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EFFECTS OF VIDEOTAPE SELF-MODELING ON THE MOTOR LEARNING OF FIGURE SKATING JUMPS

by

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THESIS

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ABSTRACT

This study investigated whether self-modeling would positively affect intermediate level figure skaters' self-efficacy, state anxiety, motivation, and jump performance more than physical practice alone. Twelve female skaters (M = 13.38 years of age, SD = 1.35) participated in a four week study where they received a self-modeling intervention (SM) for one jump and no modeling (SM-C) for a second jump. They were also compared with a separate control group (CON) of 7 skaters (M = 14.20 years of age, SD = 2.35) who received no intervention for both jumps. Analyses revealed no significant differences between the three conditions. This indicates that while no transfer effects existed between the SM and SM-C conditions, the self-modeling intervention also failed to enhance figure skaters' psychological and physical performance. The athletes' skill level, their perception of the intervention, the characteristics of the task, and the type of self-modeling employed are all discussed as possible explanations for this lack of results. Further empirical examination of self-modeling is recommended to clarify these issues.

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CHAPTER I

INTRODUCTION

Mastering the basic skills of a sport is essential to success in any sport. Many methods are available for teachers to employ to facilitate the learning of these component skills. One commonly used technique is observational learning, or modeling, whereby one learns a new skill by observing someone else perform that skill. In fact, Bandura (1986) states that "most human behavior is learned by observation" (p.47). This teaching technique has been shown to enhance motor skill acquisition and may positively affect psychological variables such as self-efficacy and anxiety (McCullagh & Weiss, 2001).

A special form of modeling involves the use of videotape feedback of the learner's own performance. Although videotape playback is commonly used in applied sport settings, limited studies have investigated its effectiveness. A more specific use of videotape is a form that provides the learner with visual information only about his or her successful performances of the skill, by eliminating his or her error performances in the learning of the skill. Using the observation of oneself engaged in adaptive behavior (i.e., successful behavior) as an intervention tool is termed self-modeling (Dowrick, 1991). The purpose of the current research was to determine whether the use of self-modeling videotapes would facilitate figure skating jump performance. This research is merited because of the lack of controlled studies that examine exclusively the effectiveness of self-modeling with respect to sport skills (see McCullagh & Weiss, 2001 for a review of modeling literature).

The use of self-modeling to facilitate figure skating jump performance is discussed within the context of Bandura's social cognitive theory (1977, 1986) and self-efficacy theory (1977, 1997). Both of these theories discuss modeling and how it may improve performance as well as psychological variables such as self-efficacy beliefs. As well, state anxiety and motivation are examined in an attempt to identify possible mechanisms underlying the technique of self-modeling.

In order to address some of the recommendations made in a recent review by McCullagh and Weiss (2001), the current study examined both quantitative (i.e., outcome) and qualitative (i.e., form) measures of performance, as well as learning. A within-participant design was used, thus controlling for individual differences and increasing the power of the study. The findings provide useful knowledge to individuals responsible for facilitating motor skill acquisition, such as physical educators, coaches, and rehabilitation therapists. It also helps to clarify whether or not self-modeling is an effective tool for skill acquisition by highlighting various factors that may affect its success in different sport contexts. Finally, by investigating these issues, we may begin to gain an understanding of the psychological variables that may act as underlying mechanisms of self-modeling.

It was hypothesized that the self-modeling intervention would facilitate both the performance and learning of figure skating jumps significantly more than practice alone. By seeing him or herself on the edited self-modeling videotape successfully completing the figure skating jumps that he or she is unable to perform consistently, the learner may experience a variety of benefits. First, learners may exhibit increased levels of self-efficacy with respect to their ability to perform the jumps. This may lead them to feel decreased state anxiety about attempting these skills. With this reduced state anxiety, the learner may be better able to learn these jumps and perform them successfully. Finally, by watching themselves on videotape, successfully performing the jumps and by feeling more efficacious about performing those jumps, learners may become more intrinsically motivated to learn the skills. Thus, the psychological variables examined may serve as mediators of the relationship between self-modeling and physical performance. In sum, a self-modeling intervention may yield the benefits of greater improvements in performance of the figure skating jumps, increased self-efficacy and intrinsic motivation, as well as decreased state anxiety about performing the jumps.

CHAPTER II

REVISED REVIEW OF LITERATURE

Modeling

Modeling, or learning through observation, is a commonly used skill acquisition technique. It has even been described as "one of the most powerful means of transmitting values, attitudes, and patterns of thought and behavior" (Bandura, 1986, p.47). According to Bandura's (1977, 1986, 1997) social cognitive theory, several necessary information sub-processes mediate the modeling process. Specifically, learners must be able to attend to, retain, and produce the skills they observe, as well as be motivated to attempt those skills.

Attention is described as an essential component that observers need to perceive the relevant features of the demonstration. This can be affected by both the features of the demonstration, such as the salience, discriminability, and complexity of the demonstrated activity, and the features of the observer, such as their cognitive capability, arousal level, and expectations (Bandura, 1986). For the retention sub-process of observational learning, the learner must retain a symbolic representation of the relevant features of the demonstration in their memory. Studies using an interference paradigm have shown that disruption of these sub-processes reduce the benefits gained from observational learning for both adults (Ste-Marie, 2000) and children (Ste-Marie, Clark, & Latimer, 2002) when compared to a full attention group. Next, learners must be capable of producing the desired skill. This involves transforming the symbolic representation from memory into an overt action. Exposure to modeling has been demonstrated to increase the accuracy of learner's responses (Carroll & Bandura, 1990). Finally, learners must be sufficiently motivated to reproduce the observed actions. Direct, vicarious, and self-produced incentives all influence whether or not learners will exhibit the modeled behavior (Bandura, 1986). Further, the four sub-processes of observational learning help the learner develop a cognitive representation, as well as an error detection mechanism for the task (Bandura, 1986).

Within the observational learning literature, various types of models have been identified and studied in order to determine the best type of model for skill acquisition. There has been considerable debate in the literature as to whether a skilled (or correct) model versus an unskilled (or learning) model is better for learning (McCullagh & Weiss, 2001). The contrast between these model types is that a skilled model performs the observed skill flawlessly, while a learning model is a less skilled performer who exhibits an improvement in their performance over the course of the study. Thus, the unskilled model demonstrates both error and correct performances. Some studies have supported the use of a correct model (McCullagh & Meyer, 1997) while others have argued that a learning model is better (Hebert & Landin, 1994).

Other types of models tested in the literature are those of coping and mastery models. These two model types are very similar to skilled and learning models. The distinguishing feature is that coping and mastery models vary with respect to the psychological responses they portray. Coping and mastery models display either positive or negative cognitions with respect to the task being demonstrated, whereas correct and learning models simply demonstrate different abilities for the physical performance of the task. More specifically, a coping model is similar to a learning model, in that they do not demonstrate a perfect performance. A coping model is one that is shown as having negative cognitions and fears and progresses from displaying a low level of performance and ability to cope with the task to displaying more positive cognitions and improved performance. In contrast, a mastery model displays a high level of proficiency and confidence for the task right from the outset. It has been suggested that mastery models may be better than coping models for improving physical skill performance (Clark & Ste-Marie, 2002). Conversely, when compared to mastery models, coping models may have a stronger influence in improving self-efficacy (Clark & Ste-Marie, 2002; Weiss, McCullagh, Smith, & Berlant, 1998).

Considering that coping models may have a strong effect on self-efficacy while mastery models may be more effective for improving performance, perhaps a model type that combines aspects of these two types of models would be effective for improving both self-efficacy and actual performance. As well, Bandura (1986) and others (McCullagh & Weiss, 2001) have suggested that the learner's perception of their similarity to the model may explain why modeling influences performance. Learners may perform better after watching a model that they perceive as being similar to themselves versus a model that they perceive as dissimilar to themselves. Perhaps watching a model that the learner perceives as being very similar to him or herself improve in skill level to master the skill, without exhibiting negative cognitions or errors in performance typically seen in coping models, would significantly improve the learner's performance. This form of model may be an effective combination of a coping and mastery model. It may be even more effective if the model is the learner him or herself since that would maximize model-observer similarity.

Self-Modeling

Indeed, this is a characteristic of a special type of modeling; that of self-modeling. Self-modeling is an intervention procedure in which people see themselves on videotape demonstrating only successful behavior (Dowrick, 1991). Thus, self-modeling is distinct from other forms of modeling because the learner watches him or herself on videotape, rather than watching someone else. Further, the observer only sees the successful performances, and the error performances are "edited out." In Dowrick's (1991) book, he divided self-modeling into two categories: positive self-review (PSR) and feedforward (FF) self-modeling. PSR refers to editing the videotape footage to remove errors and distracting footage in order to create a videotape that depicts the best behavior that the individual is capable of producing at that time (Dowrick, 1991). This is commonly used to increase the rate at which a behavior that already occurs, but at a low frequency, is exhibited. In contrast, FF self-modeling involves editing the videotape footage in order to create a videotape that shows the learner performing a behavior that he or she cannot yet demonstrate or to transfer a behavior to a new context where the behavior has not yet been demonstrated. This can be accomplished by combining component skills that the learner can already perform or by making the videotape appear as if the behavior is performed in a new context or setting (e.g., from practice to competition). For the current research, the PSR form of self-modeling will be studied.

To date, most self-modeling studies have been conducted in therapeutic and educational settings or with special populations (McCullagh & Weiss, 2001). These studies have targeted a wide variety of behaviors, such as social interaction (Dowrick, 1979), on-task behavior (Clare, Jenson, Kehle, & Bray, 2000), cognitive skills (Schunk &

Hanson, 1989), sexual arousal (Hosford, 1980), weight loss (Owusu-Bempah & Howitt, 1983), and grooming skills (Petroski, Craighead, & Horan, 1983). While it is beneficial to know that self-modeling can be applied to various populations, the vast differences between the behaviors treated make it difficult to draw conclusions on the general effectiveness and mechanisms of self-modeling. As well, simply because self-modeling may be effective with clinical populations, it does not imply that its effectiveness can be generalized to sport skills. For many of the clinical behaviors treated with self-modeling, psychological variables, such as anxiety, may play a very different role than they do in the acquisition of physical skills. In addition, due to the physical nature of sport skills, evaluating the effectiveness of self-modeling interventions requires more than examining the frequency of the desired behavior. Factors such as the quality as well as the outcome of skill execution must also be examined.

In a review of self-modeling studies with clinical applications, Meharg and Woltersdorf (1990) examined 27 self-modeling studies and found that all of the studies reported positive results after a self-modeling intervention, and 10 of the 12 studies that compared self-modeling with another intervention technique showed self-modeling as having a superior treatment effect over other interventions (e.g., other model, role playing, unedited videotape feedback, and cash rewards). Due to the lack of research on videotape self-modeling, Meharg and Woltersdorf included studies from a variety of sources other than published journal articles, such as book chapters, conference presentations, and unpublished manuscripts. This illustrates one of the limitations of trying to generalize from the self-modeling literature; many of the studies on this topic have not been scrutinized under strict peer reviewed criteria. As well, many of the self-modeling studies conducted are of weaker methodological designs. That is, many of the studies are single case designs or involve very small sample sizes, which do not allow for generalizations to a larger population or statistical tests of significance. While these studies provide useful descriptive data, they are limited in that they do not allow for objective comparisons between groups to compare self-modeling with other forms of modeling and a control group.

While the therapeutic self-modeling literature supports the use of self-modeling as a technique, it provides limited information on its applicability to the physical domain. The self-modeling studies that have examined skills in the physical domain have been mainly case studies and unpublished dissertations (Dowrick, 1999). Results from these studies have shown that self-modeling may improve performance for skills such as rock climbing (De Ghetaldi, 1998), basketball free throw shooting (Bradley, 1993; Melody, 1990), golf putting (Drazin, 1985), and weight lifting (Franks & Maile, 1991). While these studies have shown some positive results supporting the use of self-modeling, they have not provided enough information about this technique to generalize to other domains.

There have also been a few published studies that have examined self-modeling in applied sport situations. Dowrick and Dove (1980), for example, used the FF self-modeling technique and found that children with spina bifida improved their swimming performance after viewing edited videotapes showing only their successful swimming behavior. They also observed that this improved performance was maintained at one-week and ten-week follow-ups, indicating that the children had successfully learned those new skills. This study was limited in generalizability, however, since it only included three participants and each child received different amounts of exposure to their self-modeling videotapes. Further, the authors did not study the effects of the intervention on the children's self-efficacy, anxiety, or motivation levels.

Starek and McCullagh (1999) conducted a study that began to delve into the relationship between self-modeling and psychological variables. They compared the effect of PSR self-modeling with other modeling on the performance of beginning swimmers. The other model used was an advanced beginner swimmer who was capable of performing all of the swimming skills, but was obviously not an expert swimmer. While not clearly defined, it appears that the "other" model used was intended as a peer model. The investigators found that the self-modeling group improved their performance significantly more than the other modeling group. Although measures of both swimmers' self-efficacy and state anxiety levels showed no differences between the two groups, this study demonstrated that self-modeling may be a viable alternative to using a peer as the demonstrator for a group.

Unfortunately, Starek and McCullagh (1999) did not measure the learner's ability to retain this improved performance over time. Similar to other self-modeling studies, it was also limited in that only 10 participants were used in a between-participant design, leaving each of the two groups with a small sample size of only five participants. As well, the self-modeling intervention was only introduced for two sessions. This may partially explain the lack of significance with respect to the psychological variables studied. Further, the authors did not include a control group, so there was no information on the effect of self- and peer modeling compared to a no model condition for all of the variables studied. Despite its limitations, this study offers some interesting directions for future research. Indeed, Starek and McCullagh (1999) recommend further research on the benefits of self-modeling, urging researchers to investigate possible variables that may serve as underlying mechanisms.

While numerous authors have suggested that the mechanisms of self-modeling deserve further attention (Dowrick & Dove, 1980; Meharg & Woltersdorf, 1990; Starek & McCullagh, 1999), this topic has been left unexplored. This research is merited in order to clarify whether self-modeling has similar effects on performance and psychological variables as other forms of modeling. As well, it is important to understand which variables may affect the effectiveness of self-modeling in order to design successful interventions using this technique. Finally, further examination of psychological variables, such as self-efficacy, state anxiety, and motivation are needed because they may mediate the relationship between self-modeling and improved performance. In the next sections, each of the psychological variables to be studied will be introduced.

Self-efficacy

In Bandura's (1977, 1997) writings, he has developed a theory of self-efficacy that can be used to explain the effects of modeling. Self-efficacy refers to "the belief in one's capabilities to organize and execute the courses of action required to produce given attainments" (Bandura, 1997, p.3). Our beliefs about self-efficacy come from mastery experiences, vicarious experiences, verbal persuasion, and affective and physiological states, with mastery experiences and vicarious experiences being the strongest sources. Mastery experiences refer to instances when the learner exhibits the desired behavior. Repeated success at a target behavior provides a strong sense of mastery and thus strengthens one's self-efficacy beliefs for that behavior. In contrast, vicarious experiences involve observing others perform the target behavior without adverse consequences and then forming expectations that they too can perform that skill if they persist in their efforts. Vicarious experience provides a weaker source of efficacy expectations since it relies on inferences made based on the behavior of others.

