

SELF-MODELING AND PSYCHOLOGICAL SKILLS

The Effects of Different Self-Modeling Interventions on the Performance and Self-Regulatory Processes and Beliefs of Competitive Gymnasts

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Abstract

Self-modeling (SM) involves an observer viewing oneself on an edited video showing desired behaviors (Dowrick, & Dove, 1990). The impact of a SM video on skill acquisition has been frequently explored (e.g., Clark & Ste-Marie, 2006), however, few researchers have investigated SM in competition (Ste-Marie, Rymal, Vertes, & Martini, 2009). Also of limited study has been the underlying self-regulatory mechanisms engaged in alongside a SM video (e.g., Rymal, Martini, & Ste-Marie, 2010). To date, research has not investigated the effects of SM on gymnasts competitive bar performance or how it is used to self-regulate, nor whether SM increases self-regulation. Thus, the purpose here was to investigate the effects of a SM video on gymnasts' physical performance and self-regulation. Of further interest was to explore the combination of SM and psychological skills training (PST) on competitive performance. Eighteen gymnasts were divided into two groups; SM+PST ($n = 10$) and SM ($n = 8$). The SM+PST group took part in workshops one month prior to the competitions wherein links between SM and psychological skills were made. The SM group did not do the workshops. Gymnasts competed at four competitions; two received the SM video and two did not. For the video competitions, participants viewed their video three times prior to warm-up and once before competing. After one video competition and one competition that gymnasts did not receive the video, interview sessions were conducted with ten gymnasts. The results of the physical performance data did not show any significant group or condition main effects (all F 's < 1). Imagery ability, however, was a moderating variable. Gymnasts low in visual imagery ability benefitted from the use of the self-modeling video later in the season $F(1, 16) = 5.976, p = .026, \eta^2 = .27, (1 - \beta) =$

.63, but not early in the season. Through the qualitative analysis of interview questions, it can be said that gymnasts used the SM video as a task analysis strategy before, during, and after their competitive event. Analysis of transcripts also suggested that the SM video encouraged the use of certain self-regulatory processes and beliefs related to the forethought (i.e., before) and self-reflection (i.e., after) phases above and beyond that typically used when competing.

Please note that the references and appendices form chapter 1 (updated proposal) and 4 (general discussion) are presented in chapter 5 at the back of the thesis document. Also, chapter 5 contains only those references that are not found in the three articles presented in chapter 3. I would also like to acknowledge that chapter 1 contains much of the information presented within the articles of chapter 2. Thus, I encourage that the readers to focus on chapter 2 and the general discussion of this thesis.

A final note is that this research project has been approved by the Universities ethics committee (see Appendix A for ethics approval).

Chapter 1: Updated Thesis Proposal

Literature Review

In this literature review, I will first discuss the important aspects of modeling, and then proceed into research relating to self-modeling. Following this, the proposed theoretical framework in which self-modeling will be examined will be discussed. I will then describe recent literature that has examined self-modeling within a self-regulation framework. Finally, I will introduce a mental training workshop in which I believe the effectiveness of the use of self-modeling at competition can be increased.

Modeling

Modeling is defined as the medium in which learning through observation occurs (Williams, Davids, & Williams, 1999). This includes the process wherein a learner observes a model demonstrating a behavior and later the observer attempts that behavior (Bandura, 1986, 1997). There are many forms of modeling, particularly the observation of others and the observation of the self. A variety of ways exists in which these forms of modeling can be observed. As examples, one can view a live model, a videoed model, and in some cases a verbal explanation of a modeled action (i.e., auditory model) (see McCullagh & Weiss, 2001 for review). Observation of others may include observing individuals, such as an expert or an unskilled peer, or even observing team play.

Observation of the self, alternatively, includes what Dowrick (1999) has termed self-observation or self-modeling. Self-observation involves the observation of oneself on video at the current skill level. Self-modeling on the other hand is the observation of oneself performing at a desired skill level (Dowrick & Dove, 1980, p.51). There are two forms of self-modeling; positive self-review; and feedforward self-modeling. The positive self-review technique is where observers view their self on video showing their best performance thus far (Dowrick).

The feedforward technique of self-modeling is where observers view them self performing a skill that they have not yet achieved in a specific sequence or context (Dowrick).

According to Bandura (1986, 1997), one's self-efficacy is thought to be an intervening process of how one learns through modeling. Specifically, enactive mastery experience and vicarious experience can enhance or weaken the individuals learning or performance of that modeled behaviour (Bandura, 1986, 1997). It can be argued that the feedforward technique of self-modeling would provide both of these sources of information and thus increase the effectiveness of learning or performing through observation. A self-modeling video would clearly indicate the ability of the athlete to successfully complete the task (i.e., enactive mastery experience) as well as allow them to compare their capabilities to a new situation (e.g., edited video of a new context) without the model similarity debate (see Gould & Weiss, 1981; McCullagh, 1987). For this reason, a feedforward self-modeling intervention was used in this research.

Modeling Research

The majority of research on self-modeling has focused on motor skill acquisition (see Dowrick, 1999, for a review) with limited research related to the effects of modeling on performance in the competitive environment (Rymal, Martini, & Ste-Marie, 2010). To our knowledge, there are only two empirically based research projects that have investigated modeling as a sport performance enhancement technique. In Rymal's (2007) research, eight competitive divers viewed their feedforward self-modeling video prior to competition. Unfortunately, the results indicated that the administration of a self-modeling video did not enhance competitive performance. A qualitative portion of this research, however suggested

merits in continued investigation of self-modeling as a performance enhancement technique.

This qualitative component will be addressed in a later section.

As well, there were a number of limitations to Rymal's (2007) research that could have accounted for the non-significance. These included a considerably small sample size and limited number of data collection sites. Rymal also suggested that the time delay between the viewing of the self-modeling video and competition of the dive may have been too long (see also Bertram, Cote, Brown, Guadagnoli, & Palomaria, 2007). Furthermore, in Ashford and colleagues' (2006) meta-analysis of the modeling literature, they have suggested that the type of task being modeled has an impact on the effectiveness of a modeling intervention. Specifically, research conducted on skills with a distinct beginning and end (i.e., discrete skills) show only medium effect sizes from modeling interventions than those skills that are more continuous in nature; which have shown a greater effect from modeling. Perhaps this partially explains Rymal's lack of significance, given that divers were performing discrete skills. Interestingly, however, the skills that require the combination of many discrete skills within a complex task (i.e., serial skills) have been the least researched and future self-modeling research should consider activities in which serial skills are executed as a viable context for study.

Indeed, continued research conducted by Ste-Marie, Rymal, Vertes, and Martini (2011) attempted to address many of the limitations of Rymal's (2007) research. Specifically, their research investigated the use of a feedforward self-modeling video with 20 competitive gymnasts across four competitions. Hence, sample size and length of intervention concerns were addressed. Here, gymnasts' viewed their self-modeling video three times prior to warm-up on the balance beam and once again before competing; thus limiting the time delays between the viewing of the video and competition. Moreover, a portion of a beam routine was chosen,

making it a serial skill that was being modeled. Using competitive beam scores, it was shown that scores were significantly higher for competitions in which the self-modeling video was observed than those without it being seen. These results indicated that a self-modeling video could not only be administered effectively in a competitive environment but it also could be used to enhance competitive performance. Also within this research, a stronger qualitative component was included than that of Rymal (2007), and I will return to this research in a later section.

Given the success of the self-modeling intervention with the beam performance, one of the goals of this research was to determine if a self-modeling video can enhance another event in gymnastics; that of competitive bar performance. We also had a continued interest in why self-modeling can benefit competitive performance. To address this, I turn now to the theoretical framework of this research.

Theoretical Framework: Self-Regulation

Researchers have noted that the literature has had very little theoretical development of the underlying processes responsible for the benefits of self-modeling (e.g., Dowrick, 1999; Starek & McCullagh, 1999). Ferrari (1996) encouraged researchers to examine the theoretical treatments of modeling in relation to self-regulatory influences. Self-regulation refers to self-generated thoughts, feelings, beliefs, and actions to assist the learning process of goal directed behaviours (Zimmerman, 2000, 2004).

It is important to mention that there are different theoretical models of self-regulation. Specific to the motor learning literature, there are two popular models; Kirschenbaum's (1984, 1987) five stage model of self-regulation and Zimmerman's self-regulation model. First, Kirschenbaum proposed five stages in which a learner works through to achieve self-regulation. These five stages are labeled problem recognition, commitment, execution, environmental

management, and generalization. The first stage involves the learner taking responsibility for learning or improvement of the learning process. The second stage involves the learner committing to change and/or creating a plan of action. This plan is then executed, monitored, and evaluated in the third stage in order for behavioural change to occur. At stage four, Kirschenbaum notes the importance of the learner managing environmental aspects such as physical and social settings. These aspects can either facilitate or debilitate self-regulated behaviour. Lastly, the fifth stage involves the learner generalizing that behaviour into a new setting.

Although there are important concepts within Kirschenbaum's (1984, 1987) model, there seems to be limited validation of its effectiveness (Kitsantas & Zimmerman, 1998). Furthermore, when investigating modeling, the majority of research has often adopted Bandura's (1986, 1997) social cognitive perspective. Zimmerman's (2000, 2004) model of self-regulated learning falls within Bandura's (1986) social cognitive theory and has been used within the modeling literature (e.g., Clark & Ste-Marie, 2007; Ram & McCullagh, 2003; Starek & McCullagh, 1999; Winfrey & Weeks, 1993). For these reasons, Zimmerman's model will be chosen as the theoretical framework for this proposed research, and thus, is explained in some detail next.

Bandura proposed that there exists a relationship among three components from which we learn; (1) the environment, (2) the person, and (3) the behaviour. For example, the outside influences of the environment (e.g., self-modeling video) can influence a person's thoughts, attitudes, and beliefs, which in turn can influence the outcome of his or her behaviour. It is within this cyclical interaction that Zimmerman's self-regulation model is situated; specifically within the person component. The person component consists of another cyclical process which

involves three phases; those of forethought, performance control, and self-reflection. Each of these phases is comprised of self-beliefs and/or sub-processes. Before describing these beliefs and processes, it is important to note that Zimmerman explains these phases in relation to executing a specific skill, however considering the context of this proposed research, I will explain the phases in relation to a competitive performance in gymnastics, which encompasses the execution of many skills in sequence.

