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SELF-MODELING AND COMPETITIVE DIVING PERFORMANCE

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Abstract

The aim of this experiment was to investigate whether a self-modeling intervention could enhance competitive diving performance along with psychological mechanisms, such as self-efficacy, self-talk, and mental readiness. Eight participants (*M* age =12.6) competed at two competitions where one of their dives received the self-modeling video while the other acted as a control. At each competition, measures associated with the participants' self-efficacy, self-talk, mental readiness, and diving performance were collected. In addition, the participants responded to four questions relating to their thoughts and feelings of the self-modeling video intervention. Separate analyses of variance were conducted on all dependent measures. The results revealed no significant difference for all dependent measures between the self-modeling and control dive. This indicates that the self-modeling video failed to enhance competitive diving performance, and did not have an effect self-efficacy, self-talk, and mental readiness. Furthermore, imagery ability was measured to determine whether it acted as a possible moderating variable. However, this was not found to be a moderating variable between the self-modeling video and performance. Possible explanations for the lack of significant results with the quantitative data are forwarded. A deductive analysis of the participants' transcripts was conducted where Zimmerman's (1989, 2000) self-regulation framework was adopted. Discussion of the qualitative data will focus on the participants' use of the self-modeling video with respect to self-regulatory processes.

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Chapter 1: Introduction

It has been well documented that athletes and coaches incorporate sport psychology interventions as a means to enhance competitive performance. Studies have shown that mental practice can be an effective means for enhancing physical performance (Feltz & Landers, 1983; Mamassis & Doganis, 2004; Rogerson & Hrycaiko, 2002). While there has been much research incorporating interventions such as imagery, goal setting, and relaxation to improve competitive sport performance, the use of modeling is less popular as an intervention in the sport environment. Modeling has been defined as a process where a learner observes a model demonstrating a behavior and later the observer attempts that behavior (Bandura, 1986; 1997). Bandura (1986) describes modeling as "one of the most powerful means of transmitting values, attitudes and patterns of thought and behavior" (p.47). It is our hypothesis that modeling may be a useful competitive performance enhancement technique. More specifically, self-modeling, a specific form of modeling, may be effective for competitive performance enhancement.

Self-modeling has been defined as "the behavioral change that results from the repeated observation of oneself on videotapes that show only desired target behaviors" (Dowrick, & Dove, 1980, p51). Self-modeling is further subdivided into two subcategories; positive self review and feedforward techniques. Positive self review is a technique used that "result[s] in images in adaptive behavior as fined tuned examples of the best the individual has been able to produce thus far" (Dowrick, 1999, p25). Therefore, in a diving context, a positive self review video would illustrate the divers' best performance on a specific dive. The feedforward method described by Dowrick (1999) is a technique where the video is edited so that the "components are arranged in a new sequence or placed in a new context", (Dowrick, 1999, p25), and an image of a new, or enhanced, skill can be created. In this situation, the edited video could consist of clips sequenced together from different attempts at that dive in order to present the optimal performance. For example, after having videotaped a number of attempts of the dive, a self-modeling video could consist of attempt number one's take off, attempt number four's middle section of the dive, and attempt number two's entry into the water. The present experiment will use the feedforward method of self-modeling.

Self-observation, another self-as-a-model technique that can be contrasted with self-modeling, is a video that is not edited. In a self-observation situation, the diver would observe him or herself on video performing a dive that he/she is learning without the errors edited out. Therefore, the observer is viewing him or herself executing a skill the exact way he or she had performed it, including mistakes. The self-observation literature has shown it to be an effective intervention for skill acquisition (e.g.,Laguna, 1996). Studies have been conducted on the comparison of various modeling techniques (e.g., Clark & Ste-Marie, 2002; Clark & Ste-Marie, 2006; Starek & McCullagh, 1999). In Clark and Ste-Marie's (2006) study they compared a self-modeling group and a self-observation group. Results illustrated that the self-modeling group demonstrated superior swimming performance compared to both the self-observation and control group. For this reason, self-modeling will be the intervention technique used in this experiment.

Diving is one of many sports where physical and psychological components can have an effect on competition outcomes. Divers compete anywhere between 5-10 dives, depending on the level and type of competition in which they are involved. The use of video technology by coaches and practitioners with their athletes has been studied (e.g., Halliwell, 1990; Templin & Vernacchia, 1995), and the literature suggests that most of this research has been conducted for skill acquisition and not skill performance. This distinction between skill acquisition and skill performance is important to highlight. Skill acquisition is more concerned with the process of learning a skill, whereas performance is the observable behavior of a skill that has already been learned (Magill, 2001). In our context, the performance of the skill is at the competition itself and it is in the competitive environment of diving that we will test self-modeling as a competitive performance enhancement technique.

Dowrick (1999) reviewed over 150 research studies on self-modeling. Most of these studies, however, involved cognitive and classroom behavior skills. Only limited research has been done with motor skills. Moreover, the motor skill literature has focused on the benefits of self-modeling on skill acquisition (Dowrick & Dove, 1980; Ram & McCullagh, 2003; Starek & McCullagh, 1999), with only one study using a feedforward technique to improve competitive performance. This competitive setting was power lifting (Maile, 1985 as cited in Franks & Maile, 1991). A major limitation, however, was that the research was a single case study. As such, there was no control group and the data therefore can not be generalized. Maile, however, did have promising findings, and thus, further research is warranted on self-modeling and competitive performance enhancement.

Given this, the primary objective of this study is to investigate whether self-modeling can enhance competitive performance in a diving environment. The secondary aim of the study is to examine the potential underlying psychological mechanisms that influence this enhancement, such as self-efficacy, self-talk, and mental readiness.

Why is this research important? This can be addressed at two levels. First, at the practical level, if self-modeling can be established as an effective competitive performance enhancement technique, athletes will have one more tool to help lead them along the process of achieving their athletic dreams. At a theoretical level, the potential mechanisms for the benefits of self-modeling have not been studied extensively (Dowrick, 1999). Thus, including potential psychological mechanisms in this research will contribute to our understanding of why self-modeling may contribute to competitive performance enhancement.

Chapter 2: Literature Review

In the literature review, I will first review self-modeling research, then proceed into the theoretical background of modeling according to Bandura's Social Cognitive Theory and the role of self-efficacy. I will then describe the psychological variables involved in the self-modeling research. This will be followed by a literature review of imagery in competitive performance and its link to self-modeling. Finally, the specific psychological constructs relating to optimal performance that will be studied in this research will be reviewed.

Self-modeling research

Dowrick's (1999) recent review on self-modeling research showed that most of the research on self-modeling was completed in the teaching setting with disruptive students or school-related cognitive skills. Many studies provided evidence of behavioral change in the classroom setting. Kehle, Clark, Jenson and Wampold (1986), for example, performed a study using the self-modeling intervention on four students who were classified as disruptive and off-task behavioral students. Results showed that three of the four students decreased their disruptive and off-task behavior by a factor of four. Therefore, the students were averaging 47% of off-task behavior where it then decreased to approximately 11%. In addition, the fourth participant viewed an unedited video and increased his off-task behavior to 55%. Once shown his edited video, however, this participant increased his on-task behavior within the range of the others (Kahle, et al., 1986). Another study examined the effects of self-modeling on children with selective mutism (Dowrick & Hood, 1978, as cited in Dowrick, 1999). For this study the child's speech was first recorded while responding to questions from his/her mother. The video was then edited in the context of a new setting. Specifically, self-modeling videotapes were created so that the children would observe themselves speaking or answering a question in their classroom setting. Both children showed immediate and significant improvements in their classroom speaking. The above studies, however, had very small sample sizes, no control group, and were conducted on a classroom behavior, and thus may not transfer to motor skills.

Schunk and Hanson (1989) have also shown self-modeling benefits. In their research they examined the effects of a self-modeling video on children encountering mathematical difficulties. Three experiments were conducted, wherein all three results indicated that the self-modeling group demonstrated greater achievement outcomes in their mathematical skills than the control group (Schunk & Hanson, 1989).

Despite the abundance of research on self-modeling of these cognitive/behavioral skills a more limited number have been done with motor skills. One such study was conducted by Dowrick and Dove (1980) on swimming performance of children with spina bifida. A positive self-review video was used where evidence of distress in the water from the participant were removed. Results indicated that there were moderate gains in all three of the children's swimming performance. Also, the child who received the greatest amount of self-modeling interventions showed the most improvement over the sessions. Similarly, Dowrick and Raeburn (1995) conducted a study on rapid skill training for children with physical disabilities. They not only examined self-modeling but they also compared this to a videotaping only group (i.e. self-observation). In 14 of the 18 cases, the self-modeling intervention showed a significant increase in behaviors compared to the self-observation group. Similar self-modeling benefits were found for other studies using swimming skills (Clark & Ste-Marie, in press; Starek & McCullagh, 1999).

Based on this review, it is evident that self-modeling can be used as a means to enhance motor skill acquisition, however a gap in the literature exists with respect to self-modeling as a competitive performance enhancement technique. In Dowrick's review of over 150 self-modeling studies, very few were specific to competitive performance enhancement. Dowrick

(1999) gave an example of the application of a self-modeling video to enhance the technique of a gymnast landing a tumbling line. A self-modeling video was constructed illustrating the gymnast mastering the components of the tumbling line. After viewing the self-modeling video three times, the gymnasts performed her floor routine in practice and in competition successfully (Dowrick, 1999). However, this was only an example of the application of a self-modeling video with no empirical data collected. Another example was an interesting study by Maile. Maile used the self-modeling technique with a national level power lifter in a competitive situation (as cited in Franks & Maile, 1991). The self-modeling video consisted of two parts. The first part was of the lifter putting the desired amount of weight on the bar that would be needed to be successful in competition. The second part of the video consisted of the athlete completing the lift while exerting great effort, and only showed the lifter and the bar, without the weights being seen. This was important as the video had been edited to look as though the power lifter was lifting the weight that had been seen being placed on the bar, when in fact she was lifting a lighter weight. Therefore the video portrayed the lifter lifting the desired weight. The participant won her competition and improved her performance more than 10% within a year.

A major limitation with Maile's research, however, was that it was a single case study. As such, there was no control group and the data therefore can not be generalized. Obviously, there is a large gap in the literature concerning the possible benefits of self-modeling as a competitive performance enhancement technique. Further, Maile did not investigate why the self-modeling intervention generated the competitive performance gains. This gap in the literature is also a noted weakness with self-modeling research in general (Clark & Ste-Marie, in press; Dowrick, 1999; Starek & McCullagh 1999).

In the next section, I address the research that has attempted to investigate the potential underlying mechanisms for self-modeling benefits from the framework of motor skill acquisition, and later move into the issues related to competitive performance enhancement.

The Social Cognitive Theory

When researchers have attempted to address the benefits of self-modeling, the theoretical background adopted is typically Bandura's (1986) Social Cognitive Theory and the role of self-efficacy. The Social Cognitive Theory has received the most attention when attempting to show a relationship between modeling, psychological variables, and performance (Singer, Housenblas, & Janelle, 2001). This approach suggests that "overt action is not necessary for the acquisition of response, especially behaviors that are social or cognitive in nature" (Singer, et al., 2001, p205-206). An observer can learn a behavior that has not yet been acquired through the use of images or verbal representation. Bandura (1986) suggests that most behavior is learned through modeling and proposed that there is a relationship among three components; (1) the person, (2) the behavior, and (3) the environment. For example, the outside influences from the environment can influence the person's thoughts, attitudes, and beliefs, which in turn can influence the outcome of the behavior (see also Zimmerman, 1989; 2000).

Within the person component lies the important process of self-efficacy. Self-efficacy has been defined as the belief in one's capabilities to accomplish a specific skill (Bandura, 1997) and is one of the socio-cognitive determinants of behavior in Social Cognitive Theory. Bandura (1997) suggests that one's self-efficacy is an intervening influence of action, and efficacious beliefs can enhance or weaken an individuals' learning or performance. There are four information sources involved in self-efficacy: enactive mastery experiences, vicarious experiences, verbal persuasion, and affective and physiological states (Bandura, 1997). The most influential of these sources are enactive mastery and vicarious experiences. Bandura (1997) proposes that an enactive mastery experience is the most powerful source of efficacy information. Enactive mastery experiences clearly indicate the ability of the individual to successfully complete a task through the use of authentic evidence. One can then refer back to previous successful performances illustrating his or her competence in that situation.

Vicarious experiences allow an individual to compare their capabilities to a model. They can relate their ability in certain situations and compare it to the attainment of others in the similar situation (Bandura, 1997). Therefore, the individual observes someone performing an action, the result of that action is judged, and then it is related to the beliefs in his/her own capabilities. The influence of the vicarious experience on self-efficacy depends on the perceived similarity the observer has with the model. The more the observer perceives the model to be similar in personality and performance characteristics, the more influence the modeling will have on his/her behavior (Bandura, 1997).

Gould and Weiss (1981) examined model similarity on self-efficacy and muscular performance endurance. Female participants were divided into two groups. One group viewed a similar female model, while the other group viewed a male (dissimilar) model performing the task. Results indicated that the group that viewed the similar model held their legs up significantly longer than the group that viewed the dissimilar model. Gould and Weiss (1981) also found a significant correlation between self-efficacy and performance of the task. This result supports Bandura's idea that self-efficacy beliefs in one's capabilities can influence his or her performance and that model similarity is an important factor for successful modeling.

McCullagh (1987) also examined model similarity on the outcome and form scores of climbing a ladder. The results indicated that those who perceived the model to be similar performed better than those who perceived the model to be dissimilar (McCullagh, 1987). Shunk, Hanson, and Cox (1987) also showed that the more similar the model was perceived to be, the greater the increase in self-efficacy and mathematical performance. These studies suggest that model similarity can influence skill acquisition and behavioral activities, but again these studies were either done on skill acquisition or cognitive behavior and not competitive performance enhancement.

Considering the importance of these two sources of information, it can be easily argued that self-modeling should provide both enactive mastery experience and modeling similarity. Watching oneself on video performing the desired behavior will highlight mastery experiences because the video has edited out any undesired behavior. Since Bandura (1997) has indicated enactive mastery experience as the most powerful source of information for self-efficacy, self-modeling should serve as a means to influence self-efficacy, which in turn would possibly enhance subsequent performance. As illustrated earlier, model similarity can also influence the outcome of skill and self-efficacy. In self-modeling the individual is viewing him or herself on video. Therefore, self-modeling provides the most similar model, that being oneself, and should be a technique that increases self-efficacy and subsequently improves skill acquisition and performance. Although this argument logically follows from Bandura's theory, the data has been equivocal for this prediction, as will be evident in the next section.

Self-modeling Research Investigating Psychological Variables

As mentioned, the psychological variable the most studied is self-efficacy. For example, in Schunk and Hanson's (1989) investigation on self-modeling and children with mathematical difficulties, they were not only interested in the effects of a self-modeling video on learning a math skill but they were also interested in the children's beliefs in their abilities (self-efficacy). The results indicated that children in the self-modeling groups increased their self-efficacy beliefs significantly more so than those not receiving self-modeling.

Self-efficacy has also been studied in conjunction with self-modeling in the motor skill literature. For example, a study conducted by Ram and McCullagh (2003) examined performance and psychological responses through the use of a self-modeling intervention. It was hypothesized that self-modeling would increase self-efficacy and performance of intermediate volleyball players, however the results did not support their hypothesis. Similar results were found with figure skaters (Law & Ste-Marie, 2005), and gymnasts (Winfrey & Weeks, 1993) when self-modeling interventions were conducted with these athletes; self-efficacy, nor physical performance, improved for either study. The three experiments above looked at intermediate level athletes while using positive self-review videos and not the feedforward technique. Therefore, it is possible that the videos were showing mistakes in the skills. Also, the research above investigated the process of learning a skill and not competitive performance enhancement.

Starek and McCullagh (1999) also conducted a self-modeling study on adult swimmers wherein, in addition to swimming performance, self-efficacy was examined. Participants were divided into either a self model or a peer model group. The results indicated that there was a significant difference between the modeling conditions. Specifically, the self-modeling group's swimming was better than the peer modeling group by the last session. No significant differences, however, were found for self-efficacy between the two modeling conditions.

Despite these negative findings, other research has shown self-efficacy to increase when learning motor skills with a self-modeling intervention. Clark and Ste-Marie (in press), for example, are one of few who have shown that children who received self-modeling increased their self-efficacy more than self-observation and control groups. Interestingly, Clark and Ste-Marie's research is the one of the few studies to date that have adopted a more complete theoretical framework for the study of self-modeling (see also Kitsantas & Zimmerman, 1998). More specifically, they used Zimmerman's theory of self-regulated learning.