Self-modeling can arguably provide both a strong sense of mastery, as well as the vicarious experience of seeing a videotape of oneself successfully performing a skill. By viewing oneself performing the desired skill, it provides the learner with a mastery experience since he or she is watching and recalling his or her own past experience. As well, by viewing the videotape, the learner also receives the vicarious experience or sensation of being an observer and watching someone (him or herself) succeed at that skill. Self-efficacy theory also involves the idea that the more similar the model is to the learner, the more the learner will attend to the model and thus learning will be facilitated; having oneself as a model would be the ultimate in similarity. If self-efficacy beliefs, however, do not change with the use of self-modeling, researchers may need to find another explanation for why self-modeling works.

In the therapeutic and educational literature, self-modeling has been associated with increases in self-efficacy (Dowrick, 1999). In a series of experiments examining the effects of self-modeling on children's cognitive skill learning, Schunk and Hanson (1989) found that children who viewed self-modeling videotapes judged their skill acquisition progress greater and demonstrated higher instructional performance, self-efficacy, and skill than children who did not. The authors also suggested that this may be most effective with children who are experiencing problems with the skill or who doubt their capabilities. Various unpublished dissertations have also found increased self-efficacy beliefs after self-modeling interventions aimed at sport performance have been implemented (Bradley, 1993; Scraba, 1989). In fact, it has been suggested that increases in perceived self-efficacy account for a large portion of the benefits experienced after self-modeling interventions (Bandura, 1997; Dowrick, 1999; McCullagh & Weiss, 2001; Meharg & Woltersdorf, 1990).

The effect of self-modeling on sport performance was studied by Winfrey and Weeks (1993). They investigated the effect of self-modeling videotapes versus physical practice alone on gymnast's ability to learn a new balance beam routine, as well as their self-efficacy levels. While no significant differences were found between the two groups with respect to self-efficacy levels or balance beam performance, they did uncover some interesting results. For the self-modeling group, the correlation between participant's self-rated performance scores and actual performance scores was significant. This indicated that the self-modeling group may have developed a more accurate estimation of their own abilities. As well, the lack of significant improvement of self-efficacy scores may have been due to the fact that the investigators used a state sport-confidence inventory (Vealey, 1986) to assess self-efficacy rather than questions designed to measure participant's self-efficacy with respect to the specific elements that made up the balance beam routine. Another limitation, similar to other self-modeling studies, was that the self-modeling videotape was not updated to account for improvements in the participant's performance over the course of training. As a result, more research into the relationship between self-modeling and self-efficacy is warranted in order to clarify this relationship.

Self-efficacy is also purported to have a positive affect on learner's anxiety levels (Bandura, 1997), with stress and anxiety being alleviated through increased self-efficacy for the task at hand. State anxiety is therefore another psychological variable that may be implicated in the self-modeling process, and will be discussed in the following section.

State Anxiety

State anxiety refers to a "transitory emotional state or condition of the human organism that is characterized by subjective, consciously perceived feelings of tension and apprehension, and heightened autonomic nervous system activity" (Spielberger, Gorsuch, & Lushene, 1970, p.3). Various theories and models have been developed in an attempt to explain the relationship between anxiety and performance (Woodman & Hardy, 2001). These theories, however, examine only the relationship between anxiety and performance, usually in a competitive setting, and do not adequately address how anxiety may affect practice and learning. While much research has examined athletes' anxiety prior to and during competition, anxiety outside the competitive arena may be very different. Thus, it would be beneficial to employ measures designed for use in situations other than competition. For example, Spielberger et al. (1970) developed the State-Trait Anxiety Inventory (STAI) that measures both state and trait anxiety in a noncompetitive environment. The use of this measure may help to shed some light on the relationship between self-modeling, state anxiety, and performance in the practice environment.

Given that social cognitive theory (Bandura, 1986) indicates that the learner's cognitive capabilities, arousal level, and expectations mediate attention, it seems likely that high anxiety levels may affect the learner's ability to attend to the modeled action, thereby decreasing the learning benefits gained from the self-modeling intervention. As well, self-efficacy theory (Bandura, 1997) cites physiological states, and how they are interpreted, as a source of self-efficacy beliefs. If individuals perceive themselves as experiencing high levels of physiological stress or negative mood, they tend to have less confidence in their ability to perform the activity.

Further, Bandura (1997) views anxiety and poor performance as being the result of low self-efficacy beliefs about performing the desired skill under specific circumstances. If a learner experiences low self-efficacy beliefs and high levels of anxiety about attempting a new skill, this may impede their ability to learn that skill. This is a concern for athletes in sports where injury during practice is a very real possibility and can severely affect the remainder of their competitive season (e.g., fall during a difficult figure skating jump or gymnastics element). These athletes may be anxious about attempting new and more difficult skills because of this increased potential for injury. Perhaps viewing an edited videotape that shows the learner successfully completing the skill will decrease his or her state anxiety level, through its positive effect on self-efficacy, thereby allowing the learner to engage in practice of the skill with more confidence and tenacity. This could also encourage them to attempt the skill in the future. In fact, self-modeling has been shown to decrease anxiety about feared activities (Dowrick, 1999).

Bandura's (1997) notion that self-efficacy beliefs "influence both anxiety and quality of performance but that anxiety generally does not contribute independently to performance" (p.390) has also been supported by research in the sport domain. Craft, Magyar, Becker, and Feltz (2003) recently conducted a meta-analysis of the relationship between responses on the Competitive State Anxiety Inventory-2 and sport performance. They concluded that self-confidence was a better predictor of sport performance than either cognitive or somatic anxiety, and that all three concepts were interrelated. As well, they suggest that self-efficacy, which is a state-specific measure, may be a better predictor of sport performance than self-confidence, which is a more global measure. In addition, it has been suggested (Jones & Hanton, 2001) that perhaps self-efficacy moderates the relationship between anxiety (cognitive and somatic) and performance by affecting how pre-competition feelings are interpreted. While these researchers examined anxiety in relation to competition, their conclusions are consistent with Bandura's (1997) propositions concerning self-efficacy and performance, which can be applied to the practice environment as well. Therefore, it is important to examine the effect of self-modeling on the learner's state anxiety in order to determine whether this teaching technique follows assumptions based on social cognitive theory and self-efficacy theory, and to clarify the effects of self-modeling on these variables and subsequent performance. The final psychological variable of interest in the proposed research is motivation, and is introduced next.

Motivation

Motivation can be defined as the "hypothetical construct used to describe the internal and/or external forces that produce the initiation, direction, intensity, and persistence of behavior" (Vallerand & Thill, 1993, p.18, translated from French). While over 800 publications have examined the intrinsic/extrinsic motivation dichotomy (Vallerand, 1997), others have criticized that motivation is likely not just a dichotomous concept. Forerunners with this criticism include Deci and Ryan (1985). Deci and Ryan extended the idea of intrinsic/extrinsic motivation to include other forms of motivation along a continuum in their self-determination theory. Self-determination refers to feeling free to choose one's behavior. Self-determination theory proposes a self-determination continuum that extends from intrinsic motivation to extrinsic motivation and amotivation, and includes various types of regulation that lie in between. Intrinsic motivation refers to behaviors performed due to the individual's interest and enjoyment in the activity (e.g., running because you enjoy it) and is the most self-determined form of motivation. Extrinsic motivation involves behaviors displayed in order to gain rewards that come from outside the activity (e.g., winning a medal). Extrinsic motivation can also be broken down into different types of regulation. Identified regulation refers to a valued behavior that is seen as being chosen by oneself, but is still performed to reach some desired outcome (e.g., weightlifting to build strength so that performance improves), while external regulation refers to behavior regulated by rewards or to avoid negative consequences (e.g., going to practice to avoid being yelled at by the coach). Amotivation refers to the absence of motivation (e.g., not training for an upcoming competition) and is the least self-determined form of motivation (Vallerand & Rousseau, 2001). Guay, Vallerand, and Blanchard (2000) have taken this continuum and developed a situational motivation scale (SIMS) designed to capture an individual's level of motivation in each of these categories.

Deci and Ryan (1985) have also postulated that optimal, or self-determined, motivation is a product of satisfying three essential psychological needs. These are: autonomy, competence, and relatedness. Autonomy refers to feeling as if your actions are volitional, while relatedness refers to feeling connected to those around you. Finally, competence refers to being effective in interactions with your environment and to reach valued outcomes. For the purposes of the current study, we are interested mainly in feelings of competence. In fact, this construct seems to be related to Bandura's (1977, 1986, 1997) idea of self-efficacy, or one's belief in their ability to perform a given task.

According to Deci and Ryan (1985), perceived competence and intrinsic motivation should be closely related, such that "the more competent a person perceives him or herself to be at some activity, the more intrinsically motivated they will be at that activity" (p.58). Within the feedback literature (also referred to as verbal reinforcement), it has been demonstrated that positive feedback about one's performance increases feelings of competence, while negative feedback decreases intrinsic motivation, as it implies incompetence. As well, individuals who receive negative feedback are also less intrinsically motivated than those who receive no performance feedback (Vallerand & Reid, 1984). In fact, perceived competence has been demonstrated as mediating changes in the relationship between feedback and intrinsic motivation (Vallerand & Reid, 1984, 1988). While most of the research into the relationship between perceived competence and intrinsic motivation has involved studies specifically using verbal reinforcement, Deci and Ryan (1985) also acknowledge that other sources of feedback may have the same effect on intrinsic motivation. They state "most sports have sources of performance feedback built into them. The difficulty of the slope one can negotiate in skiing...are sources of direct feedback; one can observe one's own competencies" (p.320). Thus, by providing positive feedback through the self-modeling videotape, both through the instructions to "pay attention to how well you are performing in this video," and by the actual videotape footage of a successful performance, it may help to increase the learner's feelings of competence and thereby lead to increased intrinsic motivation for the skill. As well, it may help to buffer the negative feedback gained from unsuccessful attempts at the skill during practice.

Deci and Ryan's (1985) view of perceived competence may be similar in some ways to Bandura's (1997) view of self-efficacy, which is also postulated to result in increased intrinsic motivation for the task. Bandura (1997) views motivation as a cognitively produced construct, where individuals motivate themselves through self-regulatory mechanisms, namely forethought. He believes that individuals form beliefs about their capabilities, anticipate the outcomes of different actions, set personal goals, and plan courses of action to reach valued outcomes and to avoid aversive ones. Intrinsic interest (or self-motivation) is developed through affective self-reactive and self-efficacy mechanisms. If an individual feels high self-efficacy beliefs and derives self-satisfaction from an activity, he or she will have increased intrinsic interest for that activity. Bandura (1997) believes that it is the individual's "affective self-reactions to their own performances that constitute the principal source of reward" (p.219) and that "a high sense of efficacy promotes mastery experiences that, over time, provide self-satisfactions conducive to growth of interest" (p.220). As you can see, this idea of self-efficacy leading to increased interest in the task, derived from the individual's own positive feelings, draws a parallel to Deci and Ryan's (1985) idea of feelings of personal competence leading to increased intrinsic motivation and enjoyment in a given activity.

While self-determination theory and social cognitive theory share the idea that the learner's feelings of competence, or self-efficacy, for a task will influence their motivation and performance of that activity, these theories do disagree with respect to the origins of motivation. Deci and Ryan's (1985) major criticism of social cognitive theory seems to be that behavior is based upon expectation of reinforcement for that behavior, making self-efficacy an external concept, rather than a need that is intrinsic to the individual. They also argue that social cognitive theory lacks explanation of possible internal drives. Bandura (1997) has clarified what he terms "self-motivation," and his description includes the idea of self-motivation as being self-satisfying and resulting in intrinsic interest. So, while Bandura's (1997) conceptualization of self-efficacy and self-motivation may not be considered internal drives, they do reflect behavior that is performed for the enjoyment it produces, similar to Deci and Ryan's (1985) concept of intrinsic motivation that is due to inherent interest and enjoyment in the activity. Despite this disagreement on whether self-efficacy and competence are extrinsic or intrinsic concepts, both theories do recognize the importance of feelings of competence in promoting optimal motivation.

Since both of these theories acknowledge the important role of motivation in producing and persisting in behavior, it would be beneficial to examine whether self-modeling affects the learner's degree of intrinsic motivation. It is clearly suggested by both Deci and Ryan (1985) and Bandura (1977, 1986, 1997) that the learner's feelings of competency or self-efficacy about a given task will directly affect their motivation to perform that task. As self-modeling has been demonstrated to increase learners' feelings of self-efficacy for a given task, it is important that we also examine the learner's degree of intrinsic motivation to perform the task. This will provide us with additional knowledge about whether the same relationship exists between self-efficacy and intrinsic motivation after exposure to self-modeling as it does under other manipulations, such as verbal feedback. Since self-efficacy and competence are both purported to influence the learner's intrinsic motivation, we believe that employing the SIMS will provide us with valuable information as to the effect of self-modeling on intrinsic motivation in the practice environment.

Design Considerations

After examining the research on self-modeling with respect to motor skill acquisition, it is obvious that further research is merited on this topic. Previous research in this area has been plagued with design issues, such as small sample sizes, lack of controls, and the lack of learning measures. To clarify whether or not self-modeling facilitates sport skill acquisition, studies must be done that measure both performance and learning. Measuring learners' performance during the acquisition portion of an intervention captures only the temporary effects of the independent variable. To measure long-term performance or learning, a retention test is necessary. In motor learning studies, the retention test usually measures the learners' performance in the absence of the independent variable, after the effects of the independent variable have had time to fade, minutes to days after the acquisition phase (McCullagh & Weiss, 2001). This performance versus learning distinction has been a weakness of self-modeling studies to date. Neither Winfrey and Weeks (1993) nor Starek and McCullagh (1999) included a retention test as part of their design. Winfrey and Weeks (1993) did include a posttest; however, it was conducted at the end of the final week of the self-modeling intervention and therefore did not assess long-term effects of the intervention. Dowrick and Dove (1980) did include a one-week and a ten-week follow-up to measure maintenance of behaviors after the removal of the self-modeling intervention. However, their study only included three participants and thus does not provide conclusive support for the use of self-modeling to facilitate motor skill learning.

Therefore, a controlled experiment with a larger sample size and a retention test would be an important contribution to the literature. As well, psychological variables such as self-efficacy, state anxiety, and intrinsic motivation should be studied in order to try to understand the underlying mechanisms of self-modeling. Understanding the relationship between these variables and self-modeling will increase the knowledge surrounding this intervention and help to explain its benefits and possible lack thereof to the learner. Given that most of the self-modeling research has been done with special populations, it is also of interest to study this intervention with a population of healthy children or young adults.

