uOttawa

L'Université canadienne
Canada's university

FACULTÉ DES ÉTUDES SUPÉRIEURES ET POSTOCTORALES

uOttawa

L'Université canadienne
Canada's university

FACULTY OF GRADUATE AND POSDOCTORAL STUDIES

Lindsay McCardle

AUTEUR DE LA THÈSE / AUTHOR OF THESIS

M.A. (Human Kinetics)

GRADE / DEGREE

School of Human Kinetics

FACULTÉ, ÉCOLE, DÉPARTEMENT / FACULTY, SCHOOL, DEPARTMENT

Running Head: Self-modeling and Self-regulation

TITRE DE LA THÈSE / TITLE OF THESIS

Diane Ste-Marie

DIRECTEUR (DIRECTRICE) DE LA THÈSE / THESIS SUPERVISOR

CO-DIRECTEUR (CO-DIRECTRICE) DE LA THÈSE / THESIS CO-SUPERVISOR

EXAMINATEURS (EXAMINATRICES) DE LA THÈSE / THESIS EXAMINERS

Rose Martini

Yves Lajoie

Gary W. Slater

Le Doyen de la Faculté des études supérieures et postdoctorales / Dean of the Faculty of Graduate and Postdoctoral Studies

The effects of self-modeling on self-regulation in skill acquisition:

The self-reflection phase

Lindsay McCardle

Thesis submitted to the Faculty of Graduate and Postgraduate Studies
In partial fulfillment of the requirements for the degree of
Master's of Arts in Human Kinetics

School of Human Kinetics
Health Sciences
University of Ottawa

Your file Votre référence
ISBN: 978-0-494-48480-7
Our file Notre référence
ISBN: 978-0-494-48480-7

Table of Contents

List of Tables

List of Figures

Acknowledgement

I could not have completed this thesis without the help of many important people. First, thank you to the gymnasts who volunteered to be in this research project and who made this research possible. Thanks to my committee members for excellent feedback on this project. Thanks to my lab members for your help and guidance along the way and all the good laughs. Special thanks to Mandy Rymal for being my big sister in the lab and helping with me with everything from photocopying to boys. Thanks to my parents and my family for their support in this endeavour. And finally, many thanks to my supervisor Diane Ste-Marie, for her academic guidance, her many, many edits, and her unending support in both school and life.

Université d'Ottawa University of Ottawa
Service de subventions de recherche et déontologie Research Grants and Ethics Services

HEALTH SCIENCES AND SCIENCE RESEARCH ETHICS BOARD

CERTIFICATE OF ETHICAL APPROVAL

This is to certify that the University of Ottawa Health Sciences and Science Research Ethics Board has examined the application for ethical approval of the research project entitled **Effect of self-modeling on self-regulation in the acquisition of gymnastics combinations (file H 04-07-01)** submitted by Lindsay McCardle and supervised by Diane Ste-Marie of the School of Human Kinetics of the University of Ottawa. The REB found that this research project met appropriate ethical standards as outlined in the Tri-Council Policy Statement and in the Procedures of the University of Ottawa Research Ethics Boards, and accordingly gave it a Category 1a (approval). This certification is valid one year from the date indicated below.

July 11, 2007
Date

Catherine Paquet
Protocol Officer for Ethics in Research
For Daniel Lagarec, Chair of the
Health Sciences and Science REB

550, rue Cumberland 550 Cumberland Street
Ottawa (Ontario) K1N 6N5 Canada Ottawa, Ontario K1N 6N5 Canada

(613) 562-5841 • Téléc./Fax (613) 562-5338
http://www.uottawa.ca/services/research/rgc/index.html

Abstract

Dowrick (1999) proposed the method of feedforward self-modeling in which a video is edited to show a higher level of performance than the learner's current ability. In this experiment, the feedforward self-modeling video showed a gymnast performing a combination of two floor skills which they were able to do separately but not yet in combination. Eight gymnasts (7 females, 1 male; *M* age = 9.9) participated in a pretest, nine intervention sessions and a post test. During the intervention sessions, the gymnasts received a feedforward self-modeling video for one skill combination and no intervention for a control skill combination. I investigated the possible influences of viewing the feedforward self-modeling video on the gymnasts' self-regulatory processes within the context of Zimmerman's (2000) model of self-regulation. There was a specific focus on the self-reflection phase. Thus, the use of self-evaluation criteria, the dimensions of causal attributions for both good and poor performances, self-satisfaction, and use of inferences were measured. Separate ANOVAs showed that feedforward self-modeling and control conditions did not differ for any of the dependent variables. A significant main effect was found for dimension for the Revised Causal Dimension Scale (McAuley, Duncan & Russell, 1992) for both good ($F(3,21) = 14.249, p<.001$, *partial* $\eta^2 = .671$) and poor performances ($F(3,21) = 9.994, p<.001$, *partial* $\eta^2 = .588$). Participants made attributions which were internal, unstable and controllable in both cases. Further research is encouraged with feedforward self-modeling interventions in order to determine their impact on self-regulated learning.

Chapter 1: Introduction

Modeling, also called observational learning, is the process of observing another person, or oneself on video, and using that observation as a guideline to reproduce those observed actions (Bandura, 1977a). It has been described as "one of the most effective means of transmitting values, attitudes, and patterns of thoughts and behaviours" (Bandura, 1986, p.47). While Bandura's (1977a, 1986) idea of modeling was conceptualized within Social Cognitive Theory and directed towards the learning of social behaviours, modeling is also a common tool used within the motor skill domain. It is often difficult to explain a motor skill in words without using some form of visual demonstration to give the learner an idea of how it is supposed to look. Bandura suggests that modeling allows the learner to create a cognitive representation of the skill which guides performance of the skill.

In any sport where there is much risk involved in performing a skill or where equipment is not always available, modeling could be an efficient use of time. For example, when athletes are waiting for their turn they could engage in observational learning. Similarly, when the number of trials should be low due to physical risk to the athlete, modeling can be an effective tool. Gymnastics is a sport which has these factors; therefore modeling can easily be argued to have potential benefits in a gymnastics training regimen.

Much of the research on modeling (e.g., McCullagh, 1987) and self-modeling (e.g., Starek and McCullagh, 1999) has focused on the benefits to physical performance. However, there is a gap concerning why modeling, and specifically self-modeling, may benefit motor skill execution. It has been suggested that self-modeling may influence athletes' self-regulation of learning (e.g., Clark & Ste-Marie, 2007; Law & Ste-Marie, 2005). To investigate this further, this research will examine the effects of self-modeling on participants' self-regulatory processes. Specifically, feedforward self-modeling will be used as little research in motor skill learning has been conducted with this type of modeling. Indeed, only one study by Franks (Franks & Maile, 1991) has investigated feedforward self-modeling with motor skill learning in a non-empirical case study design.

This research on self-modeling and its potential impact on self-regulatory processes is both theoretically and practically relevant. In terms of theory, this research will contribute to the literature focused on how self-modeling affects participants, namely in terms of their self-regulation. Researchers have identified the need for such theoretical development (see Dowrick, 1999). Practically, the proposed research will provide insight into the use of a self-modeling technique in a gymnastics training program.

Chapter 2: Literature Review

Observational learning has received much attention in the literature. Bandura's (1977a, 1986) social cognitive view of modeling has provided a framework for much of the observational learning research. Bandura's Social Cognitive Theory (SCT) will be adopted as a framework for this research. When examining observational learning two questions are of importance: *what* is observed and *how* it is used (Hodges, Williams, Hayes & Breslin, 2007). While Scully and Newell (1985) have focused on what information is gained during modeling, Bandura's SCT centers on how that information is used. The present experiment is interested in how a self-modeling intervention might be used and SCT lends itself well to this purpose. In the next sections SCT will be described more fully, followed by research on modeling and self-as-a-model interventions.

Modeling

Social Cognitive Theory

Bandura (1986) suggests that modeling accounts for a substantial portion of our learning. He proposes that there are four subprocesses in observational learning. The learning stage consists of the first two subprocesses, attention and retention, whereas the performance stage is made up of reproduction and motivation subprocesses. First, the subprocesses of the learning stage will be described.

Attention. The attention subprocess encompasses the learner's level of attention to the demonstration (Bandura, 1977a, 1986). Characteristics of the model and of the learner can influence the learner's perception of the demonstration. Learner characteristics which shape attention can include cognitive capacity, arousal level and expectations; for example, four- and five-year-old children who did not yet have the cognitive ability to spontaneously create verbal reminders of a demonstration did not learn a sequence of motor skills as effectively as seven- and eight-year-olds who did create verbal reminders (Weiss, 1983). On the other hand, characteristics of the demonstration such as complexity and saliency can also influence attention; the more relevant the demonstration, the more the learner will pay attention (McCullagh & Weiss, 2001).

McCullagh and Weiss (2001) also note that characteristics of the model, such as age and skill level, may also play a role in influencing attention. Bandura (1986) argues that it is important to focus on and assign meaning to the perceived demonstration in order to cognitively process the perceptions and thus retain the information gathered. As will be discussed in more detail later, model similarity is an important factor for heightening this attention subprocess (McCullagh, 1987).

Retention. The second subprocess, retention, involves the creation of a cognitive representation in the learner's memory of the demonstration that he/she has just seen (Bandura, 1977a, 1986). The learner generates an abstraction of the elements relevant to learning. Bandura suggests that these internal guides of the skill are necessary for skill reproduction. Rehearsal and actual physical practice of the modeled skill help to increase retention. The physical practice of the skill alludes to the next subprocesses, reproduction.

Reproduction. More than cognitive rehearsal, physical practice allows the learner to obtain information on the deficiencies in the performance and in the cognitive representation of the motor skill (Bandura, 1977a, 1986). This occurs in the third subprocess, behaviour reproduction, which involves the spatial and temporal organization of subskills to match the cognitive representation. With motor skills, the reproduction phase can be more complicated than originally postulated by Bandura for social skills (McCullagh & Weiss, 2001). That is, a person may well know what to do (strong cognitive representation) but still not be able to actually execute the skill. To accommodate for this, researchers appraise motor learning not only by motor execution, but also by verbal reproduction or recognition of the correct performance of the skill (McCullagh & Weiss, 2001).

Evaluation of the production of a motor skill can also involve both form and outcome criteria of its physical execution. Form criteria assess the specific components of a skill and their execution. Outcome criteria evaluate whether or not the skill results in the desired effect. The cognitive representation is said to act as a standard of performance. Bandura (1986), however, notes that behaviour reproduction is difficult to correct when it is unobservable by the performer. Thus, viewing oneself on video is suggested as a tool, as long as the learner has the cognitive conception of how the skill should look.

Motivation. Bandura's (1977a, 1986) last stage involves motivation. Motivation is needed to reproduce the behaviour. Bandura suggests that motivation to enact what one has observed comes from three different sources. These are direct, vicarious and self-produced incentives. People are more likely to produce behaviours which are directly reinforced, either externally or through enjoyment. In addition, if the modeled behaviour was reinforced or effective for the model, it is more likely to be imitated. Lastly, if one's evaluation of one's own behaviour is satisfactory, it is more likely to be reproduced. These incentives motivate learners to attend to, retain and reproduce a demonstration due to the anticipation of reinforcement.

Modeling and Physical Practice

When incorporating modeling into a training program to learn new skills, as one would find in a sport setting, it is important to compare the effectiveness of modeling versus physical practice. Does the creation of a cognitive representation, as forwarded by the social cognitive perspective (Bandura, 1977a, 1986), assist in learning a new skill? Using a computer task, Deakin and Proteau (2000) found that observation without any physical practice of the skill led to an accurate cognitive representation however, physical interaction with the task was necessary to make the representation functionally significant. Deakin and Proteau suggest that interspersing modeling within the physical practice would result in learning equivalent to physical practice alone, while reducing the number of physical trials necessary to learn the task.

Shea, Wright, Wulf, and Whitacre (2000) used a similar computer task and found that, at the retention test, observational learning combined with physical practice resulted in learning similar to physical practice only. On a transfer task, however, participants who received the combination performed significantly better than those who received physical practice alone. These authors suggest that observational learning and physical practice emphasize separate elements of learning. Though these studies did not use a motor skill like one would find in sport, these findings are promising for the use of modeling when acquiring a new skill. Indeed, our experimental design has taken these findings into account as we intersperse the self-modeling video with physical practice of the skill.

Research using sport skills has also shown that modeling leads to improvement in performance. For example, modeling, when compared to a control group, has enhanced performance in such skills as dart throwing (Kitsantas, Zimmerman & Cleary, 2000), climbing strategy (Boschker & Bakker, 2002), a timing task (Blandin, Lhuisset & Proteau, 1999), a ball roll up task (Martens, Burwitz & Zuckerman, 1976), and gymnastics (McAuley, 1985). It has also been more effective than imagery in squat lift outcome performance (SooHoo, Takemoto & McCullagh, 2004). Zetou and colleagues (Zetou, Fragouli & Tzetzis, 1999; Zetou, Tzetzis, Vernadakis & Kioumourtzoglou, 2002) showed that a group who viewed an expert model demonstration performed better than a group who received unedited video feedback for the volleyball serve, set and overhand pass. Coping models, which improve from one demonstration to another, have been linked to enhanced performance compared to an expert model in a timing task (Blandin, Lhuisset & Proteau, 1999), dart throwing (Kitsantas, Zimmerman & Cleary, 2000), and a ball roll up task (Martens, Burwitz & Zuckerman, 1976). In sum, many different forms of models have been shown to be a beneficial intervention for learning a motor skill. In the next section, the important factor of model similarity is elaborated upon.