Self-regulation refers to "self-generated thoughts, feelings, and actions that are planned and critically adapted to the attainment of personal goals" (Zimmerman, 2000, p.14). Zimmerman's theory lies within Bandura's social cognitive perspective, specifically inside the person component. In this component there are three cyclical phases, referred to as forethought, performance control, and self-reflection (Zimmerman, 2000). Clark (2005) proposed that applying a self-modeling intervention would increase a learner's self-regulating processes compared to a self-observation intervention and control. More specifically, viewing a self-modeling video would influence the forethought phase by influencing self-efficacy, goal setting, and motivation. The forethought phase would then influence the physical behavior. Goal setting, for example, was thought to influence how the learner regulates because it is a measurement of how the learner progresses. Clark also proposed that viewing the self-modeling video would increase self-satisfaction due to one positively reflecting on his/her performance in the video. Results illustrated that the self-modeling group had significantly greater performance scores, increased self-efficacy, more intrinsic motivation, and greater self-satisfaction in the retention phase. Therefore, viewing oneself on video performing to the best of one's ability modified a number of self-regulatory processes, including self-efficacy.

In sum, self-modeling has been repeatedly shown to enhance motor skill acquisition, but only sparse investigation has been conducted on its possible benefits for competitive performance enhancement. In addition, self-efficacy has been touted as a possible mechanism for the benefits of self-modeling, but has received only limited support to date. The rationale for its possible contributions to motor performance enhancement is strong though, and thus it will be included as a measure in this investigation. Although other self-regulatory processes were evidenced in Clark's research with children's swimming performance, it is thought that it would be better to investigate possible mechanisms tied more with competitive performance enhancement techniques. With such limited research on self-modeling and motor performance, however, the closest literature to review that would serve to support the prediction that self-modeling could be a competitive performance enhancement technique was considered to be imagery.

Why imagery? It can easily be argued that self-modeling is much like imagery. Imagery has been defined as "an experience that mimics real experience. We can be aware of 'seeing' an image, feeling movements as an image, or experiencing an image of smell, taste, or sounds without actually experiencing the real thing" (White & Hardy, 1998, p.389). Basically, the only striking difference between imagery and self-modeling is that imagery lacks the external stimulus that is provided by the "observation of oneself on videotapes that show only desired target behaviors" (Dowrick & Dove, 1980, p.51).

Moreover, modeling, also referred to as observational learning, has been found to have similar functions as that of imagery. Paivio's (1985) original framework for determining when and why imagery was used consisted of a cognitive specific (CS), cognitive general (CG), motivational specific (MS), and motivational general (MG) function of imagery. Hall, Mack, Paivio, and Housenblas (1998), however, added two subcategories onto the motivational general category of imagery, demonstrating that both motivational general-arousal (MGA) and motivational general-mastery (MGM) functions also exist. Cummings, Clark, Ste-Marie, McCullagh, and Hall (2005) developed the Functions of Observational Learning Questionnaire and found that, similar to imagery, observational learning is also used for both cognitive and motivational functions of performance. Taken together, these two arguments support the idea that imagery research can be used to support predictions concerning the potential effectiveness of self-modeling as a competitive performance enhancement technique. For this reason, relevant aspects of the imagery literature are reviewed next.

Imagery Research

Many athletes report using imagery as a tool to learn skills or improve performance (White & Hardy, 1998). There is ample evidence to show that imagery is used as a competitive performance enhancement technique (see Hall, 2001, for a review). Thus, unlike self-modeling, imagery has been much studied in the competitive environment (Hall, Rogers, & Barr, 1990; Munroe, Hall, & Simms, 1988; Vadocz, Hall, & Maritz, 1997). For example, when surveyed, it was found that athletes indicated using more imagery in conjunction with competition than in practice (Hall et al., 1990). Also, research by Orlick and Partington (1988) found that 99% of Canadian Olympic gymnasts report using mental imagery before the 1984 Olympics, and that the gymnasts found it to be very beneficial in facilitating sport performance. Other research with gymnasts and canoeists (White & Hardy, 1998), elite roller skaters (Vadocz et al., 1997), and elite ballet dancers (Fish, Hall, & Cumming, 2004) have all shown imagery to be a tool used by these athletes to enhance competitive performance.

Imagery and self-modeling have also been studied in conjunction with one another. For example, Ram, McCullagh, and Skaling (2004), compared a modeling, imagery, and combination intervention with weight trainers. Their results showed that after the first intervention the modeling group demonstrated a major increase in performance compared to the imagery and combination groups (Ram et al. 2004). Also, Soohoo, Tackemoto, and McCullagh's (2004) findings suggest that a modeling condition, compared to an imagery condition, was preferred by participants performing a squat lift.

These positive results for imagery in competitive situations, suggest that self-modeling can be a useful tool for competitive athletes as well. In fact, self-modeling could be an even better intervention than imagery for those athletes who are not able to control or create vivid images. There are two factors that can be used to support this notion, both relating to imagery content. The first is related to whether the image is positive or negative, and the second is related to the ability to create a vivid image. With regard to positive and negative imagery, studies have shown that the use of negative imagery can be detrimental to athletic performance (Powell, 1973; Woolfolk, Parrish, & Murphy, 1985). For example, Woolfolk and colleagues (1985) compared a positive imagery, negative imagery and a control group in a golf putting task. Results indicated that the positive imagery group improved significantly while the negative imagery produced significant declines in performance (Woolfolk et al., 1985). In self-modeling, however, the observer views his/her own performance completed successfully. Therefore, a self-modeling video would not involve negative images; only the positive aspects of the performance would be seen, thus yielding similar performance benefits as that seen with positive imagery.

For the factor of imagery ability and vividness, research has shown that these are key factors involved with imagery benefits. Isaac (1992) examined the influence of image vividness on trampoline performance. Participants were divided into an imagery group and a control group. The Vividness of Movement Imagery Questionnaire (VMIQ) was used as a measure of the participant's image vividness. Results revealed that the imagery group performed better than the control group, but those who scored high on vividness improved significantly higher than those who scored low on vividness (Isaac, 1992). These results illustrate an athlete's vividness of their imagery can significantly affect the benefits of imagery.

Similarly, imagery ability may also affect whether imagery enhances competitive performance. For example, Goss, Hall, Buckolz, and Fishburne (1986) administered the Movement Imagery Questionnaire (MIQ) to a group of athletic students belonging to a summer sports program in order to distinguish between three imagery ability groups. They demonstrated that those who were good in both visual and kinesthetic image ability took the least number of trials when learning a motor skill. Therefore, those high in visual and kinesthetic imagery ability performed better than those low in visual and kinesthetic imagery ability. Self-modeling, however, would not require these two factors associated with imagery effectiveness. The benefit of self-modeling is that the external stimulus is provided, so the person does not have to generate the image, let alone make it vivid. The video is the image that will yield the competitive performance enhancement benefits.

In the experimental design, I have introduced two imagery measures to capture whether a person's imagery ability and/or vividness impacts on the effectiveness of the self-modeling intervention. There are two possible scenarios that may follow from this added analysis. First, if an individual has mastered the ability to image then he/she is likely able to gain benefits from his/her own use of imagery before competition, thus, they may not yield benefits from the self-modeling video. Those, however, who are not good imagers and are not able to effectively create a vivid image, the self-modeling video could provide benefits.

Alternatively, perhaps it is those who are good imagers that would benefit the most. A self-modeling video may provide additional information to good imagers and in doing so enhancing their benefits from the video. Thus, those who are not good imagers may not benefit from the video at all. Therefore, each participant's image ability and vividness were measured to see if these were variables that would influence the effectiveness of the self-modeling intervention.

As indicated by Martin, Moritz, and Hall (1999), most research has measured imagery ability through the use of the Movement Imagery Questionnaire-Revised (MIQ-R; Hall & Martin, 1997) and imagery vividness with the Vividness of Movement Imagery Questionnaire (VMIQ; Isaac, Marks, & Russell, 1986). Both of these tools have been shown to be reliable and valid measures (Hall & Martin, 1997; Isaac et al., 1986). Therefore, these two instruments will be used to measure the participants' ability and vividness of imagery in order to determine whether imagery ability acts as a moderating variable.

Psychological Constructs Relating to Optimal Performance

As previously identified, a noted gap in the self-modeling literature is the lack of explanatory variables for its benefits. A secondary objective of this research, therefore, is to identify possible psychological variables, in addition to self-efficacy, that may explain any performance benefits observed for self-modeling. After reviewing the literature concerning optimal performance in competitive situations, Thomas, Murphy, and Hardy (1999) determined that many constructs relate to the competitive environment. Self-talk, emotional control (i.e., anxiety/arousal issues), goal-setting, imagery, negative thinking, and relaxation are strategies used in a competition setting (Thomas et al., 1999). Two psychological variables were chosen from these many factors, specifically anxiety/arousal levels that lead to mental readiness, and self-talk. In the next sections, the rationale for the inclusion of these constructs as measures in this research is provided.

Self Talk. Hackfort and Schwenkmezger (1993) defined self-talk as a "dialogue [in which] the individual interprets feelings and perceptions, regulates and changes evaluations and convictions, and gives him/herself instructions and reinforcement" (p.355). Sports psychologists have suggested that positive self-talk, or affirmation statements, is a strategy that should be used in competition (Cox, 2002). In a study conducted to assess performance strategies in the development and validation of a measure of athletes' psychological skills, eight factors were loaded into a factor analysis to ascertain their importance for a competition setting (Thomas et al., 1999). The factor that had the highest weighting was self-talk, suggesting that this is an important factor for competitive performance. Rushall (1984) proposed that self-talk used in competition should be task specific, utilize mood words, and more importantly, it should be positive.

Studies have shown that positive self-talk can be associated with good performance (e.g. Mahoney & Avener, 1977) and that negative self-talk can be associated with poor performance (e.g. Van Raalte, Brewer, Rivera, & Petipas, 1994). Also, Moran (1996) suggests that positive self-talk is a form of praise in which helps the individual focus on the present and not on past errors, whereas, negative self-talk is a form of criticism (Moran, 1996). It is also said that negative self-talk hinders performance because it is "inappropriate, irrational, counterproductive, or anxiety producing" (Theodorakis, Weinberg, Natsis, Douma, & Kazakas, 2000). Self-talk is often studied in combination with other psychological constructs as a means to either increase or change behavior. Rogerson and Hrycaiko (2002), for example, examined the effectiveness of relaxation centering and self-talk on save percentages of goaltenders (number of shots saved, divided by the number of shots scored, and multiplied by 100). The results showed that, immediately after the intervention was administered, the participants increased the save percentages in the game setting. Also a study conducted by Cumming, Nordin, Horton, and Reynolds (2006), combined self-talk with an imagery intervention. The findings showed that facilitative imagery in combination with facilitative self-talk increased dart throwing performance and debilitative imagery with debilitative self-talk actually worsened dart throwing performance (Cumming et al., 2006)

If self-talk has been effective in improving performance, it can be argued that an intervention that increases positive self-talk and lowers negative self-talk would be useful. It is our belief that a self-modeling video of an athlete performing a dive flawlessly will do this (i.e. facilitative image); specifically it will increase their use of positive self-talk and lower negative self-talk. Moreover, Zinsser, Bunker, and Williams (1998) suggest that self-talk is an important key to self-confidence. A study exploring self-talk and other affective states support this thesis as it was found that that self-talk could be linked to self-confidence (Hardy, Hall, & Alexander, 2001). Singer et al. (2001) also underlined that confidence is a belief system in one's ability to be successful, and that self-talk is a representative of that belief system. In support of this idea, according to Bandura's (1986, 1997) Social Cognitive Theory, self-talk could be considered a source of self-efficacy since it represents a form of verbal persuasion (Hardy, 2006). As noted earlier, the self-modeling video is expected to increase one's self-efficacy by acting as a representation of one's beliefs system to successfully compete the dive. As a corollary then, one will verbally represent their self-efficacy through the use of positive self-talk. Thus, the self-modeling video is expected to increase participants' positive self-talk and lower negative self-talk by acting as a representation of their belief system in their ability to successfully complete their dive performance.

Mental Readiness. Moris, Davis, and Hutchings (1981) have defined both cognitive and somatic anxiety. They define cognitive anxiety as "negative expectations and cognitive concerns about oneself, the situation at hand, and potential consequences" (p.541). Further, Moris et al. defined somatic anxiety as "one's perceptions of the physiological-affective elements of the anxiety experience, that is, indications of automatic arousal and unpleasant feeling states such as nervousness and tension" (p.541). Anxiety/arousal and its relationship to performance has been examined in the competitive atmosphere (e.g.,Woodman, Albinson, & Hardy, 1997). When investigating the nature of the relationship between anxiety/arousal and performance, there are many models found in the literature. Yerkes and Dodson's (1908) inverted-U hypothesis, also known as the Yerkes-Dodson Law, Hanin's (1980, 1986) individual zone of optimal functioning (IZOF), and most currently accepted is Hardy and Fazey's (1987) cusp catastrophe model.

Proponents of the inverted-U hypothesis proposed an inverted-U relationship between performance and anxiety/arousal. Yerkes and Dodson's (1908) suggested that as arousal increases, performance will also increase up to an optimal level. If arousal passes that optimal level, however, performance will decrease. Klavora (1979) examined the inverted-U hypothesis with basketball players. The results supported the relationship between the inverted-U and performance in that, those under moderate levels of state anxiety performed the best, while those under very high or low levels of anxiety performed worse (Klavora, 1979). Also interesting, Lowe (1971) conducted a study on 11-12 year old baseball players and their batting performance (as cited in Zaichkowsky & Baltzell, 2001). The results showed that the best batting performance occurred with those who had moderate levels of state anxiety, referring to their immediate emotional state characterized by fear, tension or physiological arousal, and the worse batting performance was for those with either very high or very low state anxiety. Gould, Petlichkoff, Simons, and Vevera (1987) performed a study with pistol shooting where results indicated a significant inverted-U relationship between somatic anxiety and performance.

There have, however, been many criticisms with the inverted-U hypotheses. First, a number of studies have not found an inverted-u relationship between arousal and performance (e.g., Basler, Fisher, & Mumford, 1976). Second, the interpretations of the results become difficult because the word "arousal" and "anxiety" have been used interchangeably (Zaichkowsky & Baltzell, 2001). Third, and the largest criticism, is that arousal is not viewed as multidimensional, such that high or low levels of arousal can be associated with poor or optimal performance (Zaichkowsky & Baltzell, 2001). It has been suggested by Anderson (1990) that a refinement, such as 'zones', of the inverted-U hypothesis is needed, but that we should not abandon this hypothesis all together.

Hanin (1980, 1986) proposed that each person had his/her own individual zone of optimal functioning (IZOF), and that an individual will perform his/her best at his/her own optimal level of anxiety (as cited in Woodman & Hardy, 2001). The model is made up of two categories, an optimal zone and a nonoptimal zone (Kamata, Tenenbaum, & Hanin, 2002). If a person is in his/her optimal zone, the quality of the upcoming performance will be better than if the person is in a nonoptimal zone (Kamata et al., 2002). Hanin (1986) stated that an individual's zone can be derived from multiple measures of anxiety and performance, or recalling anxiety levels in past peak performances (as cited in Woodman & Hardy, 2001). Turner and Raglin (1991) found that track and field athletes who competed within their individual zone of optimal functioning did better than those who competed outside their individual zone. Also, Woodman and collegues (1997) found that participants who had their combined cognitive and somatic anxiety scores within their zone of optimal function performed better on a bowling task than those who were outside their optimal zones.

The shortcoming of many anxiety and performance models is the inability to fully explain the complex relationship within either a uni or two-dimensions. The catastrophe model of anxiety and performance, however, explains this relationship within three-dimensions. Such a model is proposed by Hardy and Fazey (1987). Their model is the most current model used when explaining the interaction between performance and anxiety components (cognitive anxiety and somatic anxiety) (Krane, 1992). This model suggests that the determining factor for whether performance will be positive or catastrophic is physiological arousal (i.e., somatic anxiety) (Hardy & Fazey, 1987, as cited in Woodman & Hardy, 2001). If one is under high levels of physiological arousal, his/her performance will become "catastrophic" (Woodman & Hardy, 2001).

To elaborate, cognitive anxiety is the splitting factor which determines if physiological arousal, which is the asymmetry factor, is smooth and small or catastrophic (Woodman & Hardy, 2001). Therefore, when cognitive anxiety is high, performance will benefit as long as physiological arousal is low, but if physiological arousal is also high performance will be detrimental. When cognitive anxiety is low, however, changes in physiological arousal will present performance in an inverted-U shape (Woodman & Hardy, 2001). A catastrophe in performance occurs when cognitive anxiety is high and physiological arousal rises to a certain point, after this point performance will suffer (Woodman & Hardy, 2001). This model also suggests that one's certain or optimal point, which distinguishes performance benefits and performance detriments, is different for each individual. In support of this, there have been recent debates over whether anxiety facilitates performance or debilitates performance. For example, Jones, Swain, and Hardy, (1993) found that those who were classified as good gymnastics performers reported their cognitive anxiety as being facilitative, while poor performers reported it as debilitative. Therefore, in relation to the individual zone of optimal functioning, individuals have their own unique zone in which they perform best as well as a point where a catastrophe may occur.