The forethought phase occurs before the performance. Thus, it is related to the thoughts, feelings, beliefs used to prepare the individual before the behaviour (Zimmerman, 2004). This phase is further divided into task analysis and self-motivational beliefs. Processes relating to task analysis include goals setting and strategic planning. Goals setting refers to intended outcomes for learning or performance (Lock & Latham, 1990). Specific strategic planning processes include self-instruction or imagery, as examples that can be to enhance performance (Zimmerman, 2004). Zimmerman argued that these strategic planning processes can enhance performance as they can serve to direct cognitions, control affect, or control motor execution (Zimmerman, 2000). I would argue, however, that although Zimmerman suggests that it is only strategic planning strategies that are used to modify these three important elements, that other processes and self-beliefs within his model can also be conceptualized to do the same. For example, when setting a process goal, the goal can be set for the purpose of executing a skill correctly (i.e., motor execution), remaining calm (i.e., controlling affect), or remembering corrections from a coach (i.e., directing cognitions).

Self-motivation beliefs include the construct of self-efficacy, outcome expectations, task interests and values, and goal orientations. Self-efficacy refers to the belief in one's capabilities to manage thoughts, feelings, and actions (Bandura, 1997). Outcome expectations are the

judgments or beliefs with regard to the ultimate outcomes or liabilities that the behaviour will produce. Task interest and values relates to the internal motivation and values that surpass extrinsic outcomes. Lastly, goal orientation refers to whether a person is oriented more towards personal mastery of the skill or towards performing the skill better than others (i.e., rational for learning).

The performance control phase occurs while physically attempting the skills. This phase includes processes that are used to improve the quality of mental and physical activities (Zimmerman, 2004). There are two components; the self-control component and the self-observation component. Within the self-control component, self-instruction, imagery, attention focusing, and task strategies exist. To note, is that these strategies differ from those in the forethought phase in that they are employed during the execution of the skill and not before the skill. Self-instruction refers to describing how to proceed while performing. The imagery process refers to producing a mental picture. Attention focus refers to the process of structuring the environment to avoid or eliminate distractions (Hidi, 1995). Task strategies grow out of the task analysis component (Zimmerman) however it focuses on reducing the task down to its essential parts. As for the self-observation component, these processes involve 'self-observing' and monitoring performance. This includes self-recording and meta-cognitive monitoring. The difference between the two is that self-recording is keeping a physical record of the performance, whereas self-monitoring is mentally tracking one's performance (Zimmerman).

The third phase is self-reflection. Here, the beliefs and processes refer to the reaction of a learner toward his or her performance after the skills were attempted. The purpose this phase is to influence the learners' reactions to their efforts as well as influence following efforts that could occur in the forethought phase (Zimmerman, 2004). There are two classes of self-

reflection which are self-judgments and self-reactions. Self-judgments are comprised of self-evaluations and causal attributions. Self-evaluation involves evaluating one's own performance based on the comparison to a standard or goal (Zimmerman, 2000, 2004). The standard may be set according to mastery, previous performance, normative, and/or collaborative criteria. Causal attributions refer to one's reasoning to their performance as either controllable or uncontrollable (Weiner, 1979). Self-reactions consist of processes and beliefs related to self-satisfaction and adaptive/defensive inferences. Self-satisfaction relates to whether one is satisfied or dissatisfied with their outcome and, depending on their satisfaction, this will affect whether one will decide to retain or adapt a previous strategy (adaptive inference) or decide to avoid or disengage in order to protect them self from dissatisfaction (Zimmerman, 2004).

Modeling Research within Zimmerman's Self-Regulation Model

Clark and Ste-Marie (2007) responded to the limited theoretical development in the modeling literature and adopted Zimmerman's (2000) self-regulated learning model as a theoretical framework in their investigation of the benefits of self-modeling. In their research, they investigated self-regulatory beliefs and processes of 33 children learning a swim stroke; the measures included self-satisfaction, self-efficacy, and intrinsic/extrinsic interest. The authors found a significant difference between the self-regulatory processes of participants in the self-modeling group compared to the control group. Specifically, at the retention test, the self-modeling group showed significantly higher levels of self-efficacy, intrinsic motivation, and self-satisfaction, than the control group. Although significant differences were found, a limit of the Clark and Ste-Marie's research is that it only investigated a few of the processes and beliefs within Zimmerman's model.

Within this research, Clark, Martini, and Ste-Marie (2006) also explored the thoughts and processes of the swimmers. Here, a think aloud procedure was used where the children were asked to verbalize all their thoughts and feelings while viewing their self-modeling video. The results showed that the majority of the themes related to positive and negative self-evaluations as well as comments relating to improvement of that swim skill. Of importance is that the researchers chose to use continuous skills (i.e., swimming) and not a serial skill. More importantly, only quantitative measures were used to tap into the self-regulatory processes and beliefs when perhaps a qualitative investigation using interviews would have added richness to the data. Furthermore, although the researchers did attempt to explore the thoughts and beliefs of the swimmers, they did not use Zimmerman (2000, 2004) as a theoretical framework for the qualitative data analysis.

A final point about Clark and colleagues' research (2006, 2007) is that it was done within a learning context and not a competitive performance environment. I highlight this because Zimmerman's model is developed for a learning context, and thus it is obvious that it can be used in motor skill learning research. My interest, however, is in competitive performance, and so one may question its appropriateness in this setting. Rymal and colleagues (2010), however, were the first to propose that Zimmerman's self-regulation model should not be restricted to the learning context, but also be used in the competitive performance enhancement situations. To support this, they argued that many self-regulatory beliefs and processes described for learning (e.g., imagery, self-evaluation, self-efficacy, goal setting, and strategic planning) also occur in a competitive environment. For example, Monsma and Feltz's (2006) contended that figure skaters should develop the ability to effectively self-evaluate, self-monitor, set goals, and attribute their results; all processes that exist within Zimmerman's model. Consequently, the

transition of Zimmerman's self-regulation model into my research paradigm is deemed fitting. Indeed, that research by Rymal, et al. (2010) is good evidence of the usefulness of Zimmerman's model. They explored what self-regulatory processes were used by divers who viewed a feedforward self-modeling video within the competitive environment.

Using Zimmerman's self-regulation model for a deductive analysis of the interview questions, Rymal and colleagues' (2010) results suggested that participant's engaged in a number of self-regulatory processes while using the self-modeling video. Particularly, the majority of the themes were representative of the self-regulatory processes and beliefs within the forethought and self-reflection phases, while very few reflected those found in the performance control phase.

Although the authors did use a qualitative approach, of note is that their interview questions were not designed specific to Zimmerman's model and thus they did not directly tap into all possible processes and beliefs of the three phases of self-regulation. In fact, the authors suggested that the lack of representation of performance control processes may have been because the questions were directed to the thoughts while viewing the video, before the dive (forethought phase), and after the dive (self-reflection phase). Thus, there were not any questions tapping into the thoughts, feelings, or beliefs that occurred during the dive (performance control phase). Therefore, the researchers suggested that probing questions be incorporated in order to gain a greater depth of the participants transcripts. Also of note is that the researchers chose a discrete skill (i.e., a dive) when investigating a self-modeling intervention with competitive athletes, and therefore future research with a serial skill may provide more benefits to performance. All together, the results of this study provided only limited insight as to what self-regulatory processes may be occurring while using a self-modeling video.

From this, Ste-Marie and colleagues (2011) attempted to overcome some of the limitations in the preceding research on divers by developing a more elaborate interview questionnaire and increasing the sample size of the population studied. As mentioned previously, 20 competitive gymnasts viewed a self-modeling video at competition, not yet mentioned is that they also answered six questions relating to how the gymnasts used the video prior, during, and after competing their beam routine. Within the six question, however, three of the questions pertained to what was happening while viewing the video, one question was directed toward what was happening after the viewing but before the gymnast competed, the next question asked if any information was used during or after competing the beam routine, and the remainder questions were directed towards general thoughts about the intervention once the competitive season had concluded. The researchers conducted a deductive analysis of the interview questions using Zimmerman's (2000, 2004) self-regulation model. The results were similar to the diving research, where practically all of the themes fell within the forethought phase (75%) and self-reflection phase (23.5%). Interestingly, the majority of the themes related to only specific processes or beliefs in the two phases. For example, 50% of the themes in the forethought phase were represented by strategic planning (i.e., controlling affect, directing cognitions, and directing motor execution) while outcome expectations, task interests, and goal orientations were not represented.

Although the above research on divers and gymnasts support that self-regulatory processes and beliefs do occur during a competitive performance when accompanied by a self-modeling video, probing questions were not used. In both, Rymal et al., (2010) and Ste-Marie et al., (2011) analysis of the interview question, they have suggested that future research incorporate probing techniques into the interview questions in order to obtain more detailed

responses of the self-regulatory processes involved with the use of a self-modeling video. Moreover, the researchers also put forth that the lack of results reflected in the performance control phase is due to the limited questions specific to that phase. Specifically, Rymal et al., (2010) did not ask questions related to what was happening during performance and Ste-Marie et al., (2011) had only one question and even then it was combined with a question related to the self-reflection question. Thus, not only probing questions were encouraged, but also a variety of questions specific to the processes and beliefs within each phase has been recommended. Additionally, the researchers recommended using an experimental design that can test whether self-modeling in fact encourages more self-regulation than no self-modeling. At this point in time, no research has yet compared self-regulatory processes and beliefs found in the self-modeling intervention to the control intervention. Thus, it is still unknown whether the administration of a self-modeling video influences self-regulatory processes and beliefs more than no self-modeling video.

This comparison is thought to be a fruitful avenue for inquiry as research on academics has shown that the greater ability to self-regulate through such processes as self-evaluating, goal setting, and planning, the greater the academic performance (e.g., Zimmerman & Martinez-Pons, 1986). Therefore, if self-regulation can increase performance, understanding whether self-modeling influences self-regulation would raise insightful results. Specifically, is it in fact that the improved performance results are based on the self-modeling video increasing self-regulation?

In conclusion, there is evidence that a self-modeling video can be implemented into a competitive environment and produce positive performance results (e.g., Ste-Marie et al., 2011) while also tapping into some of Zimmerman's (2000, 2004) self-regulatory processes and beliefs

(e.g., Rymal et al., 2010). The proposed research will investigate more thoroughly these self-regulatory processes and whether they are enhanced through a self-modeling intervention. There is also an interest in investigating the possibility that the effectiveness of a self-modeling video could still be increased. The next section consists of a discussion of a possible way in which this can be done. That is, through the administration of psychological skills training workshops alongside a self-modeling intervention.

Psychological Skills Training plus Self-modeling

The following section will be used to discuss how a self-modeling video accompanied with psychological skills training could be used to increase the effectiveness of a self-modeling intervention. The mental skills such as imagery, attention focus, goal setting, and self-talk were chosen for this research and thus discussion for the reason behind these choices will be clarified.

