratified to create equal assignment to treatment groups based on gender.

### **Assessments**

*Movement Imagery Questionnaire (MIQ)* – The Movement Imagery Questionnaire (MIQ; Hall & Pongrac, 1983; Appendix D) would be used as a participant screening device because it measures both visual and kinesthetic imagery ability. This instrument has been used in many studies involving imagery and has been shown to have acceptable reliability with the test-retest coefficient of .83 following a one-week interval. Internal consistencies reported in the imagery literature have ranged from .87 - .89 for the visual subscale and .88 - .91 for the kinesthetic subscale (Hall, Pongrac, & Buckholz, 1985).

*Sport Imagery Questionnaire (SIQ)* – The Sport Imagery Questionnaire (SIQ; Hall, Mack, Paivio, & Hausenblas, 1998; Appendix E) would be used to assess changes in the skiers' use of the different functions of imagery as a result of the training program. The SIQ is a 30-item self-report questionnaire that asks the skiers to rate on a 7-point scale (1 = rarely and 7 = often) how often they utilize five different types of images: cognitive general imagery (CG), cognitive specific imagery (CS), motivational general-

mastery imagery (MG-M), motivational general-arousal imagery (MG-A), and motivational specific images (MS). All items factor above the criterion level (.40) and all subscales have an acceptable internal consistency (alpha-coefficients of above .70) (Hall, Mack, Paivio, & Housenblas, 1985).

*Performance Likert Scale* – This assessment would consist of one question which asks participants to rank on a 5-point scale (1 = poor and 5 = excellent), measuring how they felt their performance went. All twelve participants will fill this assessment out following each time trial (see Appendix G).

*Revised Likert Scale* – This assessment consists of twelve questions (one for each study member) which asks the head coach and assistant coach to rank each participant of the study (1 = poor and 5 = excellent) according to how well each did technically during each time trial. The head coach and assistant coach will fill out this assessment following each time trial (see Appendix G).

## **Procedure**

### **Pretest**

All members of the Nordic ski team would be asked to volunteer to complete the Movement Imagery Questionnaire (Hall & Pongrac, 1983). Members who pass the Movement Imagery Questionnaire will be asked to participate in two time trials. The women will complete a five kilometer time trial using the skating technique as well as a ten kilometer race using the classic technique. The men will complete a ten kilometer race using the skating technique as well as a twenty kilometer race using the classic technique. If the participant consents to participate in the study, they will not be told which group they are assigned. As all participants are on the same collegiate ski team and

will be seeing one another on a daily basis, they will be asked to sign a confidentiality statement regarding communication around the present study.

### Intervention

Baseline. Baseline measures of performance will be established no later than one week prior to the present six week study. These baseline measures will be used to establish a starting performance level of each participant. Within a two week period, all interested members of the ski team will complete two time trials. The women will complete a five kilometer and a ten kilometer time trial while the men will complete a ten and a twenty kilometer time trial. One time trial will be conducted using the skating technique while the other time trial will be conducted using the classic technique. Participants will be asked to fill out a performance Likert scale following each race. All participants completing these two races will potentially be used in the present study. The head coach and assistant coach will each be asked to fill out a revised Likert scale for each participant following each baseline time trial.

### Experimental Group

Following the period of baseline measures, members of the experimental group will be assigned to participate in visuomotor behavior rehearsal (VMBR) training. Members of this group will receive an audio CD that they will be asked to listen to two times per week. This audio CD will run about fifteen minutes in length and will involve three parts: relaxation through the reading of Edmond Jacobson's progressive relaxation technique, listening to a recording of five specific Nordic skiing techniques, and listening to the same recording of the identified Nordic techniques focusing on personal skill and technique. Members will meet with the supervisor of this study once as a group when



they receive their assigned audio CD to go over guidelines on how to correctly do the assigned relaxation and mental rehearsal technique. Members will be asked to keep a time log of the days in which they listened to their audio CD as well as how long it took them.

Along with these bi-weekly sessions, participants will be asked to complete as many races as possible throughout their competitive season. These races will be varied in length and technique. Subjects in the experimental group will be asked to complete the Sport Information Questionnaire (Hall, Mack, Paivio, & Hausenblas, 1998), as well as the performance Likert Scale (1 = poor and 5 = excellent) following each time trial. If participants rank themselves as 'poor' on the Likert scale or do not complete the race due to illness or technical problems, that race will be thrown out and the participant will be asked to "make-up" the race following the sixth week of the current study if there are still scheduled races.

#### Control Group

Following the period of baseline measures, member of the control group will be given an audio CD containing various pieces of classical music. Participants will be asked to listen to their audio CD two times per week for fifteen minutes. Members will be asked to keep a time log of the days in which they listened to their audio CD as well as how long it took them. Visuomotor behavior rehearsal will not be introduced to this group although members of the control group will be asked to complete a performance Likert Scale (1 = poor and 5 = excellent) following each race.