For this study, figure skaters were chosen as the target population. This was done for several reasons. First, figure skating is a closed skill; therefore, the external environment remains relatively static and thus can easily be controlled to prevent the influence of environmental factors on the intervention. Second, videotape playback is commonly used in figure skating as a tool for learning and performance enhancement. Therefore, skaters are accustomed to incorporating such extras into their training routine. Given that singles figure skating is an individual sport, this facilitated the data collection process by enabling the researcher to arrange times to meet with the participants on a one-on-one basis, rather than as a large group. As well, due to the evaluative criteria used in figure skating, this sport allows for performance measures of both the outcome and the form of jump execution. Finally, because jumping receives much emphasis in skaters' training, this study appealed to the coach and skater because it encouraged practice of the skater's newest and most difficult elements.

Another important point is that self-modeling has not yet been investigated with figure skaters; however, imagery and other psychological techniques have frequently been examined with this population (Garza & Feltz, 1998; Rogers, Hall, & Buckolz, 1991). Athletes report using imagery for skill development and performance enhancement (Munroe, Giacobbi, Hall, & Weinberg, 2000) as well as to regulate emotions and to cope or master challenging sport situations (Martin, Moritz, & Hall, 1999). In fact, mental practice has been defined by Marteniuk (1976) as "improvement in performance that results from an individual's either thinking about a skill or watching someone else perform it" (p.224). Within this definition, observational learning and imagery are seen as synonymous mechanisms of mental practice. In fact, some researchers have suggested that imagery and observational learning may share similar cognitive processes (Bandura, 1986; McCullagh & Weiss, 2001). While the various uses of observational learning have received little attention in the literature, Cumming, Clark, Ste-Marie, McCullagh, and Hall (in press) have recently developed the Functions of Observational Learning Questionnaire (FOLQ) to further examine athletes' uses of observational learning. They found that athletes appear to use observational learning in similar ways to how they use imagery; however, more research is needed to delve further into this issue. As well, a study of motor evoked potentials (MEP) from transcranial magnetic stimulation found that similar levels of MEP facilitation occurred under observational and imagery conditions for hand movements (Clark, Tremblay, & Ste-Marie, 2004). This indicates that similar cognitive activity may be involved for both techniques. This lends further evidence to the study of self-modeling, opening the door for possible future comparison studies of self-modeling with other psychological interventions.

In a recent review of the modeling literature, McCullagh and Weiss (2001) made several recommendations for future research in this area. First, they highlighted that while motor learning studies tend to make a distinction between performance and learning effects; this is rarely done in sport psychology studies. As well, this distinction should also be made for other dependent variables, such as psychological variables, to gain a better understanding of the modeling process and its long-term effects. Another area of concern is the differentiation between outcome and form. While some researchers have attempted to measure both outcome and form, this is not consistently done. Further, they advocate the use of a task analysis approach to better understand the effects of modeling on different types of physical skills. Finally, a point made that is especially relevant to the current research, is that there has been limited study of self-modeling with physical skills and that very little empirical verification of this technique has been done. This demonstrates the need to critically examine this skill acquisition technique.

In light of recent recommendations made in reviews of the literature on modeling (McCullagh & Weiss, 2001) and self-modeling (Dowrick, 1999), the current study contributes to both the modeling and self-modeling literature. Modeling studies have been identified as giving little attention to learning versus performance effects, and few studies examine both form and outcome when assessing performance. Specifically within the self-modeling literature, controlled studies are needed to clarify the relationship between self-modeling, performance, and related psychological variables. Attention has also been drawn towards the necessity of determining whether "individuals can learn from an approach in which they see only successful performances of a skill they are having difficulty performing" (McCullagh & Weiss, 2001, p.216). The current study addresses each of these concerns and contributes knowledge that may be useful to sport psychologists and coaches working in the field.

Purpose

Therefore, the purpose of this study was to determine whether a self-modeling intervention would facilitate intermediate level figure skater's jump performance and learning significantly more than physical practice alone. As well, it was hypothesized that skaters would also have increased self-efficacy for the jumps that received the self-modeling intervention. This increased self-efficacy may help to decrease skaters' state anxiety about attempting those jumps and to increase their intrinsic motivation to learn those jumps. It was also hypothesized that these psychological benefits may, in turn, lead to improved performance of these jumps. Thus, the psychological variables of self-efficacy, state anxiety, and intrinsic motivation may mediate the self-modeling and physical performance relationship.

CHAPTER III

REVISED METHODOLOGY

Participants

The participants will be intermediate level figure skaters in Eastern Ontario. Intermediate level is operationally defined as skaters who have completed the Junior Bronze Free Skating Test but have not yet attained the Senior Silver Free Skating Test. Skaters at this level are capable of performing all single rotation jumps, and are starting to learn double rotation jumps. This population is predominantly female, but also includes males. Skaters at this level typically range in age from approximately 11 to 16 years of age. Inclusion criteria will be that skaters (a) are between the ages of 11 and16 years, (b) fit the definition of intermediate level skater, (c) are registered in and available for testing during specified free skating sessions, (d) are willing to attempt the skating elements identified as the ones they are attempting to learn, (e) are willing to be videotaped during practice, and (f) are willing to watch their self-modeling videotapes at the specified times and to complete the questionnaires. Since the skaters are between 11 and 16 years of age, parental consent is also required. As well, the skater's coach must agree to the intervention since it will be incorporated into the skater's training schedule.

The sampling technique will be a non-random method. The sample will consist of approximately 18 skaters; 12 of which will be in the within-participant treatment group (i.e., received both the self-modeling condition (SM) and a control condition (SM-C)) and 6 of which will be in the between-participant control group (i.e., received only the control condition (CON)). This sample will be a combination of a convenience, purposive, and snowball sample. A convenience sample will be used since we have worked with the coaches at one of the clubs previously and some of them have indicated an interest in participating in the current study. As well, we have a contact at a second club and therefore will collect data at that club as well. This is also a purposive sample since I am interested in targeting a specific group of athletes – figure skaters. These skaters must fit specific criteria to participate in the study. As a former figure skater, my background in this sport facilitates the data collection and analysis process. As well, other former figure skaters work in the same laboratory as myself, and thus are able to help with the scoring portion of this study. It is a snowball sample because, once recruited, skaters may recommend other skaters who fit the criteria and may be interested in participating. This combination of convenience, purposive, and snowball non-random sample was chosen because the intervention is time intensive for both the participants and the researcher; therefore participants who are invested in the intervention are preferred. As well, it would not be feasible to recruit a large number of participants due to the extensive amount of videotaping that is required.

Materials

The psychological variables of self-efficacy, state anxiety, self-determined motivation, and motivation to skate will be measured using self-report questionnaires that have been designed by other researchers. The advantage of the self-report questionnaires is that participants can report their actual feelings, rather than the researcher having to estimate their feelings. The disadvantage to this is that accurate data depends on the participants' ability to accurately report their true feelings at a specific moment in time.

Self-efficacy. Bandura (1997, 2001) advocates the use of individualized self-efficacy questionnaires and has generated specific guidelines for the construction of setting-specific self-efficacy questionnaires. Following these guidelines, the self-efficacy questionnaire will have two questions, one for each of the jumps the skater will attempt (Appendix A). Each question is rated on a 10-point scale, ranging from 1 *(cannot do it)* to 10 *(very sure I can do it)*, indicating the learner's degree of certainty in their ability to perform that skill at that time. A score of 1 for a specific item implies very low self-efficacy for that skill, while a score of 10 implies very high self-efficacy for that skill. Questions will be individualized for each participant by changing the name of the skill to reflect the different jumps each participant is attempting. This will be done because self-efficacy beliefs are specific to the individual and the task at hand.

State anxiety. The learner's state anxiety will be measured using the State-Trait Anxiety Inventory or STAI (Spielberger et al., 1970) which includes a subscale (form X-1; Appendix B) to measure state anxiety, or one's anxiety in a specific situation. The other subscale of the STAI (form X-2) measures trait anxiety, or one's general feelings of anxiety. Only the state anxiety form will be used in this study because we are only interested in anxiety in the learning setting, rather than the learner's general level of anxiety. The STAI state scale includes 20 statements that the participants are asked to rate on how well each statement represents how they feel "at this moment." These statements are rated on a 4-point scale, ranging from 1 *(not at all)* to 4 *(very much so)*. Some of the items are worded so that a high rating indicates high anxiety, while others are worded so that a high rating indicates low anxiety. The statements that need to be reverse scored (i.e., a rating of 1 is given a score of 4) are indicated in the STAI Manual (Spielberger et al., 1970). Scores for each individual statement are summed, giving the overall score for the questionnaire. Scores range from a low of 20, indicating that the individual has low anxiety about this situation, to a high of 80, indicating that they have high anxiety about this situation. Spielberger et al. (1970) demonstrated that the STAI is a reliable and valid instrument. Other authors have provided evidence for the validity of the STAI as well (as cited in Spielberger, 1972).

Motivation. The learner's level of self-determined, or intrinsic, motivation will be measured using the Situational Motivation Scale (SIMS) (Guay, Vallerand, & Blanchard, 2000; Appendix C). This scale was developed to measure an individual's level of motivation on the intrinsic motivation to amotivation continuum in a specific situation. This questionnaire asks the participants why they are engaged in this particular activity and gives 16 reasons. For each of these reasons, participants are asked to rate how true the statement is on a 7-point scale, ranging from 1 *(corresponds not at all)* to 7 *(corresponds exactly)*. The statements vary, to include statements for the subscales of intrinsic motivation, identified regulation, external regulation, and amotivation. Scores are obtained by summing the participant's ratings for each of the items of a specific subscale. Scores for each subscale range from a low of 4, indicating that the individual does not possess that type of motivation, to a high of 28, indicating that the individual is strongly motivated in that fashion. To create an overall score for motivation, known as a self-determination index, scores on the individual subscales can be weighted and summed (Vallerand & Rousseau, 2001). To create this index, each subscale is assigned a specific weighting (e.g., intrinsic motivation, identified regulation, external regulation, and amotivation are weighted as +2, +1, -1, -2 respectively). High, positive scores reflect high levels of self-determined motivation (intrinsic motivation and identified regulation) and high negative scores reflect high levels of non-self-determined motivation (external regulation and amotivation). For the purposes of this study, only the self-determination index and intrinsic motivation subscale scores will be used in the analysis because we are interested in the learner's degree of intrinsic motivation. While the SIMS is a very recent questionnaire, and therefore has not had much time to be scrutinized, it has been shown to demonstrate construct validity and internal consistency for the motivation subscales (Guay et al., 2000). As well, the self-determination index has been demonstrated as being a reliable and valid method of creating an overall motivation score (Vallerand & Rousseau, 2001).

Motivation to skate. To assess whether skaters' initial level of motivation to learn the skating jumps moderates the effects of the self-modeling intervention, skaters will be asked to complete a second motivation questionnaire, entitled the Motivation to Skate scale (Appendix D). The questionnaire will consist of two questions, one for each of the jumps selected for the study. For each jump, skaters will be asked to indicate how motivated they are to perform that jump on a 10-point scale, ranging from 0 to 100%. High scores indicate that skaters are very motivated to learn the jump, while low scores indicate low levels of motivation to learn the jump. Based on responses from this questionnaire, skaters will be grouped as having either high or low motivation to learn the specific skating jumps. High versus low motivation will then be used in the analysis to determine whether it moderates the effect of self-modeling on performance.

All of these self-report questionnaires measure how the participant feels at a specific time about a specific situation. This is essential since the participants' beliefs about executing a specific skill, rather than how they feel in general, may affect their learning and performance of that skill (Bandura, 1997). The participants will be required to complete each of the questionnaires at the beginning of the study, at the midpoint of the intervention, at the final intervention session, and during the retention test at the end of the study.

Jump performance. The learner's performance and learning will be measured using an adapted version of the Skate Canada (2002) and International Skating Union (2000, 2001) judging guidelines for free skate elements (Appendix E). Two numeric scales will be created: one for jump outcome (i.e., degree to which skaters correctly complete the jump) and one for jump form (i.e., quality of jump performance). Scores on the outcome scale will range from 0 *(did not attempt)* to 10 *(errorless performance)*, with the specific errors that correspond to more or less serious deductions falling along the continuum (e.g., a score of 1 indicates a fall on the take-off, while a score of 9 indicates a touch-down on the landing of the jump). Scores on the form scale will also range from 0 *(did not attempt)* to 10 *(excellent speed, flow, and technique).* Thus, the performance evaluation consists of two scales: one assessing the outcome and one assessing the learner's form for each jump element. A certified figure skating judge will be shown the scales prior to the rating of the videotapes in the study in order to gain her input on the design of the scales and any modifications she feels will improve the scales. The performance and form scales will undergo preliminary testing by having the raters use the scales on preexisting figure skating footage to determine its practicality.

Performance and learning will be assessed by videotaping the skaters' performance of the desired skills at specific intervals. Two independent raters, blind to the conditions, will later rate these videotapes using the performance scales previously described. A subset of the videotape footage will be scored by both raters and then inter-rater reliability will be computed. This process will be repeated using different subsets of the videotape footage until inter-rater reliability is deemed acceptable. When inter-rater reliability is deemed sufficient, one of the raters will score the remaining footage and then rescore the subset of videotape footage used for inter-rater reliability to determine test-retest reliability. The raters will be former figure skaters, with extensive knowledge of the technical aspects of jump performance. By using performance scales adapted from existing judging guidelines, it provides the opportunity to compare the raters' scores to those of actual judges, if deemed necessary, to further determine the reliability and validity of these scales.

Practice logs. Each skater will also be asked to complete a jump practice log for the two jumps selected for the study. For two free skate sessions per week, skaters will be asked to indicate how often they attempt each of the two jumps and the outcome of each of these attempts (Appendix F). This information will be used to determine whether skaters spend more practice time on one of the two jumps and may help to explain possible results, or lack thereof, of the study.

Procedure

First, the completed proposal must receive approval from the University of Ottawa ethics committee. Since a similar study being conducted by the researcher's supervisor currently has ethics approval, minor changes to that design will be submitted to the ethics committee for review as amendments to the initial ethics application (Appendix G). Thus, a second ethics application may be deemed unnecessary. Once approved, local figure skating clubs will be contacted via telephone and email, and asked to give their consent to allow the researcher to recruit skaters from their club for the study. Information packages will then be distributed to the head coaches at each club that grants its consent, detailing the commitment involved in the study. The researcher or the coaches at each club will distribute information and consent forms (Appendix H), describing skaters' responsibilities during the study, to skaters who meet the criteria for the study. Each skater's parent or guardian must also sign the consent form because the participants will be less than 18 years of age. As well, verbal consent will be obtained from each skater's coach. All potential participants will be informed that their data will be kept completely confidential and kept in a place that can only be accessed by the researcher. As well, no names will appear on the data; instead each skater will be assigned a participant number. They will also be informed that all data will be destroyed five years post publication of any results of the study.

Once consent forms have been signed and returned to the researcher, each participant and his or her coach will be asked what jump elements the skater is currently trying to learn. Two jump elements that he or she can perform, but not consistently, will be selected. The skater will complete the questionnaires concerning their self-efficacy, state anxiety, self-determined motivation, and motivation to skate, as well as a general information questionnaire (Appendix I). He or she will also be videotaped performing the two jump elements previously identified. This information will serve as the pretest data to compare with the intervention and retention data. At this time, jump practice logs will also be distributed to the skaters. The data collection for each skater will take place over a four week period during either the summer or fall training and will be conducted by the researcher.