Imagery. White and Hardy (1998) defined imagery as “an experience that mimics real experience. We can be aware of ‘seeing’ an image, feeling movements as an image, or experiencing an image of smell, taste, or sounds without actually experiencing the real thing” (p.389). For successful performance enhancement through imagery, imagery ability is considered to be very important (see Hall, 2005), and a skill that can be improved through training (Rodgers, Hall, & Buckolz, 1991). Rymal and Ste-Marie (2009) have suggested that viewing an external stimulus that provides a proper demonstration may give athletes the information needed to create controlled, positive, and vivid images. Thus, a self-modeling video could be used as a source that interacts with one’s imagery and therefore could help develop controlled and effective images.

Another aspect of imagery that is considered important is timing. The imagery literature has shown that imagery in actual speed (e.g., Callow & Hadry, 2005), slow motion imagery (e.g.,

Calmels & Fournier, 2001), or the combination of both are beneficial to performance. For example, Calmels and Fournier found that gymnasts slowed their imagery down for the difficult skills in their routine. The use of a self-modeling video would be used to illustrate the proper timing and rhythm (real time) of how the skill should be imagined as well as allowing them to slow the video down at any point. Thus, this could help develop real time, slow motion, or the combination of imagery timing.

Also of significance is the type of imagery. Imagery can be either visual or kinesthetic. Visual imagery is described as either seeing yourself from an internal or external perspective, whereas kinesthetic imagery is feeling the sensations of muscle movements (Callow & Hardy, 2005). With respect to visual imagery, researchers have suggested that the external perspective of imagery has a greater effect on skills that emphasize form and technique (e.g., White & Hardy, 1995). Considering this research will be using the sport of gymnastics, and a gymnast's score is based on form and technique, the self-modeling video may in fact be more effective in creating a controlled and vivid external perspective (see also Smith & Holmes 2004). Interestingly, research has also shown the effectiveness of kinesthetic imagery (see Hall, 2001). Although not tested, a self-modeling video could possibly influence both types of imagery. For example, in Hars and Calmels (2007) research, gymnasts reported that they experienced kinesthetic sensations while viewing them self on video during practice. Thus, the self-modeling video could be used not only to encourage gymnasts to visually image an external perspective of them self but also to incorporate kinesthetic sensations.

Attention focus. Maintaining focus and avoiding distractions is key in competitive performance (Hatzigeorgiadis & Biddle, 2002; Moran, 2004). Janelle (2002) has claimed that it is critical to focus on relevant, information rich areas of the visual scene for effective sport

performance. Thus, focusing on an external relevant cue to gain information could be beneficial to competitive performance. Simulation training, which is also associated with effective focus (Schmid & Peper, 1998), could also be reflected in a self-modeling video. That is, a self-modeling video could simulate a real-life competitive situation and thus could lead to positive transfer to the competition (see Moran, 2004).

Additionally, Shaw (2002) has suggested that pre-performance routines help develop focus by sequencing thoughts or actions before skills are performed. A self-modeling video could be used as a part of a pre-performance routine similar to Moran and colleagues (2002) virtual walkthrough as a means to develop strategic planning processes to focus on for their upcoming event. This can also help develop mindfulness by directing one's focus on the present and not irrelevant cues.

In sum, the self-modeling video could be used during a training session to guide the gymnasts in considering it as simulation training that will encourage them to focus on relevant cues in their performance. The video could also be promoted as a pre-performance tool to assist them in being mindful and strategic for the upcoming competition.

Goal setting. Goal setting is the process in which one establishes goals or objectives in order to achieve a task (Lock & Latham, 1985). Weinberg and Butt (2005) have suggested some steps to help develop effective goal setting strategies. It is our belief that the video could contribute to proper goal setting processes.

Researchers have shown that developing appropriate goals (i.e., specific and difficult) have a greater effect on performance compared to 'do it your best' goals (e.g., Locke & Latham, 1990). The self-modeling video would illustrate a performance at a higher skill level which may help develop a specific and challenging goal. Additionally, viewing a self-modeling video

would emphasize proper form, technique, and strategies which may help to establish process, performance, and outcome goals; which are thought to be beneficial in sport (e.g., Burton, Naylor, & Holliday, 2001). An example of this is seen in Maile's (1985) (as cited in Franks & Maile, 1991) research where a self-modeling video was used to illustrate a power lifter lifting a desired weight (performance goals) and winning a competition (outcome goal). As a result, the power lifter ended up winning her competition and increasing her performance more than 10% within that year.

It is also important to set short and long term goals (e.g., Gould, 2001). A self-modeling video could create an opportunity for an athlete to develop these two forms of goals because the video can act as a means to break down the skills into essential parts (e.g., Rymal et al., 2010) thus creating an opportunity for an athlete to develop continuous short term goals in order to reach their long-term goal. For example, a short term goal could be to do one half of the routine with the form and technique as seen in the video at their next practice and the other half at the following practice. This may in turn create a long term goal of performing the entire routine like seen in the video at their next competition.

Self-talk. Self-talk has been referred to as what athletes say to themselves (internal or out loud) to direct actions and to think appropriately about their performance (e.g., Van Raalte, Cornelius, Brewer, & Hatton, 2000). According to Bandura (1986; 1997), self-talk is a representation of one's beliefs. The use of a self-modeling video may increase positive self-talk by acting as a representation of the gymnast's belief in her ability (i.e., self-efficacy) to perform the competitive routine well. Moreover, instructional self-talk may require technical key words to foster skill learning (e.g., Zinsser, Bunker, & Williams, 1998). Therefore, a self-modeling

video which clearly illustrates proper technical and key points could encourage the development of technical words that could perhaps help performance.

Effective self-talk can also be associated with positive key words or trigger words (Henschen, 2005). The self-modeling video could assist an athlete in developing these words at the appropriate time. For example, an athlete would view their self-modeling video and acknowledge the proper timing of letting go of the bar in a flyaway dismount and choose a trigger word (e.g., “now”). In doing this, the athlete is now focusing on what they want to accomplish (e.g., timing of a release) and not what they do not want to accomplish (e.g., letting go too early). This allows the athlete to direct their attention away from negative thoughts and focus their attention on an objective they want to accomplish, which is essential for effective self-talk (Henschen, 2005).

In summary, I plan to introduce psychological skills training workshops consisting of mental skills such as imagery, focus, goal setting, and self-talk and couple them with a self-modeling video. I propose that these training workshops will increase the effectiveness of the self-modeling intervention that is used during the actual competition.

Conclusion

Women’s gymnastics consists of four events; bars, beam, floor, and vault. The research is particularly interested in providing a competitive performance enhancement tool for the event of bars and gaining an understanding of the manner in which this tool operates. Specifically, there are three research questions which will be written in the form of three articles;

- 1) Does psychological skills training incorporated with a feedforward self-modeling video improve competitive performance more than self-modeling alone at competitions?

- 2) What specific self-regulatory processes are employed in a competitive environment related to a feedforward self-modeling video? Is there a difference when accompanied with psychological skills training?
- 3) Are there similarities or differences in the self-regulatory processes when administered a feedforward self-modeling video compared to when the video is not seen?

Significance

It is my belief that the proposed research will contribute to practical and theoretical aspects of performance enhancement. At a practical level, there is evidence that self-modeling can enhance gymnastics performance (e.g., Ste-Marie, et al., 2011) but if self-modeling incorporated with psychological skills training workshops can also be established as a more effective performance enhancement technique, gymnasts will have a better tool to help them along their path to their athletic success. At a theoretical level, the further examination of Zimmerman's (2000, 2004) self-regulation model can help to gain more in depth understanding of the processes and beliefs underlying the benefits of self-modeling. Additionally, this research will provide insight to whether a self-modeling video can enhance self-regulatory processes which in turn may have an effect on increased performance.

Method

Participants

Nineteen female gymnasts between the ages of 9 and 16 years old ($M age = 12.11$, $SD = 2.17$) were recruited to participate in this research project. One participant was removed from the research due to illness; thus the final participant number was 18. The gymnasts were divided

into two different groups; psychological skills training in addition to the self-modeling video (PST+SM; $n = 9$) and self-modeling only group (SMO; $n = 11$). Each participant was administered their self-modeling video at two competitions (i.e., experimental condition) and two competitions acted as the control condition. These gymnasts were recruited through a local gymnastics club in the Ottawa area; Ottawa Gymnastics Centre. Recruitment was conducted through word of mouth by the researcher. Permission to approach was granted from the club. Before participation, both the athlete's and parent's informed consent was obtained.

Materials

A Sony video camera (model number DCR-HC65/HC85) mounted on a tripod was used to film the athletes in training in order to gather the footage needed for the construction of the self-modeling video. The tripod was set from the side angle in order to represent the judges' perspective of the competitive bar routine. The videos of the athletes' bar routine were transferred into the Dartfish Pro Software to be edited into the self-modeling videos. Two Sony seven inch screen portable DVD players were used for the athletes to view their self-modeling video during the psychological skills training workshops and competitions. Two Toshiba Satellite laptop computers with 15" x 16" screen sizes were also used during the psychological skills training workshops. Additionally, a Sony tape recorder (TCM-450DV) was used to record the responses of the interview questions for the examination of the self-regulatory processes engaged in during a competitive event.

Measures

Physical performance. Physical performance was measured based on the judges' scores at each of the competitions. Noteworthy is that we used execution scores out of ten in order to

have a consistent start value between all the gymnasts. To clarify, a gymnasts' score is made up of two parts; an A-score which relates to whether the required elements were satisfied; and a B-score which refers to how the skills were performed (i.e., the quality of the performance). The A-score differs based on the gymnasts' competitive level however the B-score always remains the same (i.e., a score out of ten). As a result, one gymnast may have a higher start value due to her degree of difficulty than another athlete in a lower level. Therefore, by using the only execution scores we are eliminating the possible confound of base score variability as a result of higher degree of difficulty values. Additionally, each participant's competitive bar routine was videoed and these videos were scored by one judge that was blind to the conditions. The judge's scores did not differ from the physical performance scores at the competitions and therefore was not included as a second dependent measure of physical performance.

Semi-structured interview questions. The semi-structured interview questions were developed based on Zimmerman's (2000, 2004, 2008) self-regulation model. Zimmerman (2008) suggests that when developing interview questions examining self-regulatory processes and beliefs, one should incorporate questions relating to all the phases of self-regulation (see also Schmitz & Wiess, 2006). Thus, the interview questions consisted of questions referring to the thoughts, processes, and beliefs involved in the three phases of Zimmerman's model; forethought, performance control, and self-reflection phase. There was however two separate interview guides for the experimental condition and the control condition (i.e., experimental interview questions and the control interview questions) (see Appendix A).