### Coaching Group

Each coaching staff will also be asked to complete a specifically revised performance Likert Scale for subjects in the experimental group as well as the control group. This revised Likert scale will ask the coach and assistant coach to judge the subjects on their technical performance rather than time, and will be completed following each race.

### Post-test

If the participants have been compliant with all parts of the intervention including making up any missed or non-useable races, performance will be measured using an equation commonly used at NCAA Nordic skiing races that measures what percentage back an identified skier is from the average time of the top three places. This equation will be used after each completed race to determine if and when any improvements have occurred. The SIQ and performance Likert scale will be completed by the experimental group, the control group will also complete the performance Likert scale, and the head coach and assistant coach will complete the revised Likert scale for each participant to obtain these measures.

Following the completion of the final race, all participants and coaching staff will be given a full debriefing of the purpose of the study. Visuomotor behavior rehearsal can be offered to the control group following this study if significant performance differences are found in the experimental group

### **Data Analysis**

Two hypotheses will be evaluated.

Hypothesis I: The performance of participants in the experimental group will increase following the visuomotor behavior rehearsal intervention, while the performance of the control group will remain close to the same.

Hypothesis II: The technical skills of the participants in the experimental group will increase while the technical skills of the control group remain the same.

For each of these hypotheses, scores of the SIQ and performance time will be analyzed using a paired t-test to determine the significance of change within the scores.

### **Summary and Conclusion**

The above research design is offered to the reader in an attempt to illustrate a viable method for evaluating and testing the efficacy of this study's hypotheses. The results yielded from this study could potentially support the implementation of a mental rehearsal training program and could be generalized to athletes in general.

This thesis is presented in an effort to support the premise that the implementation of the above mental rehearsal training program is likely to positively effect the overall performance of those athletes who participate, specifically race times, technique and skill development, and concentration and relaxation. This hypothesis has been supported through the presentation and synthesis of recent research literature on the positive effects of mental rehearsal on participants.

While there is a plethora of information about the effects mental rehearsal has on an athlete's performance, there is little research regarding the correlation between implementing a mental rehearsal program and an athlete's confidence or self-esteem. An

athlete's confidence about his or her athletic ability is going to affect performance. Is it possible for a mental rehearsal program to enhance not only physical capabilities, but inner confidence levels? More studies are needed to further answer this question as an athlete's confidence level can either "make" them or "break" the athlete.

The fact is, very few athletic programs today are focusing on the mental aspect of sport as intently as the physical aspect. Mental rehearsal training, specifically the visuomotor behavior rehearsal technique, has been documented to have many positive effects on an athlete's performance. Benefits include relaxation and anxiety reduction, error correction, concentration, and skill development (Suinn, 1980). This author believes that implementing a mental rehearsal training program in a collegiate setting with the Nordic ski team will not only provide the benefits listed above, but will also increase the confidence and overall performance of the athletes. Increasing the confidence level of athletes is the first step towards deterring them from turning toward illegal performance enhancers.

It is clear that in today's world winning is the uniform goal of all athletes no matter in what sport they compete. Nordic skiing is no exception to this goal. While it may be important to the athlete to win, it is important to society that they do it in the right way, possibly through mental rehearsal training. This author believes that incorporating a mental rehearsal training program into an existing training regimen will help positively affect an athlete's performance, thus deterring them from using illegal performance enhancers, and helping them maintain a healthy role-model image for young athletes today.

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## APPENDICES

## APPENDIX A

### INFORMED CONSENT FORM

My name is **[Coach's Name]**, and I am the Nordic ski coach at **[Institutions Name]**. This season I would like to add a new element to our training program known as mental rehearsal training. I believe that imagery and relaxation can have a positive affect on physical performance when done weekly. This training program will allow us to see if this is true while potentially increasing your overall performance.

This training program will last throughout the duration of our competition season. If you decide to participate, this program will require one-half hour of your time per week including activities such as filling out short weekly questionnaires, and the completion of at least ten races throughout your competition season (January – March).

The potential benefits from this study are:

- Faster race times
- Increased concentration and relaxation
- Improved technique and skill development
- Decreased levels of anxiety

However, I cannot guarantee that you personally will receive any benefits from this program. Results may vary from person to person.

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission. All skiers' identities will be kept confidential. Any collected evaluations will only be viewed by **[Coach's Name]**.

There is minimal risk involved by participating in this program as its main focus is on imagery and relaxation.

Your participation is voluntary. Your decision whether or not to participate will not affect your relationship with the coaching staff or the **[Institutions Name]**. If you decide to participate, you are free to withdraw your consent and discontinue participation at any time without penalty.

If you have any questions in regard to this training program, you may contact **[Coach's Name]**.