After the initial session, skaters will be assigned to one of two groups: the treatment group or the control group. For skaters assigned to the within-participant treatment group, one of the jump elements will be randomly assigned to the self-modeling condition (SM), and the other will be assigned to the control condition (SM-C). Thus, each skater in this group will receive the self-modeling intervention for one of their skills and no intervention for the other skill. Another group of skaters will be assigned to the between-participant control group. For these skaters, two jump elements will be selected, using the same format as the treatment group; the only difference will be that they will not receive the self-modeling intervention for either of the jumps. Thus, both jumps will be assigned to the control condition (CON). This group will serve as an additional control to control for any possible transfer effects that may exist in the treatment group. Transfer effects refer to benefits, or adverse consequences, the skater may receive from viewing the self-modeling tape for one jump (SM) that may affect his or her performance on the jump that does not receive that treatment (SM-C). Thus, the information or benefits derived from viewing a successful performance of one jump may transfer to another similar skill; in this case the skill is a second skating jump.

During the intervention phase, skaters will view a videotape and will then be videotaped performing the selected jumps twice per week over the course of the three week period. Skaters in the treatment group will view their self-modeling videotape for the skill that is assigned to the self-modeling condition and will receive no intervention for jumps in the control condition. The individualized self-modeling videotapes will be created by editing the previous session's videotape footage to show the skater performing his or her best performance of the jump assigned to the self-modeling condition. Each skater's self-modeling videotape will show the desired performance four times, to create a video clip that is approximately 30 seconds in length. Skaters' self-modeling videotapes will be updated after each session so that they reflect the skaters' best performance to date. Skaters in the control group will simply receive their regular training and will participate in the videotaping sessions for the study, but will view a videotape unrelated to skating rather than a self-modeling videotape. The control group's videotape will consist of a 30 second video clip of the movie "Shrek". To prevent skaters in the control group from becoming bored with the videotape, a different "Shrek" video clip will be shown at each session. After viewing either their self-modeling videotape or the control videotape, skaters will be given approximately five minutes to warm-up the jumps selected for the study. At the end of the five minutes, they will be videotaped performing each of the two jump elements twice.

Skaters will also complete the self-efficacy, state anxiety, self-determined motivation, and motivation to skate questionnaires at the second videotape session during week two of the intervention (the midpoint) and at the final intervention session in week three. The questionnaires will be completed after viewing either the self-modeling or the control videotape but prior to physically practicing the skills. The order in which the participants complete the questionnaires will be randomized to reduce any effect of always completing the questionnaires in the same order.

The retention test will take place one week (week four) after the final intervention session. At this time, skaters will complete the psychological questionnaires again and will be videotaped performing their selected jumps. After the conclusion of the study, skaters will be debriefed concerning the purpose of the study. As well, the jump practice logs will be collected from the skaters and they will complete a follow-up questionnaire (Appendix J) in order to determine their perception of the intervention. The follow-up questionnaire asks whether they found the self-modeling intervention useful, and in what ways. As well, it asks whether they would consider using it as a regular part of their training. They will also be asked if they have any suggestions to improve the intervention. This anecdotal evidence will be compared with the quantitative results obtained from the questionnaire and performance data to see if they show the same trends. As well, skaters in the control group will be informed that they can receive the intervention after the conclusion of the study if they so wish. All skaters will be given a copy of their videotape footage for both jumps selected for the study as well as a summary of the information from their jump practice log.

Data Analysis

The questionnaire and performance data will be entered into a spreadsheet and analyzed using the SPSS statistical analysis program. A 2 x 4 (Condition x Time) analysis of variance (ANOVA) with repeated measures for both factors will be performed separately for each of the dependent variables of self-efficacy, state anxiety, self-determined motivation, intrinsic motivation, motivation to skate, performance outcome, and performance form. To determine whether there are transfer effects between the self-modeling (SM) and control (SM-C) conditions for the treatment group, separate ANOVAs will be conducted for each dependent variable to compare these conditions to the control (CON) group. Thus, one set of analyses will compare the SM and CON conditions, and a second set of analyses will compare the SM-C and CON conditions. These analyses will be done separately due to the complex design of the study, where the self-modeling group is a purely within-participant design, and the control group involves a between-participant design. By comparing these groups separately rather than including all three conditions in one analysis, it prevents the cell sizes from being inflated above their true value. For all tests, alpha will be set at the .05 level. Since separate ANOVAs are being conducted for each of the seven dependent variables, alpha will be adjusted using the Bonferroni adjustment to the .007 level. If intervention effects are present, further analyses will be conducted, using only skaters in the within-participant self-modeling group, to test our mediation and moderation hypotheses. Regression analyses will be conducted to determine whether self-efficacy, state anxiety, and self-determined motivation mediate the relationship between self-modeling and physical performance. This analysis will be done separately for each of the possible mediators. As well, skaters will be grouped according to their initial level of motivation to skate (e.g., high or low) and separate 2 x 2 (Condition x Motivation) ANOVAs with repeated measures for condition will be performed separately for performance outcome and performance form to determine whether motivation to skate moderates the effect of self-modeling on physical performance.

Limitations

There are some limitations to the current study. First, the sample size may not be sufficiently large to adequately detect differences due to the intervention. However, by utilizing a within-participant design, an attempt has been made to reduce variability due to individual differences. Since the sample only contains intermediate level figure skaters, the findings of the current study cannot be generalized beyond this population. In addition, the length of the intervention may be a limiting factor. Due to the nature of figure skating jumps, three to four weeks may not be long enough for learners to demonstrate significant improvement in their jump execution. As well, because self-modeling is the only intervention used, no comparisons can be made with other forms of modeling.

Another limitation is the measures used. In the current study, only self-efficacy, state anxiety, and motivation are examined in relation to physical performance. As a result, other variables, that may act as mediating mechanisms in the self-modeling and performance relationship, are excluded. As well, there is the possibility that the questionnaires used are not sensitive enough to detect changes that occur as a result of the self-modeling intervention. Finally, in the scoring of the skater's jump performance there may be some variability in the ratings, due to the personal opinions of the raters. As well, the rater's viewing of the jumps is dependent on the quality of the videotaping, and due to some camera angles, it may be difficult to clearly view all faults made in a jump. There is also the possibility that the skaters may perform a jump perfectly during a practice that the researcher does not videotape, but does not execute the jump when the researcher videotapes the practice. This may lead to a false negative, and cause the researcher to conclude that the skater is unable to perform that jump at all, rather than that they can perform it, but inconsistently.

PART TWO: PRESENTATION OF THE ARTICLE

CHAPTER IV

PRESENTATION OF THE ARTICLE

This section contains an article, written in APA format, detailing the results of the self-modeling group. I plan to submit this article to *The Sport Psychologist*.

Running Head: SELF-MODELING AND FIGURE SKATING PERFORMANCE

Effects of Self-Modeling on Figure Skating Jump Performance and Psychological Variables

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Abstract

This study investigated whether self-modeling would improve intermediate level figure skaters' jump performance, as well as their self-efficacy, intrinsic motivation, and state anxiety when compared to physical practice alone. Twelve female figure skaters (M = 13.38 years of age, SD = 1.35) participated in a within-participant design where they received a self-modeling intervention for one jump and a control condition for another jump. We hypothesized that jumps in the self-modeling condition would show greater improvement in performance outcome and form scores, and that the psychological variables would mediate this relationship through skaters' increased self-efficacy and intrinsic motivation and decreased state anxiety for performing these jumps. Counter to our predictions, no differences existed between the conditions. Skaters' feedback provided insight into possible explanations for these results.

Effects of Self-Modeling on Figure Skating Jump Performance and Psychological Variables

Mastering the component skills of any sport is essential to long-term success in that sport. One technique commonly employed by coaches and instructors to facilitate sport skill acquisition is that of modeling, or observational learning. In fact, modeling has been described as “one of the most powerful means of transmitting values, attitudes, and patterns of thought and behavior" (Bandura, 1986, p.47) and has been shown to be an effective method for facilitating skill acquisition and modifying psychological responses (McCullagh & Weiss, 2001).

A special form of modeling is that of self-modeling, whereby the learner views him or herself on edited videotape, performing only successful behavior (Dowrick, 1991). There are two forms of self-modeling: positive self-review (PSR) and feedforward (FF). PSR self-modeling refers to editing the videotape footage to remove errors and distracting footage in order to create a videotape that depicts the best behavior the individual is capable of producing at that time (Dowrick, 1991), while FF self-modeling involves editing the videotape footage to create a videotape that shows the individual performing a skill that he or she is not yet capable of performing (Dowrick, 1991). In the current study, the effects of the PSR form of self-modeling will be examined.

Self-modeling has been reported as being an effective means of enhancing performance in both therapeutic and educational settings and for a variety of skills, such as social adjustment, communication, academic, and physical skills (Dowrick, 1991, 1999). However, it has received relatively little empirical examination with respect to sport skills (see McCullagh & Weiss, 2001 for a review of modeling literature).

Considering the frequent use of videotape feedback in the sport environment and the benefits associated with modeling, the use of self-modeling as an intervention technique in sport merits further investigation.

Bandura's (1977, 1986, 1997) social cognitive theory of observational learning acknowledges the role of self-modeling in enhancing skill acquisition. According to this theory, model similarity is an important contributor to the effectiveness of observational learning. Learners who watch a model that they perceive as being similar to themselves may relate more to the model, thus paying more attention to the successfully modeled skill, which, in turn, may positively impact their self-efficacy and subsequent performance of that skill. Having oneself as a model would maximize model-observer similarity. As well, self-modeling may have an impact on several psychological variables that have been suggested as possible mediators of the modeling process, such as self-efficacy, state anxiety, and intrinsic motivation. Bandura (1977, 1986, 1997) suggests that modeling increases the learner's sense of self-efficacy, or belief in their ability to perform the modeled action, by providing a vicarious mastery experience of the task. Mastery experiences are cited as the strongest source of self-efficacy information (Bandura, 1977, 1986, 1997). By showing the learner him or herself on videotape, successfully performing the task, this may create a more powerful experience - that of an actual mastery experience. Elevated self-efficacy concerning the task at hand is also purported to help the learner better manage their anxiety about attempting the skill and to increase their motivation to perform the skill (Bandura, 1997).

While most of the self-modeling research to date has been in therapeutic and educational settings, it has suggested that self-modeling increases a learner's self-efficacy and decreases his or her anxiety about performing the desired skill (Dowrick, 1999). For the wide variety of behaviors treated in these settings, psychological variables, such as anxiety, may play a very different role than they do in the acquisition of physical skills. That is, we cannot simply generalize these results to sport skill acquisition and should, instead, study self-modeling within the sport context. Thus, we turn next to research on self-modeling specifically within the sport environment.

Several studies examining the effectiveness of self-modeling found that it improved participants' performance of various sport skills, such as rock climbing (De Ghetaldi, 1998), basketball free throw shooting (Bradley, 1993; Melody, 1990), golf putting (Drazin, 1985), and weight lifting (Franks & Maile, 1991). These studies have been mainly case studies and unpublished dissertations (Dowrick, 1999). One of the few published self-modeling studies within sport, conducted by Dowrick and Dove (1980), employed a multiple baseline single-participant design to examine the effectiveness of self-modeling versus a no modeling control condition on the swimming performance of children with spina bifida. They found that the self-modeling intervention had modest but lasting effects on swimming performance, even at a ten-week posttest. Starek and McCullagh (1999) also investigated the effectiveness of self-modeling on swimming performance, but compared it to a peer modeling condition. They found that while the self-modeling group showed significant gains in swimming performance compared to the peer modeling group, no differences existed between the two groups with respect to self-efficacy or state anxiety. As well, Starek and McCullagh (1999) suggested that motivation may affect the effectiveness of the intervention, but did not test this hypothesis empirically.

Despite this supporting evidence, other studies have not mirrored these results. Winfrey and Weeks (1993), for example, compared the use of self-modeling with a no modeling control group on gymnasts' balance beam performance and found no differences between the two groups with respect to balance beam performance or self-efficacy. Similarly, using a multiple baseline single-participant design, Ram and McCullagh (2003) found that self-modeling had no effect on volleyball serve performance or self-efficacy. Clearly, more research is needed to determine the effectiveness of this technique for enhancing physical performance, as well as possible psychological mediators, such as self-efficacy, state anxiety, and intrinsic motivation.

In addition to providing contradictory evidence surrounding the effectiveness of self-modeling for skill acquisition, the studies conducted to date exhibit several methodological limitations. First, experimental designs were not consistently used, preventing the use of statistical analysis of differences that may exist between conditions and groups and comparisons with a no modeling control group. Related to this, all of the studies to date have involved 11 or fewer participants. This is especially problematic since between-group designs were often utilized, resulting in very few participants in each group. As well, only two studies to date (Dowrick & Dove, 1980; Winfrey & Weeks, 1993) examined the long-term effects of the intervention by including a posttest in their design. While the study of self-modeling with respect to motor skill acquisition is relatively new, each of these limitations needs to be addressed in order to further understand this intervention technique.

The current study addresses many of these limitations. First, a within-participant design was used to reduce variability in the results due to individual differences. This was also beneficial because the intervention was very time intensive and it was not feasible to test a large number of participants. Second, this study sought to remedy the fact that modeling studies have been identified as giving little attention to the performance versus learning distinction (McCullagh & Weiss, 2001). In our experimental design, the inclusion of acquisition and retention tests allows for investigation of both performance and learning respectively. As well, both performance outcome and form were measured to give a more complete picture of skill execution. Third, by comparing the self-modeling condition with a no modeling control condition, it provides an opportunity to view the effect of self-modeling versus practice alone. By expanding upon the psychological variables studied with respect to self-modeling and including self-efficacy, state anxiety, and intrinsic motivation, it may help to clarify the relationship between self-modeling, physical performance, and related psychological variables. Finally, this study adds further empirical study to the question of determining whether "individuals can learn from an approach in which they see only successful performances of a skill they are having difficulty performing" (McCullagh & Weiss, 2001, p.216).

The sport context of study was that of figure skating. Figure skaters were selected as the population for the current study for a variety of reasons. First, figure skating is a closed skill; therefore, the external environment remains relatively static and thus can easily be controlled to prevent the influence of environmental factors on the intervention. Second, videotape feedback is commonly employed in figure skating, thus skaters are accustomed to incorporating such extras into their training routine. As well, due to the evaluative criteria used in figure skating, this sport allows for performance measures of both the outcome and the form of skill execution. Finally, because jumping receives much of the emphasis in skaters' training, an intervention targeting this skill is appealing to coaches and skaters since it encourages practice of the skaters' newest and most difficult elements.