Model Similarity

Model characteristics can influence the modeling process (Bandura, 1977a, 1986). One such characteristic is the similarity between the model and the learner. Personal relevance is argued to increase as the model becomes more similar to the learner (Schunk, 1987). Consequently, a similar model leads to better physical performance benefits (Gould & Weiss, 1981; McCullagh, 1987; McCullagh & Weiss, 2001). Gould and Weiss (1981), for example, investigated the effect of model similarity on participants' performance of a muscular endurance task. In their study, they defined a similar model as one that was similar in age and athletic ability to the learner.

Participants who viewed a similar model performed better on the leg muscular endurance task than those who observed a dissimilar model. Gould and Weiss suggest that modeling may be important for the motivation aspect of performance since the task in their research required little actual learning from the demonstration, but a high level of effort when performing.

Similarly, McCullagh (1987) manipulated model similarity by telling participants that the model was either new at the task or was chosen because of her extensive experience in the task, though the actual video demonstration seen by both groups of participants was identical. A manipulation check showed that those who were told the model was new rated the model as more similar than did those who were told the model was experienced. Performance differences were dependent on perceptions of similarity: those in the perceived similar model groups scored better than those in the perceived dissimilar model groups.

These studies (Gould & Weiss, 1981; McCullagh, 1987) suggest that models who are perceived by the learner to be similar lead to better learning from demonstrations. Thus, it could be argued that by maximizing observer-model similarity, the greatest effect of modeling can be achieved (Ram & McCullagh, 2003). It is clear that the most similar model one could have would be him- or herself and the most common way to do this is to capture a person on video and allow them to view the video. Using oneself as a model through video can involve either self-observation or self-modeling (Dowrick, 1999). Both techniques, as well as the findings from self-as-a-model studies, will be discussed next.

Self-as-a-model

Franks and Maile (1991) point out that using videotape analysis is "an essential element in understanding how one learns and performs well-skilled motor acts" (p.231). Important to note is that Dowrick (1999) differentiates between self-observation and self-modeling. In self-observation, one views a video of his/her actual performance, without any editing. Self-modeling, on the other hand, is the observation of oneself on video which has been edited to show only desired target behaviours.

In self-modeling, Dowrick (1999) further differentiates between two self-modeling techniques. The first is positive self review; this involves showing only desired behaviour at the learner's current level. For example, if a gymnast performs a good back handspring on the beam on only two out of ten tries, a positive self review self-modeling video would show only the two best performances.

Feedforward self-modeling, on the other hand, involves editing the video to show the behaviour in a new situation or to show a new combination of skills that has never actually been executed. In gymnastics, an example of this type of editing could be seen when a gymnast is able to perform two separate skills but is not able to connect the skills in combination. For example, the gymnast might be able to do a back walkover and a back handspring, but not immediately one after the other. The video however, could be edited to show a back walkover followed by a back handspring with no pause between the skills. McCullagh, Weiss and Ross (1989) suggested that for maximal observational learning to occur, the level of skills modeled should be just above the learner's current level. Feedforward self-modeling would certainly provide this type of experience.

Dowrick (1999) also noted in his review of the self-modeling literature that the majority of self-modeling studies have been in therapeutic settings and use a positive self review technique. Most show moderate improvements in performance of or in the rate of the desired behaviour. Relatively few studies, however, have been conducted in motor skill learning. Further, of those motor learning studies conducted, equivocal findings are reported; thus continued research on the use of self-modeling is justified.

Some of the studies in the motor domain have demonstrated positive performance results following a self-modeling intervention (e.g. Dowrick & Dove, 1980). Dowrick and Dove, for example, used a multiple baseline design and found improved swimming performance when three children with spina bifida viewed positive self review videos of their swimming performance. Starek and McCullagh (1999) also used positive self review videotapes in swimming, but with adult beginners. In their experimental design, they compared participants viewing a peer model with those who received the self-modeling videos. They showed that the self-modeling participants improved performance in as little as two intervention sessions and were superior to the peer model group. No control group, however, was employed in this study and the sample size for each modeling group was very low (n=5).

Not as much research has been done using the feedforward technique. The one reported study involved a case of a female power lifter who increased the weight she was lifting after viewing a feedforward self-modeling video (Maile, as cited in Franks & Maile, 1991). This study, however, only involved a single case study approach. Notable is that positive performance results were seen in all of these studies, however, none employed a comparison control group.

Yet other studies have not shown such promising results (e.g. Ram & McCullagh, 2003). Ram and McCullagh found no definitive trend of performance increase in the volleyball serve in their multiple baseline study. Using positive self review of balance beam routines, Winfrey and Weeks (1993) also found no improvement in balance beam performance when gymnasts who received a self-modeling intervention were compared to a control group. Finally, Law and Ste-Marie (2005) studied figure skaters' jumps performance following a 6-week positive self review self-modeling intervention. They found no physical performance benefits in the self-modeling jump in comparison to the control jump, nor in comparison to a control group who received no self-modeling intervention. Interestingly, however, the figure skaters commented, in verbal reports, on increased self-confidence as a function of the positive self-review intervention. In fact, the athletes reported enjoying the intervention. Evidently, positive performance effects are not universal in the self-modeling literature within the motor skill domain.

There have been several reasons presented as to why performance effects were not obtained in these studies. First, Winfrey and Weeks (1993) suggest that not updating the self-modeling video may have contributed to the lack of performance effects in their study. During their six-week intervention, the gymnasts saw the same self-modeling video at each session. They suggested that the gymnasts maybe perceived themselves as not improving, thus preventing any self-modeling benefits. Dowrick and Dove (1980) also note the importance of updating the video. In their study, one participant received an extended intervention in which his video was updated and he continued to show improvement during the extended intervention. Both Maile (Franks & Maile, 1991) and Starek and McCullagh (1999) used updated videos and found positive performance results. Law and Ste-Marie (2005) however, also updated videos for each session but did not find performance improvements. Therefore, while video updating is important, and will thus be used in this research, it can not be the only factor contributing to lack of improvement noted in other studies.

Another factor that may be important to consider for the effectiveness of self-modeling interventions is the time spent with the intervention. Participants in Ram and McCullagh's (2003) study voiced shock at seeing themselves on video. The authors proposed that the athletes may have needed additional time to adjust to seeing themselves on video and that not having that time could minimize benefits. Besides the time to adjust, the timing of viewing the video might also be of importance. Franks and Maile (1991) suggested that the self-modeling video should be seen as close to actual performance as possible. In the Winfrey and Weeks (1993) study, participants viewed their video before practice began. This was done for the purpose of keeping coaches and other athletes naïve to the intervention. The balance beam portion of practice, however, would likely not have commenced immediately, but might have been up to a couple of hours later. Therefore, a sufficient length of time with the intervention (Feltz, 1982; Franks & Maile, 1991) and more immediate timing between viewing of the self-modeling video and the physical practice of the skill might be important factors in a self-modeling intervention. These two factors are addressed in the experimental design of this research by having a relatively long intervention of nine intervention sessions and by having the athletes view the video during the floor exercise section of their practice.

In addition, Winfrey and Weeks (1993) also forwarded the idea that self-modeling may be less effective with intermediate level gymnasts as compared to beginners.

Winfrey and Weeks suggest that beginners have more room for improvement and might show more significant results. Law and Ste-Marie (2005) echoed the same idea and noted that beginners are more likely to be inconsistent in their skill performance and have less technical knowledge than intermediate level athletes. Hence, beginner athletes might be more likely to benefit from a self-modeling intervention, and thus novice gymnasts will be the target group for this study.

Another possible reason for differences in performance results might be the mediating effect of certain psychological variables. Little research has examined why self-modeling benefits learning of social, cognitive or motor skills. The variables which have received the most study are self-efficacy and anxiety (Dowrick, 1999). For instance, improvement of self-efficacy has been suggested as a possible an outcome of a self-modeling intervention (Bandura, 1986). Bandura (1977b) defines self-efficacy as one's certainty in his or her ability to complete a specific task. One of the sources of self-efficacy outlined by Bandura is mastery experiences. Knowing that one has already done something well will increase one's belief that he/she is able to do it again. Self-modeling is proposed to provide such an experience and, because it has high personal relevance, it should also increase the amount of attention paid to the video.

Self-modeling research measuring self-efficacy has demonstrated equivocal findings. Some have shown no increases in self-efficacy (e.g. Law & Ste-Marie, 2005; Ram & McCullagh, 2003) while others have shown benefits (e.g. Clark & Ste-Marie, 2007; Starek & McCullagh, 1999). Winfrey and Weeks (1993) suggest that self-efficacy judgments of the gymnasts in their study were more realistic after having viewed the self-modeling video as the participants' self-efficacy ratings were significantly correlated with their self-rated performance measure. The control group gymnasts did not demonstrate this correlation. Starek and McCullagh (1999) contend that a similar mechanism may have operated in their study on adult swimmers. After the self-modeling intervention, participants continued to show high self-efficacy-performance accuracy. For the participants in the other model condition, self-efficacy judgments were well above their performance scores. Law and Ste-Marie (2005) found no significant difference in self-efficacy scores for the figure skating jump that received the positive self review self-modeling intervention versus the jump without the intervention. Ram and McCullagh's (2003) study with volleyball players also showed no conclusive trends in self-efficacy. While more research is needed to further investigate the role of self-efficacy in self-modeling, the present research will focus on processes occurring immediately after performance of a skill combination.

Research has also explored anxiety as a possible mediating variable of self-modeling benefits. Starek and McCullagh (1999) and Law and Ste-Marie (2005) both investigated levels of anxiety. Neither study, however, found significant decreases in anxiety levels after the self-modeling intervention. Law and Ste-Marie did note that the figure skaters in their study did not have high anxiety levels to begin with as they were all capable of performing the jumps being studied just not on a consistent basis.

Law and Ste-Marie (2005), however, suggest another possible mechanism which may have operated in their study. This related to the fact that the figure skaters were asked to begin a log book of the amount of practices they performed of each jump and the number of times they completed the jump. The authors proposed that the act of keeping the log book allowed the skaters to self-regulate which might have resulted in increased performance of all the jumps. Additionally, Starek and McCullagh (1999) suggest that athlete's motivation and attributional style may play a role in self-modeling. Thus, both Law and Ste-Marie, and Starek and McCullagh propose studying self-regulatory processes in relation to self-modeling.

In conclusion, self-modeling has been shown to have equivocal performance effects, with benefits being noted in swimming (Clark & Ste-Marie, 2007; Dowrick & Dove, 1980; Starek & McCullagh, 1999), and power lifting (Franks & Maile, 1991), but no benefits in figure skating (Law & Ste-Marie, 2005), gymnastics (Winfrey & Weeks, 1993), and volleyball (Ram & McCullagh, 2003). The equivocal findings suggest that further research is needed to understand the effectiveness of a self-modeling intervention and to understand the basic psychological mechanisms that influence its effectiveness. It has been suggested that investigating the effect of self-modeling on self-regulation might prove to be a fruitful avenue of research (Law & Ste-Marie, 2005; Starek & McCullagh, 2003).

Schunk and Zimmerman (1997) also suggested that social modeling aids in development of self-regulatory learning strategies. Kitsantas, Zimmerman and Cleary (2000) investigated this idea using a dart-throwing task and compared mastery and coping models. The authors concluded that modeling was helpful in improving performance and increasing self-efficacy, self-satisfaction and strategy attributions when compared to a no-model control group. Use of coping models, in which the model improved over trials, resulted in better self-regulation than the use of mastery models.

Indeed, the first researchers to use a self-regulation framework within the investigation of self-modeling in children showed interesting results (Clark & Ste-Marie, 2007). Before reporting on this research, however, the basic concepts and models of self-regulation will be presented.

Self-regulation

In their examination of the development of academic self-regulatory competence, Schunk and Zimmerman (1997) suggest that social modeling can be an important source for the initial development of self-regulatory strategies. Self-regulation refers to the metacognitive, behavioural, and motivational processes in which individuals engage for the purpose of learning and achieving their goals (Kirschenbaum, 1984, 1987; Kitsantas & Zimmerman, 1998, 2002; Zimmerman, 1989, 2000, 2004). There are two basic self-regulation models that have been used in the motor learning domain; specifically Kirschenbaum's (1984; 1987) five-stage model which will be described first and Zimmerman's (1989, 2000, 2004) cyclic model that will follow.