Hence, it seems evident that anxiety (cognitive and somatic) is relevant when relating to one's readiness to perform. The above three models/theories support this. Though we have outgrown the inverted U hypothesis, it has provided the baseline for other theories to go above and beyond when exploring the relationship between anxiety and physical performance. Catastrophe is an example of such an extension as it suggests that there is an interaction between cognitive and somatic anxiety with relation to performance and in order for one to become optimally ready, it is the combination of their anxiety that influences performance outcome.

In most studies, the Competitive State Anxiety Inventory-2 (CSAI-2) has been the tool used when measuring anxiety (as well as self-confidence). It has been deemed difficult, however, to get coaches and athletes compliance to fill out this 15-30 minute questionnaire right before their competition. Thus, for the purpose of this research, we will be measuring one's mental readiness while using Krane's (1994) Mental Readiness Form-Likert (MRF-L). This measure investigates both cognitive and somatic anxiety, as well as self-confidence in the form of three scales representing mental readiness. The MRF-L was chosen because of its quick and easy completion process. This quickness factor was deemed important due to the limited amount of time between dives at a competition, as well decreasing the amount of possible distraction of the athletes from their competition. Considering the amount of time between each dive, the CSAI-2 would not be pragmatic. For the remainder of this thesis, the term 'mental readiness' will be used due to Krane's (1994) caution that the MRF-L should not be used as a replacement of the psychometrically sound CSAI-2 for accurately measuring cognitive, somatic anxiety, and self-confidence. For this reason, we will not refer to the MRF-L as a measure of anxiety, but rather as an indicator of mental readiness.

Past research in self-modeling has not been successful in showing that anxiety levels (as measured by the CSAI-2) were related to self-modeling benefits (e.g., Clark, 2005; Starek & McCullagh, 1999). That past research, however, was conducted for the purpose of skill acquisition rather than enhancing competitive performance. It can be thought that anxiety levels would generate more effects in the competitive environment due to the competition aspect and it representing a measurement of success. In support of this claim, White and Hardy (1998) found that canoeists and gymnasts perceived a training situation to be more relaxed than a competitive situation. Furthermore, examining anxiety prior to competition seems to be appropriate considering the results suggests by Highlen and Bennett (1983), illustrating anxiety levels are higher prior to competition in elite divers.

Our specific prediction for one's mental readiness is that athletes will better achieve their optimal zones of "mental readiness" if they view a self-modeling video than if they do not. Indeed, Vadocz et al's., (1997) study on rollerskaters found that the best predictor of low cognitive anxiety, an aspect thought to be beneficial for competition, was a previous best performance. A self-modeling video is predicted to produce an enactive mastery experience, simulating a personal best performance. Thus, by watching a self-modeling video prior to competition, the athletes may better achieve their optimal zone of mental readiness for competition. Also of importance, watching the self-modeling video is thought to increase one's positive self-talk and lower one's negative self-talk. In doing so, one's belief in his/her ability to perform is verbally represented and, therefore, will contribute to the achievement of mental readiness.

Summary

While the effects of self-modeling have been studied with motor skill acquisition, very limited cases have been researched in the competitive situation. Thus, further research is needed to explore self-modeling in competitive environments. Specifically, the proposed objectives of the present study are, (1) to investigate whether a self-modeling intervention can enhance competitive diving performance, and (2) to examine the potential underlying mechanisms that may influence this enhancement such as, self-efficacy, mental readiness, and self-talk. In addition, though not a main objective of this experiment, imagery ability and vividness will be investigated in order to examine the possibility of them moderating the effectiveness of a self-modeling intervention. It has been suggested that imagery ability can moderate the link between imagery and performance (Martin et al., 1999). Therefore, perhaps imagery ability can also moderate the effects between the self-modeling video and performance.

To this end, a self-modeling video was constructed for each participant and viewed by participants (five or ten minutes) before competing the selected dives for the intervention. After viewing the self-modeling video, the participants completed the questionnaires relating to mental readiness and self-efficacy. The participants then competed their dive and completed the self-talk subscale of the Test of Performance Strategies (TOPS, Thomas et al., 1999). In addition, both prior and post data collection, the imagery ability questionnaires were administered to each participant.

It was predicted that self-modeling will be effective for competitive performance enhancement as revealed by higher scores on the selected dive. Also, was predicted that the self-modeling intervention would increase their self-efficacy, and increase positive self-talk while at the same time decreasing negative self-talk. Finally, the self-modeling intervention was expected to enable the divers to be more mentally ready to compete. Main effects were not found, and the moderating variable of imagery ability was included in a secondary analysis.

Chapter 3: Methodology

Participants

The participants were 13 competitive divers (1 male and 12 female), all belonging to the Nepean Ottawa Diving Club in Ottawa Ontario. Their competitive levels were as follows; provincial A (n=1), provincial B (n=4), and provincial D (n=3). These levels are categorized based on the age of the athletes. For example, provincial D divers are age 11, provincial C are 12-13 years, provincial B are 14-15 years, and provincial A divers are 16 years and up. The divers' ages ranged between 10 and 15 years (M=12.75, SD=2.12). For specifics on each diver, including the dives chosen for the experiment, refer to Table 1. All of the participants were recruited using a convenience sampling method. Permission to approach the divers was obtained from the coaches, and before participation both the parents and participants consent was obtained. The experiment successfully went through the ethics review board at the University of Ottawa in order to ensure all standards were met (see appendix A).

Table 1.

Gender (M/F), Age (yrs), and Dive chosen of each participant for the self-modeling video (SM) and the control dive (C)

Participant	Gender	Age	SM dive	C dive
1	M	14	Back 2 ½	Inward 2 ½
2	F	10	Inward 1 ½	Back 1 ½
3	F	15	Inward 2 ½	Back 1 ½ SS 1 ½ twist
4	F	10	Back 1 ½ (pike)	Inward 1 ½
5	F	13	Front 1 ½ SS 1 twist	Inward 1 ½ (pike)
6	F	11	Inward 1 ½	Front 1 ½
7	F	15	Back 2 ½	Front 2 ½
8	F	14	Front 1 ½	Inward 1 ½
9	F	17	Reverse 2 ½	Inward 2 ½
10	F	12	Front 1 ½	Inward 1 ½

Materials

A Sony video camera was used to film multiple attempts of the participants' dives. The videos of the participants' dives were then transferred into a Microsoft Movie Maker software program where they were edited into the self-modeling video. Therefore, only the best parts of the dive, cut and pieced together from different clips of that same dive, were arranged in order to illustrate as near to a perfect execution of the dive as possible from the video footage. In most cases, it was only the entry that needed to be cut out and replaced. Therefore, the videos consisted of the actual dive with a "rip" entry into the water. A "rip" is considered to be a clean entry into the water with no splash. After each participant's dive had been edited, a video sequence of the dive was created wherein the dive was shown five times repeatedly, with 1-2 seconds of interspersed blank screens between each edited dive. Considering that each dive took approximately 5-10 seconds, this resulted in the total self-modeling tape length lasting no longer than 50 seconds. Throughout the duration of the experiment, the participants viewed their self-modeling video on an 11.5' by 8' screen IBM Think Pad lap top computer.

Measures

Self-efficacy. The self-efficacy scale was developed based on Bandura's (2005) guidelines for developing a self-efficacy scale specific to a diver's performance at a competitive event. The participants rated their competence of successfully completing a dive and receiving specific scores. Here, the participants indicated their competence on a likert scale ranging from 0-100 in increments of ten (see appendix B).

Self-talk. A subscale from the TOPS was used to measure the participants positive and negative self-talk (Thomas et al., 1999). This tool measures psychological skills in both competition and practice. The psychological skills selected for the test were based on three other instruments that have been used in the sport psychology field; the Psychological Performance Inventory (PPI) (Loehr, 1986), the Psychological Skills Inventory for Sport (PSIS) (Mahoney, Gabriel, & Perkins, 1987), and the Athletic Coping Skills Inventory-28 (ACSI-28) (Smith, Schutz, Smoll, & Ptacek, 1995). Participants indicated their agreement on a five point likert scale about the statements provided from the time they received their self-modeling video to the time they competed their dive. Thomas et al. (1999) have shown this to be a valid and reliable instrument. In addition, the subscale of the self-talk items showed high internal reliability (0.80) (Thomas et al., 1999). For the purpose of the study, only the questions pertaining to the portion on positive and negative self-talk were used from the TOPS. (see appendix C).

Mental readiness. Mental readiness was measured through the use of Krane's (1994) Mental Readiness Form-Likert (MRF-Likert). The MRF-Likert consists of three subscales; somatic anxiety, cognitive anxiety, and self confidence. Participants rate their thoughts, how their body feels, and their feelings on an 11 point likert scale (see appendix D). The MRF-Likert takes seconds to complete and Krane (1994) describes it as a "brief and accurate measure of competitive anxiety" (p.199).

This tool has been shown to be both a valid and reliable measure of somatic and cognitive anxiety, as well as self confidence. Concurrent validity was satisfied using Pearson product-moment correlations between the CSAI-2 and the MRF-Likert (cognitive anxiety = .76, somatic anxiety = .69, and self confidence= .68), and it has been shown not to be influenced by social desirability.
(Krane, 1994).

Image Ability. Two self-report tests were used to measure the participant's imagery ability and image vividness. Isaac and colleagues' (1986) Vividness of Movement Imagery Questionnaire (VMIQ) (see appendix E), and Hall and Martin's (1997) Movement Imagery Questionnaire-Revised (MIQ-R) were chosen for the experiment (see appendix F).

For the VMIQ, participants rate their vividness of image movements on a five point likert scale, 1 representing a perfectly clear image, and 5 representing no image at all (Isaac et al., 1986). The VMIQ consists of two subscales, one related to visualizing oneself performing a task, while the other is related to visualizing someone else performing the task. Therefore, the participants rate their vividness for both visualizing oneself and visualizing another.

The MIQ-R is designed to measure visual and kinesthetic imagery ability. Participants rate how easy or difficult a movement has been imaged on a seven point likert scale. The MIQ-R consists of eight items wherein the participant is required to execute a movement pertaining to that specific item, image that movement, and then rate how difficult or easy the movement was imaged. The participants do this from both a visual and kinesthetic perspective. Both instruments have been shown to be reliable and valid in the imagery literature (Isaac et al., 1986; Hall & Martin, 1997).

Physical performance. The judges' scores on the selected dives were used as the physical performance measure.

Procedures

Preparations prior to the intervention. As mentioned, permission to approach the athletes and to be onsite for preliminary preparations had been provided by the coach (see appendix G). Informed consent from adults and athletes were also obtained prior to data collection (see appendix H and I). Once informed consent was obtained, in consultation with the coach and athlete, the two dives were selected from the diver's competitive repertoire. These dives were chosen based on similar difficulty levels based on Dive Ontario's rules as well as similar comfort levels relating to the participants perception of each dive. One dive received the self-modeling intervention and the other served as the control.

During this brief individual consultation, each participant also completed all forms relating to the psychological constructs of self-efficacy, self-talk, and mental readiness in order to represent a baseline measure. The participants were first asked to indicate what best represents their current perceptions of self-efficacy for the two experimental dives. They then completed the self-talk measures for the two dives reflecting on what thoughts they typically have for the specified dive when in competition. For the MRF-L, they were asked to complete the MRF-L from the perspective of their optimal competition state, again reflecting on that state as if at a competition. Finally, both the MIQ-R and the VMIQ were administered by the researcher to all participants. The administration of the imagery questionnaires was completed based on the individuals' accessibility within the pre-intervention phase.

The video taping of the dive selected to receive the self-modeling intervention was taken during the diver's training sessions approximately a month and a half prior to the competitions. During these training sessions, the participant's dives were filmed by the researcher in order to obtain the footage needed to construct the self-modeling videos. In most instances, 15-20 of the attempts at the selected dive including 5-10 entries, were videotaped for each participant to be used for the construction of the self-modeling video. Once the footage was collected, the coaches were asked for their expertise in selecting the parts of the dive would be spliced together to create the self-modeling dive. The construction process took place until the coaches deemed the video acceptable.

Intervention. Prior to data collection at a specified competition site, the participants viewed their self-modeling video three times the week before the competition. The viewings took place at the home pool deck during their usual practice session. If a viewing was missed, which occurred on some occasions, the third viewing took place at the competition hotel a day or two before the competition. Data was collected at three different competition sites, two within Ontario and one in Alberta, with the same procedure at each site. On the competition day, five to ten minutes prior to the dive selected for the self-modeling intervention, participants viewed their self-modeling video. The participants then completed the Self-Efficacy measure, and the MRF-L. These questionnaires took only seconds to complete. Participants then proceeded with their regular pre-dive competition routine until completion of their dive. Upon the completion of the dive, participants completed the self-talk subscale of the TOPS, reflecting on the time elapsed between viewing the self-modeling video and completing the dive. The same procedure was followed for the selected control dive, with the exception that no self-modeling video was presented. In addition, at the end of each competition, the participants were asked four questions relating to the administration of the self-modeling video. The responses to the questions were tape recorded separately for each participant.

Post intervention. Post data collection, participants were re-administered both the MIQ-R and the VMIQ in order to measure imagery ability after the self-modeling intervention had been given.

Data Analysis

During data collection, five participants were only able to compete at one of the data collection sites. This was a result of either dropping out because of injury, or not obtaining qualifying scores to move on to the next competition. Given that we wanted to have a minimum of two competitions to use for data analysis purposes, only eight participants were used for subsequent analyses. The data collected was entered into SPSS data sheets and analyzed through the SPSS program. Analysis of variance (ANOVA) with repeated measured on all variables was performed separately for each of the measures. The scores from the dive that received the self-modeling intervention were compared to the scores from the dive that did not receive the self-modeling intervention. Homogeneity was tested for all measures in order to confirm that further analysis could be completed.

Chapter 4: Results and Discussion

Results: Quantitative Measures

The specific hypotheses for each quantitative measure and the results obtained for each are presented.

Physical Performance

It was hypothesized that the dive that received the self-modeling video would reveal a greater increase in physical performance as compared to the control dive. This was measured by the scores given by the judges at two competitions. The scores were calculated from the average of three of five judges scores, dropping the highest and lowest scores, and multiplying that score by the degree of difficulty (DD) of the dive. The DD may differ for each dive, for example a back 2 ½ is considered to be more difficult, and therefore worth a higher DD (DD = 2.8) than a front 2 ½ (DD = 2.2). For this reason, difference scores from each participant's baseline were used in the analysis of physical performance. Difference scores were used in order to ensure that any change in physical performance at the data collection sites were due to an actual increase or decrease from the participant's baseline. The baseline scores were determined from the previous closest competition with respect to the beginning of data collection in this experiment. The baseline method was used in order to best represent each participant's performance level at that particular time.

A 2 (condition) X 2 (competitive session) ANOVA for performance with repeated measures on both factors was conducted. The analysis revealed no significant differences between the dive that received the self-modeling video and the control dive, $F(1,7) = 1.25$, $p > 0.05$ (see Figure 1)

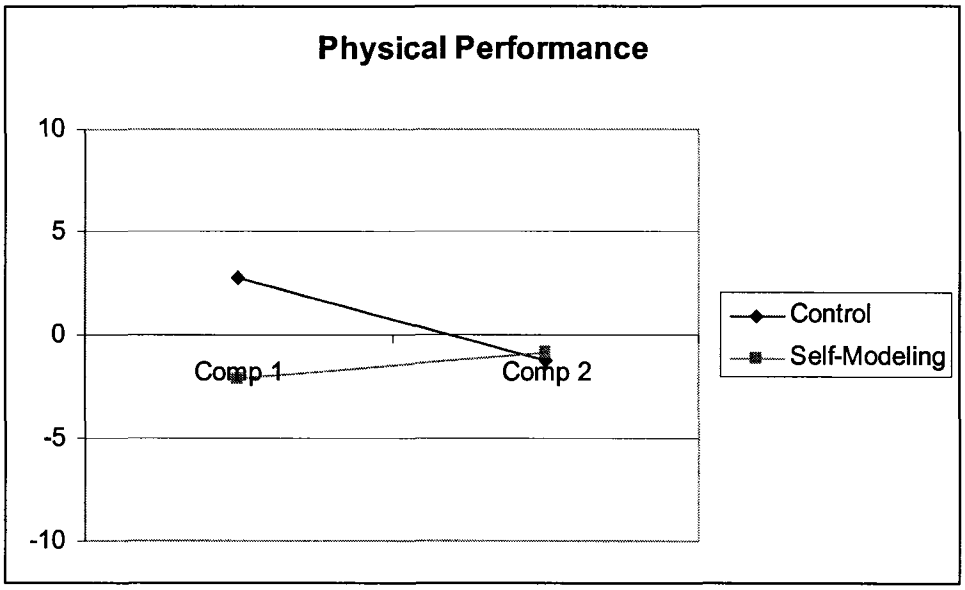

Figure1. Physical performance difference scores between SM and C dive for competition one and competition two.