Thus, the purpose of this study was to examine the effectiveness of self-modeling, versus physical practice alone, on the performance of figure skating jumps as well as the psychological variables of self-efficacy, state anxiety, and intrinsic motivation. We hypothesized that the self-modeling intervention would improve skaters' feelings of self-efficacy, which would decrease their state anxiety, and increase their intrinsic motivation for attempting those jumps. These combined outcomes would lead to improved physical performance of those jumps. Thus, we hypothesized that the psychological variables would mediate the self-modeling and performance relationship.

Method

Participants

Participants were 12 intermediate level female figure skaters, 11 to 16 years of age (M = 13.38, SD = 1.35), from two skating clubs in an Ontario region. At the intermediate level, skaters are working towards the Skate Canada Senior Bronze, Junior Silver, or Senior Silver Free Skating Test. Skaters at this level are capable of performing all single rotation jumps, and are learning double rotation jumps. Inclusion criteria for the study were that the skaters be (a) between 11 and 16 years of age, (b) classified as being at the intermediate level, and (c) available for testing at least twice per week. The researcher contacted the head coaches of the skating clubs who provided consent for skaters at their club to be recruited. The coaching staff recommended skaters who fit the criteria for the study and the researcher then approached these skaters, described the study to them, and provided them with information and consent forms. Skaters who returned both the parental and skater consent forms participated in the study. All of the skaters, except for one, were recruited from the same skating club. Data collection was completed over the summer and fall months.

Materials

Skaters' jump performance was recorded using a Sony Digital 8 Handycam (model DCR-TRV230) digital video recorder. This footage was then transferred to a laptop computer (HP Pavilion zt1185) and edited using Microsoft® Windows Movie Maker to create the individualized self-modeling tapes. To create each skater's self-modeling videotape, the footage of her jump performance from the previous session was downloaded to the computer and previewed. The researcher identified her best performance of the jump element assigned to the self-modeling condition and then saved that footage onto a compact disc as a Movie Maker file. The footage was repeated so that the skater saw her best attempt of the desired element four times. Thus, any distracting footage or other jump elements were removed. This process was repeated after every intervention session so that skaters' self-modeling tapes reflected their best performance to date. Each self-modeling videotape was approximately 30 seconds in length and was viewed on a 12" by 9" laptop computer screen.

Jump performance. Jump performance was measured using an adapted version of the Skate Canada (2002) and International Skating Union (2000, 2001) judging guidelines for free skate elements, created through consultation with a certified figure skating judge. Two rating scales were created; one for jump outcome (i.e., degree to which skaters correctly completed the jump) and one for jump form (i.e., quality of jump performance). Scores on each of the performance scales ranged from 0 *(did not attempt)* to 10 *(errorless performance)*. During each session, skaters completed two attempts of each of the two jumps selected for the study. The scores from the two attempts of each jump were averaged to create one score for that jump for that session. Two independent raters, blind to the conditions, scored the videotape footage for a subset of the skaters. Their scores were compared to determine inter-rater reliability. Correlations of the two raters' scoring of the performance data revealed acceptable inter-rater reliability for both the performance outcome ($r = .99$) and performance form ($r = .96$) scales. Since reliability was deemed acceptable, one of the raters scored the remainder of the videotape footage. The same rater later rescored the original subset of videotape footage to determine test-retest reliability, which was also deemed acceptable for both the performance outcome ($r = .99$) and performance form ($r = .97$) scales.

Self-efficacy. Self-efficacy was measured using an individualized self-efficacy questionnaire, generated according to Bandura's (1997, 2001) guidelines regarding such scales. The questionnaire asked the skaters how confident they were in their ability to successfully perform each of the two jumps selected for the study. The skaters rated their self-efficacy separately for each of the two jumps on a 10-point scale, ranging from 1 *(I cannot do it)* to 10 *(very sure I can do it)*. Higher scores indicate higher feelings of self-efficacy for that jump.

State anxiety. The learner's state anxiety was measured using the State-Trait Anxiety Inventory or STAI (Spielberger, Gorsuch, & Lushene, 1970) which includes a subscale (form X-1) to measure state anxiety, or one's anxiety in a specific situation. The other subscale of the STAI (form X-2) measures trait anxiety, or one's general feelings of anxiety. Only the state scale was used in this study, as we were interested in the learner's anxiety about performing the specific jumps selected in the practice setting. The STAI state scale includes 20 statements that the participants are asked to rate according to how well each statement represents how they feel "at this moment." Statements are rated on a 4-point scale, ranging from 1 *(not at all)* to 4 *(very much so)*. Some of the items require reverse scoring, as detailed in the STAI Manual (Spielberger et al., 1970). Scores range from a low of 20 to a high of 80, with higher scores indicating greater state anxiety. This scale has also been demonstrated to be reliable and valid (Spielberger et al., 1970).

Intrinsic motivation. The learner's degree of intrinsic motivation was measured using the Situational Motivation Scale (SIMS) (Guay, Vallerand, & Blanchard, 2000). This scale was developed to measure an individual's motivation on the intrinsic motivation to amotivation continuum for a specific situation. This questionnaire asks the participants why they are engaged in a particular activity (e.g., practicing specific skating jumps) and gives 16 statements. For each of these statements, participants are asked to rate how true the statement is on a 7-point scale, ranging from 1 *(corresponds not at all)* to 7 *(corresponds exactly)*. To create an overall self-determined motivation[1] score or index, scores on the individual subscales (i.e., intrinsic motivation, identified regulation, external regulation, extrinsic motivation, and amotivation) can be weighted and summed (Vallerand & Rousseau, 2001). A high positive score indicates high levels of self-determined motivation, and therefore more intrinsic forms of motivation, whereas a high negative score indicates very low levels of self-determined motivation. While the SIMS is a relatively new questionnaire, it has been shown to demonstrate construct validity and internal consistency for the motivation subscales (Guay et al., 2000). As well, the self-determination index has been shown to be a reliable and valid method of creating an overall motivation score (Vallerand & Rousseau, 2001).

Procedure

Pretest phase. Skaters in the study participated in eight sessions, each lasting approximately 15 minutes. The first was a pretest session, in which skaters were asked what jump elements they were currently trying to learn. They were asked to identify jumps that they could perform correctly "sometimes but not all the time." The researcher observed them performing these jumps, and selected two jumps that appeared to be performed at approximately the same level. These jumps were then pseudo-randomly assigned to either the self-modeling condition or the control condition. In cases where the same two jumps were selected for multiple skaters, the assignment of the jumps to the control or self-modeling conditions was counterbalanced.

Possible confounders of this research design are jump type and jump difficulty. To remedy this, jump assignment was counterbalanced according to both of these factors. Skaters in this study could be working on five possible jumps, two of which were selected for the study. Jump difficulty was determined by grouping the jumps into one of two categories (i.e., high or low difficulty), according to the test level assigned to the jump. That is, the two jumps that must be mastered at the Senior Bronze level (i.e., double salchow and double toe-loop) were assigned to the "low difficulty" level and jumps that must be mastered at the Junior Silver and Senior Silver levels (i.e., double flip, double loop, and double lutz) were assigned to the "high difficulty" level. For 8 of the 12 participants, jumps were counterbalanced according to both type and difficulty level. That is, if one skater had the double flip as the control jump and the double toe-loop as the self-modeling jump, another skater working on the same two jumps would have the reverse (e.g., the double toe-loop as the control jump and the double flip as the self-modeling jump). For 2 of the 12 skaters, jumps were counterbalanced according to difficulty only, and for the final 2 skaters, jumps were randomly assigned since the jumps selected did not match up with respect to jump type and jump difficulty. Thus, each skater received the self-modeling intervention for one jump and no intervention for the other jump.

During the pretest session, skaters also completed a demographic questionnaire, as well as the self-efficacy, state anxiety, and intrinsic motivation questionnaires. In addition, skaters were asked to complete a jump practice log two to three times per week for the duration of the study, indicating how often they attempted each of the two jumps selected for the study and the outcome of those attempts. This log was to ascertain that one jump was not being practiced more than the other jump.

Intervention phase. The intervention was then introduced twice per week for three weeks (i.e. six sessions). At the beginning of each session during the intervention phase, skaters watched their self-modeling tape once, thus seeing the self-modeling jump performed to the best of their abilities four times. The skaters' self-modeling videotapes were updated after each session to reflect improvements in their performance. If a skater did not show an improvement in her performance, then the self-modeling videotape from the previous session was used. After viewing their self-modeling videotapes, skaters were given approximately three to five minutes to practice their jumps and were then videotaped performing each of the jumps twice. At the midpoint of the intervention (i.e., the third session) and at the final intervention session (i.e., the sixth session), skaters were also asked to complete the psychological questionnaires. This was done after watching their self-modeling videotapes, but prior to physically practicing the skills. As well, skaters continued to receive their regular training and instruction program from their coach over the course of the study.

Retention phase. The final session was a retention test, held one week after the final intervention session. At this time, skaters completed the psychological questionnaires and were videotaped performing the two jumps. Note that they did not view their self-modeling videotapes during this session. Skaters were also asked to complete a follow-up questionnaire to determine their thoughts and feelings concerning the intervention. As well, the jump practice logs were collected from the skaters. At the conclusion of the study, skaters received a copy of their videotape footage for both of the jumps examined in the study.

Data Analysis

The questionnaire and performance data were analyzed using a 2 Condition (self-modeling, control) x 4 Time (pre-, mid-, final, post-intervention) analysis of variance (ANOVA) with repeated measures for both factors. Separate ANOVAs were performed for each of the dependent variables of self-efficacy, state anxiety, intrinsic motivation, jump performance outcome, and jump performance form. It has been recommended that separate ANOVAs be performed, rather than MANOVAs, under certain conditions (Huberty & Morris, 1989). For instance, if the variables examined are conceptually distinct, such as self-efficacy and anxiety, if the research is exploratory, and if the variables studied have been previously studied in univariate analysis, ANOVAs should be employed. The alpha level was set at .01 using the Bonferroni adjustment. If the ANOVA analyses were to reveal intervention effects, regression analyses would be conducted separately for each of the psychological variables of self-efficacy, state anxiety, and intrinsic motivation to determine whether they mediate the relationship between self-modeling and physical performance.

Results

Psychological and Performance Data

Paired-samples t-tests, comparing initial scores for each of the dependent variables, showed no differences between the two jumps selected for each skater at the pretest. In addition, a paired-samples t-test showed that there were no differences in the difficulty level of jumps assigned to the self-modeling versus the control condition. Finally, paired-samples t-tests of the practice log data, obtained from 10 of the 12 participants, showed that there were no significant differences in the amount of practice time spent on the self-modeling versus the control jump.

Counter to our hypotheses, the ANOVA results revealed no significant intervention effects. The scores for the dependent variables generally demonstrated a marginal change in the desired direction over the course of the intervention, but to the same extent for jumps in both conditions. The means and standard deviations of the analyses for the psychological and performance measures are shown in Tables 1 and 2. Since there were no intervention effects, regression analyses were not conducted to test the mediation hypotheses.

Main effects for time were present for state anxiety, $F(3, 33) = 5.912$, $p = .002$, $\eta_p^2 = .35$; and performance form, $F(3, 33) = 6.5$, $p = .001$, $\eta_p^2 = .37$. Marginally significant main effects for time were present for self-efficacy, $F(3, 33) = 3.97$, $p = .016$,

$\eta_p^2 = .27$; and performance outcome, $F(3, 33) = 4.16$, $p = .013$, $\eta_p^2 = .28$. Scores for each of these variables moved in the desired direction, with self-efficacy, performance outcome, and performance form scores increasing over time and state anxiety scores decreasing over time.

Follow-up Questionnaire Data

Despite the lack of significant results from the psychological questionnaires and performance data, the skaters' responses to the follow-up questionnaire were very positive and indicated that they felt the intervention had been successful. The follow-up questionnaire was completed by 11 of the 12 participants. All of the skaters who completed the questionnaire indicated that they felt the intervention had helped them improve their skill level for the jump that received the self-modeling intervention. As well, 91% of skaters who completed the questionnaire felt that it had not interfered with their regular training program. When asked if they would consider implementing self-modeling as a regular part of their practice training program, 91% said "yes" and 100% wanted to incorporate it into their competition training program. As well, all of the skaters indicated that they had enjoyed the intervention. When asked what aspects of their training they would target with the self-modeling intervention, 100% (of the 10 who wanted to use it in a training environment) indicated technical aspects of skating (e.g., jumps, spins, footwork), 70% indicated they would use it to help them improve their whole program, 30% indicated they would use it to improve their choreography, and 30% indicated they would use it to enhance their self-confidence and motivation to perform. Please note that skaters were allowed to select more than one aspect of their training to target with the intervention.

It was interesting to note that when asked how the intervention helped their performance, 55% of the skaters made comments referring to viewing errors in their performance. That is, they felt that the self-modeling videotapes helped them to see the mistakes they were making in executing the jumps, and that by viewing these errors, it helped them to correct their mistakes. It also indicates that while the videotapes depicted the best performance that they were capable of to date, and any errors that may have been present were relatively small, they did not focus on the positive aspects of their performance, but attended to the negative aspects instead. Other skaters however, focused on the positive aspects of the video performance. One skater said, “I could see everything I had to remember to think of to land [the jump]” and another commented, “It makes me feel good that I improved. It gave me confidence to work harder.” Also of interest was that skaters recommended that we show them videotape footage of their entire program, rather than focusing only on specific skills, as they felt that viewing their program would greatly help their skating.

Discussion

The purpose of this study was to determine whether a self-modeling intervention would enhance figure skater’s jump performance, self-efficacy, and intrinsic motivation and decrease their state anxiety compared to a no modeling control condition. Unfortunately, our predictions were not supported, as there were no significant differences between the two conditions for any of the dependent variables. While scores for each of the variables showed a slight change in the desired direction, these changes were evident for both conditions. Therefore, these results suggest that employing a PSR self-modeling intervention may not produce significant changes in jump performance or psychological variables above and beyond those gained from a skater's regular training program. It is important to note, however, that the skaters in the current study were mainly from a skating club where the caliber of the teaching staff and the training program is exceptional and thus these results may not be generalized to skating environments where the training program is geared more towards non-elite skaters and is less comprehensive.

The results of this study run counter to both Bandura's (1977, 1986, 1997) social cognitive theory propositions about the effects of modeling and self-modeling, and the findings of other self-modeling studies (Dowrick, 1991, 1999). Similar results, however, were obtained in a few self-modeling studies that examined sport skills. Winfrey and Weeks (1993) found that self-modeling had no effect on gymnast's balance beam performance and Ram and McCullagh (2003) found that volleyball serve performance was not conclusively enhanced by the intervention. With respect to psychological variables, various studies, in addition to the current study, have found that self-modeling had no effect on self-efficacy levels (Starek & McCullagh, 1999; Ram & McCullagh, 2003; Winfrey & Weeks, 1993) or state anxiety levels (Starek & McCullagh, 1999).