Kirschenbaum (1984, 1987) proposed a five stage model of self-regulation. The first stage is problem identification in which the learner takes responsibility for learning and the improvement of the learning process. Secondly, the learner must commit to change and/or create a plan of action. In the third stage, the learner executes the plan that has been created. At this stage, the learner attempts to minimize differences between actual performance and the set standard using a negative feedback loop. Kirschenbaum notes that self-monitoring is essential to this stage. Self-monitoring is the process in which the learner keeps track of their progress in order to compare it to a standard and self-evaluate. This self-monitoring and self-evaluation leads to change in the behaviours used in execution of the skill. At stage four, environmental aspects such as physical and social settings have an influence of self-regulated behaviour and either facilitate or debilitate the learner's attempts to reach their goals. Kirschenbaum notes that it is important to manage one's physical and social environment in order to focus on the achievement of personal goals. Lastly, in stage five, the learner generalizes the learned behaviour to other settings. According to Kirschenbaum, it takes much effort to maintain one's self-regulation across settings. Failure at this stage is common and Kirschenbaum supports an obsessive-compulsive style of self-regulation in order to avoid this failure.

Kirschenbaum's (1984, 1897) model encompasses some important concepts essential to self-regulation such as environmental influence, self-monitoring and self-regulation failure. Indeed these concepts are also found within Zimmerman's (1989, 2000, 2004) model that operates within Bandura's (1986) Social Cognitive Theory. This model (Zimmerman, 1989, 2000, 2004), which has emerged from academic achievement research (Kitsantas & Zimmerman, 1998), features a cyclic view of self-regulation and has been more widely applied to the motor skill domain (Kitsantas & Zimmerman, 1998). In fact, Kitsantas and Zimmerman (1998) highlight that research validating the effectiveness of Kirschenbaum's model has been scant. Moreover, researchers interested in modeling, as mentioned previously, often adopt Bandura's Social Cognitive Theory. Finally, early research using Zimmerman's model and specifically addressing self-modeling (Clark & Ste-Marie, 2007) has shown that self-modeling may result in increased self-regulation. Based on these three factors, Zimmerman's (1989, 2000, 2004) theoretical self-regulation framework was adopted in this research and is described in detail next.

Zimmerman's (1989, 2000, 2004) model is placed within Social Cognitive Theory (Bandura, 1986). Bandura postulates that three factors interact to explain human functioning. These three elements, environmental context, behaviour, and personal factors, reciprocally determine one another. Zimmerman's (1989, 2000, 2004) model incorporates "self-oriented feedback loops" (Zimmerman, 2000, p. 14) which operate in the triadic interaction between Bandura's factors of person, behaviour and environment (see Figure 1). At the behavioural level, self-regulation involves adjustment of performance through the use of strategies and different methods of learning. Environmental self-regulation entails monitoring and changing the environment which affects learning (i.e., Stage four of Kirschenbaum's (1984, 1987) model). At the personal level, individuals engage in covert self-regulation of affective and cognitive states. Zimmerman (2000; 2004) proposed that these feedback loops are open; this allows for a changing standard of comparison as individual learners continually set new goals.

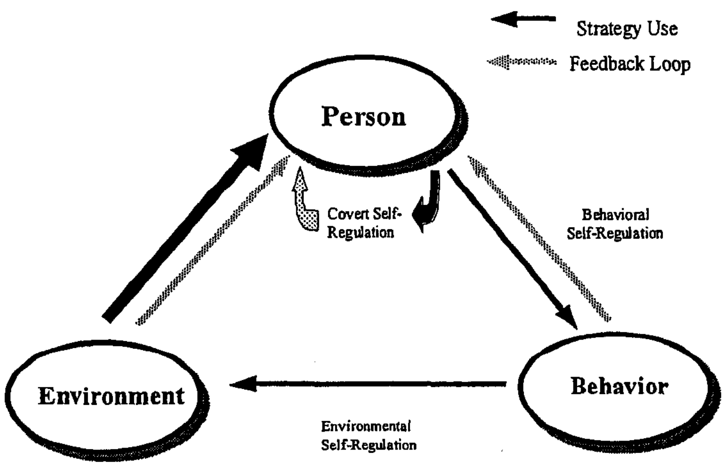

Figure 1. Triadic forms of self-regulation. Note. From "Sociocultural Influences and Students' Development of Academic Self-Regulation: A Social Cognitive Perspective" by B. J. Zimmerman 2004. In D. M. McInerney & S. Van Etten (Eds.), *Research on sociocultural influences on motivation and learning: Big theories revisited* (pp. 139-164). Vol. 4. Greenwich, CT: Information Age Press. Copyright 2004 by Information Age Press. Reprinted with permission.

Three cyclical phases, which are defined temporally, make up the structure of the covert self-regulation cycle (See Figure 2). The first phase, forethought, occurs before performance of a motor skill. The second stage is termed performance control and takes place during actual performance of the skill in question. Finally, the thoughts and cognitions that occur in the self-reflection phase come after performance. Each phase influences the following one with self-reflection processes leading to forethought processes to complete the cycle. In addition, it is also possible that processes within a phase influence each other (Cleary, Zimmerman, & Keating, 2006). Zimmerman and Martinez-Pons (1986) have demonstrated that self-reports of self-regulation of learning strategies allowed 93% accurate prediction of students' achievement groups.

In their study, Cleary et al. (2006) investigated the use of a self-regulatory training program for one session. Participants were divided into four groups. The first group received training in only the forethought phase. The second group received the training in both forethought and performance control. The third group received training in all three phases (forethought, performance control and self-reflection). Finally, the fourth group served as a control and thus received no training at all. All groups who received training performed significantly better than the control group in a 12-minute practice session of basketball free throws. The three-phase and two-phase groups executed less actual shots than either the one-phase or practice-only control groups in the 12-minute period, but still scored significantly more points. This attests to the importance of self-regulatory processes. Thus, use of all three phases is most beneficial. The self-reaction phase sets the stage for the next two phases to follow by encouraging further self-regulation of learning (Zimmerman, 2000, 2004). These self-reaction processes would

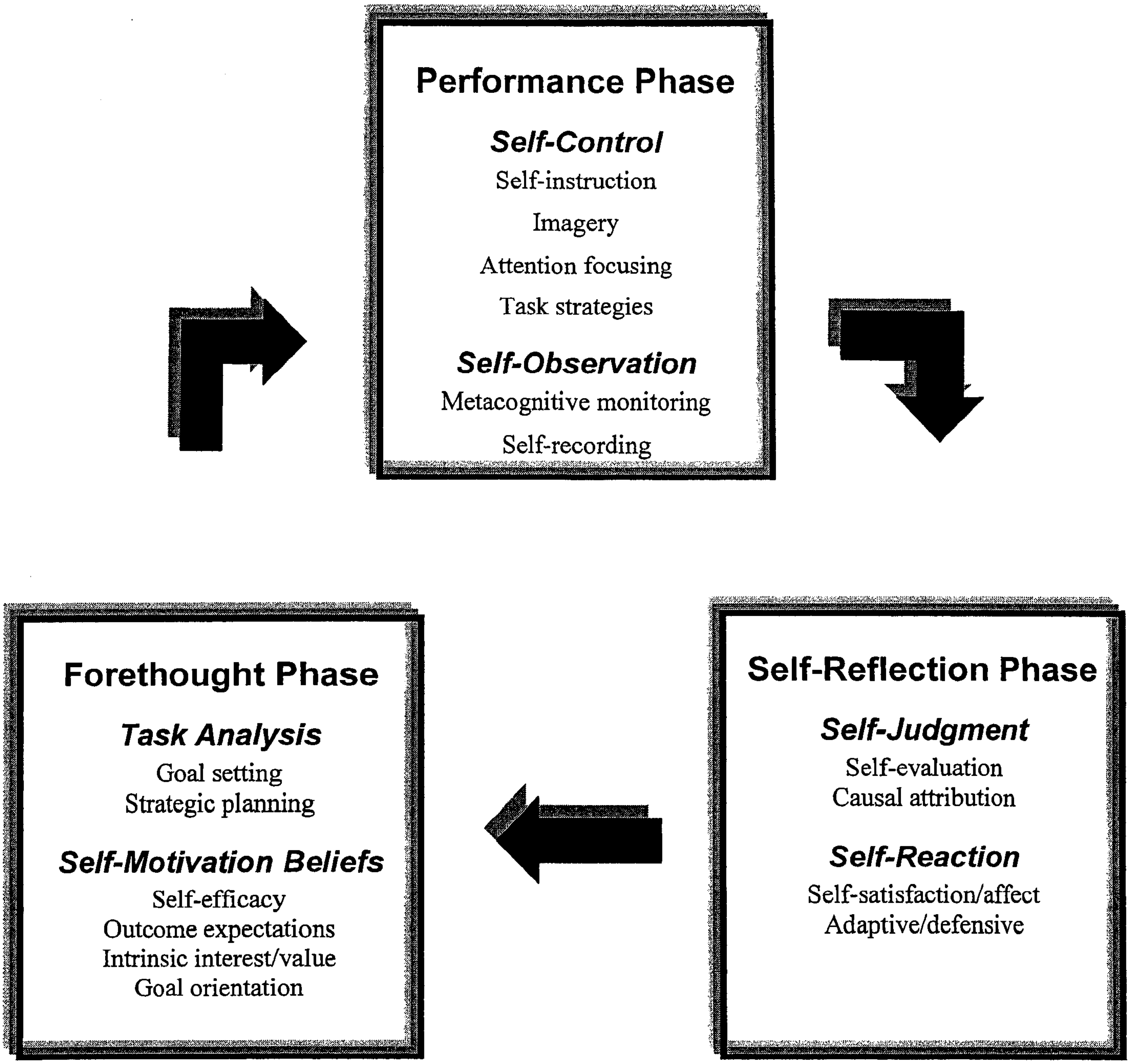

Figure 2. Cyclical phases of self-regulation. Note. From "Sociocultural Influences and Students' Development of Academic Self-Regulation: A Social Cognitive Perspective" by B. J. Zimmerman 2004. In D. M. McInerney & S. Van Etten (Eds.), *Research on sociocultural influences on motivation and learning: Big theories revisited* (pp. 139-164). Vol. 4. Greenwich, CT: Information Age Press. Copyright 2004 by Information Age Press. Reprinted with permission.

affect other self-regulatory components such as self-efficacy and intrinsic interest in the forethought phase. Further description and relevant research pertaining to each phase is described next.

Forethought

Within the forethought phase there are two components: task analysis and self-motivation beliefs (Zimmerman, 2000, 2004). Task analysis incorporates goal setting and strategic planning components. Zimmerman and Kitsantas (1996, 1997) and Kitsantas and Zimmerman's (1998) research supports the suggestion that process goals be used when first learning a skill and then the learner should shift to outcome goals as he or she masters the skill. Strategic planning involves purposefully setting a plan of action directed at achieving the goals one has set. This plan might be one that was decided upon in the self-reflection phase or generated during the forethought phase. Take for example the gymnast learning a back handspring on beam. In the self-reflection phase, she decides that she is unsatisfied with the performance and needs to see her hands hit the beam in order to improve her performance. Her strategic plan then involves her concentrating on getting her head back so that she will be able to see her hands. This plan will then be implemented in the performance control phase and she will likely self-reflect on the effectiveness of that strategy. Therefore, the planning element of self-regulation can begin at self-reflection and then continue through forethought and be implemented in performance control; and the cycle can continue.

The second component of the forethought phase concerns self-motivational beliefs such as self-efficacy and intrinsic interest (Zimmerman, 2000, 2004). These beliefs are essential because without motivation, use of the self-regulatory skills one possesses is unlikely. Bandura (1986) suggests that one can make a causal contribution to their own motivation by setting out self-incentives, creating a helpful environment and using cognitive strategies. To become an expert in a certain task, one needs high motivation to continue to self-regulate (Kitsantas & Zimmerman, 1998, 2002).

Self-efficacy (Bandura, 1977b, 1986), one's belief in their capability to succeed at a given task, is proposed to come from four sources: mastery experiences, vicarious experiences, verbal persuasion, and physiological states. Modeling can provide vicarious experiences in order to increase one's judgments of self-efficacy while self-modeling is thought to provide a mastery experience for this purpose. This, in turn, may influence other self-regulatory processes within the covert cycle. Intrinsic interest is the value one places on the skill or sport which can lead to increased effort in performance of that skill. These components of the forethought phase then impact the processes in the performance control phase.

Performance control

Zimmerman's (2000, 2004) performance control phase involves strategies which affect attention and action. Included in these are self-control and self-observation components. Within self-control, athletes can use self-instruction, imagery, attention focusing, and task strategies in order to manage their attention. In addition, self-observation techniques, such as self-recording and self-experimentation can aid in controlling attention and action. With these strategies, individuals can monitor specific aspects of their performance and the antecedents to and consequences of these behaviours. This can allow for experimentation to discover the best methods of achieving the desired results. For example, the gymnast learning the back handspring on beam may discover through self-recording that looking at her hands does not improve her performance and may adopt a new strategy (in the self-reflection or forethought phase). This is similar to Kirschenbaum's (1984, 1987) stage three in which self-monitoring was essential.