Therefore, no support was provided for the hypothesis that the self-modeling intervention would have a positive effect on competitive performance enhancement of the dive. Performance means and standard deviations of raw data can be seen in table 2 while means and standard deviations of difference scores can be seen in Table 3.

Table 2.

Means and Standard Deviations of Raw Scores for all Dependent Variables of Baseline (Base), Competition 1 (C 1), and Competition 2 (C 2)

	Self-Modeling n=8			Control n=8		
Dependent Variables	Base	C 1	C 2	Base	C 1	C 2
Physical Performance						
M	34.84	32.66	33.96	35.57	38.34	34.28
SD	3.51	6.59	8.89	7.21	7.79	7.03
Self-Efficacy						
M	45.63	45.27	47.44	56.41	57.81	54.64
SD	17.96	18.96	15.86	16.67	14.27	13.12
Positive Self-Talk						
M	4	3.97	4.28	3.97	3.81	3.7
SD	0.76	0.87	0.6	0.49	0.69	0.64
Negative Self-Talk						
M	1.46	1.87	1.42	1.29	1.71	1.38
SD	0.69	1	0.61	0.38	0.98	0.45
Mental Readiness						
M	2.9	4.83	5.35	2.27	5.04	5.19
SD	1.59	1.31	1.36	0.99	2.22	2.33

Table 3.

Means and Standard Deviations of Difference Scores for all Dependent Variables for Competition 1 (C 1), Competition 2 (C 2), and the Total Mean Scores (M Total)

	Self-Modeling n=8			Control n=8		
Dependent Variables	C 1	C 2	*M* Total	C 1	C 2	*M* Total
Physical Performance						
M	-2.18	-0.88	-1.53	2.77	-1.29	0.74
SD	6.11	8.19	6.18	4.84	3.19	3.07
Self-Efficacy						
M	-0.36	1.81	0.73	1.41	-1.77	-0.18
SD	13.03	16.60	13.08	9.60	13.79	9.53
Positive Self-Talk						
M	-0.03	0.28	0.13	-0.16	-0.27	-0.21
SD	0.89	1.15	0.85	0.90	0.72	0.64
Negative Self-Talk						
M	0.41	0.04	0.23	0.50	0.25	0.37
SD	0.81	0.28	0.49	0.93	0.39	0.49
Mental Readiness						
M	2.85	2.46	2.66	2.77	2.92	2.84
SD	1.07	1.98	1.18	1.75	2.09	1.77

Self-efficacy

Self-efficacy is the belief in one's capabilities to perform a specific task (Bandura, 1997). According to the Social Cognitive Theory (Bandura, 1977a, 1986, 1997), one's self-efficacy can influence learning or performance through four information processes. Of the four information processes, mastery experience is the most influential on one's efficacious beliefs (Bandura, 1977a, 1986, 1997). Since enactive mastery experience is the actual authentic evidence of one successfully completing a task, it was argued that a self-modeling video would provide a strong sense of self-efficacy. That is, the video would represent a mastery experience because it has been edited to show only the desired performance of the dive. Consequently, it was hypothesized that the self-modeling video would increase one's self-efficacy more for the self-modeling dive than for the control dive.

Bandura (1997) stated that self-efficacy can be measured by selecting a cut off value for the items that people would rate themselves unable to accomplish. For this reason, a cut off range was applied to the self-efficacy scale used in this research, where values under 4.5 and over 8.0 were eliminated from the averaging process in the analysis. For example, all of the participants indicated their perceived self-efficacy for both the self-modeling and control dive was 0% for receiving a perfect score of 10. More specifically, participants rated themselves fully able to accomplish scores between 3.0 (starting score deemed acceptable by the coach), and 4.0 and unable to accomplish scores between 8.0 and 10. Thus, the participants' perceived self-efficacy was best represented by the majority of scores falling in the 4.5-8.0 range. The participants' self-efficacy scores were calculated by summing up each of scores within this range on the scale and dividing by the number of items. Therefore, an average of self-efficacy levels was used as the measure. The highest possible score on the self-efficacy scale was a 100% where as the lowest possible score was 0%.

Similar to the analysis of physical performance, difference scores were used for self-efficacy. Therefore, the participants' baseline self-efficacy score was subtracted from their self-efficacy score at each of the data collection sites. After the difference scores were established, the remaining number represented the difference from their baseline efficacious beliefs and their efficacious beliefs after the intervention had been applied. For example, a positive difference score would be an increase in one's self-efficacy, while a negative difference score would be a decrease in one's self-efficacy.

A 2 (condition) X 2 (competitive session) ANOVA was conducted on self-efficacy with repeated measures on both factors. This analysis showed no significant differences in self-efficacy between the dive that received the self-modeling video and the control dive, $F(1,7) = .04, p > 0.05$ (see Figure 2).

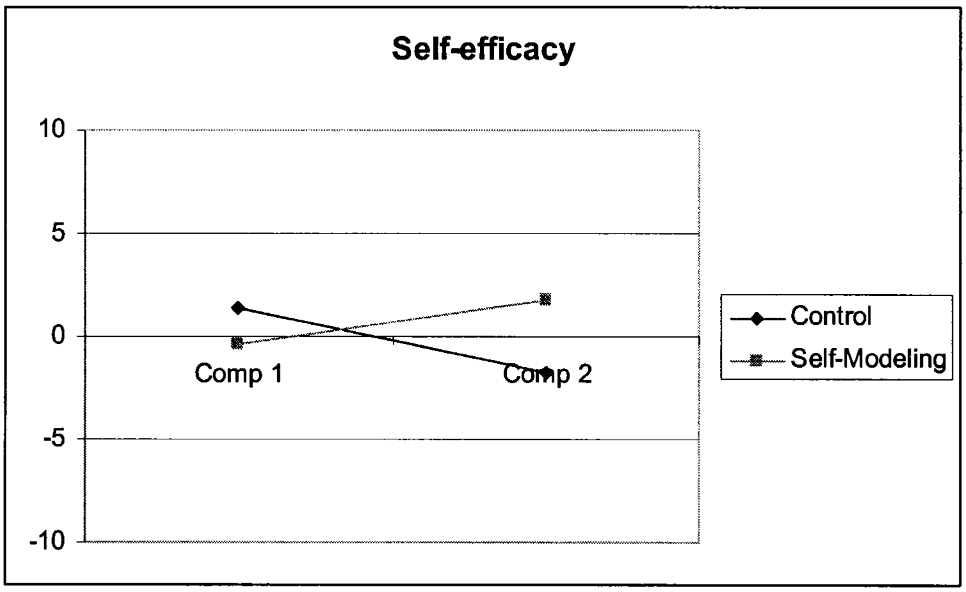

Figure 2. Self-efficacy difference scores between SM and C dive for competition one and competition two.

Self-talk

Thomas and colleagues (1999) conducted a study on performance strategies used in competition. They found that of the competition strategies used by those athletes, self-talk was the strongest factor loaded in the factor analysis. This suggests that self-talk is an important factor in competitive performance. Indeed, studies have shown that positive self-talk can be effective for performance (e.g., Van Raalte et al., 1994). For this reason, self-talk was chosen as a psychological construct related to optimal performance to be measured in the diving context. It was hypothesized that the self-modeling video would increase one's positive self-talk while lowering one's negative self-talk for the dive that received the self-modeling video.

In order to measure the participants' use of positive and negative self-talk, a subscale of the TOPS (Thomas et al., 1999) was chosen. This subscale consisted of questions relating to both positive and negative self-talk (see appendix C). The scores relating to the use of positive self-talk and negative self-talk were separated and averaged in order to create two separate measures. The baseline scores were subtracted from the scores at the data collection sites, creating a difference score. Therefore, a high difference score for all questions would be a five and a low difference score would be a one.

A 2 (condition) X 2 (competitive session) X 2 (type of self-talk) ANOVA with repeated measures on all factors was performed on the use of positive and negative self-talk for both the self-modeling and control dive. The results revealed no significant differences for the use of positive and negative self-talk between the dive that received the self-modeling video and the control dive, $F(1,7) = .53$, $p > 0.05$ (See figure 3).

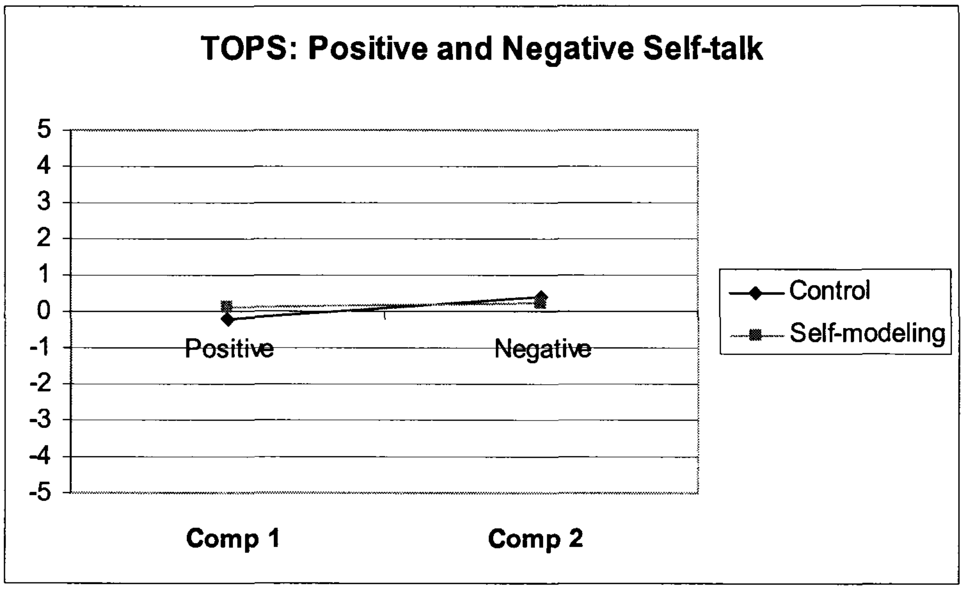

Figure 3. The use of positive and negative self-talk between the SM and C dive for competition one and competition two.

The means and standard deviations for self-talk are presented in Table 2 and 3.

Mental Readiness

In this study, the term mental readiness was referred to as a combination of one's somatic anxiety, cognitive anxiety, and self-confidence and was measured by Krane's (1994) MRF-L questionnaire. It was argued that the self-modeling video would simulate participants' personal best performance and that this would help bring the athletes to their optimal mental readiness. Again, difference scores were used in the analysis. The total average of the three scales at baseline were subtracted from the total average of the three scales from the data collection sites. Average scores were used in order to represent one's mental readiness. It was not in our interest to look at changes in intensity of anxiety (cognitive/somatic) due to the fluctuation levels of anxiety throughout competitions (Krane, Joyce, & Rafeld, 1994). Therefore, it was deemed more appropriate to use the term mental readiness as opposed to separating the three scales. A high mental readiness score is represented by an 11 and a low mental readiness scores is represented by a one.

A 2 (condition) X 2 (competitive session) ANOVA was conducted on mental readiness with repeated measures on both factors. Results showed no significant differences between the two dives, $F(1, 7) = .014, p > 0.05$ (see Figure 4).

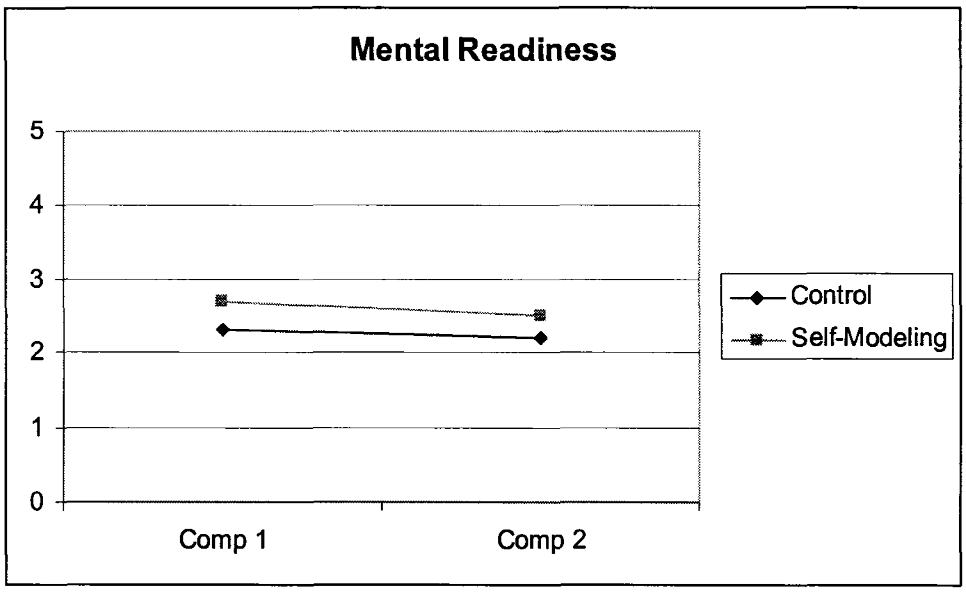

Figure 4. Mental readiness difference scores between the SM and C dive for competition one and competition two.

Therefore, the self-modeling video did not bring the participant closer to their optimal zone than no video at all. The means and standard deviations associated with this measure are presented in Tables 2 and 3.

Quantitative Measures: Discussion and Secondary Analysis

Studies have shown that self-modeling has been a useful technique in motor skill acquisition (e.g., Clark & Ste-Marie, in press; Starek & McCullagh, 1999). However, there is a lack of research on its impact in a competitive performance context. Thus, the purpose here was to investigate whether a self-modeling video would enhance competitive diving performance and whether the psychological variables of self-efficacy, self-talk, and mental readiness came into play with such enhancement. It was expected that the self modeling video would enhance an athlete's physical performance for a given dive and that the psychological constructs of self-efficacy, mental readiness, and self-talk would help explain these physical performance benefits. As noted, however, no physical performance benefits were evidenced, and the video intervention had no effects on the psychological constructs measured. Due to this non-significance on all dependent measures, a secondary analysis was performed that tests the possibility that the self-modeling intervention did not have an effect because image ability and/or vividness acted as a moderating variable.

To test this possibility, both image ability and vividness were measured before the intervention was administered. There are two potential influences of imagery ability and/or vividness on the effectiveness of the self-modeling intervention. The first involves the possibility that those who are high in imagery ability would not benefit from the intervention, whereas poor imagers would benefit. For example, if an individual has mastered his/her ability to effectively partake in imagery he/she will already be able to control and create clear and vivid images of the dive to be performed. As such, the video may be of no further use to them because they have the image needed that contributes to the competitive performance enhancement to compete the dive. Conversely, those who are not good imagers benefit from the self-modeling video because they are unable to control and create clear and vivid images, and thus, the self-modeling video supplies the necessary stimulus.

The second alternative considers the possibility that good imagers may benefit more than poor imagers from the external video because it in fact heightens their use of imagery of the dive prior to competing as the poor imagers, however, would not yield the same gains from the video. For this reason, the influence of image ability and vividness on the effectiveness of the self-modeling video was explored in the secondary analysis.

Staying consistent with our prediction, if visual imagery, for example, is a moderating variable, it is possible that a difference in performance scores of the control dive and the self-modeling dive would now be dependent upon type of imager (high versus low ability). Hall and Martin's (1997) MIQ-R was used to measure imagery ability. The MIQ-R generates both a visual imagery and a kinaesthetic imagery score for each participant. A higher score on the MIQ-R represents greater visual and kinesthetic image ability with a range between 1 and 7. Correlations were performed on the MIQ-R's (Hall & Martin, 1997) subscales for both visual and kinaesthetic imagery. This was done in order to determine if the two forms of imagery (i.e., visual and kinaesthetic) should be considered separately in the moderation check, or should be considered as a total imagery score. The correlations indicated that the MIQ-R subscales (visual/kinesthetic) were independent from each other r $(7) = .10, p = .83$ and thus, both should be used separately as moderating variables.

In order to measure participants' vividness of imagery, Isaac and colleagues' (1986) VMIQ was used. Similar to that of the MIQ-R, correlations were also performed on the VMIQ to distinguish what should be examined as possible moderating variables (i.e. total scores or subscale scores). Correlations for the VMIQ, showed that visualizing another and visualizing oneself were very highly correlated, $r\ (7) = .77, p = .04$. Therefore, the total score from the VMIQ was used as the last moderating variable.