Your signature indicates that you have read and understand the information provided above, that you willingly agree to participate, that you may withdraw your consent at any time and discontinue participation without penalty, and that you are not waiving any legal claims, rights or remedies.

---

Print Name

---

Signature of parent/legal guardian (if participant is under 18 years of age)

---

Signature of Participant

APPENDIX B

CONFIDENTIALITY CONTRACT

In order to maintain the integrity of this training program, I am asking all participants to sign this confidentiality contract that NO discussion regarding this program or one's role in the training will occur with fellow teammates or coaching staff other than the program supervisor. If there are any questions regarding this training program, you may contact [name], the supervisor or head coach.

Upon the completion of this study, all participants and coaching staff will be offered a debriefing session in which this study will be explained in depth.

If any participant is found to have breached or admits to breaching confidentiality, they will be asked to stop participating in the training program and any completed evaluations collected from them will become null and void. Breaching confidentiality will not affect your relationship with the program supervisor, coaching staff or with the [Name of your Institution].

Your signature below indicates that you have read and understand the information provided above, that you willingly agree not to discuss this study including your role in it with fellow teammates or coaching staff. Your signature indicates that you understand that if you are found to have breached confidentiality in any way, you will be asked to leave the training program.

\_\_\_\_\_  
Print Name

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

APPENDIX C  
AUDIO TIME LOG

DAY	DATE	TIME STARTED	TIME ENDED
Monday	15-January	8:00 pm	8:15 pm

APPENDIX D

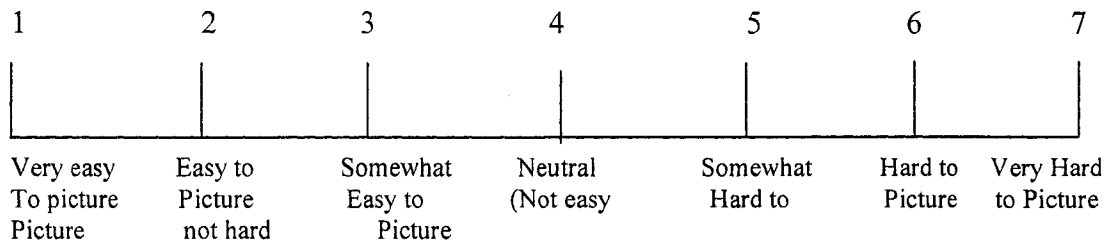
MOVEMENT IMAGERY QUESTIONNAIRE

Craig R. Hall and John Pongrac

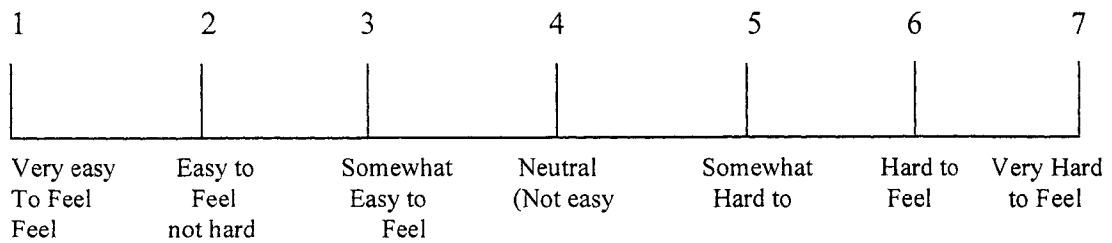
Faculty of Physical Education  
The University of Western Ontario  
London, Ontario  
Canada

**RATING SCALES**

**Visual Imagery Scale**



**Kinesthetic Imagery Scale**



**MOVEMENT IMAGERY QUESTIONNAIRE TEST ITEMS**

1. **STARTING POSITION:** Make a fist with your dominant hand the (hand you write with) and then place this hand on the same shoulder (e.g., right hand on right shoulder) such that your elbow is pointing directly in front of you.

**ACTION:** Extend your elbow so that your hand leaves your shoulder and is straight in front of you parallel to the floor. Keep your hand in a fist. Make this movement very slowly.

**MENTAL TASK:** Assume the starting position (exactly as described above). Form a clear and vivid a mental image as possible of the movement just performed. **DO NOT PERFORM THE MOVEMENT.** Now rate the ease/difficulty with which you were able to do this mental task.

Rating

2. **STARTING POSITION:** Stand with your feet and legs together and your arms at your sides.

**ACTION:** Raise your right knee as high as possible so that you are standing on your left leg with your right leg flexed (bent) at the knee. Now lower your right leg so you are once again standing on two feet. Perform these actions **slowly**.

**MENTAL TASK:** Assume the starting position. Attempt to feel yourself making the movement just performed without actually doing it. Now rate the ease/difficulty with which you were able to do this mental task.

Rating



3. **STARTING POSITION:** Stand with your feet slightly apart and your hands at your sides.