Those studies where a self-modeling intervention produced significant results differ in various ways from the current study. First, learners classified as beginners seem to benefit more from the intervention in terms of physical performance than those classified as intermediates. In both Dowrick and Dove's (1980) and Starek and McCullagh's (1999) studies, beginner level swimmers were used, and both studies found that self-modeling positively affected performance. However, similar to the current study, Ram and McCullagh (2003) and Winfrey and Weeks (1993) examined intermediate level athletes and found no performance effects. It has been suggested (Winfrey & Weeks, 1993) that since beginners have a larger margin for improvement, positive and significant results may be more easily obtained in this population. It is also possible that beginners may benefit more from watching their successful performances on videotape, since they may be less consistent in performing those skills than intermediates and may therefore exhibit more positive psychological and performance effects.

A second factor to consider is that in the published self-modeling studies to date that examined physical skills, it appears that the intervention is more successful with continuous skills as compared to discrete skills. Many of the self-modeling studies to date have examined swimming performance (Dowrick & Dove, 1980; Starek & McCullagh, 1999), which is a continuous skill, and indeed, all of these studies have found that it facilitated skill performance. None of the self-modeling studies to date that examined discrete skills, such as volleyball serve performance (Ram & McCullagh, 2003), balance beam performance (Winfrey & Weeks, 1993) and figure skating jump performance in the current study, have found an intervention effect. Perhaps there is something inherent in continuous skills that makes them more susceptible to self-modeling effects or there may be something about the swimming environment in particular that lends itself well to self-modeling effects. There have been some exceptions with regard to this factor within the self-modeling dissertations, with self-modeling enhancing basketball free-throw shooting (Bradley, 1993; Melody, 1990) and golf putting (Drazin, 1985). As a result, we encourage further examination of this distinction to clarify the relationship between self-modeling and skill type.

There are some other explanations and limitations to the results obtained. First, we may have encountered ceiling effects with respect to some of the psychological variables. Since PSR self-modeling was employed, we were required to select skills that the skaters could perform "sometimes, but not all the time" and thus they may have been highly self-efficacious and only mildly anxious for those skills from the outset, leaving little room for improvement for those variables. Skaters' initial mean self-efficacy score was 7.2 out of a maximum of 10 for jumps in the self-modeling condition and 6.7 out of 10 for jumps in the control condition. This may be remedied in future studies by including a more sensitive self-efficacy scale that asks participants how confident they are in their ability to perform the jump an ever-increasing number of times (e.g., 1 out of 10 times, 2 out of 10 times...10 out of 10 times). With respect to state anxiety, the mean initial score for jumps in the self-modeling condition was 38.3 and 38 for jumps in the control condition, with a score of 80 being the maximum and a score of 20 being the minimum anxiety score. This suggests that skaters do not feel very anxious about attempting jumps in the practice environment, and perhaps anxiety does not play a large role in skill learning after the initial familiarization with a new skill.

As well, since the intervention is very time and effort intensive, it was prohibitive to test a large number of participants, thus the sample may have been too small to detect differences between conditions. As the intervention was introduced in a naturalistic environment, other factors (e.g., verbal feedback, physical practice) may have confounded the results of the study. However, in reality, this intervention would typically be introduced as an addition, rather than a substitution, to athletes' regular training and instruction programs. Thus, it is important to examine the effects of the intervention in the environment in which it would be used by coaches and other professionals, lending further ecological validity to the study.

In addition, the use of FF self-modeling has been suggested as being more effective than employing PSR self-modeling (Dowrick, 1999). Indeed, Dowrick & Dove (1980) found that the use of FF self-modeling produced modest and long-lasting changes in children's swimming performance. This type of long-term performance change has not been examined in other self-modeling studies and thus cannot be directly compared with them. In fact, in certain instances during the current study, it would have been easier to simply edit out the skaters' errors, thus producing a FF self-modeling videotape, rather than attempting to get footage of a perfect performance, and possibly having to include a slight error in the PSR self-modeling videotape.

Feedback from the skaters, obtained from the follow-up questionnaires, brought to light an important confounding factor in self-modeling research. The skaters' perception of the self-modeling videotape may have counteracted the intervention, to a degree. When asked whether they felt the intervention had helped their performance, skaters felt it was beneficial in general; however, some of the skaters also indicated that the videotapes allowed them to see their errors and critique their performance. This directly opposes the notion of self-modeling, where the learner is supposed to see only successful performances! Despite the fact that the jumps shown on the videotapes were successful and contained very minor or no errors, skaters still found that their performance was not "good enough." This is an important factor to consider when working with athletes who are continually striving to be the best. As well, for developing athletes who often watch the professional or elite level of their sport on television, their idea of what specific elements should look like (e.g., speed, height, and flow of skill execution) may be unrealistic for their current level of expertise. Even though skaters are told to watch "how well they are performing" the desired skill on the self-modeling videotape, they may not perceive the performance as being successful enough. Thus, the athlete's perception of the performance shown on the self-modeling videotapes should be taken into consideration when implementing this type of intervention. More examination of this issue is merited in order to determine the best way to incorporate the athlete's feedback and perceptions of their performance into the self-modeling videotapes and to determine under which conditions self-modeling may be beneficial, rather than detrimental, to the athlete.

Despite these limitations, the current study contributes to the self-modeling literature. As very little study has been conducted on this topic, further research only helps to lend more information to the debate as to whether or not it is an effective technique to enhance sport skill acquisition and performance. The current study also sought to address some of the limitations cited in previous self-modeling studies. It is one of very few studies that has examined both performance outcome and performance form and is the first self-modeling study that we are aware of that specifically measured the learner's degree of motivation using a published questionnaire.

In future, we suggest that researchers conducting self-modeling studies utilize a task analysis approach to designing their studies and explaining their results. Perhaps this intervention technique is more effective with certain types of tasks and in certain sport environments. As well, other cognitive processes that were not examined in this study may play a role in the self-modeling and performance relationship and thus would shed further light upon this relationship. Examples include self-regulatory processes, such as goal setting and self-judgments, and in fact, some current research supports this notion (Clark & Ste-Marie, 2004). Finally, practitioners in the sport environment should be cautioned before simply introducing a self-modeling intervention with their athletes. The individual athlete's skill level, the characteristics of the task, the athlete's feelings towards performing that task, and most importantly, the athlete's perception of their performance shown on the self-modeling videotape are all factors that should be taken into consideration to determine whether that athlete will indeed benefit from the self-modeling intervention. Further empirical examination of this topic will help to clarify these issues and provide additional information to sport psychologists, coaches and other professionals working to help athletes reach their full potential.

References

Bandura, A. (1977). *Social learning theory.* Englewood Cliffs, NJ: Prentice-Hall.

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

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

Bandura, A. (2001). *Guide for constructing self-efficacy scales (Revised).* Available from Frank Pajares, Emory University.

Bradley, R.D. (1993). The use of goal-setting and positive self-modeling to enhance self-efficacy and performance for the basketball free-throw shot. *Dissertation Abstracts International, 54-05(A),* 1723.

Clark, S.E. & Ste-Marie, D.M. (2004). Investigating the mediating mechanisms of self-modeling. Manuscript in preparation.

Deci, E.L. & Ryan, R.M. (1985). *Intrinsic motivation and self-determination in human behavior.* New York: Plenum.

De Ghetaldi, L.R. (1998). The effect of self-modeling on climber self-efficacy, motivation, actual and perceived rock climbing skills, and knowledge in beginning rock climbers. *Dissertation Abstracts International, 59-08(A),* 2901.

Dowrick, P.W. (1991). *Practical guide to using video in the behavioral sciences.* New York: Wiley & Sons.

Dowrick, P.W. (1999). A review of self modeling and related interventions. *Applied and Preventative Psychology, 8,* 23-39.

Dowrick, P.W. & Dove, C. (1980). The use of self-modeling to improve the swimming performance of spina bifida children. *Journal of Applied Behavior Analysis, 13,* 51-56.

Drazen, D.M. (1985). The use of self-modeling to improve motor performance (golf). *Dissertation Abstracts International, 46-03(B),* 946.

Franks, I.M. & Maile, L.J. (1991). The use of video in sport skill acquisition. In P.W. Dowrick (Ed.), *Practical guide to using video in the behavioral sciences* (pp.231-243). New York: Wiley & Sons.

Guay, F., Vallerand, R.J., & Blanchard, C. (2000). On the assessment of situational intrinsic and extrinsic motivation: The situational motivation scale (SIMS). *Motivation and Emotion, 24(3),* 175-213.

Huberty, C.J. & Morris, J.D. (1989). Multivariate versus multiple univariate analyses. *Psychological Bulletin, 105(2),* 302-308.

International Skating Union (2000). *Communication 1086: Deduction sheet.* Lausanne, Switzerland: Author.

International Skating Union (2001). *Judge's manual for singles skating.* Lausanne, Switzerland: Author.

McCullagh, P. & Weiss, M.R. (2001). Modeling: Considerations for motor skill performance and psychological responses. In R.N. Singer, H.A. Hausenblas, & C.M. Janelle (Eds.), *Handbook of Sport Psychology* (2nd ed., pp.205-238). Toronto, Canada: Wiley & Sons.

Melody, D.W. (1990). The influence of self-modeling upon free-throw shooting. *Dissertation Abstracts International, 52-02(A),* 478.

Ram, N. & McCullagh, P. (2003). Self-modeling: Influence on psychological responses and physical performance. *The Sport Psychologist, 17,* 220-241.

Skate Canada. (2002). *Skate Canada official rule book.* Ottawa, ON: Author.

Spielberger, C.D., Gorsuch, R.L., & Lushene, R.E. (1970). *Manual for the state-trait anxiety inventory.* Palo Alto, CA: Consulting Psychologist Press.

Starek, J. & McCullagh, P. (1999). The effect of self-modeling on the performance of beginning swimmers. *The Sport Psychologist, 13,* 269-287.

Vallerand, R.J. & Rousseau, F.L. (2001). Intrinsic and extrinsic motivation in sport and exercise: A review using the hierarchical model of intrinsic and extrinsic motivation. In R.N. Singer, H.A. Hausenblas, & C.M. Janelle (Eds.), *Handbook of Sport Psychology* (2nd ed., pp.389-416). Toronto, Canada: John Wiley & Sons.

Winfrey, M.L. & Weeks, D.L. (1993). Effects of self-modeling on self-efficacy and balance beam performance. *Perceptual and Motor Skills, 77,* 907-913.

Footnote

[1]Self-determined motivation is a term utilized by Deci and Ryan (1985) in their conceptualization of motivation and refers to motivation that is highly intrinsic in nature. Bandura's (1997) notion of intrinsic interest, or self-motivation, can also be considered intrinsic motivation. While different terms are utilized, both refer to motivation that is due to intrinsic enjoyment and interest in the task. For clarity of writing, the term intrinsic motivation will be used throughout this article to represent the overall self-determined motivation score derived from responses on the SIMS questionnaire.

Table 1

Skaters' mean psychological questionnaire scores

	Self-efficacy		State anxiety		Intrinsic motivation	
Condition	*M*	*SD*	*M*	*SD*	*M*	*SD*
			Pretest			
Self-modeling	7.17	1.53	38.33	6.21	38.17	20.5
Control	6.67	2.35	38	8.65	41.5	22.49
			Mid-intervention session			
Self-modeling	6.42	2.54	36.92	8.47	37.25	25.73
Control	6.92	2.61	34.25	6.31	42.08	18.52
			Final intervention session			
Self-modeling	7.17	1.85	34.17	9.69	37.83	26.02
Control	7.42	2.02	33.83	8.47	44.42	16.89
			Retention			
Self-modeling	8.25	1.54	31	7.07	45.58	14.74
Control	7.92	1.97	33	8.34	44.67	19.16

Table 2

Skaters' mean performance scores

	Outcome		Form	
Condition	*M*	*SD*	*M*	*SD*
	Pretest			
Self-modeling	4.37	2.06	5.29	1.4
Control	3.29	1.1	4.92	1.16
	Mid-intervention session			
Self-modeling	4.83	2.17	5.83	1.05
Control	5	.95	5.96	.72
	Final intervention session			
Self-modeling	5.12	1.96	6	.88
Control	3.71	.92	5.58	.76
	Retention			
Self-modeling	4.42	2.39	5.75	1.16
Control	3.5	1.45	5.54	1.45

PART THREE: ELABORATED RESULTS, DISCUSSION, AND CONCLUSION

CHAPTER V

ELABORATED RESULTS

The purpose of this chapter is to provide further explanation and description of the control group. The control group (CON) will be compared with the self-modeling group in two separate analyses, first with the self-modeling condition (SM) for the treatment group and then with the control condition (SM-C) for the treatment group. Note that the self-modeling group's scores for the variables discussed within the previous article can be found in Tables 1 and 2 of the previous section. Results from the self-modeling group's data not reported in the previous article will also be presented and explained. For this section, the alpha level will be set at .007, using the Bonferroni adjustment, since we will report results on all seven dependent variables. Note that this is different from the alpha level of .01 used in the previous article, where results for only five of the dependent variables were reported.

Control Group Descriptives

Skaters assigned to the control group were all from the same skating club, different from that of the treatment group, with one exception. Since data collection was conducted at one skating club at a time, we decided to collect all data for the treatment group first, in case we could not recruit sufficient skaters for both groups. As a result, when data collection was conducted at a second skating club, we still needed one more skater to complete the treatment group. Therefore, skaters from the second club were all assigned to the control group, save one skater who received the self-modeling intervention as a member of the treatment group.

The control group consisted of 7 skaters, ranging in age from 11 to 16 years (M = 14.20, SD = 2.35). Similar to the self-modeling group, they were all working on the Senior Bronze, Junior Silver, or Senior Silver Free Skate Test. Independent-samples t-tests revealed that there were no differences between the self-modeling and the control group with respect to age or level.

Paired-samples t-tests were performed for each of the dependent variables to compare the two jumps selected for each participant in the control group. Since the pretest scores for each of the dependent variables were not significantly different for the two jumps, scores for both jumps were averaged at each of the time points to create one score for each dependent variable at each time point. For example, if the two jumps selected for one skater in the control group were the double flip and the double loop, her self-efficacy score for her double flip and for her double loop were averaged to create only one self-efficacy score for that skater. This was done for each of the dependent variables at each of the four time points in order to facilitate data analysis. As well, paired-samples t-tests confirmed that there were no differences in the difficulty level of the jumps selected for the study or the amount of practice time spent on either of the two jumps selected for skaters in the control group.

Psychological and Performance Data

Self-modeling condition versus control group. Independent-samples t-tests of the pretest data for each of the dependent variables revealed that there were no significant differences in skaters' initial scores for any of the dependent variables, except for self-efficacy, $t(17) = 2.64$, $p = .017$; and motivation to skate, $t(17) = 2.82$, $p = .015$. Although the p level was previously stated as being .007, we decided to use the .05 level as the criterion for the comparisons involving the pretest data to ensure that our more conservative significance level did not cause a positive bias in our later results. Therefore, skaters' self-efficacy and motivation to skate scores were converted to difference scores by subtracting their score at each of the time points from their initial score for that dependent variable. Thus, the difference scores reflect the magnitude and direction of change in the skaters' scores in relation to their pretest score. A 2 Condition (SM, CON) x 4 Time (pre-, mid-, final, post-intervention) ANOVA with repeated measures for time was performed for each of the dependent variables. There were no significant differences between the self-modeling group and the control group for any of the dependent variables. Please refer to Tables 3 and 4 for the control group's psychological and performance scores. As well, the self-modeling group's motivation to skate and intrinsic motivation subscale scores can be found in Table 5. There was also a main effect for time for state anxiety, $F(3, 15) = 5.531, p = .002, \eta_p^2 = .25$; with state anxiety scores for both conditions showing a decrease over time.