A median split technique was used to separate the participants into the high and low groups dependent on the three moderating variables of visual imagery ability, kinaesthetic imagery ability, and imagery vividness. The descriptive statistics are reported in Table 4 for the performance scores on the self-modeling and control dives as a function of these three moderating variables. When examining the data, only the variable of kinesthetic imagery seemed to be of interest, with the data suggesting, kinesthetic imagery may be a possible moderating variable. More specifically, those who scored high in kinesthetic imagery increased their performance score for the self-modeling dive but not for the control dive. In contrast, those who scored low in kinesthetic imagery had a decrease in their performance score for both of the dives. It is possible that those who are good kinesthetic imagers gained more from the self-modeling video because their better ability to image the "feeling of their movements" enabled them to better use the visual information being provided by the video. With only three participants in each group, however, statistical analysis is not viable, and thus future research that probes the importance of kinesthetic imagery ability and the benefits of self-modeling is warranted.

Table 4.

Means and Standard Deviations for Mean Total Physical Performance Scores as a Function of the Three Moderating Variables

	Self-Modeling		Control	
	High	Low	High	Low
Dependent Variables	n=3	n=3	n=3	n=3
Visual				
M	-1.15	-0.19	-0.94	1.03
SD	1.06	10.87	6.93	3.69
Kinesthetic				
M	1.81	-3.09	-0.03	-0.14
SD	4.89	8.82	2.15	4.42
Vividness				
M	-2.47	1.13	0.65	1.25
SD	10.01	3.19	3.09	4.00

The purpose of measuring imagery ability, including image vividness, was to investigate if one's image ability/vividness was a moderating variable for the self-modeling video. As described by Gregg, Hall and Nederhof (2005), imagery ability is the quality in one's imagery. Martin and colleges (1999) suggested that an individuals' image ability could be a moderating variable between CS (cognitive specific) imagery and performance. Since CS imagery is the rehearsal of skill, and the self-modeling video is the visual rehearsal of that skill, imagery and self-modeling can be considered very similar. Therefore, if imagery ability is a moderating variable between an imagery intervention and performance, perhaps it could also be a moderating variable between a self-modeling intervention and performance.

It was Martin and colleges' (1999) research that invoked the idea that if one had mastered his/her imagery, the self-modeling video would not have an effect on the performance, and thus, individuals who have difficulty with his/her imagery would benefit from the video. Imagery ability and vividness, however, were not found to be moderating variables between the self-modeling video and physical performance.

After ruling out the possibility of imagery ability and vividness as a moderating variable, these results suggest that implementing a self-modeling video into a competitive diving environment may not produce significant changes in dive performance. In addition, it also suggests that the psychological constructs listed above may not be affected by a self-modeling video. Thus, no self-modeling benefits were evidenced for the competitive performance of diving, regardless of imagery ability or vividness of the participants.

These results were somewhat surprising given the evidence for positive modeling benefits in the motor skill acquisition literature (see McCullagh & Weiss, 2001 for a review). As well, Maile's (1985, as cited in Franks & Maile, 1991) introduction of self-modeling as a competitive performance enhancement technique was considerably promising. Finally, the imagery literature shows numerous examples of competitive performance enhancement through imagery interventions and it was unexpected that the self-modeling video would not have similar effects.

The research that was used to support our predictions, however, differ from this research in many ways. Firstly, and most importantly, all but one of the above studies measured skill acquisition as opposed to competitive performance enhancement (e.g., Clark & Ste-Marie, 2006). Secondly, as noted by Law and Ste-Marie (2005), the type of skill used could have been a differentiating factor of the interventions effects. Of the published studies that have shown significant results in performance or self-efficacy, the skill has been continuous and not discrete. This is seen in studies investigating swimming performance (Clark & Ste-Marie, in press; Dowrick & Dove, 1980; Starek & McCullagh, 1999), compared to those studies that have used a discrete skill and do not show the same significant results, such as a volley ball serve (Ram & McCullagh, 2003), a figure skating jump (Law & Ste-Marie, 2005), or a beam performance (Winfrey & Weeks, 1993).

Similar to this study, however, there have been results that coincide with our findings. Winfrey and Weeks (1993), for example, found no differences in balance beam performance or self-efficacy between a self-modeling group and a control group. In addition, when looking at figure skating, Law and Ste-Marie (2005) did not find significance differences in jump performance or self-efficacy between the self-modeling and control conditions. Although Starek and McCullagh (1999) found significant results for swimming performance, there was no significance found for self-efficacy. While it may be that a self-modeling intervention is not effective for competitive performance enhancement, limitations to the research conducted that may have negated potential benefits are described next.

Limitations

The null effects could be linked to the number of limitations that should be noted in this research. First, a noted weakness was the sample size. The sample size was small for a number of reasons. From the outset, the sample size was small because the amount of time needed to video and construct the self-modeling video was extensive. Another reason was due to the competition aspect, as qualifying scores were needed for participants to continue with the experiment. In this case, some participants competed at only one competition since they did not achieve the score needed to move on to the next competition (provincials or nationals), resulting in a number of participants having to be dropped from data collection.

Another limitation was the number of competitions sites in which data was collected. While taking into consideration the time of season was approaching its end, the number of interventions administered to participants was rather small. As a result, there were only two competition sites where the measures were taken. Though the self-modeling video was shown to every participant three times per week prior to that competition, this may not have been an efficient amount of viewing time for the intervention to take full effect. An increase in the number of competition sites may have given an appropriate amount of time for the video to take effect. In reference to the imagery literature, Diskal and colleagues (1994) determined that imagery ability has an effect on performance and, according to Hall and colleagues (1998), the use of imagery is also related to performance. The greater ability of the imager has, the more effective it will be on performance, and the more the individual uses imagery the better the ability of imagery becomes (Rodgers, Hall, & Buckolz, 1991). Therefore, the more the individual is exposed to imagery, the ability to image increases, and in turn the greater effect it will have on performance. In saying this, it could be that the more the diver is exposed to the self-modeling video, the more effect it would have on performance, as seen in the imagery literature.

In addition to the limited number of competition sites, the intensity of each competition became more difficult. For example, the first competition was considered a regional competition, while the second competition was either provincials or nationals. In most situations the level of competitors are stronger and therefore the judges scoring may in fact be harder. Thus, it is possible that the null effects of the physical performance scores may be due to the variations that occur in judging at higher level competitions , rather than the lack of an effect for self-modeling..

Also of important note, Bertram, Cote, Brown, Guadagnoli, and Palomaria (2007) suggests that the time delay in which participants view them self on video and perform the task has an effect on performance. Specifically, Bertram and colleagues (2007) found that immediately after viewing a positive video of one self (PSR self modeling) golf putting performance significantly increased. The longer the delay in time between the viewing and performance, however, the greater the decrease in the putting benefits. In this research, participants viewed their self-modeling video five to ten minutes prior to competition the dive. Therefore, there was a time delay of approximately 2-5 minutes before they competed that dive. According to the research above, this time delay may have been detrimental to the divers performance increase.

Another issue has to do with the dependent variables. The baseline scores used for the measures may have not fully accounted for a precise representation. With respect to the self-efficacy and self-talk scores, these may have not been a proper representation of their actual belief in their capabilities or use of self-talk. That is, each participant was asked to indicate where they "usually" were at a competition for these two baseline measures and perhaps this reflection was not reliable. A better method for baseline measures for these would have been to collect all the measures at multiple competitions prior to the intervention and therefore, accurately representing the self-efficacy and self-talk.

Also, it has been suggested by Hardy (2006) there have been many discrepancies in the definitions of self-talk. More specificity, the use of imprecise definitions is an issue. In this research, the definition of self-talk was not given to the participants and it is possible that the questions relating to the use of positive and negative self-talk were not precise enough.

The physical performance baseline measures were also problematic. The baseline scores for this were taken from a competition that was situated the closest to the data collection start date in order to represent where each of them stood at that time. The limited number, specifically one competition, of baseline performance scores was due to the limited number of competitions where both the self-modeling and control dive had been competed at the same time. In the end, without going into the proceeding year's competitions, only one competition was able to represent the baseline scores. Consequently, using only one competition as a baseline score may not adequately represent the participants' performance abilities. If, for example, a participant had a bad day and had a flat entry on their dive, this would underrepresent their ability to perform that dive. On the other hand, a participant could have had an unbelievably good dive that just happened to be a fluke and in this case would overrepresent their ability. As suggested with the self-efficacy and self-talk baseline scores, it would have been optimal to have collected an actual baseline measure for all the variables from several competitions prior to data collection. However, due to time constraints and the limited number of competitions available towards the end of the season, this was, unfortunately, not feasible.

In future research it is suggested that the self-modeling video be implemented with a greater number of participants for a longer intervention time, with at least four competition sites in order to allow for time for the intervention to take effect. Also, multiple baseline scores would better represent the participants' performance and other psychological variables. Furthermore, it would be interesting to see if the intensity of the competition (regional/provincial/national) had an effect on the results of the research and therefore, future research could video the participants' actual competition dive and have blind reviewers judge and score their performance. In addition, perhaps by viewing the self-modeling video closer to the actual timing of the particular dive, within a minute of competing, the participants would benefit more form the self-modeling video. Future research should take the time delay issue into consideration when administering the self-modeling videos in a competitive environment. Interestingly, when the eight participants were examined separately some did in fact increase their performance for the self-modeling dive as compared to the control dive, as well as their self-efficacy and use of positive self-talk. It leads one to question, why did these athletes benefit? What was it that they picked up/used/modified that generated such differences? Having these positive results for some participants suggests that future research in self-modeling should be examined in the competitive performance enhancement atmosphere. In addition, perhaps there are other psychological variables not examined in this study that may have had an influence on the participants performance, such as goal setting, motivation, and focus/refocusing. These are some suggestions that could be further explored in self-modeling as a competitive performance enhancement.

Although the results of this study have not been successful in showing any change in the dependent measures, it is very interesting to note that the athletes and coaches responded positively to the intervention. Similar anecdotal evidence was found in Law and Ste-Marie's (2005) research with figure skaters. Law and Ste-Marie (2005), however, did not include a qualitative component in their design. In the research conducted here, athletes were probed after the competitions concerning the manner in which they used the self-modeling video. The next section will discuss the qualitative component of this research regarding the participants' opinion of the self-modeling video.

Results: Qualitative Measures

The qualitative approach is receiving much attention in the field of research (Weinberg & Gould, 1999). This approach has been argued to enrich and illuminate the experiences participants have with any given intervention, in this case, the self-modeling video (Bryman, 1988). Its purpose here was to explore, beyond pencil and paper measures, the effects of a self-modeling video on some of the cognitions and/or affect of the athletes.

This exploration was completed after each competition, following the collection of pencil-paper measures. Specifically, the participants responded to four questions relating to their thoughts, feelings, and how they used the self-modeling video. The first question asked participants what they were thinking about while they were watching themselves on the video. The second asked how the video made them feel as they were watching themselves. The third asked how they felt after they watched the video, but just before they competed their dive. While the fourth and final question asked the participants what they did with the information they got from watching the video, more specifically, how did they use it before they competed?

The coding process took many attempts in order distinguish an appropriate framework to best represent the responses of the participants. The complete process involved the following steps. First, each of the recorded statements were typed out verbatim from the audio recordings and coded by the single researcher responsible for data collection. An inductive analysis of transcripts was used where the transcripts were distributed to five other researchers. Each researcher was asked to read over the transcripts and to code the statements based on the preliminary coding system that had been constructed by grouping the statements according to emerging themes. For example, a statement consisting of words such as see, feel or imaged, was to be classified as an imagery theme, whereas statements using words or phrase related to confidence or 'I can do it', were classified as self-confidence themes. The researchers re-grouped to discuss this initial coding process, but it was determined that the researchers had poor intra-rater reliability and that a more refined framework was needed.

Thus, the researchers discussed amongst themselves whether a deductive framework would be useful. During this collaboration, it became evident that the participants' statements of the use of the self-modeling video could be conceptualized within the literature on self-regulation. Within the laboratory, Dr. Ste-Marie has been studying Zimmerman's self-regulation of learning theory and it was proposed to determine if the verbatim transcripts could be coded within that framework. Once Zimmerman's (1989, 2000) self-regulation framework was adopted, the researchers re-coded the same three participants statements based on the Zimmerman's description of the self-regulatory processes involved in the three phases of his theory. While the next group meeting produced a more consistent interpretation by the researchers, more refinement was needed in order gain a clear understanding concerning each of the self-regulatory processes represented within Zimmerman's model, as well as examples of statements signifying each process. After a clear consensus as to the defining characteristics of each self-regulatory process, it became evident that the statements in the verbatim transcripts could be coded according to self-regulatory processes.

Indeed, self-regulation has been applied in the motor skill context with success (Kitsantas & Zimmerman, 1998). Moreover, recent research by Clark and Ste-Marie (in press), had adopted Zimmerman's self-regulation framework when addressing self-modeling and swimming performance. Here, it was shown that the self-modeling intervention increased children's self-regulatory processing. Also of interest is that Law and Ste-Marie (2005) proposed that the application of the self-modeling video and the use of log books among figure skaters could have been a means in itself to self-regulate and self-monitor. Zimmerman's self-regulation of learning model, was thus used for deductive analysis of the verbatim transcripts obtained from the divers in this research. Zimmerman's model is now discussed in more detail to assist with the understanding of the deductive analysis.

Self-regulation refers to "self-generated thoughts, feelings, and actions that are planned and critically adapted to the attainment of personal goals" (Zimmerman, 2000, p. 14). Zimmerman's (1989, 2000) model of self-regulated learning is situated within Bandura's (1986) social cognitive perspective that proposes a relationship between the person, the behaviour, and the environment. The person component refers to one's thoughts, attitudes, and beliefs which are influenced by what occurs in the environment (i.e. administration of a self-modeling video), and in turn effects the outcome of the behaviour. Encompassed in the person component of the Bandura's tri-cyclical phases is self-regulation (Zimmerman, 2000). Moreover, Zimmerman's (1989, 2000) self-regulation model consists of three phases that, similar to Bandura's structure, work in a cyclical fashion. Figure 5 illustrates the model of self-regulated learning within Bandura's Social Cognitive Theory.

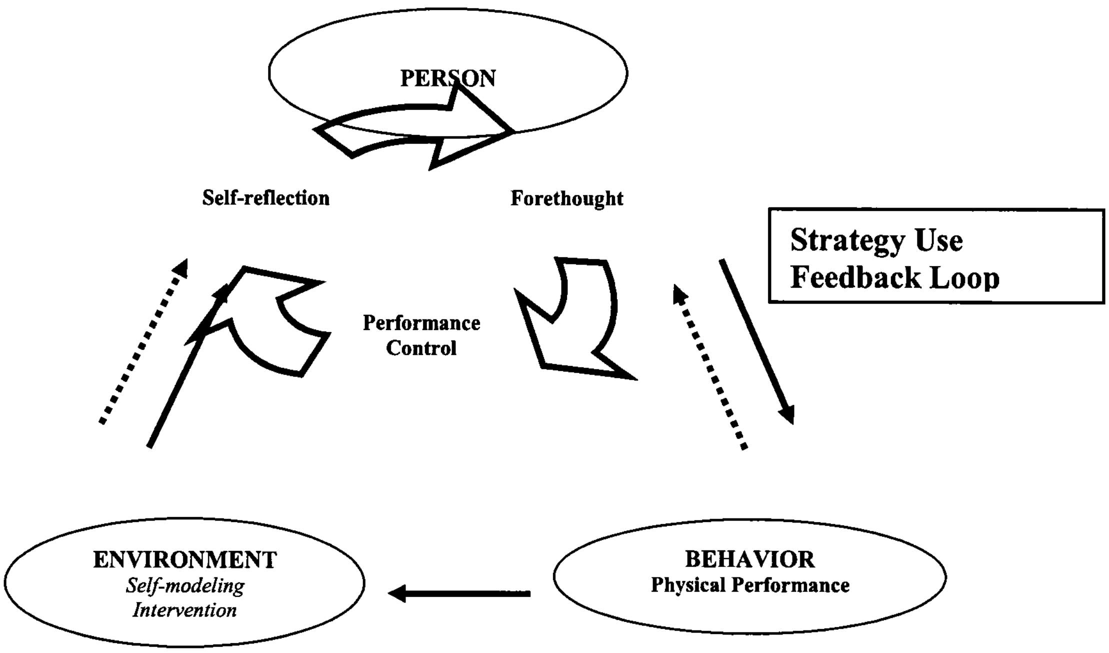

Figure 5. Triadic forms of self-regulation with the cyclical theory of self-regulated learning. Note. From "A social cognitive view of self-regulated academic learning." By B. J. Zimmerman, 1989, *Journal of Educational Psychology, 81*, p. 330.