Self-reflection

Following performance execution, learners then react to their performance in the self-reflection phase (Zimmerman, 2000, 2004). This involves two elements: self-judgment and self-reactions. In the self-judgment component, learners self-evaluate in comparison to a standard (as in Kirschenbaum, 1984, 1987). In addition, learners also attribute their performance to certain factors. The second aspect of self-reflection is self-reaction. This involves one's approval of his or her performance (self-satisfaction) and his or her conclusions about how to adjust their method of learning or performing in future attempts (adaptive or defensive inferences). These inferences are the root of specific strategic plans in forethought and self-control strategies used during performance execution. Thus, one could argue that perhaps the critical phase of self-regulation is the self-reflection phase as it "jump starts" the processes that will be engaged in during the forethought and performance control phases. For this reason, this research project will focus on the self-reflection phase of Zimmerman's model of self-regulated learning. Each of the four processes within this phase will now be discussed in more detail, as well as research pertaining to each.

Self-judgment. As stated, self-evaluation involves a comparison of one's performance to a standard (Zimmerman, 2000, 2004). Such standards might include self (mastery or past performance) or normative criteria. Mastery criteria involve sequences of standards which begin at an easy level and gradually progress to a more difficult level. Criteria can also be based on previous performance of the learner. For example, if a gymnast successfully completes four out of ten trials one day, then the next day she would compare her performance to that standard of four out of ten. Conversely, a learner may use others' performances as a standard of comparison. The goal is to have a better performance than another person and is the basis of most competitions.

Criteria for standards can come from different sources: social norms, previous performances, goals (Zimmerman, 1989) or models (Bandura, 1986). It is likely that individuals use more than one source for developing a performance standard (Cleary, Zimmerman & Keating, 2006). Ames (1992) argues that use of a self-referent criterion leads to improved motivation and performance. Zimmerman (2000) notes that social comparisons emphasize negative aspects of performance as well as accent social factors as causes of performance. By giving the athlete a personal performance against which to judge subsequent performances, the use of a feedforward self-modeling video could help the athlete to develop a self-referent criterion. This could likely lead to better motivation and performance as suggested by Zimmerman (2000, 2004) and Ames (1992). To assess this, we will introduce a self-evaluation measure which examines how often athletes are using different types of criteria.

Self-evaluation also involves the evaluation of strategies used during performance execution, such as self-talk or imagery. Positive evaluation of a certain technique will lead to continued use of that technique whereas negative evaluation will lead to a change in strategy.

Still within the self-judgment component, learners attribute the results of their performance to certain factors (Zimmerman, 2000, 2004). Making attributions requires cognitive assessment of the factors that lead to the performance going well or not so well. Zimmerman and Kitsantas (1996, 1997) have demonstrated that attribution of poor performance to strategic inadequacies tends to lead to sustained self-regulation, self-efficacy and effort. In addition, Zimmerman and Kitsantas (1997) found that the use of strategy attribution correlated with higher self-satisfaction, higher self-efficacy and better performance. Both expert basketball (Cleary & Zimmerman, 2001) and volleyball (Kitsantas & Zimmerman, 2002) players made more strategic attributions than non-experts and novices. In Cleary and Zimmerman's (2001) study, attribution differences in players' levels corresponded significantly to performance level.

In his theory of causal attributions, Weiner (1979, 1985) outlines three dimensions of attributions. First is locus of causality in which causal attributions vary on a scale from internal to external to the learner. Stability is the second dimension of causality and refers to how the causes can vary from unstable to stable. A stable cause is one which will not change in the future, such as one's height, while an unstable cause is perceived as variable, such as one's level of effort. Attributional causes can also vary in controllability, from controllable to uncontrollable. A controllable cause is one that the individual has the power to change. Weiner suggests that good performance is best attributed to internal, stable and controllable causes. Poor performance, on the other hand, is best ascribed to causes which are external, unstable and controllable.

Studies in sport have shown that those who win are more likely to attribute their win to internal, personally controllable and stable causes (e.g., McAuley & Gross, 1983;

Wilson & Stephens, 2005). Grove and Prapavessis (1995) found that high ability squash players were more likely to rate their attributions as stable than low ability players regardless of outcome of the game. In terms of locus of causality, high ability players made more internal attributions when they won than when they lost. In contrast, low ability players made less internal attributions when they won versus when they lost. The greatest difference between high and low performers in the Wilson and Stephens' (2005) study of basketball players occurred on the stability dimension. These authors noted that low performers perceived the causes of their performance as unstable which is adaptive. Bond, Biddle and Ntoumanis (2001) examined attributions and self-efficacy. For successful performers, the stability dimension of attributions significantly predicted post-competition self-efficacy, with stable attributions predicting increased self-efficacy. Therefore, causal attributions can be an important factor in self-regulation of learning and performance.

Self-modeling may lead to external, unstable and controllable attributions for poor performances. The logic here is that the athlete can see on the feedforward video that they are capable of performing the combination of skills; therefore, their poor performance must be due to use of an inadequate strategy rather than inability. Similarly, having seen that they are able to complete the skill combination, learners will make stable, internal and controllable attributions for good performances of the self-modeling skill combination. This hypothesis is tested using a measure of attribution dimensions.

Considering that Zimmerman's (2000, 2004) model includes attributions as a self-reflection element which explains both failure and sustained effort, Zimmerman's model can account for both continuation and failure of self-regulation of learning. This component of Zimmerman's theory contrasts with Kirschenbaum's (1984) as his theory focused solely on failure of self-regulation due to an inability to generalize self-regulation to new contexts.

Self-reaction. Self-satisfaction is the first part of the self-reaction component, and involves the appraisal of one's performance and the affect which accompanies this approval or disapproval (Zimmerman, 2000, 2004). Positive affect will lead to individuals continuing to pursue their goals whereas negative affect will likely result in avoidance. Expert and non-expert athletes have shown higher satisfaction levels with their performances than novice players (Cleary & Zimmerman, 2001; Kitsantas & Zimmerman, 2002). Self-reaction to success can have a large influence on levels of intrinsic motivation, which is situated in the forethought phase (Zimmerman & Kitsantas, 1996). Additionally, Zimmerman and Kitsantas note that satisfaction with one's performance leads to continued effort in that task. It is argued here that self-satisfaction with performance could increase after viewing a feedforward self-modeling video because the athlete has seen that he or she has the potential to perform at the desired level. A self-satisfaction measure has been introduced to test this idea.

Inferences comprise the second part of the self-reaction component. Making inferences entails drawing conclusions about what one needs to change in later attempts of the skill in order to learn or improve performance (Zimmerman, 2000, 2004). Zimmerman suggests that adaptive inferences direct the learner to new self-regulation strategies in an effort to perform at a higher level. On the contrary, defensive inferences aim to minimize dissatisfaction in the future and therefore to avoid further effort in learning since this will likely lead to disappointment. Relatively little research on self-regulation in the motor domain has focused on inferences. Kitsantas and Zimmerman (2002) found that expert volleyball players proposed more changes in technique in subsequent attempts than novice players. Cleary, Zimmerman and Keating (2006) found that use of adaptive inferences, such as needing to change strategies, correlated positively with performance. Defensive inferences, however, impeded strategy changes. Feedforward self-modeling may help athletes to develop adaptive inferences in order to improve their performance. The athlete sees that he or she is able to perform the target skill combination therefore if their current performance is not at that level, the athlete must need to change something about their effort in order to improve. A measure assessing the frequency of use of adaptive and defensive inferences is used to examine this potential relationship.

Self-modeling and self-regulation

Using Zimmerman's (2000, 2004) self-regulation model as a framework, Clark and Ste-Marie (2007) compared self-observation and self-modeling interventions. The children who received a self-modeling video of their swimming performance demonstrated significantly better swimming skills at the retention test than those who received self-observation intervention. Use of the self-modeling video also improved self-efficacy, intrinsic motivation and self-satisfaction with performance more than the self-observation or the control videos. In addition, a think aloud protocol was used during this study (Clark, Ste-Marie & Martini, 2006). More than half of the verbalizations realized by the children were either positive or negative descriptions of specific swimming elements and prescriptive comments about what should be done in the next attempt. Clark, Ste-Marie and Martini concluded from the think aloud data that self-as-a-model interventions (self-observation and self-modeling) were useful as the children used the interventions to evaluate performance and plan for future performances. However, their study only investigated one self-reflection process, that of self-satisfaction. Further research is needed into the consequences of using a self-modeling video on athlete's self-regulation. Specifically, more in depth exploration of the self-reflection phase is warranted. Additionally, Clark and Ste-Marie used positive self review self-modeling whereas the current study will employ a feedforward technique.

Thus, the purpose of this experiment is to investigate the effect of a feedforward self-modeling intervention on gymnasts' self-regulation. In particular, processes of the self-reflection phase will be targeted in order to gain an understanding of how self-modeling might lead to changes in these specific processes. It is hypothesized that use of a self-modeling video will (1) lead to internal, personally controllable and stable attributions for good performances and (2) lead to external, personally controllable, and unstable attributions for poor performances; (3) result in increased self-satisfaction with performance. No specific hypotheses were generated for self-evaluation and inferences as these questionnaires have not previously been used in research. In examining these processes, we might gain a better understanding of how self-modeling affects self-regulatory processes.

Chapter 3: Method

Sample

The sample consisted of 8 participants from a gymnastics club in the Ottawa region. They were novice level competitive gymnasts (Level 2-5 in the Ontario Competitive Program), with a mean of 3.25 years in gymnastics (SD = 0.46) and 1.25 years competing (SD = 0.46). Participants were training an average of 13 hours per week (SD = 4.2). Ages ranged from 9 to 11 years (M = 9.875, SD = 0.83). Yando, Seitz and Zigler (1978) have suggested a two-factor theory of imitation as an extension of Bandura's (1977a, 1986) Social Cognitive Theory. Yando et al. stress that the cognitive development of a child is a crucial factor in observational learning. In her modeling research with children aged 4-, 5-, 7- and 8-year olds, Weiss (1983) found that the 7- and 8- year olds performed better than the 4- and 5-year olds on a novel sequence of familiar motor skills. The older children took fewer trials to learn, performed more correct skills and demonstrated less inattentive behaviours as a function of the modeling intervention. Therefore, participants aged 9- to 11-years, as used in this study, should have the cognitive capacity to learn from a self-modeling video.

Materials

Creation of self-modeling videos

Participants were videotaped using a Sony digital video camera recorder, model DCR-HC85. Microsoft Movie Maker software was used to edit the self-modeling videos. An IBM Think Pad lap top computer with a 14-in screen was used to show each participant their self-modeling video. A number of paper-and-pencil measures, described next, that tapped into the self-regulatory processes of self-reflection were administered to participants.

Self-evaluation

To date, no research in the motor domain using Zimmerman's (2000, 2004) self-regulation model has investigated self-evaluation. Of importance in assessing this process is ascertaining the type of criterion, if any, that is being used by the gymnast. Therefore, two questionnaires relating to self-evaluation were created (see Appendices A and B); one for the skill combination that received the self-modeling intervention, and one for the control skill combination. Ideas for items came from the criteria Zimmerman suggests that athletes use for self-evaluation. Items were created based on the criteria that might be used by gymnasts. Wording was appropriate for children. Thus, the self-evaluation questionnaires assess how often each criterion is used on a 5-point Likert scale ranging from never to always. Examples of criteria include (1) an earlier performance by the athlete and (2) another gymnast's performance. The two self-evaluation questionnaires were identical except for the fact that the questionnaire which was used with the skill combination having received the intervention included the self-modeling video as a criterion.

Validity refers to the degree to which a questionnaire measures what it is purported to measure and can be interpreted as such (Urbina, 2004). Construct validity examines whether a questionnaire measures factors which are theorized to be a part of the psychological process being measured (Murphy & Davidshofer, 2005). Thus, a team of five researchers well informed on Zimmerman's (2000, 2004) model of self-regulated learning evaluated whether the two self-evaluation questionnaires reflected Zimmerman's concept of self-evaluation. The researchers agreed that the items used in the questionnaire were an accurate representation of self-evaluation

Face validity is the assessment of whether or not a questionnaire seems on the surface to measure the construct (Taylor, 2005). To assess the face validity of the self-evaluation questionnaires, 14 gymnasts aged 9 to 11 and six competitive gymnastics coaches were asked to evaluate a first iteration of the questionnaires. These gymnasts and coaches were asked to respond to three questions pertaining to the questionnaire: (1) If the questionnaire was a reasonable way to gain the information about possible self-evaluation criteria used by gymnasts; (2) If the questions were well-designed and clear; (3) If the questions would be understandable for 9 to 11 year olds. Additionally, open space at the bottom of the page was left for any further comments. Face validity at this level was confirmed as the coaches and gymnasts agreed that using a questionnaire was appropriate. With the exception of one gymnast, all coaches and gymnasts concurred that the questions were clear and concise. As such, only minute changes were made to the wording of the items.