Self-modeling control condition versus control group. Independent-samples t-tests of the pretest data for each of the dependent variables revealed no significant differences in skaters' initial scores for any of the dependent variables except for motivation to skate, $t(17) = -3.69, p = .003$. Therefore, skaters' motivation to skate scores were converted to difference scores using the same procedure described in the previous section. Another set of 2 Condition (SM-C, CON) x 4 Time (pre-, mid-, final, post-intervention) ANOVAs with repeated measures for time were conducted for each of the dependent variables. There were no significant differences between the two conditions for any of the dependent variables. However, there was a main effect for time for state anxiety, $F(3, 15) = 4.96$, $p = .004$, $\eta_p^2 = .23$; with scores for both conditions decreasing over time.

Self-modeling group. The dependent variables of motivation to skate and the intrinsic motivation subscale of the SIMS were also examined with respect to the SM versus the SM-C conditions for the self-modeling group, but were not discussed in the article presented previously. Participants' motivation to skate was measured so that we could determine whether skaters differed with respect to their initial motivation levels. This measure was employed so that skaters could be separated into groups of high or low levels of initial motivation to skate. This was done because initial motivation to skate may have moderated the effects of the intervention. Since skaters did not differ on this scale at the beginning of the study and since no changes were evident in their levels of motivation to skate over the course of the study, we did not conduct the moderation analysis. As a result, we felt that we could omit these results from the thesis article.

In addition to examining skaters' overall self-determined motivation score on the SIMS, we also examined their scores on the intrinsic motivation subscale. This was done because we were interested specifically in changes in their intrinsic motivation score. The overall self-determined motivation score does reflect this, but it also factors in other forms of motivation, weighted with respect to their degree of self-determination. Skaters' intrinsic motivation scores did not change over the course of the study, thus we omitted these results from the article and discussed only the self-determined motivation scores. The self-determined motivation scores showed greater variation than the intrinsic motivation subscale scores, indicating that skaters' scores for other, less self-determined forms of motivation (e.g., amotivation) may have decreased, thereby increasing their overall self-determined motivation score without affecting their intrinsic motivation subscale score.

Control Group Follow-up Questionnaire Data

Follow-up questionnaires were collected from all 7 of the skaters in the control group. When asked whether or not they felt that the study had helped their jump performance (even though none of them received the self-modeling intervention), 86% said "yes." None of the skaters felt that the researcher had interfered with their regular training. All of the skaters indicated that, if given the opportunity, they would like to incorporate the self-modeling intervention into their regular training routine, and 86% indicated that they would like to use it in competition as well. When asked what aspects of their skating they would use the intervention for, 86% of skaters indicated they would use it to improve technical aspects of their performance, 71% indicated they would use it to improve their whole program, 57% indicated they would use it to enhance their confidence and motivation to perform, 43% indicated they would use it to improve their choreography, and 14% indicated they would use it for relaxation and arousal purposes. Finally, all 7 skaters indicated that they enjoyed participating in the study.

Despite the fact that these skaters did not receive the self-modeling intervention, and instead watched a videotape unrelated to skating, many of the skaters felt that their performance had improved due to participation in the study. When asked how it had helped their performance, many of them commented on how the increased one-on-one time with the researcher, and receiving a different point of view on how to improve their jumps had helped them. This speaks to the idea that perhaps these recreational level skaters simply needed to feel that they were receiving more attention than they normally would in the practice environment. As well, some of the skaters indicated that participation in the study forced them to spend more time practicing the selected jumps. This may reflect the fact that much of their practice time is unstructured and having a scheduled time to practice the jumps in front of the researcher may have helped them to organize their time. As well, since skaters were often seen talking or doing other tasks unrelated to skating during their designated practice time, the presence of the researcher may have encouraged them to be more conscientious on the ice. Finally, one skater made a comment about watching the control videotape that we found especially interesting. She said "I think that watching a video that takes my mind off skating helps me a lot because I am told that I think too much, and therefore cannot land the jump." This skater clearly felt that not watching herself was beneficial.

CHAPTER VI

ELABORATED DISCUSSION AND CONCLUSION

With respect to the control group, we found that they were not significantly different from the SM-C condition on any of the dependent variables. This suggests that there were no transfer effects between the two conditions for the self-modeling group. That is, jumps in the SM-C condition for the self-modeling group did not benefit from the skater seeing a self-modeling videotape for another, but somewhat similar, jump. If there had been a transfer of benefits derived from viewing the self-modeling videotape, the SM-C condition would be expected to have superior scores for the performance and psychological variables compared to the control group who did not watch a self-modeling videotape for any of their jumps.

However, counter to our predictions, the SM condition was also not significantly different from the control group for any of the dependent variables. This indicates that the self-modeling intervention did not have any greater effect on the skaters' jump performance or psychological variables than simply following their regular training program over time. It was expected that skaters would have higher performance, self-efficacy, and intrinsic motivation scores, as reflected by both the overall self-determined motivation scores and the intrinsic motivation subscale scores, and lower state anxiety scores for jumps in the SM condition than for jumps in the SM-C condition and skaters in the control group. A detailed discussion of possible explanations for the self-modeling group's performance is presented in the previous article and therefore, will not be repeated here.

Aside from the possibility that self-modeling is not effective as an intervention technique, there may be other explanations for why the control group was not significantly different from the treatment group's SM and SM-C conditions. As described in the revised methodology, skaters in the control group were recruited from a different skating club than skaters in the self-modeling group. From our observations, and in talking with the coaching staff, it was evident that this skating club had a significantly different environment than the skating club where the self-modeling group was recruited. The control group's skating club had a more recreational focus and therefore skaters at this club did not have the same type of training program and practice schedule as skaters in the self-modeling group. In general, they skated fewer days per week and the coaching staff was not as strict at ensuring that skaters were on-task during their practice time (i.e., more talking, water breaks, and other off-task behaviors were observed). As a result, skaters from this club who participated in the study as members of the control group were suddenly given more one-on-one time than they were accustomed to and were required to complete tasks, such as the practice log, which they had not previously done. Skaters in the self-modeling group indicated that they had previously kept practice logs or similar journals.

By making these changes to the control group's environment, the increased emphasis on their practice time and required on-ice attendance for the study may have impacted their skating and caused them to demonstrate significantly more improvement in their jump performance and psychological responses than would be expected from their normal practice over the same time period. In fact, skaters in the control group commented that they felt the practice log helped their skating performance by encouraging them to stay on-task and by providing them with a concrete idea of how much time they were devoting to practicing their jumps. Comments such as these were also made by the coaches and parents of skaters in the control group. This illustrates, similar to the ideas discussed in the previous article, that the athlete's perception of the intervention, or lack thereof, may play an important role in the outcome of the study.

It is also possible that since skaters in the control group were not as accustomed to having research conducted at their club as skaters in the self-modeling group, they may have experienced the Hawthorne effect and demonstrated improvement simply due to the presence of the researcher. Skaters in the control group may have also increased the effort and attention put into practicing their jumps so that the researcher would view them more favorably.

Ideally, we would have preferred to have a control group from a skating club that was almost identical to the self-modeling group's skating club in order to control for differences such as sport environment; however, we were required to work with the clubs that were available to us and willing to participate in the study. Other skating clubs in the area, that are very similar to the self-modeling group's skating club, were approached about participating in the study, however, they declined. In future studies, we will continue to attempt to recruit both the treatment group and the control group from clubs that are as similar as possible with respect to coaching, training programs, and overall sport environment.

In addition, various modifications can be made to improve this design for future self-modeling studies. First, by recruiting a greater number of participants, it would provide an opportunity to identify differences that exist between groups that are obscured when power is too low. Perhaps incorporating a longer baseline period would allow the researcher to gain a more complete and stable measure of athlete's initial level of performance. Related to this, an immediate posttest would provide information about short-term maintenance of the desired behavior following the self-modeling intervention that could be compared with the one-week posttest for longer-term maintenance of the desired behavior. It would also be of interest to use a more condensed intervention schedule to investigate whether intensive exposure to self-modeling produces greater performance change than the same amount of self-modeling exposure, spread over a longer time frame. As well, various other self-modeling studies have examined the correlation between the learner's perception of their performance and their actual performance scores (Winfrey & Weeks, 1993; Starek & McCullagh, 1999). Unfortunately, we were unable to do so in the current study, but it is a notion worth investigating: Does self-modeling help us to form a more accurate perception of our performance and does this more accurate perception somehow enable us to better learn the desired skill?

In summary, the results of this study did not support our hypotheses regarding the effects of self-modeling on figure skating jump performance. Skaters in the self-modeling group did not exhibit significantly superior self-efficacy, state anxiety, intrinsic motivation, performance outcome, and performance form scores for jumps assigned to the SM condition when compared to jumps assigned to the SM-C condition and to skaters in the control group. Explanations for this lack of results include the use of PSR versus FF self-modeling, the skill level of the athlete, characteristics of the task, and the athlete's perception of the intervention. As well, possible ceiling effects with respect to the psychological variables and differences in coaching, training programs, and sport environment between the self-modeling group's and the control group's skating clubs may have affected the outcome of the study.

Researchers should consider each of these factors, and attempt to incorporate the athlete's input and perception of their performance into the design and implementation of the study. While participant recruitment can be challenging, every attempt should continue to be made to recruit control subjects from as similar an environment as possible to the treatment group. In addition, future self-modeling studies should investigate other cognitive processes, such as self-regulatory processes, that may be involved in the self-modeling and performance relationship. Researchers should also compare the effectiveness of PSR self-modeling with other forms of modeling and self-modeling, as well as other forms of videotape feedback, such as self-observation and the use of split-screen viewing techniques.

Coaches, psychologists, and other professionals working with athletes in the field should be cautious when introducing self-modeling as a performance enhancement and skill acquisition technique. Self-modeling may not be effective with all sport skills and should be individualized to each athlete's needs, desires, and intents for employing this technique. Considering the wide-spread use of videotape feedback in sport and advances in technology, research in this area may benefit both researchers studying modeling and professionals aiming to help their athletes excel in sport. Clearly, more research is needed to clarify these issues before guidelines can be established to help practitioners maximize the use of self-modeling in their athletes' training programs.

PART FOUR: CONTRIBUTION OF COLLABORATORS

CONTRIBUTION OF COLLABORATORS

For my master's thesis research, I decided to investigate the use of self-modeling to enhance motor learning. This was an area of research that my advisor, Dr. Diane Ste-Marie, was actively exploring. Through discussions with Dr. Ste-Marie and the other students in her laboratory and after reading the modeling and self-modeling literature, we developed our research question and the methodology for this study. I then wrote the draft of my thesis proposal, which was edited by Dr. Ste-Marie. We continued this process until we felt that it was ready to submit for my proposal defense.

Based on suggestions made by my committee members, Dr. Michelle Fortier and Dr. Yves Lajoie, several changes were made to the methodology. Specifically, a separate control group was added to control for any possible transfer effects of the self-modeling intervention from the self-modeling condition to the control condition for the within-participant treatment group. As well, the Motivation to Skate scale was added to assess skaters' initial levels of motivation towards learning the specific skating jumps selected for the study and to determine whether their motivation level moderated the effects of the intervention on jump performance. Finally, a jump practice log was added to gather information on the amount of practice time the skaters dedicated to each of the jumps selected for the study.

I was responsible for contacting numerous skating clubs and coaches in the area and for distributing the information and consent forms to them. As well, I videotaped all of the sessions, collected the questionnaires, and created the self-modeling videotapes for each skater. I also scored all of the videotape footage, and performed the test-retest reliability scoring. Andrea Cooper, another graduate student in our lab and a former competitive figure skater, scored a portion of the videotape footage so that we could establish inter-rater reliability for the performance scales.

As well, I completed all of the data entry. The statistical analysis was decided upon through consultation with Dr. Ste-Marie, Dr. Fortier, Dr. Lajoie, Dr. Blanchard, and members of our laboratory group. Once the data analysis was completed, I wrote the draft of the thesis article, the remaining sections of the thesis, and made revisions to the chapters from the thesis proposal. As with the proposal document, Dr. Ste-Marie edited the drafts until we decided that it was ready to submit for the thesis defense.

PART FIVE: REFERENCES AND APPENDICES

REFERENCES

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavior change. *Psychological Review, 84(2),* 191-215.

Carroll, W.R. & Bandura, A. (1990). Representational guidance of action production in observational learning: A causal analysis. *Journal of Motor Behavior, 22(1),* 85-97.

Clare, S.K., Jenson, W.R., Kehle, T.J. & Bray, M.A. (2000). Self-modeling as a treatment for increasing on-task behavior. *Psychology in the Schools, 37(6),* 517-522.

Clark, S.E. & Ste-Marie, D.M. (2002). Peer mastery versus peer coping models: Model type has differential effects on psychological and physical performance measures. *Journal of Human Movement Studies, 43,* 179-196.

Clark, S.E., Tremblay, F. & Ste-Marie, D.M. (2004). Differential modulation of corticospinal excitability during observation, mental imagery and imitation of hand actions. *Neuropsychologia, 42(1),* 105-112.

Craft, L.L., Magyar, T.M., Becker, B.J., & Feltz, D.L. (2003). The relationship between the Competitive State Anxiety Inventory-2 and sport performance: A meta-analysis. *Journal of Sport and Exercise Psychology, 25(1),* 44-65.

Cumming, J., Clark, S.E., Ste-Marie, D.M., McCullagh, P. & Hall, C. (in press). The development of the functions of observational learning questionnaire. *Psychology of Sport and Exercise.*

Dowrick, P.W. (1979). Single dose medication to create a self model film. *Child Behavior Therapy, 1(2),* 193-198.

Garza, D.L. & Feltz, D.L. (1998). Effects of selected mental practice on performance, self-efficacy, and competition confidence of figure skaters. *The Sport Psychologist, 12,* 1-15.

Hebert, E.P. & Landin, D. (1994). Effects of a learning model and augmented feedback in tennis skill acquisition. *Research Quarterly for Exercise and Sport, 65,* 250-257.

Hosford, R.E. (1980). Self-as-a-model: A cognitive social learning technique. *The Counseling Psychologist, 9(1),* 45-62.

Jones, G. & Hanton, S. (2001). Pre-competitive feeling states and directional anxiety interpretations. *Journal of Sport Sciences, 19,* 385-395.

Marteniuk, R.G. (1976). *Information processing in motor skills.* New York: Holt, Rinehart & Winston.

Martin, K.A., Moritz, S.E. & Hall, C.R. (1999). Imagery use in sport: A literature review and applied model. *The Sport Psychologist, 13,* 245-268.