In Table 5, the three phases of self-regulation described by Zimmerman (2000) along with the processes involved in each phase is presented. A review of all the research with each of these self-regulatory processes would be too extensive for this phase of the research, consequently, just a basic overview of the processes that comprise each phase is provided. The first of these three phases is forethought, which involve the thoughts and cognitions engaged in before the skill is attempted. The first part in the forethought phase is task analysis. Here, an individual sets goals and implements strategic planning in order to analyze tasks and prepare for personal, behavioural, and environmental changes (Zimmerman, 2000). In relation to strategic planning, there are many methods in which an individual may partake. For example, an athlete may use key words, images, and other strategies that are appropriate and useful for proper skill execution (Zimmerman, 2000).

Table 5.

Zimmerman's (2000) self-regulatory process involved in the person component of Bandura's (1977a; 1986; 1997) Social Cognitive Theory

Forethought	***Performance Control***	***Self-reflection***
Task analysis *Goal setting* *Strategic planning (e.g., imagery, self-instruction)*	**Self-control** *Self-instruction* *Imagery* *Attention focusing* *Task strategies*	**Self-judgement** *Self-evaluation* *Causal attribution*
Self-motivational beliefs *Self-efficacy* *Outcome expectations* *Intrinsic interest/values* *Goal orientation*	**Self-observation** *Self-recording* *Self-experimentation*	**Self-reaction** *Self-satisfaction* *Adaptive/defensive inferences*

The second part of this forethought phase is self-motivational beliefs. Goal stetting or strategic planning has little value unless one is motivated to set goals and plan (Zimmerman, 2000). One such motivational belief is self-efficacy. Therefore, depending on one's self-regulatory efficacy, which is the belief in one's capabilities to manage thoughts, feelings, and actions, this will affect his or her effort to self-regulate (Zimmerman, 2000). In addition to self-efficacy, there are many other processes involved in motivational beliefs. Outcome expectations are judgements or beliefs of the outcomes a behaviour will produce (Bandura, 1986); i.e., it is the consequence of the act (e.g., trophy) and not the act itself. Intrinsic interest and values is another factor within this component and this relates to one's internal motivation and commitment with the skill. Lastly, goal orientation refers to whether a person is oriented more towards personal mastery of the skill or towards performing the skill better than others (Zimmerman, 2000).

The second phase is the performance control phase, which consists of self-regulatory processes that occur while physically attempting the actual skill or behaviour. Self-instruction, imagery, attention focusing, and task strategies are considered to be self-regulatory processes that comprise the self-control component. Knowing that Zimmerman's theory is cyclical (2000) it is not surprising that this component comprises those same strategies that were considered within strategic planning used in the forethought phase. As well, within the performance control phase, are self-observation processes. Self-observation involves one observing his or her own performance and monitoring personal, behavioural, and environmental processes while doing the skill (Zimmerman, 2000). Techniques involved in self-observation are self-recording and self-experimentation. Self-recording involves the gathering of information when it occurs and keeping a record of it for evidence (Zimmerman, 2000). Therefore, the individual is able to refer back to the records for patterns of behaviours in which they would like to change or keep. Self-experimentation, in many cases, is a technique that results from self-observing. In a specific situation, if a person believes that they are not receiving the proper information from their behaviour, they may experiment and vary different behaviour in order to gain the proper information (Zimmerman, 2000).

The third phase of self-regulation is self-reflection, which refers to the reaction the learner gives to his/her performance, and thus, occurs after the skill or behaviour is attempted. The self-reflection phase involves self-judgments and self-reactions. Self-judgment is comprised of one's evaluations of one's own performance, such as doing comparisons to a standard or goal (Zimmerman, 2000). This evaluation is done through standards that may be set according to mastery, previous performance, normative, and/or collaborative criteria. Also within self-judgement, are causal attributions. Zimmerman (2000) describes attributions as how the learner relates his/her results to either ability or effort and this becomes essential to self-reaction. Also of importance, attributions are not outcomes of evaluation one's performance, but they depend on cognitive appraisals of, for example, efficacy or explanatory environmental factors (i.e., self-modeling video) (Zimmerman, 2000).

Self-reaction allows the individual to distinguish whether they are satisfied or dissatisfied with the outcome, as well as setting inferences, which can be adaptive or defensive (Zimmerman, 2000). This process relates to how one perceives his/her own need to change a self-regulatory behaviour in order to improve performance (Zimmerman, 2000). For example, an adaptive inference would direct people to a new and improved form of self-regulation, such as adopting a new strategy. If, the learner is using a self-instruction strategy that he/she perceive as not benefiting them, the learner will then adopt a new strategy, such as imagery, which he/she believe could benefit their skill. Therefore, the learner is reflecting on their strategies by attributing their results to poor choice of strategy, and reacting through an adaptive inference to change that strategy. Defensive inferences, on the other hand, are processes that are used to protect a person from dissatisfaction or failure. Procrastination is a good example of such an inference. Here, the learner would postpone doing the skill in order to save them self from feelings of failure or being dissatisfied (Zimmerman, 2000). In all instances, inferences are used when one needs to alter their self-regulatory strategies. Thus, the learning will go back to the forethought phase and, for example, choose a different strategic planning method, which would in turn change the process in the performance control phase.

Once it was decided to use Zimmerman's theory for the deductive analysis and a clear understanding of each of the self-regulatory processes within this theory was achieved, the same three participants' transcripts were coded a final time by the group of five researchers. At this point, greater agreement was obtained by the group and all participants' transcripts were then coded by two of the researchers that were involved in the coding from the beginning. Therefore, ten participants' statements were coded for the analysis of transcripts. These ten participants competed in at least one competition and answered the four questions relating to their views of the self-modeling video. Cohen's Kappa (Cohen, 1960) was used to verify inter-rater reliability between these two researchers. This method was chosen due to it being the most commonly used to establish inter-rater reliability. Also, Cohen's Kappa is appropriate for nominal scales, which was the classification of our self-regulatory category system. Further, Cohen's Kappa takes into account the judges' agreement as well as agreements expected by chance (Cohen, 1960). Initially, inter-rater reliability was satisfied for the number of statements coded, indicating that the researchers were in agreement on how many statements each participant expressed in the answers to the questions. However, inter-rater reliability, although close, did not meet acceptable standards for the actual self-regulatory codes given to the statements. Hence, further discussion by the raters concerning the distinction of each code followed and then all transcripts were coded again. At this stage, inter-rater reliability was deemed acceptable (K= .94). Therefore, both researchers were in agreement of the number of statements represented in an answer and the coding of each statement. From this, the frequency (i.e., the number of times a code was represented) of the self-regulatory processes used by participants was determined, as well, the percentage of representation of each self-regulatory process was calculated (please refer to Table 6). Through this analysis it was clearly evident that viewing the self-modeling video impacted on the processes involved in the participants' forethought and self-reflection phases.

Table 6.

Frequencies and Percentages of Self-Regulatory Processes

Dependent Variables		Frequency	Percentage
Forethought Phase			
Task analysis	Goal setting	5	5.4
	Strategic planning affect	8	8.7
	Strategic planning imagery	13	14.1
	Strategic planning task	25	27.2
	Strategies		
	Strategic planning attention	0	0
	Focusing		
Self-motivational beliefs	Self-efficacy	18	19.6
	Outcome expectations	0	0
	Intrinsic interest/values	0	0
	Goal orientation	0	0
TOTAL		69	75
Self-Reflection Phase			
Self-judgement	Self-evaluation	8	8.7
	Causal attributions	4	4.3
Self-reaction	Self-satisfaction	11	12
TOTAL		23	25
Total		92	100

Qualitative Discussion

The purpose of the qualitative portion was to explore the views of the participants in regards to the administration of the self-modeling video. Specifically, the participants' thoughts, feelings, and how they used the information they received from viewing the self-modeling video were analyzed. As noted earlier, this was an exploratory portion of the study wherein Zimmerman's (1989, 2000) self-regulation theory was adopted as a theoretical framework for deductive analysis.

The analysis showed that the athletes did utilize a number of the self-regulatory processes involved in the forethought and self-reflection phase of self-regulation. In relation to the forethought phase, which involves such processes concerned with task analysis and motivational beliefs, the most represented process were concerned with task analysis (55.4%). Task analysis incorporates goal setting and strategic planning components. The most popular processes identified in this research were involved in strategic planning (50%). Within strategic planning, the tactic of task-strategies (27.2%) was mentioned the most, followed by imagery (14.1%), and then affect (8.7%).

Most popular, as seen in the percentages above, were statements that Zimmerman (2000) has labelled task-strategy. Zimmerman (2000) described this strategy as "reducing a task to its essential parts and recognizing it as meaningful" (p. 19). Within this experiment, participants described using the video to break down their dive into specific parts that were essential to the outcome of their performance. A clear example of this is seen in the statement from participant seven;

> I was trying to think about the different things I needed to do on my dive, so like the first round I watch to see if my feet were jumping back or not, because that's a problem I have…the second time I tried to watch my arms, and the third time I tried to watch my come out [entry], and the fourth time I tried to watch it all together.

The use of video as a means for breaking skills down into parts (task strategies) has been a technique seen in other self-regulation research. In support of this, 100% of the participants in Law and Ste-Marie's (2005) study indicated that they would use the self-modeling video in competition training and that they would use it for studying their technical execution of a jump.

Also in regards to the motor execution, many participants indicated that they used the video to describe how to proceed through forming mental pictures. That is, they used the video to produce images of their performance. For example, participant four said, "when I was on the board and on the end of the board waiting to dive, I was trying to replay the video in my mind so then I could do the same thing on the video".

Not only did participants use strategic planning tactics for motor execution, they also used many strategic planning tactics relating to affect. In terms of affect, participant ten said that "it was making me feel more calm", while participant two said that, "it made me feel comfortable knowing that I had something right in front of me that I could just lead from".

A less popular process also involved in strategic planning was goals (5.4%). Participant two stated that the self-modeling video made her think "about how I was going to perform the dive, and I was thinking about doing it really good". Here, the participant has decided on how she would like to perform the dive (i.e. set a goal to do the dive "really good"). It is not surprising to hear goal setting statements as Zimmerman and Kitsantas (1997) have identified goal setting as a key self-regulatory process. More importantly, learners who shift from process goals to outcome goals attain a great skill acquisition (Kitsantas & Zimmerman, 1997). Also, Kitsantas and Zimmerman (1998) used a demonstration (i.e. a model) while also incorporating different types of goal setting techniques. In their research all participants were showed the same videotape demonstration of a dart throw, where the results showed that those who were in the modeling condition with dynamic goal setting (shifting from process goals to outcome goals) showed the greatest increase in dart throwing performance. Therefore, it is obvious that modeling and goal setting have been coupled together as self-regulatory processes influencing performance. Similarly, in the quotation above, a model (i.e. self-modeling video) was used and a goal was set based on what the participant wanted her performance to be.

As for the component of self-motivational beliefs found in the forethought phase, statements linking directly to self-efficacy were evident (19.6%). More specifically, participants expressed that the self-modeling video made them feel more efficacious in their ability to perform their dive. After watching the video, participant two believed that she 'knew' she could do the dive, therefore believing in her capabilities to perform her dive. She said, "it made me feel more confident in that I can, *I know* [italics added], I've seen myself do the dive and I know I can do it". Self-efficacy seems to be the most popular self-regulatory variable measured in the modeling literature (Dowrick & Raeburn, 1995; Starek & McCullagh, 1999). Law and Ste-Marie's (2005) research on figure skaters used a positive self-review video of self-modeling and in the follow up questionnaire, skaters commented that they enjoyed the self-modeling video and it made them feel more confident. The comments of the skaters are similar to the comments of participants in this research. Both reveal that the self-modeling video influenced their belief in their abilities to perform a task (i.e., self-efficacy). Also, in support of this research finding, Clark and Ste-Marie's (in press) results showed that the self-modeling group had significantly greater increases in self-efficacy when compared to a self-observation and control group. Though Clark and Ste-Marie's (in press) research was done with motor skill acquisition, and not as a competitive performance enhancement technique, it gives support to the notion that self-modeling influences the self-regulatory process of self-efficacy.

In the self-reflection phase, self-regulatory processes that fell within the self-judgment component (13%) and self-reaction component (12%) were also observed through the qualitative analysis of the participants' statements. A process within the self-judgement component was that of self-evaluation (8.7%). A statement was coded under self-evaluation if the athletes compared themselves to a goal or past/present performance. For example, when asked what she was thinking about while watching the video, participant seven stated, "one thing I was trying to think about was the thing I was having trouble with earlier in the practice". She later expressed that she was watching for a specific technical aspects of the dive to see how it should be done. Therefore, the participant was using the information on the self-modeling video for comparison to a performance in an earlier practice. Clark, Ste-Marie, and Martini's (2006) research, showed that children also used self-as-a-model videos to evaluate performance and make comparisons.

One other self-regulatory process within the self-judgement component involved how one attributed his/her performance to certain factors (4.3%). One such an instance was when asked how the information from the video was used, participant ten replied "well it made it a lot easier I guess because you get to, you just know more what to do, what to fix, and what to keep the same". This participant was suggesting that by viewing their self-modeling video, their dive seemed easier, therefore giving reasoning for their dive. The use of attributions as a self-regulatory process are also seen in research conducted with basketball (Cleary & Zimmerman, 2001), and volleyball players (Kitsantas & Zimmerman, 2002).

Self-satisfaction was the only self-reaction process that emerged through the qualitative data, with 12% of statements falling in this category. Participant nine expressed her satisfaction relating to her video by stating that "I saw the entry, the entry was very good", while another (participant five) stated that "the video would probably get me good points". In both statements the participants are indicating that they are satisfied with their performance that was seen in the video. The fact that higher levels of self-satisfaction can occur following a modeling intervention has been evidenced in other research. In Kitsantas, Zimmerman, and Cleary's (2000) research, three conditions were compared on a dart throwing task (coping model condition, mastery model condition, and control). The results showed that the girls who were in both modeling conditions showed more self-satisfaction in their dart throwing than the control. Clark and Ste-Marie's (in press) research showed that self-satisfaction increased by the retention phase which is a process that participants in this research acknowledged in the transcripts as a means of what they felt, thought, and how they used the self-modeling video. A distinction must be made, however, as both Katsantas and colleagues' (2000) research and Clark and Ste-Marie's (in press), involved motor learning as opposed to competitive performance enhancement.

Overall, the qualitative data of the present research supports Clark and Ste-Marie's (in press) findings that indicate the existence of a relationship between self-modeling and self-regulation. This research is, however, limited. As such, further research on the relationship between self-modeling and self-regulation should continue in order to gain an in depth understanding of the possible interactions between these two factors.

Notable is that there are other self-regulatory processes that did not arise in the present study. One such process, for example, is intrinsic interest (motivation). Previous research by Kitsantas, et al (2000) found a strong correlation between intrinsic interest and self-efficacy. Therefore, the more self-efficacious the more intrinsic interest one has in regard to the task. The qualitative analysis of this research has shown that the participants' self-regulatory process of self-efficacy had been influenced through the viewing of the self-modeling video, though not seen in the pencil and paper measures. In saying this, while taking into consideration that athletes usually compete because they choose to, the strong relationship between self-efficacy and intrinsic interest alludes to further research investigating intrinsic interest in relation to a self-modeling video in a competitive environment.

It is important to mention that for the purpose of this research, the questions directed the participants to refer to their thoughts while the video was viewed, before the dive was competed (forethought), and after the dive was competed (self-reflection). Therefore, the performance control phase was not directly addressed in this research. Future research, however, could frame questions in order to bring to the surface any processes utilized during a self-modeling intervention involved in all three phases of self-regulation.

If we take a step back and attempt to provide a brief snapshot of each participant's overall view of the self-modeling intervention, we see positive comments for the intervention. In relation to each participant's summary, participant one stated that the video made him feel more confident. Also, he said that he took the dive from the video and used it to create an image in his mind. Similarly, participant two also indicated that she used the video to break the dive down in order to create a mental picture of that dive. Therefore, the video was used as a form of imagery. The participant also stated that the video made them feel more confident in their ability to perform that dive. Where, participant three used the video specifically for breaking her dive down into separate parts so she was able to see how it should be done correctly. Moreover, participant four indicated that she used the video to look at different aspects of the dive. The first time she would watch for one thing, the second time she would focus on a different aspect, and finally viewing it as a whole at the end. One participant, participant five, was thinking about what she was going to do on the board and how she was going to do the dive in the competition while watching the self-modeling video.