To further assess face validity, coaches were also asked to rate their level of agreement that the items reflected self-evaluation on a 5-point Likert scale. All questions received ratings of 3 or above by all coaches. The one exception was the item relating to a goal set for themselves as the standard of comparison. One coach suggested that the athlete's coach would be setting goals for the athlete and that this would be a more commonly used standard. Thus, an item was added to the self-evaluation questionnaires to assess how often athletes were comparing themselves to a goal set by their coach.

Attributions

In other self-regulation studies including attributions as a measure (Kitsantas & Zimmerman, 2002; Zimmerman & Kitsantas, 1996), participants were asked after two consecutive failures why they thought they had failed. Their verbalizations were coded to understand the athletes' attributions. Attributions, however, are also important after successful performance. Additionally, in a gymnastics setting, it is important to minimize the interruption of practice; therefore, rather than interrupt them during their practice trials, a paper-and-pencil test was used following completion of all attempts at the skill in question.

The Revised Causal Dimension Scale (CDSII; McAuley, Duncan & Russell, 1992) was designed to capture Weiner's (1979, 1985) theory of causal attributions. Considering the link between Zimmerman's (2000, 2004) concept of attributions and Weiner's theory, the CDSII was used to gather information on the attributions made by the gymnasts in this experiment. The CDSII has been shown to have reliable coefficient alpha levels across the four dimensions, ranging from .60 to .92 (McAuley, Duncan & Russell, 1992). Moreover, the CDSII has been successfully applied in sport settings (e.g., McAuley & Shaffer, 1993; Wilson & Stephens, 2005). The CDSII measures the level of each of four dimensions of causal attributions as perceived by the respondent for the reasons given. The four dimensions are locus of causality, stability, personal control and external control, each represented by 3 items. In completing the CDSII, the participant first gives a reason or reasons for their performance and then rates the reason on the different items on a 9-point scale with anchors at each end representing opposite ends of each dimension.

For children, Vlachopoulos, Biddle and Fox (1996) suggested use of a 5-point Likert scale as well as some modification of the wording in order to make the items more understandable for children. Vlachopoulos et al. assessed the factor structure of their modified version and found that the 4-factor model was the best fit. However, the external control scale was considered unreliable due to a high error of measurement. The authors had reduced the number of items from 3 to 2 per dimension, and subsequently suggested increasing the number of items per dimension. Therefore, in this version of the scale (see Appendices C and D), the wording and the 5-point scale used by Vlachopoulos et al. were kept. As well, the other 4 items from McAuley et al.'s (1992) CDSII were retained with minor modifications in wording. Finally, the scale was kept at the same 5 points used by Vlachopoulos, et al.

Self-satisfaction

Measures of self-satisfaction in self-regulation research have consisted of one question asking how satisfied the athlete is with their performance (e.g., Zimmerman & Kitsantas, 1996, 1997). The question is followed by a scale of 1 to 10 ranging from not satisfied to very satisfied. Clark and Ste-Marie (2007) included "happy faces" of varying emotions at points 1, 4, 7, and 10 to convey the meaning of the scale to children in their study. This measure was used in this study (see Appendix E).

Inferences

Only one self-regulation study in the motor skill domain has included inferences as a measure (Kitsantas & Zimmerman, 2002). Kitsantas and Zimmerman evaluated inferences by asking three questions after the participant had missed two volleyball serves. The questions addressed whether or not the participant thought about why they made the error, if they would change anything in the next attempt, and if they ask for feedback when continually making an error. Participants answered either yes or no. However, because we wanted to have minimal interruption of the participants' practice, it was decided to use a questionnaire after the practice to make the measurement less intrusive. Moreover, we are interested in the types of strategies/changes the athletes might adopt, and therefore created a questionnaire to better reflect this self-regulatory process (see Appendix F). The questionnaire included strategies which were based on Zimmerman's (2000, 2004) description of adaptive and defensive inferences.

Similar to the self-evaluation measure, construct validity was assessed. To ensure that the inferences questionnaire accurately reflected Zimmerman's (2000, 2004) concept of adaptive and defensive inferences, a team of researchers was consulted. The researchers concurred that the inferences questionnaire was representative of Zimmerman's concept.

Fourteen gymnasts aged 9 to 11 and six competitive gymnastics coaches assessed the inferences questionnaire for face validity, i.e., whether on the surface the questionnaire seems to measure the intended concept. The gymnasts and coaches replied to three questions about the appropriateness of a questionnaire and whether the items were clear and age-appropriate. As well, any further comments on the questionnaire were welcomed. Both the coaches and the athletes agreed that using a questionnaire was appropriate to obtain the information needed. However, the coaches felt that the questionnaire instructions were not clear enough, and thus they were modified accordingly. Some coaches also commented that young athletes would have difficulty understanding the items without any guidance. However, since the gymnasts who also reviewed the questionnaire did not state any concerns about the complexity of the items, no changes were made.

Furthermore, coaches rated on a 5-point Likert scale their level of agreement that the items reflected inferences. Coaches varied on their ratings with responses ranging from 1 to 5. A criterion measure of a mean rating of 3 or above for each item was arbitrarily chosen as being reflective of the item's appropriateness for inclusion. The mean evaluation for each item was 3 or above and thus all items were kept as part of the questionnaire.

For reliability analysis of the pilot data, the 14 gymnasts completed the inferences questionnaire thinking about a skill or skill combination they had practiced that day. Adaptive items (1, 3, 6) had a Cronbach's alpha of .459. Defensive items (2, 4, 5) had a Cronbach's alpha of .716. While reliability analyses did not meet the .7 standard for both subscales (Nunnally, 1978), the items seemed to hold together and thus, were left unchanged. Reliability analyses were conducted on the experimental data before statistical analyses were conducted.

Procedure

Ethical clearance was obtained from the University of Ottawa Research Ethics Board. In order to recruit participants, a gymnastics organization was contacted first for authorization to conduct research at their facility. Secondly, coaches' approval was acquired in order to allow their athletes to participate in the study. Finally, parents were approached to ask their son/daughter to participate and were given information letters, assent and consent forms. These forms were then completed and returned to their coach or the researcher. Participants were asked to keep a log book that tracked the number of attempts of each of their floor skills similar to the procedure in Law and Ste-Marie's (2005) study. This was intended to track how much practice each separate skill combination received during the athletes regular practice schedule. It is conceivable that after watching the feedforward self-modeling video, an athlete may practice that particular skill combination more than the one which does not receive the self-modeling video. Thus, it was ideal to keep track of the practice of the skills of concern in the experiment. Use of the log book was implemented ahead of time so as not to confound with the self-modeling intervention as had occurred in Law and Ste-Marie's research with figure skaters.

Unfortunately, participants did not follow up with the log book, even after several reminders from the experimenter. Only one, out of eight participants, returned a log book and it was not fully completed. Despite the reminders, some participants claimed to have simply forgotten to write in it, whereas most participants reported having lost the log book. Clearly, this is a limitation of this research, as it is no longer possible to analyze whether practice habits changed in response to viewing of the self-modeling video.

Skill combination selection

Participants chose two floor exercise skill combinations from a list of possible choices (see Appendix G). Possible skill combinations were split into three levels of difficulty. For each participant, both skill combinations were of the same difficulty. One combination was in the forward direction and the other in a backward direction in order to minimize possible transfer of learning from the skill receiving the self-modeling intervention. The combinations were then randomly assigned to either self-modeling condition or to the control condition with the constraints that skill combinations were balanced in the two conditions across participants. The participants had not previously attempted the skill combinations used in the study.

Creation of self-modeling video

Participants were videotaped for their first self-modeling video in a session before the pre-test. Participants completed 4-8 trials of each of the two skills which comprised the self-modeling combination. The videos of the two skills were combined to create a feed-forward self-modeling video. At sessions three and seven, participants were again videotaped attempting the two skills which were part of their self-modeling combination in order to update their video.

Pre-test phase

The pre-test was used in order to determine that there were no differences in the two conditions before the intervention began. After the assignment of the skill combinations to the two experimental conditions, the participants attempted each skill combination nine times in three sets of three trials. Physical assistance was given to those gymnasts who needed it. After each set of three, the participants were given various measures for the self-regulatory processes[1]. The order of the control and the self-modeling skill combinations was counterbalanced across participants. In addition, the last

[1] This thesis was part of a larger SSHRC-funded project which investigated all three phases of Zimmerman's (2000) self-regulation model. Thus, after the first set of trials, athletes completed questionnaires relating to forethought processes. After the second set, questionnaires relating to performance control were complete, followed by the self-reflection measures used for this thesis once all trials were complete. Similarly, sessions 1, 4, and 7 were dedicated to forethought measures, while trials 2, 5, and 8 were used for performance control measures. Self-reflection measures for this thesis were completed at the remaining sessions.

three attempts of each skill combination were videotaped for later assessment of performance scores.

The self-reflection measures were administered after the last set of three trials. Participants first completed the self-satisfaction measure. Secondly, the Revised Causal Dimension Scale (CDSII; McAuley, Duncan & Russell, 1992) was administered twice for each combination. For the control combination, participants completed one CDSII for a well performed combination and one CDSII for a poorly performed combination. The CDSII was also completed for both a well performed and poorly performed combination for the self-modeling combination. The self-evaluation questionnaire for the appropriate combination (i.e., self-modeling or control) was given. Finally, participants completed the inferences questionnaire.

Intervention phase

The intervention phase consisted of nine sessions. These nine sessions were intended to be spread evenly with two sessions per week, thus resulting in a 4.5 weeks intervention phase. The mean length of the intervention phase was 9.28 weeks (SD = 4.08) for the nine sessions, with a range of 7.0 to 19.29 weeks. Sessions were counterbalanced for the practice order of feedforward self-modeling and control skill combinations. Athletes worked with the researcher in groups of one to three gymnasts at a time, with the restriction that none of the gymnasts were attempting the same skill combinations. After each trial of the skill combination, athletes received general encouragement from the experimenter, e.g. keep it up, good work, but no knowledge of performance was given. The participants were shown their feedforward self-modeling video two times: once prior to the initiation of the nine attempts and once after five attempts of the skill combination. It has been suggested that repeated viewing of a modeling video before and during practice aids in observational learning (Deakin & Proteau, 2000; Magill, 1993). Self-reflection measures were taken at the conclusion of the nine trials at every third session (sessions 3, 6, and 9), in the same order as that described in the pre-test phase. Having time as a factor allowed insight into the timing of any self-modeling benefits to self-regulation. For the control skill combination, the participants attempted nine combinations; however no self-modeling video was used. Moreover, performances of the last three trials were videotaped for each the self-modeling and control combinations at every third session (session 3, 6 and 9). These performance attempts will later be analyzed for a physical performance measure which is not used in this thesis.

Post-test phase

A final post-test session was included which followed the same procedure as the pre-test. Thus, participants completed nine trials of each combination and completed all self-reflection measures for each combination.

Chapter 4: Results and Discussion

Data Analysis

The purpose of the present research is to examine the influence of a feed-forward self-modeling intervention on participants' self-regulation. Thus, analyses will focus on the differences between the self-modeling and control conditions for each of the four self-reflection processes. As well, data will be analyzed for differences across time.

All analyses were conducted at a significance level of $p < .0125$ with a Bonferroni correction due to multiple uses of univariate analysis of variance (ANOVA).

Self-evaluation

In order to obtain a score for the self-evaluation measure, an average of the ratings for the four or five (for self-modeling) items was taken. Therefore, the scores could range from 1 to 5, with low scores meaning little use of self-evaluation and high scores, in contrast, representing more frequent use of self-evaluation. Data were checked for normality; one outlier was found. Considering the small number of participants, the outlier was reduced as per suggestions by Tabachnick and Fidell (2001). The outlier was reduced to one point above the next highest score. In order to assess the possibility of pre-test score as a covariate, a one-way ANOVA was performed on pre-test scores. No difference was found between control and self-modeling conditions ($F(1,2) = .2$, $p > .0125$). In addition, Pearson correlations were run between pre- and post-test scores for the control ($r = -.139$) and for self-modeling ($r = .246$). Given that there was no differences between conditions at pre-test and low correlations from pre- to post-test, pre-test scores were not used as a covariate. Pre-test scores were then included in the acquisition analysis.

A 2 (Condition: self-modeling and control) x 4 (Time of measurement) ANOVA with repeated measures on all factors was conducted for the dependent variable of self-evaluation. No significant main effect was found for condition ($F(1,7) = 0.177, p > .0125$) or session ($F(3,21) = 3.089, p > .0125$). The interaction between condition and session was also not significant, $F(3,21) = 1.676, p > .0125$. Finally, a 2 Condition repeated measures ANOVA was run on post-test data. No significant differences were found between self-modeling and control conditions ($F(1,7) = 0.74$, $p > .0125$; see Table 1).

Table 1

Means (SD) on the Self-Evaluation Questionnaire

	Condition	
Session	Control	Self-Modeling
Pre-test	3.72 (0.62)	3.9 (0.42)
Session 3	4.03 (0.56)	4.1 (0.53)
Session 6	4.44 (0.50)	4.15 (0.50)
Session 9	3.9 (0.57)	4.1 (0.51)
Post-test	4.0 (0.65)	4.15 (0.71)

Note. Self-evaluation scores ranged from 1 to 5, with a higher score indicating more frequent use of self-evaluation criteria.