The experimental interview questions and control interview questions were designed to tap into the forethought phase relating to task analysis processes and to self-motivational beliefs. The performance control questions related to the self-control and self-observation processes.

The questions relating to the self-reflection phase were designed to tap into the self-judgment and self-reaction beliefs and processes. Of importance is that additional questions relating specifically to the self-modeling intervention were embedded within the experimental interview questions for all three phases. Thus, all remaining questions were the same for both conditions. Also of importance is that the questions are followed by probing questions in order to gain an in depth knowledge of the processes engaged in.

Procedures

Pre-intervention. Informed assent and consent was obtained by the athletes and their parents. The athletes were asked to complete a demographic information form in which information about the athletes' age, competitive level, years of competitive experience, number of hours of training each week, and whether they had any previous experience with sport psychology interventions was obtained (see Table 1). Important to note is that gymnasts did not have previous sport psychology experience beyond the skills that they incorporated in their everyday training. Following the signing of all the forms, the gymnasts were randomly assigned into the PST+SM group or the SMO group. These two groups were matched to the best of my ability based on age and competitive level of the athletes.

Table 1

Demographic Information Relating to Gymnasts' Age, Competitive Level, Years of Experience Competing at that Level, Total Years of Competitive Experience, and Number of Training Hours per week.

Participant	Age	Group	Comp Level	Year at Comp Level	Total Comp Years Experience	Hours of Training / Week
1	10	SMO	5	1st	3	17
2	15	SMO	6	1st	5	17
3	11	SMO	7	1st	3	17
4	15	SMO	7	1st	5	17
5	9	SMO	5	1st	2	17
6	11	PST+SM	5	1st	2	17
7	10	PST+SM	5	1st	2	17
8	12	PST+SM	5	1st	3	17
9	9	PST+SM	7	1st	2	18
10	13	PST+SM	8	3rd	5	18-22
11	13	SMO	8	3rd	5	18-22
12	12	SMO	7	3rd	4	17
13	13	SMO	6	1st	3	17
14	13	PST+SM	8	3rd	5	18-22
15	14	PST+SM	8	3rd	6	18-22
16	13	PST+SM	8	3rd	5	18-22
17	9	PST+SM	5	1st	2	17
18	16	PST+SM	8	3rd	7	18-22

Note: Comp = Competitive

For both groups, the video taping of the bar routine was taken during the normal everyday training hours. During this time, the researcher filmed multiple attempts of the athlete's bar routine until the appropriate amount of footage needed to construct the self-modeling video was obtained. From this footage, only the best performances of each skill that comprise the routine was clipped together to create as near perfect a routine as possible. The

appropriate footage was chosen in collaboration with the gymnasts coach. For example, a gymnast could have footage from five full bar routines but only the first routine's mount (e.g., a kip), the fifth routine's middle portion (e.g., cast handstand followed by a sole circle connected to an uprise), and the third routine's dismount (e.g., giant to flyaway with a stuck landing) would be selected for the self-modeling video construction. Participants were also dressed in their competitive attire in order to simulate a competitive situation.

Intervention. The two groups followed slightly different protocol. Therefore for clarity, this section will discuss the additional experimental intervention procedures for the PST+SM group separately from the SMO group. In particular, the PST+SM group required a separate procedure before the actual competition procedure began and thus will be discussed first. Following this, the competition procedure will be discussed as it is the same for both groups.

The procedure for the 10 athletes in the PST+SM group included four weeks of psychological skills training workshops one month before the actual competition procedure. Prior to the workshops, a self-modeling video for each person in this group was constructed. After the construction of the self-modeling videos, the athletes partook in six to eight workshops that lasted approximately 30 minutes each over the four week time span. The variation in the sessions was dependent upon the number of gymnasts in the workshop and not the content covered; the content that was covered was the same for each participant. That is, if the workshop consisted of a large group (e.g., five or more) the gymnasts would have to wait to use either the DVD player or lap top and therefore the amount of content covered during that time was less; this lead to a second session in order to cover the remaining content. As a results, week one consisted of two sessions on focus, week two consisted of two sessions on imagery, week three consisted of one to two goal setting sessions, and week four consisted of one to two sessions on

self-talk. The four week training workshop timeline is based on Rose and Christina's (2006) suggestion of at least four weeks of video training needed for effective benefits. Within each training session, the athletes were not only informed of the specified mental skill and how it can affect performance but the emphasis was on how a self-modeling video can influence each of the skills (see Appendix C for outline of procedural timeline of each training intervention).

As an overview, in week one, athletes were introduced focus/attention control. Within these two sessions, the athletes were informed of possible ways in which their self-modeling video could help assist in controlling their focus and attention. Within week two the two days of how a self-modeling video could affect their imagery processes were introduced to the athletes. During week three, the athletes were introduced to goal setting and how their self-modeling video can be used to develop appropriate goal setting strategies. In the fourth and final week, the athletes were introduced to two self-talk interventions relating to how their self-modeling video could be used to assist in the use of proper self-talk strategies (see procedure sections if the following article for details).

After the four week psychological skills training workshops it was possible that the participants' gymnastic performance of the routine improved over the four week training. In this case, the self-modeling video was updated. The next section will describe the competition procedures for both groups in detail.

Prior to data collection, athletes in the two groups were guided through the protocol once with the researcher in order to familiarize themselves with the procedures that were to occur at the specified competition sites. The data was conducted at four competitions within Ontario. The self-modeling video was shown at two of the four competitions where the order to which the video was administered was counterbalanced within the gymnasts. Specifically, half of the

gymnasts viewed their video at competitions one and three and the other half were administered their video at competitions two and four. Thus, this research consisted of two experimental competitions and two control competitions within each group (PST+SM and SMO).

The two groups followed the same procedures once the competitive season began. Each athlete had access to a private DVD for their viewings. The duration of the self-modeling depended on the participant's routine requirements. Generally, a gymnast's bar routine will take anywhere between 20 seconds to 1 minute and thus the self-modeling viewings could last between a minute and a half to three minutes. Due to the variation of each participant's routine, the athletes viewed their self-modeling video three times approximately five minutes before partaking in their bar warm-up. Following their warm-up, the athletes viewed their self-modeling video once more. The athletes then continued with their regular pre-competition routine until they were called by the judges to compete. After the completion of one of the experimental competitions, athletes were interviewed. The interview lasted approximately 20-30 minutes where their responses to the questions were tape recorded separately for each participant.

For the control competitions, the gymnasts followed their typical pre-competition routine and were not provided with the self-modeling video. Similar to the experimental condition, the gymnasts were interviewed using the control interview questions at the completion of one of the control competitions.

Data Analysis

Quantitative Data

The physical performance data was entered into a PSAW data sheet and analyzed through the PSAW 18.0 program. It was possible that the effectiveness of the self-modeling video would

occur later in the season as a result of the gymnasts becoming comfortable with the procedures during the competition. Therefore, competitive session was added as a factor in the design; the first two competitions were considered early in the season and the last two were considered late. Thus, to answer the first question, a 2 (group: PST+SM vs. SMO) X 2 (condition: SM vs. C) X 2 (competitive session: early vs. late) mixed ANOVA with repeated measures on the last two factors was conducted. Specifically, it was hypothesized that the PST+SM group would show significantly higher performance scores at the competitions that receive the self-modeling videos compared to the SMO group. To determine this, the two-way interaction between group and condition was investigated.

Qualitative Data

For the qualitative data analysis, ten of the 18 participants were involved in the qualitative interviews related to the specific use of the self-modeling with respect to self-regulation. Nine of these partook in both the experimental and control interview questions and thus were used for the examination of whether self-modeling influences self-regulation. The one participant that was not included in this portion of the qualitative examination was because she was only involved in the experimental interview session.

To explore the second question relating to the self-regulatory processes and beliefs employed through the use of a self-modeling video, a content analysis was performed on the gymnasts' self-modeling interview transcripts and were deductively coded using Zimmerman's (2000, 2004) model of self-regulation. Furthermore, group comparisons were also examined.

Also, it was thought that the self-modeling video would increase the use of self-regulation during a competitive performance. Therefore to answer the third question, the self-regulatory processes and beliefs represented at the self-modeling competition were compared to

the processes and beliefs represented at the control competition. The transcripts were compared through a content analysis while using Zimmerman's (2000, 2004) model of self-regulation to deductively code the transcripts.

Chapter 2: Three Articles

Background of Three Articles

Background of Three Articles

Self-modeling is technique where an individual observes him/herself on video showing the desired target behaviours (Dowrick, 1999). There are two forms of self-modeling, positive self review and feedward, and the focus of the research herein was the feedforward type of self-modeling. For this technique, an individual views themselves on an edited video showing the intended behaviour either in a new context or new form that has not yet been achieved (Dowrick, 1999). It has been suggested that the time required for the editing process of the feedforward self-modeling video is one possible reason why there has been very little research related to the effects of the technique. Although some studies have investigated this technique in the learning environment, very few researchers have used it within a competitive environment (Rymal, Martini, & Ste-Marie, 2010; Ste-Marie, Rymal, Vertes, & Martini, 2011).

Within Ste-Marie, Rymal, Vertes, and Martini's (2011) research the feedforward self-modeling video increased gymnasts' competitive beam performance. Furthermore, their research adapted Zimmerman's (2000, 2004) self-regulation framework when examining, through qualitative interviews, competitive gymnasts' processes and beliefs when administered a feedforward self-modeling video at competition. The gymnasts stated that they used their video alongside other self-regulatory strategies such as imagery, self-talk, focus, and goal setting (see also Rymal, Martini, & Ste-Marie, 2010). Thus, not only has the video been proven to have positive effects on competitive performance, these athletes have also acknowledged using other psychological skills when administered their video. For this reason, one objective of this research was to examine the combined use of feedforward self-modeling with psychological skills to determine whether the effectiveness of the self-modeling video could be increased.

Alongside competitive performance measures, both Rymal and colleagues (2010) and Ste-Marie and colleagues (2011) conducted interviews with the athletes in order to explore the self-regulatory processes and beliefs engaged in when viewing the video. Their research showed that not only did athletes partake in self-regulatory strategies after the administration of a self-modeling video; the gymnasts also mentioned engaging in processes and beliefs relating to controlling affect, directing cognitions, and guiding motor execution before and after competing. Notable weaknesses within the interview guides, however, were stated by the researchers. For example, probes were not incorporated in the interview. Therefore, this research developed a more elaborate interview guide to explore the competitive self-regulatory processes and beliefs. Also of interest was whether the self-regulatory processes and beliefs engaged in were influenced differently when accompanied with psychological skills training.