Participants six's comments were brief. She did, however, mention she watched the video to see what to improve on in her dive. In contrast to the other participants, participant seven expressed many views when referring to her self-modeling video. She watched the video and broke down her dive into different parts, then used what was seen on the video to visualize before she had competed. She also mentioned that watching the video made her feel much more confident that she could perform the dive just like what was seen in the video. In addition, participant eight's comments were directed towards how satisfied she was with her dive on the video and that it made her feel good to watch it. Participant nine watched the video while comparing what she had done in practices with what was being seen on the video. Participant ten's comments were directed towards the video making her feel calmer because she was able to watch her self perform that dive.

This qualitative portion suggests that the self-modeling technique had participants engage in self-regulation. The participants used the video in order to self-regulate in both the forethought and self-reflection phases of Zimmerman's (1989, 2000) self-regulation framework. For the most part, participants used the self-modeling video as a means to plan strategies. Although many self-regulatory themes were evident, two processes were most widely commented on. Particular to strategic planning, task strategies, which relates to breaking down the task into essential parts and acknowledging that each are meaningful (Zimmerman, 2000), was the most popular and self-efficacy was the second.

Conclusion

The main purpose of this research was to investigate the use of a self-modeling video in a competitive diving environment. More specifically, whether a dive receiving a self-modeling video would yield a better performance compared to a dive not receiving a video.

The secondary aim was to investigate the effects of the self-modeling video on such psychological constructs as self-efficacy, self-talk, and mental readiness.

Based on Dowrick's (1999) review, as well as previous literature in self-modeling (e.g., Dowrick & Dove, 1980; Starek & McCullagh,1999; Ram & McCullagh, 2003; Law & Ste-Marie, 2005; Clark & Ste-Marie, in press), most research has been done with motor skill acquisition and not competitive performance enhancement. However, Maile's study on a national power lifter used a feedforward self-modeling technique in order to enhance performance (as cited in Franks and Maile, 199). The results demonstrated promising findings for a self-modeling video as a competitive performance enhancement technique. Therefore, it was predicted that the dive that received the self-modeling video could be used as a competitive performance enhancement technique.

With respect to the competitive performance literature, it was predicted that the dive that received the self-modeling video would increase one's self-efficacy, produce a great use of positive self-talk and lower the use of negative self-talk, and in doing so bring an individual to his/her optimal state of mental readiness.

The results, unfortunately, did not support out predictions. The physical performance results showed no significant difference between the dive that received the self-modeling video and the control drive. Thus, suggesting that the self-modeling video dose not have an effect on competitive diving performance. As for self-efficacy, self-talk, and mental readiness, the results showed no significant difference between the two dives. Therefore, similar to that of physical performance, it seems as though the self-modeling video did not have an effect on one's self-efficacy, their use of positive or negative self-talk, as well as their state of mental readiness.

A secondary analysis looked at the possibility of imagery ability as a moderating variable. For example, if there were differences in dive performance scores between those who are considered good imagers and those who are poor imagers. Therefore, imagery ability would moderate the results. However, the results did not show this and thus imagery ability did not moderate the results of dive performance.

Interestingly, despite the results of the quantitative portion of the research, the qualitative portion suggests that the self-modeling video did have an effect on the participants' self-regulatory processes. Here, Zimmerman's (1989; 2000) self-regulation theory was used as a theoretical model for the deductive analysis of the participants answers to fours questions relating to the administration of the self-modeling video. This portion of the research suggests that a self-modeling video can influence processes involved in the forethought and self-reflection phase. This relationship between self-modeling and self-regulation is also seen in Clark and Ste-Marie (in press). It is a possibility, however, that the self-regulatory processes that emerged in this research were no different from the participants' usual regulatory methods and thus further research should be conducted to determine if the self-regulatory processes identified were above and beyond those that normally occur in the competitive arena.

As mentioned, there are limitations to this research, giving possible insight to why the self-modeling video did not show significant results. For example, the sample size was small and the number of competition sites was few. There is a possibility that the self-modeling video did not have enough time to take effect with only two competitions. On top of this, only one baseline score was used for physical performance, and as for the psychological variables, an actual baseline score from a previous competition was not obtained.

Consequently, various modifications can be made in order to help improve the design for future research of self-modeling in a competitive environment. First, the recruitment of participants should be greater and would therefore increase the power of the research and possibly allow for an analysis using a multiple regression. Furthermore, an increase in the number of baseline scores would provide the researcher with a better representation of the diver's initial performance status and psychological constructs.

Moreover, the qualitative portion of the present research suggests that the self-modeling video is influencing some self-regulatory processes. However, only the forethought and self-reflection phases were tapped into due to the framing of the questions. Perhaps, incorporating all three of Zimmerman's (1989; 2000) phases of self-regulation would enable a better understanding of the relationship between self-modeling and self-regulation.

In sum, the results suggest that further research is need in this area. Research has shown equivocal findings relating to self-modeling and skill acquisition. Some support modeling as beneficial (e.g., Clark & Ste-Marie, in press; Ram & McCullagh, 2003; Starek & McCullagh, 1999), whereas some researchers have found no differences in performance (e.g., Law & Ste-Marie, 2005; Ram & McCullagh, 2003; Winfrey & Weeks, 2003). Although, results of this research were not seen for physical performance, self-efficacy, self-talk, and mental readiness, the qualitative portion suggests that a self-modeling video induced participants to engage in self-regulatory processes that have been shown to result in learning advantages. Perhaps with a longer and more intense intervention, such engagement in self-regulatory processes would result in gains in physical performance.

Reference

Anderson, K.J. (1990). Arousal and the inverted-U hypothesis: A Critique of Neiss's "reconceptualizing arousal". *Psychological Bulletin, 107, 96-100.*

Bandura, A. (1977a). *Social learning theory.* New Jersey: 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. (2005). *Guide for constructing self-efficacy scale.* Retrieved for the world wide web on October 2005 at http://www.des.emory.edu/mfp/self-efficacy.html..

Basler, M.L., Fisher, C., & Mumford, N.L. (1976). Arousal and anxiety correlates of gymnastics performance. *Research Quarterly,47, 586-589.*

Bertram, C.P., Cote, A., Brown, M., & Guadagnoli, M.A. (2007) The effects of positive video modeling during warm-up. *Journal of Sport and Exercise Psychology, 29, s55-56.*

Bryman, A. (1988). *Quantity and Quality in Social Research.* Laughborough University, London. Routledge

Clark, S.E. (2005). *Investigating the impact of self-as-a-model interventions on children's self-regulation of learning, swimming performance, and thought processes.* Unpublished doctoral dissertation, University of Ottawa, Ontario.

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

Clark, S. E. & Ste-Marie, D. (in press). Investigating the impact of self-as-a-model interventions on children's self-regulation of learning and swimming performance. *Journal of Sport Sciences.*

Clark, S.E., & Ste-Marie, D.M. (2006). Self-regulation and swimming performance. Manuscript accepted. *Journal of Sport Sciences.*

Clark, S.E., Ste-Marie, D.M., & Martini, R. (2006). The thought process underlying self-as-a-model interventions: An exploratory study. *Psychology of Sport and Exercise, 7, 381-386.*

Cleary, T.J. & Zimmerman, B.J. (2001). Self-regulation differences during athletic practice by experts, non-experts, and novices. *Journal of Applied Sport Psychology, 13,* 185-206.

Cohen, J. (1960). *A coefficient of agreement for nominal scales*. Educational and Psychological Measurement. XX, 1.

Cox, R., H. (2002). *Sport Psychology: Concepts and applications* (4th ed.). N.Y., McGraw-Hill companies.

Cummings, J., Clark, S.E., Ste-Marie, D.M., McCullagh, P., & Hall, C. (2005). The functions of observational learning questionnaire (FOLQ). *Psychology of Sport and Exercise, 6, 517-537.*

Cumming, J., Nordin, S. M., Horton, R., & Reynolds, S. (2006). Examining the Direction of Imagery and Self-Talk on Dart-Throwing Performance and Self Efficacy. *The Sport Psychologist. 20(3), 257-274.*

Gregg, M., Hall, C., Nederhof, E. (2005). The Imagery Ability, Imagery Use, and performance Relationship. *Sport Psychologist. 19(1), 93-99.*

Dowrick, P.W. (1999). A Review of self-modeling and related interventions. *Applied and*

Preventative Psychology, 8, 23-29.

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.

Dowrick, P.W., & Raeburn, J.M. (1995). Self-modeling: Rapid skill training for children with physical disabilities. *Journal of Developmental and Physical Disabilities, 7, 23-37.*

Durand-Bush, N., Salmela, J.H., & Green-Demers, I. (2001). The Ottawa Mental Skills Assessment Tool (OMSAT-3). *The Sport Psychologist, 15, 1-19.*

Feltz, D.L., & Landers, D.M. (1983). The effects of mental practice on motor skill Learning and performance: A meta-analysis. *Journal of Sport Psychology, 5, 25-57.*

Fish, L., Hall, C., & Cumming, J. (2004). Investigating the use of imagery by elite ballet dancers. *Avante, 10, 26-39.*

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

Gould, D., & Weiss, M. (1981). The effects of model similarity and model talk on self-efficacy and muscular endurance. *Journal of Sport Psychology, 3, 17-29.*

Gould, D., Petlichkoff, L., & Vevera, M. (1987). Relationship between Competitive State Anxiety Inventory-2 subscale scores and pistol shooting performance. *Journal of Sport Psychology, 9, 33-42.*

Goss, S., Hall, C., Buckolz, E., & Fishburne, G. (1986). Imagery ability and the acquisition and retention of movements. *Memory and Cognition, 14, 469-477.*

Hackfort, D., & Schwenkmezger, P. (1993). *Anxiety.* In R.N. Singer, H.A. Hausenblas,

& M.C. Janelle. (Eds.) *Handbook of Sport Psychology,* (2ed, pp.290-318) New York, John Wiley & Sons Inc.

Hardy, J. (2006). Speaking clearly: A critical review of the self-talk literature. *Psychology of Sport and Exercise. 7(1), 81-97.*

Hardy, J., Hall, C.R., Alexander, M.R. (2001). Exploring self-talk and affective states in sport. *Journal of Sport Sciences, 19, 469-475.*

Hall, C.R. (2001). Imagery in sport and exercise. In R.N. Singer, H.A. Hausenblas, & M.C. Janelle. (Eds.) *Handbook of Sport Psychology,* (2ed, pp.290-318) New York, John Wiley & Sons Inc.

Hall, C.R, & Martin, K.A. (1997). Measuring movement imagery abilities: A revision of the Movement Imagery Questionnaire. *Journal of Mental Imagery, 21, 143-154.*

Hall, C., Mack, D., Paivio, A., & Hausenblas, H. (1998). Imagery use by athletes: Development of the sport imagery questionnaire. *International Journal of Sport Psychology, 29, 73-89.*

Hall, C., Rodgers, W.M., & Barr, K.A. (1990). The use of imagery by athletes in selected sports. *The Sport Psycholoist, 4, 1-10.*

Halliwell, W. (1990). Providing sport psychology consultant services in professional hockey. *The Sport Psychologist, 4, 369-377.*

Highlen, P.S., & Bennett, B.B. (1983). Elite divers and wrestlers: A comparison between open- and closed-skill athletes. *Journal of Sport Psychology, 5, 390-409.*

Isaac, A. (1992). Mental practice- does it work in the field? *The Sport Psychologist, 6, 192-198.*

Isaac, A.R., Marks, D., & Russekk, E. (1986). An instrument for assessing imagery of movement: The Vividness of Movement Imagery Questionnaire (VMIQ). *Journal* *of Mental Imagery, 10,* 23-30.

Jones, G., Swain, A.B.J., & Hardy, L. (1993). Intensity and direction dimensions of competitive state anxiety and relationships with performance. *Journal of Sport Sciences, 11,* 525-532.

Kamata, A., Tenenbaum, G., & Hanin, Y.L. (2002). Individual zones of optimal functioning (IZOF): A probabilistic Estimation. *Journal of Sport and Exercise Psychology, 24,* 189-208.

Kehle, T.J., Clark, E., Jenson, W.R., & Wampold, B.E. (1986). Effectiveness of self-observation with behavior disordered elementary school children. School Psychology Review, 15, 289-296.

Klavora, P., (1979). Customary arousal for peak and athletic performance. In P. Klavora & J. Daniel (Eds.), *Coach, athlete, and the sport psychologist* (pp.155-163). Toronto, Canada: University of Toronto.

Krane, V. (1992). Conceptual and methodological considerations in sport anxiety research; From the inverted-u hypothesis to the catastrophe theory. *Quest, 44,* 72-87.

Krane, V. (1994). The mental readiness form as a measure of competitive state anxiety. *The Sport Psychologist, 8,* 189-202.

Krane, V., Joyce, D., & Rafeld, J. (1994). Competitive anxiety, situation criticality and softball performance. *The Sport Psychologist, 8,* 58-72.

Kitsantas, A., & Zimmerman, B.J. (1998). Self-regulation of motoric learning: A strategic cycle view. *Journal of Applied Sport Psychology 10(2),* 220-239.

Kitsantas, A. & Zimmerman, B.J. (2002). Comparing self-regulatory processes among novice, non-expert and expert volleyball players: A microanalytic study. *Journal of Applied Sport Psychology, 14,* 91-105.

Kitsantas, A., Zimmerman, B.J., & Cleary, T. (2000). The role of observation and emulation in the development of athletic self-regulation. *Journal of Educational Psychology, 92, 811-817.*

Laguna, P.L. (1996). The effects of model demonstration strategies on motor skill acquisition and performance. *Journal of Human Movement Studies, 30, 55-79.*

Law, B., & Ste-Marie, D.M. (2005). Effects of self-modeling on figure skating jump performance and psychological variables. *European Journal of Sport Science, 5(3), 143-152.*

Loehr, J.E. (1986). Mental toughness training for sports: Achieving Athletic Excellence. Lexington, MA Stephen Green Press.

Magill, R., A. (2001). Introduction to motor skill learning. *Motor Learning: Concepts and Applications,* (6th ed, pp.168-182). New York, The McGraw-Hill Companies, Inc.

Mahoney, M.J., & Avener, M. (1977). Psychology of the elite athlete: An exploratory study. *Cognitive Therapy and Research, 1, 135-141.*

Mahoney, M.J., Gabriel, T.J., & Perkins, T.S. (1987). Psychological skills and exceptional Athletic performance. *The Sport Psychologist, 1, 181-199.*

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

Mamassis, G., & Doganis, G. (2004). The effects of a mental training program on juniors pre-competitive anxiety, self-confidence, and tennis performance. *Journal of Applied Sport Psychology, 16, 118-137.*

McCullagh, P. (1987). Model similarity effects on motor performance. *Journal of Sport Psychology, 9, 249-260.*

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

Moran, P.A. (1996). *The psychology of concentration in sport performance.* East Sussex, UK: Psychology Press Publishers.

Moris, L., Davis, D., & Hutchings, C. (1981). Cognitive and emotional components of anxiety: Literature review and revised worry-emotionality scale. *Journal of Educational Psychology, 75, 541-555.*

Munroe, K., Hall, C., & Simms, S. (1998). The influence of type of sport and time of season on athletes' use of imagery. *The Sport Psychologist, 12, 440-449.*

Orlick, T., & Partington, J. (1988). Mental links to excellence. *The Sport Psychologist, 2, 105-130.*

Paivio, A. (1985). Cognitive and motivational functions of imagery in human performance. Canadian Journal of Applied Spot Sciences, 10, 22-28.

Powell, A. (1973). Negative and positive mental practice in motor skill acquisition. *Perceptual and Motor Skills, 37, 312.*

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

Ram, N., McCullagh, P., & Skaling, S. (2004). Assessing differential learning form modeling and imagery interventions using latent growth curve models . *Journal of Sport and Exercise psychology, 28, S152* (NASPSPA Abstract).

Rodgers, 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.

Rogerson, L.J., & Hrycaiko, D.W. (2002). Enhancing competitive performance of ice hokey goaltenders using centering and self-talk. *Journal of Applied Sport Psychology, 14, 14-26.*

Rushall, B.S. (1984). The content of competition thinking. In W.F. Straub, & J.M. Williams, (Eds.), *Cognitive Sport Psychology* (pp. 51-62). Lansing, NY: Sport Science Associates.

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

Shunk, D.H., Hanson, R.A., & Cox, P.D. (1987). Peer-model-attributes and children's achievement behaviors. *Journal of Educational Psychology, 79, 54-61.*

Singer, R.N., Hausenblas, H.A., & Janelle, M.C. (2001). Modeling: Considerations for motor skill performance and psychological responses. *Handbook of Sport Psychology,* (2ed, pp.205-238) New York, John Wiley & Sons Inc.