In the present study, we examined whether a feedforward self-modeling video would have an impact on gymnasts' use of self-evaluation criteria. A self-evaluation questionnaire was developed and used to assess how frequently participants were using different self-evaluation criteria. No a priori hypotheses were made about the potential effect of a self-modeling video. The results showed that the self-modeling intervention did not have an effect on participants' use of self-evaluation criteria. This is the first study, to my knowledge, which has investigated such a possibility. Thus, while some studies have shown self-modeling to be beneficial to physical performance of a skill being learned (e.g., Starek & McCullagh, 1999), self-modeling does not seem to increase self-evaluation.

Ames (1992) has suggested that for individuals of low ability, social comparison has negative consequences for self-regulation, such as the use of less effective learning strategies. Hence it is important that individuals use self-referent criteria for self-evaluation. Four items on the self-evaluation questionnaire in this study examined how often participants used self-referent criteria. Means on those items ranged from 4.06 to 4.46 on a 5-point Likert scale. One item referred to a normative criterion, that is, comparison to another gymnast's performance. This item's mean was 3.46. Thus, participants were using self-referent criteria more often; however social comparison was also being used. By examining the means, no differences were noted between the self-modeling and control conditions, thus there is no evidence that the self-modeling intervention resulted in the participants using more self-referent criteria.

Attributions

The CDSII, with wording and scale modified for use with children, constituted the second dependent variable. Scores were obtained by taking the sum of the ratings on each dimension. The possible range on each dimension is from 3 to 15. For the locus of causality dimension, a high score indicates internal attributions, whereas a low score reflects external attributions. For the dimension pertaining to stability, high scores represent stable attributions while low scores indicate unstable attributions. Attributions considered personally controllable obtain a high score on the personal control dimension whereas personally uncontrollable attributions are represented by a low score. Finally, a high score reflects externally controllable attributions on the external control scale. In contrast, attributions considered uncontrollable by others are indicated by low scores. The CDSII was completed twice at each self-reflection measurement period, once for good performance and once for a poor performance. Each will be examined in turn, beginning with CDSII: good performance.

The data for CDSII: good performance were checked for outliers. One outlier was found and was increased in order to retain that participant for further analysis as suggested by Tabachnick and Fidell (2001). Reliability analysis showed that Cronbach's alpha was above the suggested .7 level (Nunnally, 1978) for the dimensions of personal control (α = 848), stability (α = .849), and external control (α = .826). Cronbach's alpha for the locus dimension was below the recommended level (α = .607), however these results were still included in analysis and thus results for this scale should be interpreted with caution.

Pearson correlations were performed on pre- and post-test scores for each dimension and each condition. Correlations were low to moderate, ranging from $r = .293$ on the personal control dimension for the control condition to $r = .579$ on the locus dimension for the control condition. Additionally, a 4 (Dimension) x 2 (Condition) ANOVA with repeated measures on both factors was run to assess any differences between conditions at pre-test. The main effect for condition was non-significant, $F(1,7) = 3.011$, $p > .0125$. Consequently, pre-test scores were not used as a covariate in further analyses.

A 4 (Dimension) x 4 (Time) x 2 (Condition) ANOVA with repeated measures on all factors was performed on the CDSII: good performance. There was a significant main effect for dimension, $F(3,21) = 14.249$, $p<.001$, *partial* $\eta^2 = .671$ (see Table 2). Pairwise comparisons revealed differences between the following dimensions: locus of causality ($M = 12.47$, $SD = 1.97$) and external control ($M = 7.0$, $SD = 2.47$; $p < .01$); locus of causality and stability ($M = 7.18$, $SD = 2.77$; $p < .01$); external control and personal control ($M = 13.13$, $SD = 1.80$; $p < .01$); and finally, stability and personal control ($p < .01$). No other main effects were found for time ($F(3,21) = 0.63$, $p >.0125$) or condition ($F(3,21) = 2.4$, $p>.0125$). In addition there were no significant interactions between dimension and time ($F(9,63) = 1.282$, $p>.0125$), dimension and condition ($F(3,21) = 1.574$, $p>.0125$), time and condition ($F(3,21) = 1.151$, $p>.0125$). The three-way interaction between dimension, time and condition was also not significant, $F(3,21) = 1.611$, $p>.0125$.

To analyze whether any differences existed at post-test for the CDSII: good performance data, a 4 (Dimension) x 2 (Condition) ANOVA with repeated measures on both factors was performed. There was no main effect for condition, $F(1,7) = 0.92$, $p >.0125$. The main effect for dimension, however, was significant, $F(3,21) = 9.994$, $p<.001$, *partial* $\eta^2 = .588$ (see Table 2). Pairwise comparisons revealed that there were significant differences between the following: locus of causality ($M = 12.38$, $SD = 2.57$) and external control ($M = 6.5$, $SD = 2.16$; $p < .01$); external control and stability ($M = 8.69$, $SD = 3.64$; $p < .01$); and external control and personal control ($M = 12.63$, $SD =2.47$; $p < .01$). There was no interaction for the post-test data, $F(3,21) = 2.067$, $p>.0125$.

Table 2

	Acquisition		Post-test	
CDSII Dimension	Control	Self-Modeling	Control	Self-Modeling
Locus of Causality	12.8 (2.2)	12.1 (1.9)	12.4 (2.6)	12.4 (2.7)
External Control	6.8 (3.2)	7.3 (2.0)	6.3 (2.1)	6.6 (2.3)
Stability	7.4 (2.7)	7.0 (2.9)	8.9 (3.8)	8.5 (3.6)
Personal Control	13.7 (1.6)	12.6 (2.2)	12.0 (2.9)	13.3 (2.5)

Note. CDSII scores range from 3-15 with higher scores meaning internal locus of causality, higher levels of external control, stability, higher levels of personal control.

Data for CDSII: poor performance was analyzed next. There were four missing values, which were replaced by the mean. Six outliers were also found and modified according to suggestions from Tabachnick and Fidel (2001) in order to keep those participants and render the data normally distributed. Reliability analysis of the measure used showed that the dimensions of personal control ($\alpha = .769$) and stability ($\alpha = .763$) met the standard (Nunnally, 1978). Locus of causality ($\alpha = .648$) and external control ($\alpha = .622$) however, did not; thus results concerning locus of causality and external control should be interpreted with caution.

To assess whether pre-test scores should be used as a covariate, Pearson correlations were run between pre- and post-test scores for each condition and each scale of the CDSII. Correlations ranged from low on the stability dimension for self-modeling ($r = .101$) to moderately high on locus dimension for the self-modeling condition ($r = .726$). Only 3 out of 8 correlations were above .6 and thus it was deemed that correlations were not high enough to warrant use of pre-test scores as a covariate. Additionally, a 4 (Dimension) x 2 (Condition) ANOVA was performed on pre-test scores. No differences were found between control and self-modeling conditions, $F(1,7) = 0.14$, $p > .0125$. Therefore, pre-test scores were not used a covariates.

A 4 (Dimension) x 4 (Time) x 2 (Condition) ANOVA with repeated measures on all factors was performed on pre-test and acquisition data. There were no main effects for time ($F(3,21) = 0.18$, $p > .0125$) or condition ($F(1,7) = 1.167$, $p > .0125$). A main effect was found on dimension, $F = 24.00$, $p < .001$, *partial* $\eta^2 = .774$ (see Table 3). Significant differences were found between the following pairs of dimensions: locus of causality ($M = 12.28$, $SD = 2.36$) and external control ($M = 6.75$, $SD = 2.25$; $p < .01$); locus of causality and stability ($M = 5.25$, $SD = 2.10$; $p < .01$); external control and personal control ($M = 12.88$, $SD = 2.67$; $p < .01$); and finally, stability and personal control ($p < .01$). No significant interactions were found.

Additionally, a 4 (Dimension) x 2 (Condition) ANOVA with repeated measures on all factors was performed on post-test data. There was no main effect for condition ($F(1,7) = 0.01$, $p > .0125$) and no interaction ($F(3,21) = 0.44$, $p > .0125$). The main effect for dimension was significant, $F(3, 21) = 15.448$, $p < .001$ (see Table 3). Pairwise comparisons revealed the following significant differences: locus of causality ($M = 12.06$, $SD = 2.74$) and external control ($M = 7.71$, $SD = 2.07$; $p < .01$); locus of causality and stability ($M = 5.31$, $SD = 2.31$; $p < .01$); external control and personal control ($M = 12.19$, $SD = 2.63$; $p < .01$); and stability and personal control ($p < .01$).

Table 3

Causal Attributions for Poor Performance: Average of Acquisition Scores and Post-Test Means (SD)

	Acquisition		Post-test	
CDSII Dimension	Control	Self-Modeling	Control	Self-Modeling
Locus of Causality	12.5 (2.2)	12.1 (2.4)	12.1 (2.9)	12.0 (2.7)
External Control	6.8 (2.2)	6.7 (2.5)	8.0 (2.6)	7.4 (2.7)
Stability	5.2 (1.6)	5.3 (1.7)	5.3 (2.4)	5.4 (2.6)
Personal Control	12.9 (2.2)	12.8 (2.5)	11.9 (2.9)	12.5 (2.9)

Note. CDSII scores range from 3-15 with higher scores meaning internal locus of causality, higher levels of external control, stability, higher levels of personal control.

In the present experiment, the Revised Causal Dimension Scale (McAuley, Russell & Duncan, 1992) was used to assess participants' causal attributions. It was hypothesized that a self-modeling intervention would allow participants to make more adaptive attributions as outlined by Weiner (1979, 1985). Weiner suggested that for a good performance attributions should be internal, stable and controllable. Adaptive attributions for a poor performance should be external, unstable and controllable. While the CDSII has split controllability into personally controllable and controllable by others, McAuley, Duncan and Russell point out that personal control is most important when making attributions. Little research has examined the impact of the external control dimension of attributions. Thus, the discussion will focus on the dimension of personal control in relation to adaptive attributions.

No other research to date has investigated the relationship between self-modeling and causal attributions. In the present study, there were no differences on attributions made between the self-modeling combination and the control combination. This was true for both a good performance and a poor performance. Therefore, it seems as though the self-modeling intervention did not impact the attributions that participants made.

The significant difference between dimensions revealed that for both a good and a poor performance, causal attributions were personally controllable, internal and unstable. The fact that the attributional patterns made by participants were similar for both good and bad outcomes is contradictory to previous research (e.g., Bukowski & Moore, 1980; Gill, 1980). I advance a couple of reasons why this may have occurred. First, participants made their own judgments about which attempts at the combination were considered "good" and "poor". Thus, it is possible that the two attempts athletes were reflecting upon while completing the questionnaire were actually quite similar and had minimal differences between them, and hence were attributed to the same causes. Previous research with attributions in sport has investigated win/lose outcomes (e.g., Grove, Hanrahan & McInman, 1991; McAuley & Gross, 1983) or easily distinguishable outcomes such as making a basketball free-throw or not (Cleary & Zimmerman, 2001). Thus the differences between good and poor performances are clear and athletes are more likely to make different causal attributions for these outcomes. Secondly, the participants in the current experiment completed the CDSII twice on the same day, one after the other. Thus, it is possible that participants did not differentiate enough between the two completions of the CDSII and answered similarly to both because of their temporal proximity. While this may be the case, the current results are supported by some research in the causal attribution domain.

Weiner (1979, 1985) suggested that attributions should always be controllable; as such, the individual feels there is something to be done to improve the situation, or that they are responsible for the good performance. Participants in this research seemed to have a sense of control over their performances, for both good and poor performances. Research by McAuley and Gross (1983) and Wilson and Stephens (2005) also found that when athletes won their games they made attributions which were personally controllable.

On the locus of causality dimension, previous research has shown that winners make attributions which are internal (McAuley & Gross, 1983; Wilson & Stephens, 2005). Internal attributions are causes which are perceived by the learner to be within him or herself such as ability, effort or mood. External causes, on the hand, are found outside the learner such as coach, weather conditions and teammates. Grove & Prapavessis (1995) also found that squash players who had high ability made more internal attributions when they won than when they lost. In the present study, participants made internal attributions for both types of attributions. This means that participants feel as though a factor within themselves is causing their performance to be good or bad. While Weiner suggested that this is adaptive for a good performance, poor performances should be attributed to external causes. This is known as the self-serving bias (Mark, Mutrie, Brooks & Harris, 1984; Weiner, 1979, 1985). Some research in sport has supported this idea (e.g., Bukowski & Moore, 1980; Gill, 1980) while others have shown that win and loss outcomes are attributed to internal causes (e.g., Grove, Hanrahan & McInman, 1991). Mark and colleagues (1984) suggested that athletes are a subpopulation which is encouraged to take responsibility for their performance, whether good or bad. Thus, this research supports this idea as participants made internal attributions for both good and poor performances. Moreover, gymnastics is a closed-skill sport (Gentile, 1972) and thus, there are not many external influences on performance. As such, it is logical that athletes might attribute poor performances to internal causes.