As a result, three research questions were investigated. Each question is presented in article format in the remainder of this chapter. The research question in the first article investigated whether psychological skills training incorporated with a feedforward self-modeling video could improve competitive performance more than self-modeling alone. Imagery ability was also factored in as a possible moderating variable of the effectiveness of self-modeling video. As for the second article, the research questions were twofold. First, I was interested in the specific self-regulatory processes employed in a competitive environment related to a feedforward self-modeling video. Second, whether there were differences in the self-regulatory processes engaged in when the use of the video in competition had been preceded by psychological skills training that informed gymnasts how to use the video versus no such training. The third and final article explored the question relating to similarities and/or

differences in self-regulatory processes when administered a feedforward self-modeling video compared to when the video is not seen.

Article 1: Enhancing Competitive Gymnasts' Bar Performance: An Investigation of Self-Modeling and Psychological Skills Training

Abstract

Video technology, alone or accompanied with mental skills, is used in many sport settings as a strategy for skill acquisition and performance enhancement (Ives, Straub, & Shelley, 2002). A specific form of video technology, termed feedforward self-modeling, is where the best performances of the individual are edited to create a near perfect behaviour (Dowrick, 1999). This research investigates the effects of feedforward self-modeling combined with mental skills training for focus, goal setting, self-talk, and imagery. Eighteen competitive gymnasts participated in either a psychological skills training and self-modeling group or a self-modeling only group. Physical performance scores from competitions where the video was administered are compared to scores where the video was not seen. Group or condition main effects were not found, however, visual imagery ability was found to moderate the benefits of the intervention. Gymnasts high in visual imagery ability showed higher scores when they viewed the video than when they did not immediately; however these benefits were not significant. Those low in visual imagery ability, showed significant benefits late the competitive season, but not in early competitions.

Key words; Imagery, Goal Setting, Self-talk, Attention Focus

Enhancing competitive gymnasts' bar performance: An investigation of self-modeling and psychological skills training in a competitive environment

Modeling has been defined as the medium in which learning through observation occurs (Williams, Davids, & Williams, 1999). Although this definition limits modeling to the learning context, there has been research that has investigated modeling as a competitive performance enhancement technique (Rymal, Martini, & Ste-Marie, 2010). Of particular interest here is the research on the use of self-modeling for competitive sport performance enhancement. Dowrick (1999) identified two forms of self-modeling; positive self-review; and feedforward self-modeling. The positive self-review technique involves observers viewing themselves on video showing their best performance thus far (Dowrick, 1999). The feedforward technique of self-modeling, however, involves viewing oneself performing a skill that has not yet been achieved in a specific sequence or context (Dowrick). Thus, a feedforward self-modeling video requires the editing of video footage from previous performances to create a new skill sequence or a given skill sequence performed in a different context. As examples, a positive self-review video would consist of footage of the best bar routine a gymnast has ever performed, whereas a feedforward video would display the combination of the best footage from different bar routines to create one optimal performance routine. Dowrick has reported that feedforward self-modeling produces greater behaviour change than positive self-review.

Furthermore, the modeling literature has traditionally been grounded within a social cognitive perspective where Bandura (1986, 1997) suggests that most behaviour is learned through modeling and that one's self-efficacy is thought to be an intervening process. That is, if one's self-efficacy is increased his/her performance could be increased. Bandura (1986, 1997) argues that enactive mastery experience and vicarious experience have the greatest influence on

one's self-efficacy and thus can enhance or weaken the individuals learning or performance of that modeled behaviour (Bandura, 1986, 1997). Thus, feedforward self-modeling would provide both sources of information. Specifically, the footage on the video would clearly indicated the ability to successfully complete the task (i.e., enactive mastery experience) as well as allow them to compare their capabilities in a new context created by editing the video (i.e., vicarious experience); which in turn increases the effectiveness of learning or performing through observation. For these reasons we have chosen the feedforward self-modeling technique to investigate performance enhancement with competitive gymnasts. Unless specified otherwise, the term self-modeling will be used when referring to the feedforward procedure in the methods and results of this research.

Ives, Straub, and Shelly's (2002) overview of video technology in sport settings demonstrated that videos can be used to enhance performance in athletes and coaches. They also noted that self-modeling videos, due to the time constraints of learning the technology and editing the video, have had insufficient use in applied settings (e.g., Gibson, McKenzie, & Lowe, 1989). One example of an applied study is that conducted by Maile (1985; as cited in Franks & Maile, 1991). In Maile's research, a national power lifter viewed her feedforward self-modeling video which illustrated a successful lift of a weight that she had not yet accomplished. The power lifter increased her performance up to 26% within the year, an amount that far surpassed the physiological changes anticipated from her training. The video, however, was shown during training and not at the actual competition site. To our knowledge, research conducted by Rymal (2007) and Ste-Marie, Rymal, Vertes, and Martini (2011) are the only empirically based projects that have investigated self-modeling as a sport performance enhancement technique during the actual competition.

In Rymal's (2007) research, eight competitive divers viewed their feedforward self-modeling video prior to competing a specific dive during competition. The results indicated that the administration of a self-modeling video did not enhance competitive performance. There were a number of limitations with that research, however. These included a considerably small sample size and a limited number of data collection sites. Rymal also suggested that the time delay between the viewing of the self-modeling video and competition of the dive may have been too long (see also Bertram, Cote, Brown, & Guadagnoli, 2007). Finally, in Ashford and colleagues (2006) meta-analysis of the modeling literature, they have suggested that the type of task being modeled has an impact on the effectiveness of a modeling intervention. Specifically, research conducted on skills with a distinct beginning and end (i.e., discrete skills) show only medium effect sizes from modeling interventions than those skills that are more continuous in nature; which have shown a greater effect from modeling. Perhaps this partially explains Rymal's lack of significance, given that divers were performing discrete skills. The skills that require the combination of many discrete skills within a complex task (i.e., serial skills) have been the least researched and Ashford et al. recommended future examinations of modeling to use serial skills.

Indeed, continued self-modeling research conducted by Ste-Marie and colleagues (2011) used the serial nature of gymnastic beam skills while also addressing many of the limitations of Rymal's (2007) research. Specifically, their research investigated the use of a feedforward self-modeling video with 20 competitive gymnasts across four competitions. Hence, sample size and length of intervention concerns were addressed. The gymnasts viewed their self-modeling video three times prior to warm-up on the balance beam and once again before competing; thus limiting the time delays between the viewing of the video and the competition. Using

competitive beam scores, scores were significantly higher at the competitions that the participants viewed their self-modeling video compared to the competitions that the video was not seen. These results indicated that a self-modeling video could be administered effectively in a competitive environment and be used to enhance competitive performance.

Not only were Ste-Marie et al. (2011) interested in improving competitive performance, they were also curious as to why a self-modeling video could enhance performance. Based on the findings of Rymal and colleagues (2010) qualitative analysis with divers who had used a self-modeling video; Ste-Marie et al. explored self-regulatory processes used by the gymnasts during the competitions in which the self-modeling video was used.

In line with Rymal et al. (2010), Ste-Marie et al.'s (2011) qualitative investigation of the gymnast's self-regulatory processes showed that the feedforward self-modeling video was coupled with the use of other mental skills such as, focus, goal setting, self-talk, and imagery. For example, athletes expressed that they used the self-modeling video to help them create a visualization of their beam routine before competing. Thus, it is obvious that these athletes were linking their video to the use of other mental skills. Moreover, these researchers proposed further investigation on the combination of self-modeling and other mental skills to increase its effectiveness. The idea of combining interventions to increase effectiveness on physical performance is well known in the sport psychology literature (Duda, Cumming, & Balaguer, 2005). As a few examples, combining psychological skills has been researched in areas such as triathlons (e.g., Thelwell & Greenlees, 2003), tennis (e.g., Mamassis & Doganis, 2004), field hockey (e.g., Thomas, Maynard, & Hanton, 2007), free weight squat (e.g., Ram, Riggs, Skaling, Landers, & McCullagh, 2007), swimming (e.g., Hanton & Jones, 1999b), and basketball (e.g., Hall & Erffmeyer, 1983).

Given the shown benefits of combining sport performance enhancement strategies, our interest was in designing a psychological skills training program that supported the use of a self-modeling video with the goal of further enhancing sport performance. To this end, the mental skills of attention focus, goal setting, self-talk, and imagery were coupled with a feedforward self-modeling video intervention to examine whether this would increase the video's effectiveness on physical performance in gymnastics. In the next sections, I briefly discuss the link between each mental skill with the feedforward self-modeling video and the reasoning behind our choice of that mental skill interacting with the video.

Attention Focus

Research has shown that avoiding distractions and focusing on relevant information rich areas of the visual scene are important in competitive performance (Hatzigeorgiadis & Biddle, 2002; Janelle, 2002; Moran, 2004). Thus, focusing on an external relevant cue such as a self-modeling video which is edited to highlight relevant information could be beneficial to competitive performance. Shaw (2002) has also suggested that pre-performance routines help develop focus by sequencing thoughts or actions before skills are performed. A self-modeling video could be used as a part of a pre-performance routine similar to Moran and colleagues (2002) virtual walkthrough as a means to develop strategic planning processes to focus on for their upcoming event. Furthermore, simulation training, which is also associated with effective focus (Schmid & Peper, 1998), could also be reflected in a self-modeling video. That is, the gymnasts are in their competitive attire performing a routine that they are soon going to perform in competition (see Moran, 2004). Finally, viewing a self-modeling video directly before competing may help develop mindfulness by directing one's focus on the present and not irrelevant cues.

Goal Setting

Researchers have suggested that developing appropriate (i.e., specific and difficult) process, performance, and outcome goals are beneficial in sport performance (e.g., Burton, Naylor, & Holliday, 2001; Lock & Latham, 1990). From this perspective, not only does the self-modeling video illustrate a performance at a higher skill level which may help develop specific and challenging goals, but it also emphasizes proper form, technique, and strategies which may help to establish process, performance, and outcome goals. It is also important to set short and long term goals (e.g., Gould, 2001). A self-modeling video could create an opportunity for athletes to develop these two forms of goals because the video can act as a means to break down the skills into essential parts (e.g., Rymal et al., 2010). For example, a short term goal could be to do the low bar portion of their bar routine as seen in the video at their next practice and the high bar at the following practice. This may in turn create a long term goal of performing the entire routine like seen in the video near the end of the competitive season.