**ACTION:** Bend down low and then jump straight up in the air as high as possible with both arms extended above your head. Land with your feet apart and lower your arms to your side.

**MENTAL TASK:** Assume the starting position. Form as clear and vivid a mental image as possible of the movement just performed. Now rate the ease/difficulty with which you were able to do this mental task.

Rating

4. **STARTING POSITION:** Stand with your feet slightly apart and your arms at your side.

**ACTION:** Jump upwards and rotate your entire body to the **left** such that you land in the same position in which you started. That is rotate to the left in a complete (360 degree) circle.

**MENTAL TASK:** Assume the starting position. Attempt to feel yourself making the movement just performed without actually doing it. Now rate the ease/difficulty with which you were able to do this mental task.

Rating

5. **STARTING POSITON:** Extend the arm of your non-dominant hand straight out to your side so that it is parallel to the ground, palm down.

**ACTION:** Move your arm forward until it is directly in front of your body (still parallel to the ground). Keep your arm extended during the movement and make the movement slowly.

**MENTAL TASK:** Assume the starting position. Form as clear and vivid a mental image as possible of the movement just performed. Now rate the ease/difficulty with which you were able to do this mental task.

Rating

6. **STARTING POSITION:** Stand with your feet and legs together and your arms at your sides.

**ACTION:** Raise your left leg as high as possible keeping the leg extended (do not bend your left knee). At the same time keep your support (right) leg straight. Now lower your left leg so you are once again standing on two feet. Perform these actions **slowly**.

**MENTAL TASK:** Assume the starting position. Attempt to feel yourself making the movement just performed without actually doing it. Now rate the ease/difficulty with which you were able to do this mental task.

Rating

7. **STARTING POSITION:** Stand with your feet slightly apart and your arms fully extended above your head.

**ACTION:** **Slowly** bend forward at the waist and try and touch your toes with your fingertips (or if possible, touch the floor with your fingertips or hands). Now return to the starting position, standing erect with your hands above your head.

**MENTAL TASK:** Assume the starting position. Form as clear and vivid a mental image as possible of the movement just performed. Now rate the ease/difficulty with which you were able to do this mental task.

Rating

8. **STARTING POSITION:** Make a fist with your non-dominant hand. Extend your arm above your head keeping your hand in a fist. Keep your other arm at your side.

**ACTION:** Swing your extended arm straight down to your side as **rapidly** as possible. Keep your arm extended and your hand clenched.

**MENTAL TASK:** Assume the starting position. Attempt to feel yourself making the movement just performed without actually doing it. Now rate the ease/difficulty with which you were able to do this mental task.

Rating

9. **STARTING POSITION:** Stand in front of the floor (exercise) mat with your feet together and your arms at your sides.

**ACTION:** Perform a front somersault (roll) on the mat and finish in a standing position.

**MENTAL TASK:** Assume the starting position. Attempt to feel yourself making the movement just performed without actually doing it. Now rate the ease/difficulty with which you were able to do this mental task.

Rating
--------

10. **STARTING POSITION:** Make a fist with your dominant hand (the hand you write with) and then place this hand on the same shoulder (e.g., right hand on right shoulder) such that your elbow is pointing directly in front of you.

**ACTION:** Extend your elbow so that your hand leaves your shoulder and is straight in front of you parallel to the floor. Keep your hand in a fist. Make this movement very **slowly**.

**MENTAL TASK:** Assume the starting position. Attempt to feel yourself making the movement just performed without actually doing it. Now rate the ease/difficulty with which you were able to do this mental task.

Rating
--------

11. **STARTING POSITION:** Stand with your feet and legs together and your arms at your sides.

**ACTION:** Raise your right knee as high as possible so that you are standing on your left leg with your right leg flexed (bent) at the knee. Now lower your right leg so you are once again standing on two feet. Perform these actions **slowly**.

**MENTAL TASK:** Assume the starting position. Form as clear and vivid a mental image as possible of the movement just performed. Now rate the ease/difficulty with which you were able to do this mental task.

Rating
--------

12. **STARTING POSITION:** Stand with your feet slightly apart and your hands at your sides.

**ACTION:** Bend down low and then jump straight up in the air as high as possible with both arms extended.

**MENTAL TASK:** Assume the starting position. Attempt to feel yourself making the movement just performed without actually doing it. Now rate the ease/difficulty with which you were able to do this mental task.

Rating

13. **STARTING POSITION:** Stand with your feet slightly apart and your arms at your side.

**ACTION:** Jump upwards and rotate your entire body to the **left** such that you land in the same position in which you started. That is rotate to the left in a complete (360 degree) circle.

**MENTAL TASK:** Assume the starting position. Form as clear and vivid a mental image as possible of the movement just performed. Now rate the ease/difficulty with which you were able to do this mental task.