Results revealed that participants in the present study made unstable attributions for both good and poor performances. This is adaptive for poor performances in that if the results are unstable, there is the opportunity for improvement (Weiner, 1979, 1985). If poor performances were considered stable, feelings of helplessness would likely follow. Thus, it is beneficial for the participants' that they are making unstable attributions for poor performances. On the contrary, good performances should be attributed to stable causes. The gymnasts in the study tended to attribute their good performances to unstable causes. That is, even though they might have done it once, the participants do not perceive that they will continue to do well. One reason for the athletes making such attributions might be that the participants were learning a skill and were not yet consistent in their performance and therefore attributed it to inconsistent factors. Grove and Prapavessis (1995) found that squash players of high ability made more stable attributions than low-ability players, regardless of their performance level. Since the participants in this study were novice-level competitors, perhaps their lower-level ability influenced their attributions. Grove and Prapavessis suggested that ability level does impact attributions which may be what occurred in this case and thus, this is a plausible reason.

Self-satisfaction

Scores on the self-satisfaction scale were the ratings given to the one item that asked how satisfied participants were with their performance that day. The scores could range from 1 to 10. High scores reflect more satisfaction with one's performance. All data were normal and no outliers were found. Following the same procedures as the other measures to check the possibility of using pre-test scores as a covariate, it was determined that pre-test scores should not used as a covariate and instead were entered with the acquisition data.

A 2 (Condition) x 4 (Time) ANOVA with repeated measures on all factors was used to analyze the self-satisfaction dependent variable. There was no main effect for condition ($F(1,7) = .02$, $p > .0125$) or time ($F(3,7) = .07$, $p > .0125$). No interactions were found, $F(3, 21) = 0.93$, $p > .0125$). A one-way ANOVA was performed on post-test data with repeated measures on the condition factor. There were no significant differences between self-modeling and control conditions at post-test, $F(1,7) = .05$, $p > .0125$.

Self-satisfaction with one's performance is an important aspect of self-regulation as it impact on individuals' motivation (Zimmerman, 2000, 2004). The positive affect associated with approval of one's own performance should lead individuals to continue in their pursuit of their goal. Conversely, the negative affect associated with disapproval of one's own performance should lead to avoidance of the task. Clark and Ste-Marie (2007) found that children's self-satisfaction with their performance was higher at retention for the group which received a self-modeling intervention compared to a control group. However, the present experiment did not find any difference between the self-modeling and control conditions. Thus, the present research did not support Clark and Ste-Marie's findings. However, the children in Clark and Ste-Marie's research received the self-modeling intervention over consecutive days, thus their evaluation of their improvement may have been more tangible and thus, they were more satisfied at the post-tests phase with their results. Moreover, Martini and Ste-Marie (submitted) conducted a self-modeling intervention with adult beginner swimmers and found no improvements in self-satisfaction. Similar to the current experiment, the participants in Martini and Ste-Marie received the intervention in a distributed fashion. Hence, it may be possible that a more intensive self-modeling intervention is beneficial for self-satisfaction with performance. In addition, the two swimming studies utilized a positive self-review self-modeling video and thus the participants saw what they had actually done. Knowing that they had actually done what they were seeing, rather than knowing that their feedforward self-modeling video was above their actual capability, may also have influenced increases in affective reactions to performance.

A final consideration is that means on the self-satisfaction questionnaire for the present research were quite stable around 8.5 out of 10 across conditions and sessions. It is thus possible that there was a ceiling effect for this questionnaire. This does make sense for gymnastics, because participants, while satisfied with their performance, may not have wanted to choose higher than 8 or 9 as it would mean that their performance was perfect.

Inferences

The inference questionnaire consisted of two subscales, one with adaptive items and one with defensive items. Scale reliability was assessed for each subscale. Cronbach's alpha was far below the recommended level of .7 (Nunnally, 1978) for both the adaptive (α = .481) and the defensive (α = .038) subscales. Thus, no inferential statistics were performed on this data set, and instead, the means were per item were examined. Examination of the item means revealed that participants had higher means for adaptive than defensive items (see Table 4) and this occurred for both the self-modeling and control conditions.

Table 4.

Inferences Item Means (SD) Across Sessions

	Item	Condition: Control	Condition: Self-Modeling
Adaptive	1. increasing effort	4.12 (1.3)	3.92 (1.3)
	3. setting a new goal	3.25 (1.3)	3.20 (1.4)
	6. changing a mental strategy	2.90 (1.1)	2.80 (1.0)
Defensive	2. giving up	1.08 (.47)	1.03 (.16)
	4. decreasing effort	1.58 (1.1)	1.55 (1.0)
	5. thought about something else	1.55 (.93)	1.50 (.82)

Note. Scores range from 1 to 5 with higher scores indicating more frequent use of inferences.

The inferences questionnaire assessed how often participants had thoughts relating to either adaptive or defensive inferences. The item means suggested that participants tended to use adaptive inferences (M = 3.37, SD = 0.87) more often than defensive inferences (M = 1.38, SD = 0.48). Zimmerman (2000, 2004) proposed that use of adaptive inferences leads to a potential improvement in self-regulation and thus, an increase in learning and performance. Hence it is favourable that participants are using more adaptive inferences and little defensive inferences. The self-modeling intervention, however, did not impact participants' inferences as the item means were nearly identical for both conditions.

General Discussion

The feedforward self-modeling intervention did not seem to be beneficial for the self-reflection phase of self-regulation. No improvements were seen for self-evaluation, attributions, self-satisfaction or inferences. The lack of significance may indicate that the intervention did not affect participants' self-regulation. It is therefore possible that a feedforward self-modeling intervention does not influence self-regulation.

Although the results of the recent research provide no evidence that viewing of a self-modeling video promotes self-reflection, it is still possible that it could have more impact on other phases of Zimmerman's (2000, 2004) model of self-regulation. For instance, because a self-modeling video has typically been shown before acquisition trials begin (i.e. Clark & Ste-Marie, 2007; Winfrey & Weeks, 1993), perhaps this intervention has more effect on processes in the forethought phase. It is plausible that watching a video of oneself performing at a level higher than one is currently able would motivate an athlete as well as increase their self-efficacy, both of which are included in Zimmerman's outline of the forethought phase. As previously mentioned, research into the effect of self-modeling on self-efficacy has been equivocal. While Law and Ste-Marie (2005) and Ram and McCullagh (2003) showed no benefit to self-efficacy, Clark and Ste-Marie (2007) found that a self-modeling intervention increased self-efficacy of children learning to swim. Winfrey and Weeks (1993) suggested that self-efficacy becomes more realistic after having seen a self-modeling video. It is important to note that all of these studies employed the positive self review method of self-modeling and thus, the effect of a feedforward self-modeling intervention on self-efficacy remains unstudied. It is likely that a feedforward video would result in an increase in self-efficacy considering that the athletes watch themselves at a higher level than that which they are actually capable. Further research into the effect of a self-modeling video on the different phases of self-regulation is warranted.

A potential reason for the lack of impact of the self-modeling intervention may be related to several limitations of the experiment. First, a small number of participants completed the experiment. There were only eight participants in the research, and of that, only one was a male. Thus research with an increased number of participants and an equal distribution of males and females is necessary. In addition, it may be that competitive gymnasts may have already adopted self-regulatory processes and thus may have less room for improvement in this area.

While the intervention was originally planned to occur twice a week for approximately five weeks, all participants took longer than this; in fact, the mean duration to complete the intervention was double this amount of time. There were several reasons as to why this occurred. First, though the coaches were at first enthusiastic to have their athletes participate in the study, they did not want their practices interrupted and so sessions had to planned around the participants' training schedules. However, in order to make it feasible for the participants, times were scheduled either before or after their practice so they did not need to come into the gymnastics facility on a separate day and this was often difficult to schedule as participants often came right from school to practice and parents did not want their children staying late at the gym. As well, data collection began during summer training, and several of the athletes took vacation or time off during the study. Finally, a couple of the athletes sustained injuries and were unable to participate in certain gymnastics activities for a length of time and continued their participation in the study when they returned to full participation in gymnastics. Thus, the intervention was not consistently implemented as planned. Important to consider though is that injuries and vacations are concerns within any sporting environment and may affect any intervention which might be applied. Hence, this lends to the ecological validity of this research project.

A final limitation of the present experiment was the concerns with the reliability and validity of the questionnaires. While two of the questionnaires have been previously used in research, two new questionnaires were generated for this project. These two questionnaires, the inferences questionnaire and the self-evaluation questionnaire still need to be fully validated. In addition there were some issues with the reliability for the inferences questionnaire and minor reliability concerns with the CDSII (McAuley, Duncan & Russell, 1992). Thus, it is important to address these issues in further research. Zimmerman and Kintsantas (Kitsantas & Zimmerman, 2002; Zimmerman & Kitsantas, 1998) have used a microanalytical approach to measuring self-regulation in sport during practice. This approach is used to intensely study human reasoning during actual performance by asking specific questions that are aimed at gaining insight into specific psychological processes at critical times during the practice. However, in order to limit the interruption of practice, a pencil-and-paper measure is needed which could be completed once practice has finished. This measure would assess the self-regulatory processes which took place that day, as opposed to a trait assessment of self-regulated learning which examines one's usual pattern of self-regulation over time. It may also be more beneficial to have more immediate questioning of the athletes after they complete an attempt at the skill combination. For instance, to assess causal attributions, the researcher could chose an attempt at the combination that was poorly performed and administer the CDSII for poor performance immediately following that particular performance rather than asking the participant to reflect back on a poor performance after all trials are complete.

Additionally, Law and Ste-Marie (2005) have suggested that self-modeling may be more beneficial for continuous skills as compared to discrete skills. For instance, several studies that have investigated a positive self review intervention with a continuous skill, swimming, have found improvements in performance (Clark & Ste-Marie, 2007; Dowrick & Dove, 1980; Starek & McCullagh, 1999). While research investigating discrete skills, such as gymnastics (Winfrey & Weeks, 1993), volleyball serve (Ram & McCullagh, 2003) and figure skating (Law & Ste-Marie, 2005) have found no improvements in performance due to a self-modeling intervention. Perhaps there is something about swimming in particular or continuous skills in general which allows the self-modeling intervention to have an effect. Ashford, Bennett and Davids (2006) conducted a meta-analysis of observational learning literature and found that while observational learning was more beneficial than practice-only conditions, this was particularly true for serial tasks. A couple of self-modeling dissertations investigating discrete tasks such as basketball free-throws (Bradley, 1993) and golf-putting (Drazin, 1985) do not follow this pattern as these studies did find performance benefits due to a self-modeling intervention. Thus, further research is needed to clarify if skill type moderates the relationship between self-modeling and performance and possibly self-regulation.

Moreover, it is important that future research examine the timing of viewing the self-modeling video which is most advantageous to learning. In the current experiment, participants viewed their self-modeling video both before their first attempt and during their practice. Perhaps athletes would benefit from seeing their video a few minutes before their performance to allow them the opportunity to plan for their next attempt. Furthermore, is viewing the self-modeling video once enough, or is it better to see the skill performed several times? It is also necessary to determine how many intervention sessions are most useful. In addition, it may be helpful for athletes to view a self-observation video, which shows what the athlete actually performed without any editing, during skill acquisition in order to see their mistakes and improve. Self-modeling may be more beneficial in competition settings, in order to improve self-efficacy and plan strategies. Obviously, there are many unanswered questions about how self-modeling can be most influential to performance, and thus further research on this topic is necessary.

In summary, the results from this experiment showed that a feedfoward self-modeling intervention had no impact on the self-reflection phase of self-regulated learning. Participants showed no benefits with respect to frequency of self-evaluation, adaptive causal attributions, levels of self-satisfaction or increased use of adaptive inferences. It is recommended, however that future research address the limitations noted of this research to further examine the impact of self-modeling on self-regulation and performance.

References

Ames, C. (1992). Classrooms: Goals, structures, and student motivation. *Journal of Educational Psychology, 84,* 261-271.

Ashford, D., Bennett, S. J. & Davids, K. (2006). Observational modeling effects for movement dynamics and movement outcome measures across differing task constraints: A meta-analysis. *Journal of Motor Behavior, 38,* 185-205.

Bandura, A. (1977a). Social learning theory. New Jersey: Prentice Hall.

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

Bandura, A. (1986). Social foundations of thought and action: A social cognitive theory. New Jersey: Prentice Hall.

Blandin, Y., Lhuisset, L., & Proteau, L. (1999). Cognitive processes underlying observational learning of motor skills. *Quarterly Journal of Experimental Psychology, 52A,* 957-979.

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

Bond, K. A., Biddle, S., & Ntoumanis, N. (2001). Self-efficacy and causal attribution in female golfers. *International Journal of Sport Psychology, 31,* 246-256.