McCullagh, P. & Meyer, K.N. (1997). Learning versus correct models: Influence of model type on the learning of a free-weight squat lift. *Research Quarterly for Exercise and Sport, 68(1),* 56-61.

Meharg, S.S. & Woltersdorf, M.A. (1990). Therapeutic use of videotape self-modeling: A review. *Advances in Behavior Research and Therapy, 12,* 85-99.

Munroe, K.J., Giacobbi, P.R., Jr., Hall, C. & Weinberg, R. (2000). The four w's of imagery use: Where, when, why, and what. *The Sport Psychologist, 14,* 119-137.

Owusu-Bempah, J. & Howitt, D.L. (1983). Self-modeling and weight control. *British Journal of Medical Psychology, 56(2),* 157-165.

Petroski, R.A., Craighead, L.W. & Horan, J.J. (1983). Separate and combined effects of behavioral rehearsal and self-other modeling variations on the grooming skill acquisition of mentally retarded women. *Journal of Counseling Psychology, 30(2),* 279-282.

Rogers, W., Hall, C. & Buckolz, E. (1991). The effect of an imagery training program on imagery ability, imagery use, and figure skating performance. *Journal of Applied Sport Psychology, 3,* 109-125.

Schunk, D.H. & Hanson, A.R. (1989). Self-modeling and children's cognitive skill learning. *Journal of Educational Psychology, 81(2),* 155-163.

Scraba, P.J. (1989). Self-modeling for teaching swimming to persons with physical disabilities. *Dissertation Abstracts International, 50-09(A),* 2830.

Spielberger, C.D. (1972). Anxiety as an emotional state. In C.D. Spielberger (Ed.), *Anxiety: Current trends in theory and research* (volume 1, pp.24-49). New York: Academic Press.

Ste-Marie, D.M. (2000). Motor learning through observation: Contributions of attention and retention processes. *Journal of Human Movement Studies, 38,* 323-349.

Ste-Marie, D.M., Clark, S.E. & Latimer, A.E. (2002). Contributions of attention and retention processes in observational learning of a motor skill by children. *Journal of Human Movement Studies, 42,* 317-333.

Vallerand, R.J. & Reid, G. (1984). On the causal effects of perceived competence on intrinsic motivation: A test of cognitive evaluation theory. *Journal of Sport Psychology, 6,* 94-102.

Vallerand, R.J. & Reid, G. (1988). On the relative effects of positive and negative verbal feedback on males' and females' intrinsic motivation. *Canadian Journal of Behavioral Sciences, 20(3),* 239-250.

Vallerand, R.J. & Thill, E.E. (1993). Introduction au concept de motivation [Introduction to the concept of motivation]. In R.J. Vallerand & E.E. Thill (Eds.), *Introduction à la psychologie de la motivation* [Introduction to the psychology of motivation] (pp.3-39). Laval, Canada: Éditions Études Vivantes.

Vealey, R.S. (1986). Conceptualization of sport-confidence and competitive orientation: Preliminary investigation and instrument development. *Journal of Sport Psychology, 8,* 221-246.

Weiss, M.R., McCullagh, P., Smith, A.L. & Berlant, A.R. (1998). Observational learning and the fearful child: Influence of peer models on swimming skill performance and psychological responses. *Research Quarterly for Exercise and Sport, 69(4),* 380-394.

Woodman, T. & Hardy, L. (2001). Stress and anxiety. In R.N. Singer, H.A. Hausenblas & C.M. Janelle (Eds.), *Handbook of Sport Psychology* (2nd ed., pp.290-318). Toronto, Canada: Wiley & Sons.

APPENDIXES

APPENDIX A

SELF-EFFICACY QUESTIONNAIRE

DIRECTIONS: For each of the jump elements listed below, please indicate *how confident you are in your ability to perform each one correctly.*

	Cannot do				Moderately certain I can do						Certain I can do
1. Name of jump: ________________	0	1	2	3	4	5	6	7	8	9	10
2. Name of jump: ________________	0	1	2	3	4	5	6	7	8	9	10

APPENDIX B

SELF-EVALUATION QUESTIONNAIRE

DIRECTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then circle the number to the right of the statement that indicates how you *feel* right now, that is, *at this moment*. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

How do you feel *right now* about practicing your ____________________ jump?	Not at all	Somewhat	Moderately So	Very Much So
1. I feel calm.	1	2	3	4
2. I feel secure.	1	2	3	4
3. I am tense.	1	2	3	4
4. I am regretful.	1	2	3	4
5. I feel at ease.	1	2	3	4
6. I feel upset.	1	2	3	4
7. I am presently worrying over possible misfortunes.	1	2	3	4
8. I feel rested.	1	2	3	4
9. I feel anxious.	1	2	3	4
10. I feel comfortable.	1	2	3	4
11. I feel self-confident.	1	2	3	4
12. I feel nervous.	1	2	3	4
13. I am jittery.	1	2	3	4
14. I feel "high strung".	1	2	3	4
15. I am relaxed.	1	2	3	4
16. I feel content.	1	2	3	4
17. I am worried.	1	2	3	4
18. I feel over-excited and "rattled".	1	2	3	4
19. I feel joyful.	1	2	3	4
20. I feel pleasant.	1	2	3	4

APPENDIX C

THE SITUATIONAL MOTIVATION SCALE (SIMS)

DIRECTIONS: Read each item carefully. Using the scale below, please circle the number that best describes the reason why you are currently engaged in this activity.

Why are you currently practicing your ________________________ jump?	Not at All	A Very Little	A Little	Moderately	Enough	A Lot	Exactly
1. Because I think that this activity is interesting.	1	2	3	4	5	6	7
2. Because I am doing it for my own good.	1	2	3	4	5	6	7
3. Because I am supposed to do it.	1	2	3	4	5	6	7
4. There may be good reasons to do this activity, but personally I don't see any.	1	2	3	4	5	6	7
5. Because I think this activity is pleasant.	1	2	3	4	5	6	7
6. Because I think that this activity is good for me.	1	2	3	4	5	6	7
7. Because it is something I have to do.	1	2	3	4	5	6	7
8. I do this activity but I am not sure if it is worth it.	1	2	3	4	5	6	7
9. Because this activity is fun.	1	2	3	4	5	6	7
10. By personal decision.	1	2	3	4	5	6	7
11. Because I don't have any choice.	1	2	3	4	5	6	7
12. I don't know; I don't see what this activity brings me.	1	2	3	4	5	6	7
13. Because I feel good when I do this activity.	1	2	3	4	5	6	7
14. Because I believe that this activity is important for me.	1	2	3	4	5	6	7
15. Because I feel that I have to do it.	1	2	3	4	5	6	7
16. I do this activity, but I am not sure it is a good thing to pursue it.	1	2	3	4	5	6	7

APPENDIX D

MOTIVATION TO SKATE

DIRECTIONS: For each of the jump elements listed below, please indicate *how motivated you are to perform each one.*

3. Name of jump: ________________ 0 10 20 30 40 50 60 70 80 90 100

4. Name of jump: ________________ 0 10 20 30 40 50 60 70 80 90 100

APPENDIX E

PERFORMANCE RATING SCALES

Video No.: ______________________________

Jump: __________________________________

INSTRUCTIONS: check the box that best describes the jump performance.

PERFORMANCE OUTCOME

Day 1	**Day 2**	**Day 3**	**Day 4**	**Score**	**Error**
				0	Did not attempt/popped
				1	Fall on take-off
				2	Fall on landing
				3	Less than required *revol'n* (single versus double)
				4	Less than required *rotat'n* (cheat) > ¼ *revol'n*
				5	Wrong edge/cheat take-off
				6	Less than required *rotat'n* (cheat) < ¼ *revol'n*
				7	2 foot take-off/landing
				8	Step out on landing
				9	Hand/foot touch-down on landing
				10	No error/clean

Outcome Score: _____________

PERFORMANCE FORM

Day 1	Day 2	Day 3	Day 4	Score	Error
				0	Did not attempt
				1	No speed: stopped before/after jump Very poor technique No flow
				2	No crossed ankles OR major wrap (above knee) No weight transfer No upper body control
				3	Minor wrap (below knee) Weight transfer ok Min. speed (skid take-off)
				4	Speed ok Flow in ok, poor flow out Swingy landing Poor upper body control
				5	Min. speed Min. flow Min. height Min. technique
				6	Adequate/average speed Good height OR good distance Air position ok Less flow on landing than take-off Min. control on landing (major struggle)
				7	Adequate speed Good height OR good distance Air position ok Adequate control of landing (some struggle)
				8	Adequate speed Good height AND distance Air position ok Controlled landing Lacking flow out of jump
				9	Good speed Excellent height and distance Air position ok Controlled landing Adequate flow in and out of jump
				10	Excellent speed Excellent height AND distance Excellent technique Total control of landing Excellent flow in and out (match) of jump

Form Score: ________________

APPENDIX F

JUMP PRACTICE LOG

Skater: ____________________________

For each jump listed below, please indicate how many times you attempted the jump AND the outcome of each attempt. Please do this for *at least* 3 sessions/week (one session on Monday, Wednesday & Friday) for each week you are involved in the study. If you want to fill it out for more sessions, please feel free to. At the end of the study, we will give you a summary of the information from your practice logs to show you how often you usually practice each jump, and statistics on your performance of those jumps. The more sessions you complete the practice logs for, the more accurate the information in your summary will be. Thanks for your cooperation!

Date:	**Jump:**				**Jump:**			
	Attempt	**Land**	**Cheat**	**Fall**	**Attempt**	**Land**	**Cheat**	**Fall**

APPENDIX G

ETHICS COMMITTEE APPROVAL

HEALTH SCIENCES AND SCIENCE RESEARCH ETHICS BOARD

CERTIFICATION OF ETHICS APPROVAL

This is to certify that the University of Ottawa Health Sciences and Science Research Ethics Board (REB) examined the application for extension of ethics approval for the research project **Can self-modeling improve competitive performance? (File H 06-01-01)** submitted by Mrs. Diane Ste-Marie of the School of Human Kinetics. This project received initial ethics approval in July 2001 by the REB as meeting appropriate ethical standards set out in the Tri-Council Policy Statement and in the Procedures of the University of Ottawa Research Ethics Boards. The University of Ottawa REB members accordingly gave it an extension of ethics approval. This ethics renewal certification is valid for one year from the date indicated below.

____
Andrée Bertrand
Protocol officer for ethics in research
For Daniel Lagarec,
Chair, Health Sciences and Science REB

February 26th, 2003
Date

destroyed. My son/daughter's anonymity will be guaranteed by assigning him/her a participant number rather than using his/her name. As well, all data will be published only in group format. This means that my son/daughter's identity will be completely concealed, and at no point will he/she be identified as a participant.

I understand that since this activity deals with performance factors, my son/daughter may feel some psychological discomfort that is typical of being videotaped performing in front of others. I have received assurance from the researchers that every effort will be made to minimize any discomfort. If at any time, my son/daughter, his/her coach, or myself would like to end his/her participation in the study, I have been assured by the researcher that we may discontinue our participation.

Any information requests or complaints about the ethical conduct of the project may be addressed to the relevant University Research Ethics Board for Health Sciences, or by calling the Protocol Officer for Ethics in Research, 550 Cumberland St., Room 160, 562-5387 or ethics@uottawa.ca. Also, I may keep this copy of the consent form in case I have any further questions or concerns.

-----------------------Please detach and return this portion to researcher-----------------------

Researcher's signature: ________________________ Date: ________________

Parent's signature: ____________________________ Date: ________________

Please indicate the freeskate sessions that your son/daughter is registered for.

Day	Session/Time

APPENDIX I

GENERAL INFORMATION QUESTIONNAIRE

SKATER INFORMATION

Skater ID Number: ______________________ Date: ________________

Sex: Male Female

Birthdate: _____________________

Last Free Skate test passed: ____________________________

Jumps I am currently learning (that I can land sometimes but not all the time):

____

TRAINING INFORMATION

Do you use imagery in your training routine? Yes No

If so, when (practice, competition)? ___________________________________

Do you use video in your training routine? Yes No

If so, when (practice, competition)? ___________________________________

If so, what do you use it for? (Circle all that apply)

a) To learn new skills

b) To rehearse my program

c) To review practice and/or competition performances

d) Other: ______________________________

Do you use other mental training tools in your training routine? Yes No

If so, which ones? (Circle all that apply)

a) Goal setting

b) Relaxation techniques

c) Cue words

d) Other: ___________________________________

What techniques do you (and your coach) use to learn new skills? (Circle all that apply)

a) Verbal explanation

b) Physical practice

c) Watching others

d) Jump Harness

e) Off-ice practice

f) Other: ______________________________

APPENDIX J

FOLLOW-UP QUESTIONNAIRE

Do you think that the self-modeling intervention helped you to improve your skill level for the jumps selected? Yes No

If so, how did it help you?

Did watching the self-modeling tapes interfere with your training routine?

Yes No

Would you consider using self-modeling tapes as a regular part of your training?

Yes No

If so, what aspects of your training would you use it for?

a) Technical aspects (e.g. jumps, spins, footwork)

b) Artistic/choreography

c) Whole program

d) Relaxation/arousal

e) Confidence/motivation

f) Other: ______________________________

Would you use self-modeling as part of your competition routine? Yes No

Did you enjoy participating in this intervention? Yes No

Why or why not?

What suggestions would you make to improve this intervention?

TABLES

Table 3

Mean psychological questionnaire scores of skaters in control group

	Self-efficacy		State anxiety		Motivation to skate		Motivation (SIMS)		Intrinsic motivation	
Session	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Pretest	5.21	1.6	43.07	11.10	63.57	14.06	36.14	15.51	19.71	4.3
Mid-intervention	5.79	1.47	37.14	7.93	76.43	16.26	41	17.6	21.86	3.35
Final intervention	5.5	1.5	37.43	8.56	71.43	15.2	41.57	17.36	20.14	4.81
Retention	5.79	2.14	38.07	9.95	72.86	17.29	41.86	16.77	20.64	3.94

Table 4

Mean performance scores of skaters in control group

	Outcome		Form	
Session	*M*	*SD*	*M*	*SD*
Pretest	3.82	1.46	5.57	.69
Mid-intervention	4.32	1.31	5.32	1.16
Final intervention	4.32	2	5.75	.71
Posttest	4.32	1.82	5.61	.54

Table 5

Mean motivation scores of skaters in self-modeling group

	Motivation to skate		Intrinsic motivation subscale	
Condition	*M*	*SD*	*M*	*SD*
	Pretest			
Self-modeling	82.5	14.22	19.67	4.94
Control	87.5	12.88	20.42	5.3
	Mid-intervention session			
Self-modeling	81.67	14.67	19.67	5.35
Control	80.83	23.53	21.42	4.83
	Final intervention session			
Self-modeling	84.17	7.93	19.92	5.62
Control	85.83	9	21.75	3.93
	Retention			
Self-modeling	85.83	10.84	21.58	4.06
Control	85	15.08	21.17	4.13