Self-Talk

Self-talk has been referred to as what athletes say to themselves (internal or out loud) to direct actions and to think appropriately about their performance (e.g., Van Raalte, Cornelius, Brewer, & Hatton, 2000). According to Bandura (1986, 1997), self-talk is a representation of one's beliefs. The use of a self-modeling video may increase positive self-talk by acting as a representation of the gymnast's belief in her ability (i.e., self-efficacy) to perform the competitive routine well. Moreover, self-talk may be used in the form of instructions, trigger words, as well as technical and positive key words to foster skill learning (Henschen, 2005; Zinsser, Bunker, & Williams, 1998). A self-modeling video, which clearly illustrates proper technical and key points, could encourage the development of positive instructional words

relating to proper execution and appropriate timing of the athletes performance. For example, an athlete would view their video and acknowledge the proper timing of letting go of the bar in a dismount and choose a trigger word (e.g., “now”); therefore focusing on what they want to accomplish (e.g., timing of a release). This also allows the athletes to direct their attention away from negative thoughts and focus their attention on an objective they want to accomplish, which is essential for effective self-talk (Henschen, 2005).

Imagery

It has been well documented that athletes use imagery as a means to enhance performance (for a review see Cummings & Ramsey, 2008). However, there are certain aspects such as the timing of one’s imagery, type of imagery, and imagery ability that can influence the success of an imagery intervention on performance (Cumming & Ramsey, 2008; Fournier, Deremaux, & Bernier, 2008). Specifically, imagery in actual speed (e.g., Callow & Hardy, 2005), slow motion imagery (e.g., Calmels & Fournier, 2001), or the combination of both are thought to be beneficial to performance. A self-modeling video could be used to illustrate the proper timing and rhythm (real time) of how the skill should be imagined as well as allowing them to slow the video down at any point. Thus, this could help develop real time, slow motion, or the combination of imagery timing. Researchers have also suggested that the external perspective of imagery has a greater effect on skills that emphasize form and technique (e.g., White & Hardy, 1995). Considering this research is in the sport of gymnastics, and a gymnast’s score is based on form and technique, the self-modeling video may in fact be effective in creating an external perspective (see also Smith & Holmes, 2004).

Research has also shown the effectiveness of kinesthetic imagery (see Hall, 2001). In fact, individuals have expressed feeling kinaesthetic sensations while viewing themselves on a

video (Hars & Calmels, 2007). Therefore, the self-modeling video could be used not only to encourage gymnasts to visually image an external perspective of them self but also to incorporate kinesthetic sensations. Although the timing and type of one's imagery is important, the ability to create and control images is considered to be essential for successful performance through imagery (see Hall, 2005). Furthermore, Rymal and Ste-Marie (2010) have suggested that viewing an external stimulus that provides a proper demonstration, such as a feedforward self-modeling video, may act as a precursor to create controlled images (see also Ram, et al., 2007).

Another relevant aspect of the imagery literature with respect to this research is the fact that one's imagery ability can moderate the effectiveness of an imagery intervention on performance (Callow & Hardy, 2005). Specifically, those who are higher in imagery ability benefit more from their imagery than those who have lower imagery ability with respect to the effects on physical performance (e.g., Cumming & Ste-Marie, 2001; Gregg, Hall, & Butler, 2007). In fact, researchers have noted that imagery and self-modeling are very similar in the underlying cognitive and motivational processes that are affected through the use of both techniques (Cumming, Clark, Ste-Marie, McCullagh, & Hall, 2005; Hall et al., 2009). Also, recent research has shown that similar brain activities occur when imaging a movement and observing a movement (Holmes & Calmels, 2008; Holmes, Cumming, & Edwards, in press). Therefore, the main difference lies within the availability of an external stimulus that is provided by the use of a self-modeling video (Dowrick & Dove, 1980; Ram, et al., 2007). As a result of these similarities, it is our belief that imagery ability could also act as a moderating variable with respect to the effectiveness of the self-modeling intervention on gymnasts' physical performance. Thus, imagery ability will be examined as a possible moderator for self-modeling benefits.

In summary, the primary purpose of this research was to investigate whether psychological skills training that incorporated a self-modeling video to show how it could be used in competition would increase gymnasts' competitive bar performance more than when the self-modeling video was used in competition without such training. To examine this, one group of gymnasts were provided with psychological skills training that included the use of the self-modeling video during those training sessions. These training sessions were conducted during the month prior to the competitive season. During the competitive season, these gymnasts were then provided with a feedforward self-modeling video at two of their competitions, but no video was used at another two competitions. Another set of gymnasts did not receive the psychological skills training prior to the competitive season, but were provided with a self-modeling video for two of their four competitions during the competitive season. Our specific hypotheses were that the bar routine scores from the competitions where participants viewed their self-modeling video would be significantly higher than the bar routines scores at the competitions that the video was not viewed. More important, the group that received the psychological skills training would show significantly higher scores at competitions that the video was viewed compared to the group that did not receive the training sessions. A secondary purpose of this research was to investigate whether imagery ability acted as a moderating variable on the effectiveness of the self-modeling video. No specific hypothesis was made for this analysis. Previous research in self-modeling has not incorporated psychological skills training prior to the competitive season, nor investigated the possible influences of imagery ability, making this research a unique contribution to the literature.

Method

Participants

Nineteen female competitive gymnasts between the ages of 9 and 16 years ($M age = 12.11$, $SD = 2.17$) participated in the research. The gymnasts were recruited from a local gymnastics club in Ottawa, Ontario, Canada. Convenience sampling and word of mouth methods were used. The competitive levels of the gymnasts varied from provincial level five to provincial level eight (see Table 1). These levels are based on Gymnastics Ontario's rules and regulations and distinguished by the required degree of difficulty in each level. Also, the number of hours a gymnast trains typically increases based on the level in which they compete. For example, level eight gymnasts are required to compete more difficult skills (i.e., higher degree of difficulty) and will train between 18 and 22 hours a week whereas a level five gymnast competes less difficult skills (i.e., lower degree of difficulty) and will train between 16 to 18 hours a week. Despite these differences, all gymnasts follow the same rules and regulations put forth by Gymnastics Ontario and compete in the same environmental context. Thus, having a sample that had competed at varied levels in the gymnastic system was not problematic. In fact, we were interested in examining this intervention with a wide level of gymnasts.

Table 1.

Gymnasts' Age, Group, and Competitive level.

Participant	Age	Group	Competitive Level
1	10	SMO	5
2	15	SMO	6
3	11	SMO	7
4	15	SMO	7
5	9	SMO	5
6	11	PST+SM	5
7	10	PST+SM	5
8	12	PST+SM	5
9	9	PST+SM	7
10	13	PST+SM	8
11	13	SMO	8
12	12	SMO	7
13	13	SMO	6
14	13	PST+SM	8
15	14	PST+SM	8
16	13	PST+SM	8
17	9	PST+SM	5
18	16	PST+SM	8

Note: SMO = Self-modeling only group. PST+SM = Psychological skills training plus self-modeling.

Materials

A Sony video Handycam camera (model number DCR-HC65/HC85), mounted on a tripod, was used to film the athletes in training in order to gather the footage needed for the construction of the self-modeling video (see procedures section on editing process). The video footage was taken from a side angle to represent the same perspective of the judges when the gymnasts would be competing. The Dartfish Pro Software (version 4.5.1.0) was used to edit the footage and construct the feedforward self-modeling videos. Two seven inch portable Sony DVD players and two Toshiba Satellite laptop computers with 15" x 16" screen sizes were used during the psychological skills training workshops. The laptops were used during the

psychological skills training workshops whenever the gymnasts were asked to manipulate the self-modeling video viewings. For example, in the imagery session participants were encouraged to slow down or speed up their video using either the Dartfish Pro Software or the touch pad on the computer to fast-forward or slow down the image. At the competition sites, only the two portable DVD players were used for the athletes to view their self-modeling video.

Intervention Fidelity

Intervention fidelity was maintained across the four week psychological skills training workshops as well as the competitions. During the psychological skills training, each workshop followed a scripted discussion format where specific content was covered. To ensure consistency in the content covered, definition sheets and worksheets were also provided to the participants. Furthermore, the researcher was actively involved in conducting the workshops and all material covered/completed was finished and reviewed on site. Thus, encouraging the athletes to participate. In addition, fidelity was maintained throughout the competitive season. Not only was the self-modeling video administered to the participants by the researcher, but the interview guide was pilot tested prior to data collection which resulted in a script that was followed by the researcher. Having one person administer the intervention and interview helped to ensure that the research was conducted in a controlled manner to each participant.

Another area relating to intervention fidelity is whether the intervention was true to the theories and goals of the research. I would argue that this has been satisfied. To ensure that the self-modeling video was a true representation of mastery and vicarious experience as described in Bandura's social cognitive theory (1986) the researcher, a certified competitive gymnastics coach, along with the gymnasts' coaches were involved in choosing the appropriate material used to create the self-modeling video. This panel of 'experts' increases the legitimacy of the

video representing successful previous performances of skills, but also put in to a new context (i.e., entire routine).

In relation to the exploration of self-regulation, the interview guide was developed based on the three phases of Zimmerman's (2000, 2004) self-regulation model. That is, questions were developed relating to all possible processes and beliefs described in Zimmerman's (2000, 2004) model.

Measures

A demographic information form was created in order to gather information about the athletes' age, competitive level, years of competitive experience, number of hours of training each week, and whether they had any previous experience with sport psychology interventions before.

Physical performance. Physical performance was measured based on the official judges' scores at each of the competitions. It is important to note that the gymnasts' total score consists of two parts; 1) an A-score for fulfilling the Element Group Requirements (EGR's) which is based on the degree of difficulty required for a given level of competition, and 2) an execution score that is marked out of ten (B-score), which represents how well the skills are performed (e.g., straight legs, pointed toes, etc.). For example, a level five gymnast may have a degree of difficulty of 2.6 but if she misses a required element (i.e., EGR) she will not receive the full marks in her A-score. Furthermore, each level of competition has different EGR's which in turn creates differences in the degree of difficulty level. Therefore, we deemed it appropriate to use only the execution score, thus eliminating the possible confound of base score variability as a result of higher degree of difficulty values. In support of this, research has suggested that skill dynamics (i.e., the execution score) and not skill outcome (i.e., the total score) be

investigated when using modeling interventions as skill form may be more sensitive than outcome scores (Ashford, et al., 2006).

Imagery ability. The Movement Imagery Questionnaire-Revised (Hall & Martin, 1997; MIQ-R) was used to measure the ability of participants to visually and kinesthetically image different movements after physically performing those movements. Specifically, the movement is read out loud and performed once. The individual then returns back to the starting position and is asked to attempt to either see (visual) or feel (kinesthetic) the movement they have just performed. The ability to see or feel the image is rated on a 7 point scale; 1= very hard to see/feel and 7 = very easy to see/feel. The questionnaire has been shown to be a valid and reliable measure of imagery ability (Hall & Martin, 1997). Furthermore, each scale displayed good internal reliability with alpha coefficients of .70 or above in this research.