Rating

14. **STARTING POSITON:** Extend the arm of your non-dominant hand straight out to your side so that it is parallel to the ground, palm down.

**ACTION:** Move your arm forward until it is directly in front of your body (still parallel to the ground). Keep your arm extended during the movement and make the movement slowly.

**MENTAL TASK:** Assume the starting position. Attempt to feel yourself making the movement just performed without actually doing it. Now rate the ease/difficulty with which you were able to do this mental task.

Rating

15. **STARTING POSITION:** Stand with your feet and legs together and your arms at your sides.

**ACTION:** Raise your left leg as high as possible keeping the leg extended (do not bend your left knee). At the same time keep your support (right) leg straight. Now lower your left leg so you are once again standing on two feet. Perform these actions **slowly**.

**MENTAL TASK:** Assume the starting position. Form as clear and vivid a mental image as possible of the movement just performed. Now rate the ease/difficulty with which you were able to do this mental task.

Rating

16. **STARTING POSITION:** Stand with your feet slightly apart and your arms fully extended above your head.

**ACTION:** **Slowly** bend forward at the waist and try and touch your toes with your fingertips (or if possible, touch the floor with your fingertips or hands). Now return to the starting position, standing erect with your hands above your head.

**MENTAL TASK:** Assume the starting position. Attempt to feel yourself making the movement just performed without actually doing it. Now rate the ease/difficulty with which you were able to do this mental task.

Rating

17. **STARTING POSITION:** Make a fist with your non-dominant hand. Extend your arm above your head keeping your hand in a fist. Keep your other arm at your side.

**ACTION:** Swing your extended arm straight down to your side as **rapidly** as possible. Keep your arm extended and your hand clenched.

**MENTAL TASK:** Assume the starting position. Form as clear and vivid a mental image as possible of the movement just performed. Now rate the ease/difficulty with which you were able to do this mental task.

Rating

18. **STARTING POSITION:** Stand in front of the floor (exercise) mat with your feet together and your arms at your sides.

**ACTION:** Perform a front somersault (roll) on the mat and finish in a standing position.

**MENTAL TASK:** Assume the starting position. Form as clear and vivid a mental image as possible of the movement just performed. Now rate the ease/difficulty with which you were able to do this mental task.

Rating
--------

## APPENDIX E

### THE SPORT IMAGERY QUESTIONNAIRE

Please rate the following skills on a scale of 1 – 7. 1 = rarely/not well 7 = often/very well

#### Cognitive Specific

1. I can easily change an image of a skill.
2. When imaging a particular skill, I can consistently perform it perfectly in my mind.
3. I can mentally make corrections to physical skills.
4. Before attempting a particular skill, I imagine myself performing it perfectly.
5. When learning a new skill, I imagine myself performing it perfectly.
6. I can consistently control the image of a physical skill.

#### Cognitive General

1. I make up new plans/strategies in my head.
2. I image alternative strategies in case my event/game plan fails.
3. I image each section of an event/game (e.g., offense vs. defense, fast vs. slow).
4. I image myself continuing with my event/game plan, even when performing poorly.
5. I image executing entire plays/programs/sections just the way I want them to happen in an event/game.
6. I image myself successfully following my event/game plan.

#### Motivational Specific

1. I image the atmosphere of winning a championship (e.g., the excitement that follows winning, etc.).
2. I imagine other athletes congratulating me on a good performance.
3. I image the atmosphere of receiving a medal (e.g., the pride, the excitement, etc.).
4. I image the audience applauding my performance.
5. I image myself winning a medal.
6. I image myself being interviewed as a champion.

Hall, C.R., Mack, D.E., Paivio, A., & Hausenblas, H.A. (1998). *The sport imagery questionnaire: Test manual*. Fitness Information Technology, Morgantown, West Virginia: University of West Virginia.

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### **Motivational General-Arousal**

1. I can re-create in my head the emotions I feel before I compete.
2. I imagine myself handling the stress and excitement of competitions and remaining calm.
3. I imagine the stress and anxiety associated with competing.
4. When I image a competition, I feel myself getting emotionally excited.
5. When I image an event/game that I am to participate in, I feel anxious.
6. I image the excitement associated with competing.

### **Motivational General-Mastery**

1. I image giving 100% during an event/game.
2. I image myself being mentally tough.
3. I imagine myself appearing self-confident in front of my opponents.
4. I image myself to be focused during a challenging situation.
5. I imagine myself being in control in difficult situations.
6. I image myself working successfully through tough situations (e.g., a power play, sore ankle, etc.).



APPENDIX F

PERFORMANCE LIKERT SCALE

Rate on a scale of 1 – 5 how well you think you performed **technically** during today's time trial.

1 = poor, 2 = somewhat good, 3 = good, 4 = very good, and 5 = excellent

Please circle your answer on the scale below.