Smith, R.E., Schutz, R.W., Smoll, F.L., & Ptacek, J.T. (1995). Development and validation of a multidimensional measure of sport-specific psychological skills: The Athletic Coping Skills Inventory-28. *Journal of Sport and Exercise Psychology, 17, 379-398.*

Soohoo, S., Takemoto, K.Y., & McCullagh, P. (2004). A comparison of modeling and imagery on the performance of a motor skill. *Journal of Sport Behavior, 27, 346-366.*

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

Templin, D.P., & Vernacchia, R.A. (1995). The effect of highlight music videotapes upon the game performance of inter-collegiate basketball players. *The Sport Psychologist, 9, 41-50.*

Theodorakis, Y., Weinberg, R., Natsis, P., Douma, I., & Kazakas, P. (2000). The effects of motivational versus instructional self-talk on improving motor performance. *Sport Psychologist. 14(3), 253-271.*

Thomas, P.R., Murphy, S.M., & Hardy, L. (1999). Test of performance strategies: Development and preliminary validation of a comprehensive measure of athletes' psychological skills. *Journal of Sports Sciences, 17, 697-711.*

Turner, P.E., & Raglin, J.S. (1991). Anxiety and performance in track and field athletes: A comparison of ZOF and inverted-U theories. *Medicine and Science in Sport and Exercise, 23, S119.*

Vadocz, E.A., Hall, C., & Moritz, S.,E. (1997). The relationship between competitive anxiety and imagery use. *Journal of Applied Sport Psychology, 9, 241-253.*

Van Raalte, J.L., Brewer B.W., Rivera, M., & Petitpas, A.J. (1994). The relationship between observable self-talk and competitive junior tennis players' match performance. *Journal of Sport and Exercise Psychology, 16, 400-425.*

Weinberg, R., & Gould, D. (1999). Personality in sport. *Foundations of Sport and Exercise Psychology. (2nd eds, pp23-46).* Human Kinetics

White, A., & Hardy, L. (1998). An in-depth analysis of the use of imagery by high level slalom canoeists and artistic gymnasts. *The Sport Psychologist, 12, 387-403.*

Winfrey, M.L.,& Weeks, D.L. (1993). Effects of self-modeling on self-efficacy and balance beam performance. [Article] *Perceptual and motor skills*, 77, 907-913

Woodman, T., Albinson, J.G., & Hardy, L. (1997). An investigation of the zones of optimal functioning hypothesis within a multidimensional framework. *Journal of Sport and Exercise Psychology, 19,131-141.*

Woodman, T., & Hardy, L. (2001). Stress and Anxiety. In Singer, R.N., Hausenblas, H.A., & Janelle, M.C. (Eds). *Handbook of Sport Psychology.* (pp.290-318). New York, John Wiley & Sons Inc.

Woolfolk, R.L., Parrish, M.W., & Murphy, S.M. (1985). The effect of positive and negative imagery on motor skill performance. *Cognitive Therapy and Research, 9, 335-341.*

Yerkes, R.M., & Dodson, J.D. (1908). The relation of strength of stimulus to rapidity of habit formation. *Journal of Comparative Neurology and Psychology, 18, 459-482.*

Zaichkowsky, L.D., & Baltzell, A. (2001). Arousal and performance. In Singer, R.N., Hausenblas, H.A., & Janelle, M.C. (Eds). *Handbook of Sport Psychology.* (pp. 319-339). New York, John Wiley & Sons Inc.

Zimmerman, B.J. (1989). A social cognitive view of self-regulated academic learning. *Journal of Educational Psychology, 81, 329-339.*

Zimmerman, B.J. (2000). Attaining self- regulation: A social cognitive perspective. In Boekaerts, M., Pintrich, P.R., & Zeidner, M. (Eds). *Handbook of Self-Regulation.* (pp. 13-39). San Diego, California: Academic Press.

Zimmerman, B.J. & Kitsantas, A. (1997). Developmental phases in self-regulation: Shifting from process goals to outcome goals. *Journal of Educational Psychology, 89,* 29-36.

Zinsser, N., Bunker, L., & Williams, J.M. (1998). Cognitive techniques for building confidence and enhancing performance. In J.M. Williams (Ed). *Applied sport psychology: Personal growth to Peak Performance (3rd ed., pp. 270-295).* Mountain, View, CA: Mayfield.

Appendices

Appendix B

Self-Efficacy Scale

This questionnaire is designed to help us get a better understanding of your belief in your ability to obtain a specific score on your __(specific dive)__. Please rate below how certain you are that you can perform __(specific dive)__ in this competition and receive the score indicated below. Your answers will be kept confidential and will not be identified by name.

Rate your degree of confidence by recording a number from 0 to 100 using the scale given below:

0	10	20	30	40	50	60	70	80	90	100
Cannot do at all					Moderately can do					Highly certain can do

I can get a score of:	CONFIDENCE
3.0	____________
3.5	____________
4.0	____________
4.5	____________
5.0	____________
5.5	____________
6.0	____________
6.5	____________
7.0	____________
7.5	____________
8.0	____________
8.5	____________
9.0	____________
9.5	____________

Appendix C

Test of Performance Strategies

Indicate your agreement about the following statement from the time you received your self-modeling video to the time you competed your dive.

	Agree		Somewhat agree		Do not agree
I talked positively to get the most out of my performance	5	4	3	2	1
I said things to help my competitive performance	5	4	3	2	1
I managed my self-talk effectively	5	4	3	2	1
I said specific cue words or phrases to help my performance	5	4	3	2	1
I imagined screwing up	5	4	3	2	1
My self-talk was negative	5	4	3	2	1
My thoughts were of failure	5	4	3	2	1

Appendix D

The Mental Readiness Form

My thoughts are:

/ 1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10 / 11 /
CALM WORRIED

My body feels:

/ 1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10 / 11 /
RELAXED TENSE

I am feeling:

/ 1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10 / 11 /
CONFIDENT SCARED

Appendix E

VIVIDNESS OF MOVEMENT IMAGERY QUESTIONNAIRE

TOTAL SCORES
(a) other =
(b) self =
Total (a)+(b) =

Movement imagery refers to the ability to imagine a movement. The aim of this test is to determine the vividness of your movement imagery. The items of the test are designed to bring certain images to your mind. You are asked to rate the vividness of each item by reference to the 5-point scale. After each item, write the appropriate number in the box provided. The first box is for an image obtained watching somebody else and the second box is for an image obtained doing it yourself. Try to do each item separately, independently of how you may have done other items. Complete all items obtained watching somebody else and then return to the beginning of the questionnaire and rate the image obtained doing it yourself. The two ratings for a given item may not in all cases be the same. For all items please have your eyes CLOSED.

Think of each of the following acts, and classify the images according to the degree of clearness and vividness as shown on the RATING SCALE.

Item	Watching somebody else	Doing it yourself
1. Standing		
2. Walking		
3. Running		
4. Jumping		

RATING SCALE The image aroused by each item might be:

Perfectly clear and as vivid as normal vision	....	RATING 1
Clear and reasonably vivid	....	RATING 2
Moderately clear and vivid	....	RATING 3
Vague and dim	....	RATING 4
No image at all, you only "know" that you are thinking of the skill	....	RATING 5

Think of each of the following acts, classify the images according to the degree of clearness and vividness as shown on the RATING SCALE

Item	Watching somebody else	Doing it yourself
5. Reaching for something on tiptoe		
6. Drawing a circle on paper		
7. Kicking a stone		
8. Bending to pick up a coin		
9. Falling forwards		
10. Running up stairs		
11. Jumping sideways		
12. Slipping over backwards		

RATING SCALE The image aroused by each item might be:

Perfectly clear and as vivid as normal vision	. . . .	RATING 1
Clear and reasonably vivid	. . . .	RATING 2
Moderately clear and vivid	. . . .	RATING 3
Vague and dim	. . . .	RATING 4
No image at all, you only "know" that you are thinking of the skill	. . . .	RATING 5

Think of each of the following acts, classify the images according to the degree of clearness and vividness as shown on the RATING SCALE

Item	Watching somebody else	Doing it yourself
13. Catching a ball with two hands		
14. Throwing a stone into water		
15. Kicking a ball in the air		
16. Hitting a ball along the ground		

Item	Watching somebody else	Doing it yourself
17. Running downhill		
18. Climbing over a high wall		
19. Sliding on ice		
20. Riding a bike		

RATING SCALE The image aroused by each item might be:

Perfectly clear and as vivid as normal vision	. . . .	RATING 1
Clear and reasonably vivid	. . . .	RATING 2
Moderately clear and vivid	. . . .	RATING 3
Vague and dim	. . . .	RATING 4
No image at all, you only "know" that you are thinking of the skill	. . . .	RATING 5

Think of each of the following acts, classify the images according to the degree of clearness and vividness as shown on the RATING SCALE

Item	Watching somebody else	Doing it yourself
21. Jumping into water		
22. Swinging on a rope		
23. Balancing on one leg		
24. Jumping off a high wall		

Appendix F

Instructions

This questionnaire concerns two ways of *mentally* performing movements which are used by some people more than by others, and are more applicable to some types of movements than others. The first is attempting to form a visual image or picture of a movement in your mind. The second is attempting to feel what performing a movement is like without actually doing the movement. You are requested to do both of these mental tasks for a variety of movements in this questionnaire, and then rate how easy/difficult you found the tasks to be. The ratings that you give are not designed to assess the goodness or badness of the way you perform these mental tasks. They are attempts to discover the capacity individuals show for performing these tasks for different movements. There are no right or wrong ratings or some ratings that are better than others.

Each of the following statements describes a particular action or movement. Read each statement carefully and then actually perform the movement as described. Only perform the movement a single time. Return to the starting position for the movement just as if you were going to perform the action a second time. Then depending on which of the following you are asked to do, either (1) form as clear and vivid a visual image as possible of the movement just performed, or (2) attempt to feel yourself making the movement just performed without actually doing it.

After you have completed the mental task required, rate the ease/difficulty with which you were able to do the task. Take your rating from the following scale. Be as accurate as possible and take as long as you feel necessary to arrive at the proper rating for each movement. You may choose the same rating for any number of movements "seen" or "felt" and it is not necessary to utilize the entire length of the scale.

RATING SCALES

Visual Imagery Scale

7	6	5	4	3	2	1
Very easy to see	Easy to see	Somewhat easy to see	Neutral (not easy nor hard)	Somewhat hard to see	Hard to see	Very hard to see

Kinesthetic Imagery Scale

7	6	5	4	3	2	1
Very easy to feel	Easy to feel	Somewhat easy to feel	Neutral (not easy nor hard)	Somewhat hard to feel	Hard to feel	Very hard to feel

. **Starting Position:** Stand with your feet and legs together and your arms at your sides.

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

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

Rating: ____________

Starting Position: Stand with your feet slightly apart and your hands at your sides.

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

Mental Task: Assume the starting position. Attempt to see yourself making the movement just performed with as clear and vivid a visual image as possible. Now rate the ease/difficulty with which you were able to do this mental task.

Rating: ____________

Starting Position: Extend the arm of your nondominant hand straight out to your side so that it is parallel to the ground, palm down.

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

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

Rating: ____________

Starting Position: Stand with your feet slightly apart and your arms fully extended above your head.

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

Mental Task: Assume the starting position. Attempt to see yourself making the movement just performed with as clear and vivid a visual image as possible. Now rate the ease/difficulty with which you were able to do this mental task.

Rating: ____________

5. **Starting Position:** Stand with your feet slightly apart and your hands at your sides.

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

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

Rating: ____________

6. **Starting Position:** Stand with your feet and legs together and your arms at your sides.

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

Mental Task: Assume the starting position. Attempt to see yourself making the movement just performed with as clear and vivid a visual image as possible. Now rate the ease/difficulty with which you were able to do this mental task.

Rating: ____________

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

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

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

Rating: ____________

8. **Starting Position:** Extend the arm of your nondominant hand straight out to your side so that it is parallel to the ground, palm down.

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

Mental Task: Assume the starting position. Attempt to see yourself making the movement just performed with as clear and vivid a visual image as possible. Now rate the ease/difficulty with which you are able to do this mental task.

Rating: ____________

perspective of what his/her optimal competitive state. After the self-modeling video has been constructed your son/daughter will be asked to view his/her self-modeling video at three of his/her competitions, within the competitive season of March 25th to August 25th. At each of the competition sites, five to ten minutes prior to your son/daughter competing his/her selected dive for the self-modeling video, he/she will be asked to watch his/her video and complete two questionnaires. The questionnaires are the Appraisal Inventory, which measures self-efficacy, and the Mental Readiness Form, which measures somatic and cognitive anxiety. Each questionnaire takes only seconds to complete. Your son/daughter will then compete that selected dive. Upon completion of that dive he/she will then complete a subscale of the Test of Performance Strategies indicating his/her use of self-talk from the time they viewed their video to the time their dive was complete. The same procedure will be followed for the second dive chosen for the experiment, but there will not be a self-modeling video for that dive.

Potential risks or discomforts: In physical sport there is a potential risk for injury. This research does not produce a greater risk than the actual sport itself. All participants will perform their own competitive dives that they have been practicing in their regular daily training. There is a risk of psychological discomfort due to the questionnaires requiring one to reflect on his/her self-efficacy, anxiety, and self-talk. The research, however, suggests that this will not occur. Every effort will be made in order to ensure that any chance of discomfort or distress are minimized. Participants are able to withdraw at any given time without penalty.

Potential benefits: As a participant of the experiment your son/daughter will receive his/her own self-modeling video and it may improve his/her competitive performance of that dive. Studying self-modeling in a competitive environment is important because it could be an applied intervention that athletes use before their competition to prepare their event. If an athlete is able to increase their performance due to the viewing of the video and the effects on the underlying mechanisms listed above, this could be used as a tool to help competitive divers increase their status in the competitive world. Self-modeling and the reason why it enhances performance has not yet been studied in a competitive environment. Therefore this study will contribute to the understanding of the effects of self-modeling and performance enhancement.

Anonymity and confidentiality: Your son/daughter's participation will remain anonymous. This will be secured through the use of participant numbers instead of names. All questionnaires, forms, and data will be kept in a locked filing cabinet in Montpetit 321 at the University of Ottawa. This location is only accessible to the principle investigator and her research assistant. Five years after the completion of the study the videotapes and written information will be destroyed.

Voluntary Participation: Your son/daughter's participation in the study is strictly voluntary and he/she will be able to withdraw at any time, without penalty. If your son/daughter chooses to withdraw in the middle of the study, all of their data that has been previously collected will be destroyed immediately.

video has been made, you will be asked to watch your self-modeling video at three of your competitions, within the competitive season of March 25th to August 25th, 2006. At each of the competition sites, five to ten minutes before competing your selected dive for the self-modeling video, you will be asked to watch your video and fill out two questionnaires. The questionnaires are the Appraisal Inventory, which measures self-efficacy, and the Mental Readiness Form, which measures somatic and cognitive anxiety. Each questionnaire takes only seconds to complete. You will then compete that selected dive. After you have competed that dive you will then fill out a subscale of the Test of Performance Strategies indicating your use of self-talk from the time you viewed your video to the time your dive was completed. The same procedure will be followed for the second dive chosen for the experiment, but you will not view the self-modeling video.

Potential risks or discomforts: In physical sport there is a potential risk for injury. This research does not produce a greater risk than the actual sport itself. You will perform your own competitive dives that you have been practicing in your regular daily training. There is a risk of psychological discomfort due to the questionnaires requiring you to reflect on your self-efficacy, anxiety, and self-talk. The research, however, suggests that this will not occur. Every effort will be made in order to ensure that any chance of discomfort or distress are minimized.

Potential benefits: As a participant of the experiment you will receive your own self-modeling video and it may improve your competitive performance of that dive. Studying self-modeling in a competitive environment is important because it could be an applied intervention that athletes use before their competition to prepare their event. If an athlete is able to increase their performance due to the viewing of the video and the effects on the underlying mechanisms listed above, this could be used as a tool to help competitive divers increase their status in the competitive world. Self-modeling and the reason why it enhances performance has not yet been studied in a competitive environment. Therefore this study will contribute to the understanding of the effects of self-modeling and performance enhancement.

Anonymity and confidentiality: No one will learn of your specific data in the experiment. That is you will remain anonymous. This will be done through the use of participant numbers instead of names. Confidentiality will be ensured because all questionnaires, forms, and data will be kept in a locked filing cabinet in Montpetit 321 at the University of Ottawa. The principle investigator and her research assistant are the only people who can look at the information. Five years after the study is done, the videotapes and written information will be destroyed.

Voluntary Participation: Your participation in the study is strictly voluntary and you will be able to withdraw at any time, without penalty. If you choose to withdraw in the middle of the study, all your data that has been previously collected will be destroyed immediately.

If you have any questions in regards to the study, you can contact the principle researcher or assistant researcher from the information listed on the first page. If you have concerns regarding the ethical issues involved contact the Protocol Officer for Ethics in Research at