Procedures

Pre-intervention. Informed assent and consent was obtained by the athletes and their parents. Following the signing of all the forms, the gymnasts were assigned into the self-modeling plus psychological skills training (PST+SM) condition (n = 10) or the self-modeling only group (SMO) condition (n = 8). When assigning groups, competitive level and age were counterbalanced.

For both groups, the video taping of the bar routine, for future editing of the self-modeling video, was taken during the standard training hours of the athletes. During this time, the researcher filmed multiple attempts of the athlete's bar routine until the appropriate amount of footage needed to construct the self-modeling video was obtained. From this footage, only the best performances of each skill that comprise the routine was edited together to create as near perfect a routine as possible. In most instances, during the construction of the self-modeling

video, the coach would recommend the skills to be used from the video training footage.

Otherwise, the researcher chose the best performances based on her background and knowledge as a certified competitive gymnastics coach. For example, a gymnast could have footage from five full bar routines but only the first routine's mount, the fifth routine's middle portion, and the third routine's dismount would be selected for the self-modeling video construction. All the video footage was taken from the side in order to represent the judges' perspective during an actual competition. To further simulate a competitive situation, participants were also dressed in their competitive attire.

Intervention. The two experimental groups differed in the month leading up to the gymnasts' competitive season based on whether they participated in psychological skills training; one group received such training and another group did not. Therefore, for clarity, the procedures related to the group that received the psychological skills training will be discussed first and then the self-modeling intervention component will be presented. The PST+SM group took part in four weeks of psychological skills training workshops one month prior to the actual competition procedure. Before these training sessions began a self-modeling video was constructed for each participant. After the construction of the self-modeling videos, the athletes received six to eight workshops that lasted approximately 30 minutes each. Although the number of sessions may have varied for the gymnasts, it was the exact same content. The number of sessions only varied as a result of the size of the group involved in the session that week. The sessions were completed in groups of two to six participants. When sessions were taught in larger groups, such as six gymnasts, they would have to wait for a DVD player or lap top to view their video. In such cases, it often required a second session that week to cover the material. This resulted in week one consisting of two focus sessions, week two consisting of two

sessions on imagery, week three consisting of one to two sessions on goal-setting, and week four consisting of one to two sessions on self-talk. The four week psychological skills training workshop timeline was based on Rose and Christina's (2006) suggestion that using video feedback over an extended period is most beneficial for performance improvements. Within each training session, the athletes were not only informed of the specified mental skill and how it can affect performance, but emphasis on how a self-modeling video can influence each of the skills was also presented.

To elaborate on the training workshops, in week one, the athletes were introduced to focus/attention control. Within the first session, the athletes were informed of the concept of attention focus and the four focusing styles described by Nideffer and Sagal (1998). This was followed by a discussion of the possible ways in which their self-modeling video could help assist in controlling their focus/attention. During the second session athletes viewed their video and identified where they believed they should focus their attentional demands throughout the bar routine. Durand-Bush (2010) has acknowledged this as a useful tool to develop focusing strategies. For example, an athlete may believe that she needs to have a narrow-external focus to prepare for her dismount landing. Athletes then partook in a distraction control activity where fellow teammates attempted to distract them by calling their name, making noise, playing floor music as in competitions all while the athletes attempted to stay focused.

In week two, athletes were informed of how the self-modeling video could affect their imagery processes. During the first session, imagery modalities (visual and kinaesthetic) and perspectives (first person and third person) were explained. The self-modeling video was discussed as a means to provide a positive, controllable, vivid, external image that could also lead to kinaesthetic sensations. The MIQ-R was also administered in this session. During the

administration of the MIQ-R, the researcher read the instructions to the gymnasts and clarified any uncertainties regarding the types of imagery. For example, if an athlete was uncertain about what kinesethic imagery was, the researcher would provide an example such as “if you squeeze your fist and then release your hand, tell me how easy or difficult it is to feel that tension again”. Once the athletes had a clear understanding of the imagery questionnaire, the researcher read out each scenario. After each scenario, gymnasts then recorded their score on the designated area on the questionnaire. In the second session, athletes had control over the speed of video replay and were able to slow it down, view it in real time, or the combination of both in order to help contribute to developing their ability to control the timing of their imagery. Gymnasts were also asked to attempt to ‘feel’ their movements while they viewed their videos in order to experience both visual and kinaesthetic imagery. Following this, athletes took part in self-directed imagery of their bar routine.

During week three, the athletes were introduced to goal setting and how their self-modeling video could be used to develop appropriate goal setting strategies. In the first session, athletes were informed on how to set SMARTTEST goals (Durand-Bush, 2010), process, performance, outcome, short term, and long term goals. The second session consisted of viewing the self-modeling video and developing appropriate short and long term goals as well as process, performance, and outcome goals based on the proper form and techniques they had seen in their video. For example, an athlete could set a short term process goal to keep her toes pointed in the handstand, as seen in the video, at the next competition. Athletes also prioritized their goals and devised an action plan on how to implement their goals in training and competition (see Durand-Bush, 2010, for workshop activities).

In the fourth and final week, the athletes were introduced to self-talk interventions relating to how their self-modeling video could be used to assist in the use of proper self-talk strategies. Session one was used to define self-talk and explain how the video could be used to create self-talk statements that may influence their belief system (e.g., self-efficacy statements), affect (e.g., mood words), and motor (e.g., instruction/technical self-talk). During the second session, athletes viewed the self-modeling video and developed positive instructional self-talk statements relating to technical aspects of their skills seen in the video. This also included key words and trigger words in order to direct their attention to what they want to accomplish with respect to their cognitions, affect, and motor execution.

After this one month duration of workshops, these athletes were no longer provided with the psychological skills training and transitioned into the use of the self-modeling video at competitions. At this point, the participants in the SMO group completed the MIQ-R in a similar manner as the SM + PST. From here, both groups now followed the same procedures. Self-modeling videos, and new self-modeling videos for the PST+SM gymnasts, were constructed prior to data collection at the first competition. Also, before the first competition, all athletes were guided through the protocol once with the researcher during their standard training session in order to familiarize them with the procedures that would occur at the specified competition sites. Data was collected at four different competition sites wherein two of the four competitions acted as the experimental condition and participants viewed their self-modeling video, and the other two served as the control condition in which no video was viewed.

For those competitions in which the self-modeling video was used, each athlete was provided with a DVD player for their viewings. The duration of the self-modeling video depended on the participant's routine requirements. Generally, a gymnast's bar routine will take

anywhere between 20 seconds to 1 minute, and thus, the self-modeling viewings could last between a minute and a half to three minutes. The athletes viewed their self-modeling video three times approximately five minutes before partaking in their bar warm-up. Following their warm-up, the athletes viewed their self-modeling video once more. The athletes then continued with their regular pre-competition routine until they were called by the judges to compete. This resulted in a total of eight viewings during the competitive season (four viewings for each of the two competitions that received the self-modeling video).

For the control competitions, the gymnasts were asked to follow their typical pre-competition routine and were not provided with the self-modeling video.

Data Analysis

One gymnast was removed from data analysis due to illness during the competitions, thus, the data from 18 participants was used in the analysis.

The physical performance data was entered into a PASW spreadsheet and was analyzed with PASW 18.0 software. The probability of making a Type 1 error in all tests was set at $p < .05$. All data are expressed as a mean and standard deviation ($SD \pm$). As mentioned, it was hypothesized that the self-modeling video would have a positive effect on physical performance, but it is possible that its effectiveness would only emerge later in the season, as the gymnasts may be adjusting to the use of the video. Therefore, time was added as a factor in the design. The first two competitions were defined as early in the season whereas the last two competitions were defined as late. This resulted in a 2 (group: SMO vs. PST+SM) X 2 (condition: SM vs. C) X 2 (time: early vs. late) mixed analysis of variance (ANOVA) with repeated measures on the last two factors.

To investigate whether imagery ability acted as moderating variable, a median split on the pre-test scores for the MIQ-R (Hall & Martin, 1997) was performed on each scale in order to divide the athletes into high imagery ability or low imagery ability groups. This resulted in nine participants in each group. In many cases a gymnast may have scored higher on one scale compared to the other. For example, a gymnast may score high in visual imagery ability and low in kinaesthetic imagery ability. Thus, separate ANOVA's were conducted for each scale on physical performance scores. Specifically, a 2 (group: high imagery ability vs. low imagery ability) X 2 (condition: SM vs. C) X 2 (time: early vs. late) mixed ANOVA's with repeated measures on the last two factors for the total MIQ-R score, visual imagery score, and kinaesthetic imagery score. Tukey's HSD post hoc tests were used to determine where significance occurred.

Results

When execution scores were examined without imagery ability as a moderator, the results did not support either of our hypotheses. That is, no significant interactions or group differences were found, suggesting that neither the self-modeling video or psychological skills training coupled with the self-modeling video increased competition performance ($F's < 1.0$; see Table 2 for means, standard deviations, and confidence intervals).

Table 2

Physical Performance Scores for the Experimental and Control Conditions at Early and Late Competitions for both Groups

Group	EV		ENV		LV		LNV	
	M (SD)	95% CI	M (SD)	95% CI	M (SD)	95% CI	M (SD)	95% CI
PST+SM	8.70 (0.79)	[8.20, 9.19]	8.87 (0.39)	[8.56, 9.16]	9.29 (0.20)	[9.12, 9.44]	8.86 (0.89)	[8.39, 9.32]
SMO	8.59 (0.68)	[8.03, 9.15]	8.69 (0.47)	[8.38, 9.01]	9.19 (0.29)	[9.01, 9.37]	8.87 (0.32)	[8.34, 9.40]

Note: EV = competition scores early in the season when the self-modeling video was administered. ENV = competition scores early in the season when the video was not seen. LV = competition scores late in the season when the video was administered. LNV = competition scores late in the season when the video was not seen.

A different picture emerged when imagery ability was used as a moderating variable for the effectiveness of the self-modeling video. To ensure that the high imagery ability and low imagery ability groups were in fact different from each other, separate t-tests were performed on gymnasts' scores for each scale of the MIQ-R. Results indicated that those characterized as high in imagery ability and low in imagery ability were significantly different from each other on all scales (MIQ-R Total, $t(2, 16) = 5.20, p < .001$; MIQ-R Visual, $t(2, 16) = 5.59, p < .001$; MIQ-R Kinesthetic, $t(2, 16) = 4.86, p < .001$), 95% CIs [2.83, 6.72], [3.51, 7.81], and [5.33, 13.56] respectively.