1    2    3    4    5

Rate on a scale of 1 – 5 how well you think you performed in terms of **time** (how fast you think you were) during today's time trial.

1 = poor, 2 = somewhat good, 3 = good, 4 = very good, and 5 = excellent

Please circle your answer on the scale below.

1    2    3    4    5

APPENDIX G  
REVISED LIKERT SCALE

Please rate on a scale of 1 – 5 how well you think **[participant's name]** performed technically during today's time trial.

1 = poor, 2 = somewhat good, 3 = good, 4 = very good, and 5 = excellent

Please circle you answer on the scale below.

1    2    3    4    5

Please rate on a scale of 1 – 5 how well you think **[participant's name]** performed technically during today's time trial.

1 = poor, 2 = somewhat good, 3 = good, 4 = very good, and 5 = excellent

Please circle you answer on the scale below.

1    2    3    4    5

Please rate on a scale of 1 – 5 how well you think **[participant's name]** performed technically during today's time trial.

1 = poor, 2 = somewhat good, 3 = good, 4 = very good, and 5 = excellent

Please circle you answer on the scale below.

1    2    3    4    5

Please rate on a scale of 1 – 5 how well you think **[participant's name]** performed technically during today's time trial.

1 = poor, 2 = somewhat good, 3 = good, 4 = very good, and 5 = excellent

Please circle your answer on the scale below.

1   2   3   4   5

Please rate on a scale of 1 – 5 how well you think **[participant's name]** performed technically during today's time trial.

1 = poor, 2 = somewhat good, 3 = good, 4 = very good, and 5 = excellent

Please circle your answer on the scale below.

1   2   3   4   5

Please rate on a scale of 1 – 5 how well you think **[participant's name]** performed technically during today's time trial.

1 = poor, 2 = somewhat good, 3 = good, 4 = very good, and 5 = excellent

Please circle your answer on the scale below.

1   2   3   4   5

Please rate on a scale of 1 – 5 how well you think [participant's name] performed technically during today's time trial.

1 = poor, 2 = somewhat good, 3 = good, 4 = very good, and 5 = excellent

Please circle your answer on the scale below.

1 2 3 4 5

Please rate on a scale of 1 – 5 how well you think [participant's name] performed technically during today's time trial.

1 = poor, 2 = somewhat good, 3 = good, 4 = very good, and 5 = excellent

Please circle your answer on the scale below.

1 2 3 4 5

Please rate on a scale of 1 – 5 how well you think [participant's name] performed technically during today's time trial.

1 = poor, 2 = somewhat good, 3 = good, 4 = very good, and 5 = excellent

Please circle your answer on the scale below.

1 2 3 4 5

Please rate on a scale of 1 – 5 how well you think **[participant's name]** performed technically during today's time trial.

1 = poor, 2 = somewhat good, 3 = good, 4 = very good, and 5 = excellent

Please circle your answer on the scale below.

1   2   3   4   5

Please rate on a scale of 1 – 5 how well you think **[participant's name]** performed technically during today's time trial.

1 = poor, 2 = somewhat good, 3 = good, 4 = very good, and 5 = excellent

Please circle your answer on the scale below.

1   2   3   4   5

Please rate on a scale of 1 – 5 how well you think **[participant's name]** performed technically during today's time trial.

1 = poor, 2 = somewhat good, 3 = good, 4 = very good, and 5 = excellent

Please circle your answer on the scale below.

1   2   3   4   5

## APPENDIX H

### EDMUND JACOBSON PROGRESSIVE MUSCLE RELAXATION SCRIPT

Let's begin. I am sitting in a comfortable position or lying on the floor. My goal is not to go to sleep but to get into a deep state of relaxation. I am dressed in comfortable clothing and I have taken precautions not to be distracted. I am ready to begin.

Make a tight fist with both of your hands by clenching your fingers together.  
Hold it to the count of three.....one.....two.....three.....Reelaaaxxxx...  
Again, make a tight fist with both hands.....tighter...  
Hold it.....one.....two.....three.....Reelaaaxxxx...  
Third time, make a tight fist with both of your hands...  
Hold it.....one.....two.....three.....Reelaaaxxxx.

Clench both fists and bring them up to your shoulders to tense your biceps...  
Tense then tightly.....one.....two.....three.....Reelaaaxxxx...  
Again, clench both fists and bring them up to your shoulders...  
Hold them tightly.....one.....two.....three.....Reelaaaxxxx...  
Once more, clench your fists and bring them to your shoulders...  
Hold tight.....one.....two.....three.....Reelaaaxxxx...

This time, tighten the muscles in your forehead and scalp by wrinkling up your forehead and raising your eyebrows at the same time...  
Hold it.....one.....two.....three.....Reelaaaxxxx...  
Again, tighten those forehead muscles...  
Hold it.....one.....two.....three.....Reelaaaxxxx...  
Third time, wrinkle and stretch those forehead muscles...  
Hold it.....one.....two.....three.....Reelaaaxxxx...