Boschker, M., & Bakker, F. C. (2002). Inexperienced sport climbers might perceive and utilize new opportunities for action by merely observing a model. *Perceptual and Motor Skills, 95,* 3-9.

Bukowski,W. M. & Moore, D. (1980). Winners' and losers' attributions for success and failure in a series of athletic events. *Journal of Sport Psychology, 2,* 195-201.

Clark, S. E. & Ste-Marie, D. (2007). Investigating the impact of self-as-a-model interventions on children's self-regulation of learning and swimming performance. *Journal of Sport Sciences, 5,* 577-586.

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.

Cleary, T. J., Zimmerman, B. J. & Keating, T. (2006). Training physical education students to self-regulate during basketball free-throw practice. *Research Quarterly for Exercise and Sport, 77,* 521-262.

Deakin, J. M. & Proteau, L. (2000). The role of scheduling in learning through observation. *Journal of Motor Behavior, 32,* 268-276.

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

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

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

Feltz, D. (1982). The effects of age and number of demonstrations on modeling of form and performance. *Research Quarterly for Exercise and Sport, 53,* 291-296.

Franks, I. M. & Maile, L. J. (1991). The use of video in sport skills acquisition. In P.W. Dowrick (Ed.) *Practical Guide to Using Video in the Behavioral Sciences, (*p.231-243). New York: John Wiley.

Gentile, A. M. (1972). A working model of skill acquisition with application to teaching. *Quest, 17,* 3-23.

Gill, D. L. (1980). Success-failure attributions in competitive groups: An exception to egocentrism. *Journal of Sport Psychology, 2,* 106-114.

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.

Grove, R. J., Hanrahan, S. J. & McInma, A. (1991). Success/Failure bias in attributions across involvement categories in sport. *Personality and Social Psychology Bulletin, 17,* 93-97.

Grove, R. J. & Prapavessis, H. (1995). The effect of skill level and sport outcomes on dimensional aspects of causal attributions. *Australian Psychologist, 30,* 29-32.

Hodges, N. J., Williams, A. M., Hayes, S. J. & Breslin, G. (2007). What is modeled during observational learning? *Journal of Sport Sciences, 25,* 531-546.

Kirschenbaum, D. S. (1984). Self-regulation and sport psychology: Nurturing an emerging symbiosis. *Journal of Sport Psychology, 6,* 159-183.

Kirschenbaum, D. S. (1987). Self-regulation of sport performance. *Medicine and Science in Sports and Exercise, 5,* S106-S113.

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

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.

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.

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,* 143-152.

Magill, R. A. (1993). Motor learning: Concepts and applications (4th ed.). Madison, Wisconsin: Brown & Benchmark.

Mark, M. M., Mutrie, N., Brooks, D. R. & Harris, D. V. (1984). Causal attributions of winners and losers in individual competitive sports: Toward a reformulation of the self-serving bias. *Journal of Sport Psychology, 6,* 184-196.

Martens, R., Burwitz, L., & Zuckerman, J. (1976). *Research Quarterly, 47,* 277-291.

Martini, R., & Ste-Marie, D. M. (submitted). Investigating self-as-a-model techniques within a self-regulation of learning framework with adults learning the butterfly stroke. European Journal of Sport Science.

McAuley, E. (1985). Modeling and self-efficacy: A test of Bandura's model. *Journal of Sport Psychology, 7,* 283-295.

McAuley, E., & Gross, J. B. (1983). Perceptions of causality in sport: An application of the Causal Dimension Scale. *Journal of Sport Psychology, 5,* 72-76.

McAuley, E., Duncan, T. E., Russell, D.W. (1992). Measuring causal attributions: The Revised Causal Dimension Scale (CDSII). *Personality and Social Psychology Bulletin, 5,* 566-573.

McAuley, E., & Shaffer, S. (1993). Affective responses to externally and personally controllable attributions. *Basic and Applied Social Psycholgy, 14,* 475-485.

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

McCullagh, P., Weiss, M. R. & Ross, D. (1989). Modeling considerations in motor skill acquisition and performance: An integrated approach. *Exercise and Sport Sciences Reviews, 17,* 475-513.

McCullagh, P. & Weiss, M. R. (2001). Modeling. In R.N. Singer, H.A. Hausenblaus, & C.M. Janelle (Eds.), *Handbook of Sport Psychology (2nd edition).* (pp. 340-361). New York, NY: John Wiley & Sons, Inc.

Murphy, K. R. & Davidshofer, C. O. (2005). *Psychological Testing: Principles and Applications (6th edition).* Upper Saddle River, New Jersey: Pearson Education, Inc.

Nunnally, J. C. (1978). *Psychometric Theory (2nd edition).* New York: McGraw-Hill.

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

Schunk, D.H. (1987). Peer models and children's behavioral change. *Review of Educational Research, 57,* 149-174.

Schunk, D. H. & Zimmerman, B. J. (1997). Social origins of self-regulatory competence. *Educational Psychologist, 32,* 195-208.

Scully, D. M. & Newell, K. M. (1985). Observational learning and the acquisition of motor skills: Toward a visual perception perspective. *Journal of Human Movement Studies, 11,* 169-186.

Shea, C.H., Wright, D.L., Wulf, G. & Whitacre, C. (2000). Physical and observational practice afford unique learning opportunities. *Journal of Motor Behavior, 32,* 27-36.

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.

Tabachnick, B. G. & Fidell, L. S. (2001). *Using Multivariate Statistics.* Boston: Allyn and Bacon.

Taylor, E. H. (2005). Using self-rating scales for assessing the severely mental ill client: A clinical and psychometric perspective. In W.R. Nugent (ed.). *Approaches to Measuring Human Behaviour in the Social Environment* (pp. 23-40). Binghamton, New York: Haworth Press.

Urbina, S. (2004). *Essentials of Psychological Testing*. Hoboken, New Jersey: John Wiley & Sons, Inc.

Vlachopoulos, S., Biddle, S., & Fox, K. (1996). A social-cognitive investigation into the mechanisms of affect generation in children's physical activity. *Journal of Sport and Exercise Psychology, 18,* 174-193.

Weiner, B. (1979). A theory of motivation for some classroom experiences. *Journal of Educational Psychology, 71*, 3-25.

Weiner, B. (1985). An attributional theory of achievement motivation and emotion. *Psychological Review, 92,* 548-573.

Weiss, M. R. (1983). Modeling and motor performance: A developmental perspective. *Research Quarterly for Exercise and Sport, 54,* 190-197.

Wilson, M. A., & Stephens, D. (2005). Great expectations: How do athletes of different expectancies attribute their perception of personal athletic performance? *Journal of Sport Behaviour, 28,* 392-406.

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

Yando, R., Seitz, V., & Zigler, E. (1978). Imitation: A developmental perspective. Hillsdale, New Jersey: Lawrence Erlbaum.

Zetou, E., Fragouli, M. & Tzetzis, G. (1999). The influence of star and self modeling on volleyball skill acquisition. *Journal of Human Movement Studies, 37,* 127-143.

Zetou, E., Tzetzis, G., Vernadakis, N., & Kioumourtzoglou, E. (2002). Modeling in learning two volleyball skills. *Perceptual and Motor Skills, 94,* 1131-1142.

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 M. Boekarts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation.* (pp. 13-39). San Diego, CA: Academic Press.

Zimmerman, B. J. (2004). Sociocultural Influences and Students' Development of Academic Self-Regulation: A Social Cognitive Perspective. In D. M. McInerney & S. Van Etten (Eds.), *Research on sociocultural influences on motivation and learning: Big theories revisited* (pp. 139-164). Vol. 4. Greenwich, CT: Information Age Press.

Zimmerman, B. J. & Kitsantas, A. (1996). Self-regulated learning of a motoric skill: The role of goal setting and self-monitoring. *Journal of Applied Sport Psychology, 8,* 60-75.

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.

Zimmerman, B. J. & Martinez-Pons, M. (1986). Development of a structured interview for assessing student use of self-regulated learning strategies. *American Educational Research Journal, 23,* 614-628.

Appendix A

Self-Evaluation Questionnaire

Participant # ______

Think about the skill combination of ___________________________ you performed today. Rate how often you compared yourself to the following:

1. Your performance from earlier or another day

1	2	3	4	5
Never				Always

2. Another gymnast's performance you saw

1	2	3	4	5
Never				Always

3. A goal you set for yourself before you started

1	2	3	4	5
Never				Always

4. Other : _______________________________

1	2	3	4	5
Never				Always

1,3 = self-referent criteria (previous performance, mastery); 2 = normative criteria

Appendix B

Self-Evaluation Questionnaire (SM)

Participant # ______

Think about the skill combination of ________________________ you performed today. Rate how often you compared yourself to the following:

1. Your performance from earlier or another day

1	2	3	4	5
Never				Always

2. Another gymnast's performance you saw

1	2	3	4	5
Never				Always

3. A goal you set for yourself before you started

1	2	3	4	5
Never				Always

4. Your performance from the self-modeling video

1	2	3	4	5
Never				Always

5. Other : ____________________________

1	2	3	4	5
Never				Always

1,3 = self-referent criteria (previous performance, mastery); 2 = normative criteria

Appendix C

CDSII Questionnaire – Positive

Participant # ______

Think about a skill combination you performed well today. Why do you think you did well? Write one or more reasons here:

Instructions: Think about the reason or reasons you have written above. The items below concern your impressions or opinions of this cause or causes of your performance. Circle one number for each of the following questions.

Is the reason something:

1. To do with you	5	4	3	2	1	Not to do with you
2. You can be in charge of	5	4	3	2	1	You can not be in charge of
3. That will stay the same in the future	5	4	3	2	1	That will change in the future
4. You can control	5	4	3	2	1	You cannot control
5. Over which other people have control	5	4	3	2	1	Over which other people have no control
6. Inside of you	5	4	3	2	1	Outside of you
7. Stays the same over time	5	4	3	2	1	Changes over time
8. Under the power of other people	5	4	3	2	1	Not under the power of other people
9. Something about you	5	4	3	2	1	Something about others
10. Over which you have power	5	4	3	2	1	Over which you have no power
11. That cannot be changed	5	4	3	2	1	That can be changed
12. That other people can change	5	4	3	2	1	That other people cannot change

****

Scoring: The total scores for each dimension are obtained by summing the items, as follows: 1,6,9 = locus of causality; 5, 8, 12 = external control; 3, 7, 11 = stability; 2, 4, 10 = personal control.

Appendix D

CDSII Questionnaire – Negative
Participant # ______

Think about a skill combination you did not do very well today. Why do you think you did poorly? Write one or more reasons here:

Instructions: Think about the reason or reasons you have written above. The items below concern your impressions or opinions of this cause or causes of your performance. Circle one number for each of the following questions.

Is the reason something:

1. To do with you	5	4	3	2	1	Not to do with you
2. You can be in charge of	5	4	3	2	1	You can not be in charge of
3. That will stay the same in the future	5	4	3	2	1	That will change in the future
4. You can control	5	4	3	2	1	You cannot control
5. Over which other people have control	5	4	3	2	1	Over which other people have no control
6. Inside of you	5	4	3	2	1	Outside of you
7. Stays the same over time	5	4	3	2	1	Changes over time
8. Under the power of other people	5	4	3	2	1	Not under the power of other people
9. Something about you	5	4	3	2	1	Something about others
10. Over which you have power	5	4	3	2	1	Over which you have no power
11. That cannot be changed	5	4	3	2	1	That can be changed
12. That other people can change	5	4	3	2	1	That other people cannot change

****

Scoring: The total scores for each dimension are obtained by summing the items, as follows: 1,6,9 = locus of causality; 5, 8, 12 = external control; 3, 7, 11 = stability; 2, 4, 10 = personal control.

Appendix E

Self-satisfaction Questionnaire for Children

Please circle the number below that best shows how good you feel about your performance of the skill combination. You can use the happy faces to know what each number means.

1 2 3 4 5 6 7 8 9 10

Appendix F

Inferences Questionnaire

Participant # ______

In the time between finishing each combination and receiving feedback from the experimenter, rate how often you thought about the following:

1. I thought about increasing my effort

1	2	3	4	5
Never				Always

2. I thought about giving up

1	2	3	4	5
Never				Always

3. I thought about setting a new goal

1	2	3	4	5
Never				Always

4. I thought about decreasing my effort

1	2	3	4	5
Never				Always

5. I thought about something else completely

1	2	3	4	5
Never				Always

6. I thought about changing a mental strategy (ex. imagery, self-talk, a new technique)

1	2	3	4	5
Never				Always

If you did not choose "1" please write what strategies you thought about changing:

____

1,3,6 = Adaptive; 2,4,5 = Defensive

Appendix G

Skill Combination Possibilities

Level	Forward combinations	Backward combinations
1	• dive roll – front walkover • front walkover – cartwheel	• cartwheel – back walkover • back walkover – back extension
2	• front handspring – cartwheel • front handspring – round off • front handspring x2	• back handspring step out x2 • round off – back handspring • back walkover – back handspring
3	• front handspring – front tuck • front handspring – fly spring • front tuck – round off	• round off – back tuck • back handspring two-foot x2