Now pucker up your lips. Wrinkle your nose and squint...  
Hold it.....one.....two.....three.....Reelaaaxxxx...  
Again, pucker your lips, wrinkle your nose and squint...  
Hold it tightly...one.....two.....three.....Reelaaaxxxx...  
Last time, pucker your lips, wrinkle your nose and squint...  
Hold it.....one.....two.....three.....Reelaaaxxxx...

Push your head back as far as it will go...  
Hold it.....one.....two.....three.....Reeelaaxxxx...  
Again, push your head back as far as it can go...  
Hold it.....one.....two.....three.....and Reeelaaxxxx...  
And again, push your head back as far as you can...  
Hold it.....one.....two.....three.....Reeelaaxxxx...

Now, bend your head forward touching your chin on your chest...  
Tightly hold that...one.....two.....three.....Reeelaaxxxx...  
Again, bend your head forward touching your chin on your chest...  
Hold it.....one.....two.....three.....Reeelaaxxxx...  
Last time, bend your head forward touching your chin to your chest...  
And hold it.....one.....two.....three.....and Reeelaaxxxx...

Take a deep breath and fill your lungs to their full capacity...  
Hold it.....one.....two.....three.....Reeelaaxxxx...  
Again, take a deep breath filling your lungs to capacity...  
Hold it.....one.....two.....three.....Reeelaaxxxx...  
Last time, take a deep breath and fill your lungs all the way up...  
Hold it.....one.....two.....three.....Reeelaaxxxx...

Tighten your stomach muscles and make your stomach rigid...  
Hold it.....one.....two.....three.....and Reeelaaxxxx...  
Again, tighten your stomach muscles, making your stomach rigid...  
Hold it tightly.....one.....two.....three.....and Reeelaaxxxx...  
Last time, tighten your stomach muscles, all the way until they are rigid...  
Hold it.....one.....two.....three.....Reeelaaxxxx...

Lift your shoulders as high as you can up toward your ears...  
Hold it.....one.....two.....three.....Reeelaaxxxx...  
Again, lift your shoulders as high as you can up to your ears...  
Hold it.....one.....two.....three.....and Reeelaaxxxx...  
Once again, lift your shoulders as high as you can towards your ears...  
Hold it.....one.....two.....three.....and Reeelaaxxxx...

Now, tighten your thigh muscles by lifting your feet a few inches off the floor...  
Hold it tightly.....one.....two.....three.....Reeelaaxxxx...  
And again, tighten your thigh muscles by lifting your feet a few inches off the floor...  
Hold it.....one.....two.....three.....and Reeelaaxxxx...  
Last time, lift your feet a few inches off the floor and feel your thigh muscles tighten...  
Hold it.....one.....two.....three.....Reeelaaxxxx...

Tighten your shin muscles by pulling your toes toward your chin...  
Hold it.....one.....two.....three.....and Reelaaaxxxx...  
Again, tighten your shin muscles by pulling your toes toward your chin...  
Hold it.....one.....two.....three.....Reelaaaxxxx...  
Last time, pull your toes towards your chin and tighten your shin muscles...  
Hold it.....one.....two.....three.....and Reelaaaxxxx...

Tighten your calf muscles by pointing your toes towards the wall...  
Hold it.....one.....two.....three.....and Reelaaaxxxx....  
Again, point your toes towards the wall and tighten your calf muscles...  
Hold it tightly.....one.....two.....three.....and Reelaaaxxxx...  
Once more, point your toes towards the wall and feel your calf muscles tighten...  
Hold it.....one.....two.....three.....and Reelaaaxxxx...

You should feel very relaxed...your body is very heavy. Take some time to explore how relaxed your body feels. Your head is clear, and all you are thinking about is how wonderful your body feels.....so relaxed.....warm.....tingly.....



## APPENDIX I

### VISUOMOTOR BEHAVIOR REHEARSAL SCRIPT - DAY ONE

Visualize...

You are done with classes for the day and are getting ready for ski practice. It is 26 degrees outside and sunny. There are fresh tracks that have been set and waxing is easy. You cannot wait to get out there. Now, gather up your classic gear, cork on some wax, and head out to the trails.

You can hear your skis gliding over the snow and the swish of your poles as they dig into the sides of the trail. Your breath swirls around you in the crisp air as you breathe in...and out...and in...and out. You get into a rhythm and can feel your body start to flow into what seems like effortless technique. You are aware of your body position...that your nose lines up with your knees...and your knees with your toes. Spend a few minutes enjoying the feel and rhythm of your body.

As you approach the first slight climb, you remind yourself to look forward...drive your right hand down the track...all the way forward as though you are throwing water at someone...your elbow is past your body...pole through and extend your arm all the way back past your hip as you drive your left arm forward...you can feel your shoulders getting into a rhythm as you focus on extending your arms and poling through...you glide up that first hill almost effortlessly.

As you reach the crest of the hill...you transition into kick-double pole...you continue to look ahead as you focus on dynamic kicks...you are driving your heels down and your toes thrust forward as though you are kicking a soccer ball...you can feel your hip rotate slightly as it also drives forward following your knee...you can feel your wax set in between each stride...you come up and over your poles in a power position...your stomach muscles tighten as your poles hit the snow and you can feel them strain slightly as you propel yourself forward both with your arms as well as your stomach...you power over the top of the hill and drop into a tuck...poles tight against your body as you catch your breath...in...and out...in...and out.

As you feel yourself begin to slow down, you pop out of your tuck and again settle you're your stride...look ahead...drive your hands forward past your body...drive your leg forward feeling your hip rotate...extend your arm past your hip...set your wax...dynamic kick...breath in...breathe out...feel your rhythm...

Stay with it...look ahead drive your hands forward past your body...drive your leg forward feeling your hip rotate...extend your arm past your hip...set your wax...dynamic kick...breath in...breathe out...feel your rhythm...relax...

When you are done with your ski, catch your breath and take a drink of water. Take a moment to feel how confident you are with your technique...when you are ready, count to three...open your eyes and notice how rested and relaxed you feel...ready to continue with your day...

## APPENDIX J

### VISUOMOTOR BEHAVIOR REHEARSAL SCRIPT – DAY TWO

Visualize...

Visualize...you are done with classes for the day and are getting ready for ski practice. It is 26 degrees outside and sunny. There are fresh trails that have been groomed and your skis are waxed and ready to go. You cannot wait to get out there. Now, gather up your skating gear and head out to the trails.

You can hear your skis gliding over the snow and the swish of your poles as they dig into the sides of the trail. Your breath swirls around you in the crisp air as you breathe in...and out...and in...and out. You get into a rhythm and can feel your body start to flow into what seems like effortless technique. You are aware of your body position...that your arms are parallel to your body...your ankles are flexed...and your hips are low and forward. Spend a few minutes enjoying the feel and rhythm of your body.

As you approach the first slight climb, you remind yourself to look forward...your hips are low and forward as you transition your body weight from side to side committing to each leg...your shoulders are forward as your arms and chest come over the top of your poles, and your stomach tightens as you initiate each pole down...pole through and extend your arms all the way back past your hips...you can feel your body getting into a rhythm as you focus on committing to each leg and poling through...you glide up that first hill almost effortlessly.

As you reach the crest of the hill...you transition into V2-Alternate...you continue to look ahead as you focus on dynamically pushing off of each ski, keeping your ankles flexed...you can feel your hips rotate slightly as you commit to each leg with every step forward...you come up and over your poles in a power position...your stomach muscles tighten as your poles hit the snow and you can feel them strain slightly as you propel yourself forward both with your arms as well as your stomach...you power over the top of the hill and drop into a tuck...poles tight against your body as you catch your breath...in...and out...in...and out.

As you feel yourself begin to slow down, you pop out of your tuck and again settle into a relaxed yet strong V2-Alternate...look ahead...push dynamically off each ski and commit to it...flex your ankles...drive your hips and shoulders forward...come up and over your poles in the power position...feel your stomach muscles tighten as you propel yourself forward...extend your arms past your hips...breath in...breathe out...feel your rhythm...

As you feel yourself begin to slow down, you pop out of your tuck and again settle into a relaxed yet strong V2-Alternate...look ahead...push dynamically off each ski and commit to it...flex your ankles...drive your hips and shoulders forward...come up and over your poles in the power position...feel your stomach muscles tighten as you propel yourself forward...extend your arms past your hips...breath in...breathe out...feel your rhythm...relax...

When you are done with your ski, catch your breath and take a drink of water. Take a moment to feel how confident you are with your technique...when you are ready, count to three...open your eyes and notice how rested and relaxed you feel...ready to continue with your day...

## APPENDIX K

### PERCENTAGE BACK FORMULA

X = Racer's time in seconds

Y = Average of the top 3 times in seconds

$((Y/X)*100)-100 = \text{Percentage back}$

Example:

<u>Name</u>	<u>Time</u>	<u>Seconds</u>
Sarah	20:14	1214
Jane	20:20	1220
Erin	20:30	1230
Jill	20:50	1250

Add together the top three times in seconds:

$$(1214 + 1220 + 1230) = 3664$$

Divide by three:

$$3664/3 = 1221.33$$

Apply Percentage Back Formula:

$$((1221.33/1250)*100)-100$$

$$= -2.2936$$

So: Jill is -2.29% back