The results that included MIQ-R total and MIQ-R Kinesthetic imagery scores did not show any significant main effects or interaction of imagery ability on physical performance (F 's < 1.0). The analysis that included visual imagery ability, however, showed a significant main effect for time, suggesting that gymnasts' competitive bar scores increased over the competitive season. More importantly, a Group X Time X Condition interaction was found, $F(1, 16) = 5.976, p = .026, \eta^2 = .27, (1 - \beta) = .63$. Tukey's post hoc analysis indicated that those high in imagery ability did not benefit from the self-modeling video and those low in imagery ability are gaining benefits from the video later in the season. Specifically, early in the competitive season, those who were low in visual imagery ability did not benefit from the self-modeling video; in fact their physical performance scores were significantly worse when they viewed the video. Late in the season, however, the low imagers benefited from the self-modeling video viewing. Thus, visual imagery ability was a moderating variable for the benefits of self-modeling, and it interacted with time during the competitive season in regards to the effectiveness of the intervention (see Figure 1).

Figure 1. Physical Performance Scores of Gymnasts with High and Low Visual Imagery Ability for the Experimental and Control conditions at Early and Late Competitions

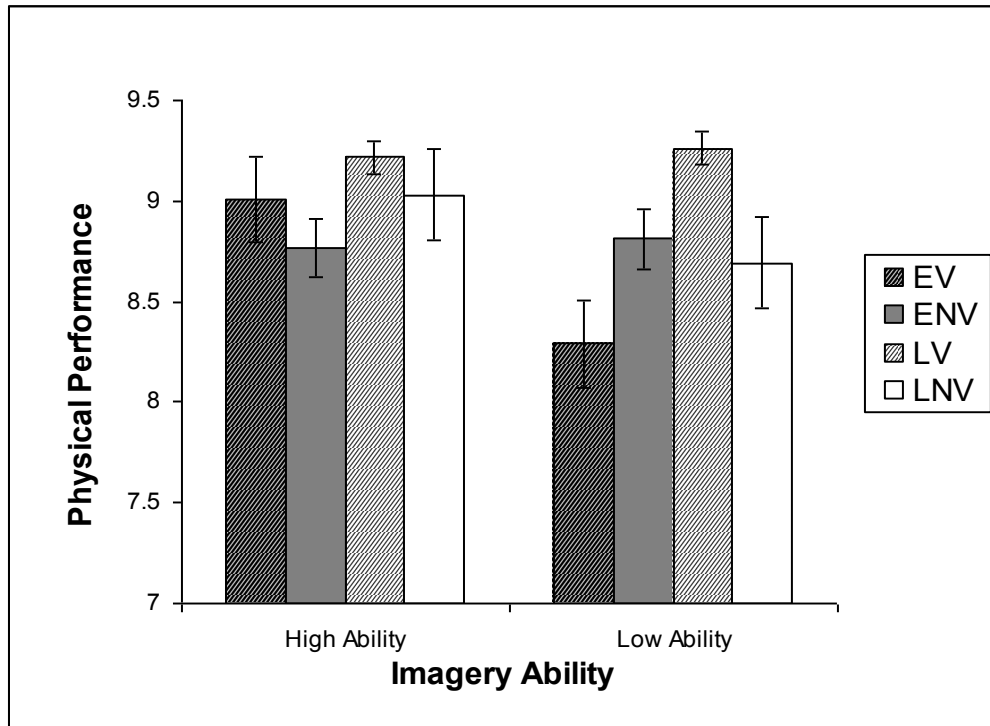


Figure 1. Physical performance scores of gymnasts with high visual imagery ability and gymnasts with low visual imagery ability for the competitions that participants viewed the self-modeling video and the competitions that the video was not viewed. Error bars represent standard errors. Note: EV = competition scores early in the season when the video was seen, ENV = competition scores early in the season when the video was not seen, LV = competition scores late in the season when the video was seen, LNV = competition scores late in the season when the video was not seen.

Discussion

The main objective of this research was to investigate whether self-modeling plus psychological skills training workshops could increase gymnasts' competitive bar performance more than a self-modeling video alone. The secondary objective was to investigate whether imagery ability acted as a moderating variable on the effectiveness of the self-modeling video.

Contrary to our hypothesis, the combination of a self-modeling video with psychological skills training did not increase the effectiveness of the video on physical performance scores.

This was unexpected based on evidence in the literature suggesting the positive effects of

combining varied mental skills on physical performance (see Duda, et al., 2005). Furthermore, evidence from Rymal et al., (2010) and Ste-Marie et al.'s (2011) suggested that athletes used such mental skills alongside the self-modeling video: A possible reasoning for the lack of significance between the two groups may be due to the small sample size, duration of the workshops, as well as prior psychological skills training. The relatively low power, $(1 - \beta) \leq .43$, suggests that an increase in the number of participants for each group may be beneficial when exploring group differences. Also, a demographic form included one question relating to prior psychological skills training. Although gymnasts did not mention any prior structured, or unstructured, psychological skills training prior to group selection, as the data collection progressed the researcher noticed that gymnasts were using psychological skills on their own. Thus, this may have caused imbalances in the groups prior to data collections. As such, future research should consider administering a baseline measure of psychological skills such as the Ottawa Mental Skills Assessment Tool (OMSAT; Durand- Bush, Salmela & Green-Demers, 2001) or the Test of Performance Strategies (TOPS; Thomas, Murphy, & Hardy, 1999). Furthermore, the athletes in the PST+SM were administered the workshops the month prior to the competitive season and these were stopped once the competitions began. Therefore without continuous exposure, participants may have not understood how to transfer each psychological skill with the self-modeling video into the competitive season. Indeed, gymnasts stated that they would have liked it if both the self-modeling video and workshops were available throughout the entire season.

Although a main effect for condition was not found in our in our initial analysis on physical performance, our results show that visual imagery ability acts as a moderating variable on the effectiveness of a self-modeling video. That is, although those high in visual imagery

ability gained an advantage of approximately 0.2 both early and later in the season, these differences were not significant. The low visual imagery ability group, however, had a substantially different pattern of results. Early in the season, the video appeared to interfere as they had lower scores when the video was viewed compared to when it was not (-.60). Later in the season, however, a large advantage (.56) was gained when the video is used.

A possible explanation for the time delay in the benefits of the self-modeling video for those low in imagery ability may be borrowed from the very idea of ability levels found in the imagery literature. That is, perhaps there is also a continuum for 'observation ability'. To our knowledge, this idea of observation ability has not been advanced in the sport performance or the motor learning literature. Greer, Dudek-Singer, and Gautreaux (2006), however, noted that children with learning delays in academia can be missing an observation repertoire that is needed to learn through observing individuals such as teachers and classmate. Moreover, with training, these children were able to acquire the ability to learn through observation. Although they argued that more research was needed for typically developing children, it could be that the gymnasts in our sample with low imagery ability may also initially have had low 'observation ability'. Relating back to Bandura's (1986) social cognitive theory, in order to retain information learned through observation one must create a mental image to guide subsequent performance of the intended behaviour. Thus, it is possible that those low in imagery ability first needed to have exposure to an external stimulus before being able to gain benefits.

Further connections between imagery and observation have been noted. A number of researchers, for example, have argued for the similarities in processing of both imagery and observation and their mutual interactions (Cumming, et al., 2005). Further, Holmes and Calmels (2008) contend that parallel neural activities are involved in observation and imagery. These

lines of evidence support the question related to why visual imagery ability may moderate the observational benefits, but do not speak directly to the associated time delay in the advantages. To this issue, we turn to the idea that, similar to changes in imagery ability from training, it is possible that benefits from observation only occurs with continued exposure for those with a lower observation ability.

A surprising result, however, is the negative effect the video had on those low in visual imagery ability early in the season. We find this result difficult to explain and suggest future researchers investigate the timeline associated with when a self-modeling video should be introduced. From a practical standpoint, these results suggest that a self-modeling video should not be administered to those low in imagery ability without some prior use of the intervention. Given the time effect, we would suggest that gymnasts gain exposure to the video as a means to achieve full benefits when used in competition. One possibility is to use the feedforward self-modeling video during mini/mock meets. This is a practice often used in the gymnastics environment and involves the gymnast's competing their routines in their own club, but under simulated a competition conditions. For example, they present their routine in front of their fellow teammates and coaches, and may have a judge visit to provide a score. Alternatively, the intervention could be incorporated into actual competitions that have a lower ranking of importance to the gymnasts, such as an early invitational competition.

Another interesting perspective put forth by Rymal and Ste-Marie (2009) is that the use of a self-modeling video may be more beneficial than an imagery intervention on those with low imagery ability as it provides clear, controlled, and complete images that do not need to be created. Holmes and Calmels (2008) presented neuroscientific evidence in a recent review of action observation and imagery research supporting such a contention. In that review, they

proposed that observation-based approaches may offer more valid and effective techniques for sport performance than that of imagery. Our results provide partial support of this point. That is, we can say that individuals with low imagery ability had significant gains from an observation based intervention compared to those high in imagery ability; although this was only seen later in the season after the second administration of the self-modeling intervention. Future research could do a more direct comparison between imagery and self-modeling interventions. Also necessary is exploration of the possibility of variations in observation ability and its interrelations with imagery ability.

As a final point, we argue that the practical significance of this research should be taken in to strong consideration. Specifically, gymnastics is a sport where a tenth of a point can make a difference between a first place and fifth place. As seen in Table 2, the mean scores later in the season for the competition where athletes viewed their video were 0.38 tenths higher than the mean score at the competition that the video was not viewed. Practically speaking, a 0.38 tenth of a score is considered to be a large lead in gymnastics. For example, in the 2008 summer Olympics, He Kexin won gold on the uneven bars with a score of 16.725 and in fourth place, Beth Tweddle, received 16.625 (ESPN, 2008). Thus, a 0.1 difference on an individual event can distinguish between medaling at the Olympics and receiving nothing. In fact, this comparison suggests that the 0.2 advantage seen for the high visual imagery ability group, while not statistically significant, does appear to be practically significant. Therefore, although a main effect for condition was not statistically significant, we would argue that all gymnasts are in fact getting practical benefits from the administration of the self-modeling video. In conclusion, this practical application of modeling to the sport context highlights the fact that, unlike imagery

(Martin, Moritz, & Hall, 1999), there is no applied model for the use of observation in motor learning and performance; such a model would be useful for practitioners.

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**Article 2: Gymnasts' Self-Regulatory Processes and Beliefs in Competition: Examining the
Impact of a Feedforward Self-Modeling Video**

Abstract

Self-regulation is thought to be an important tool in athletic success (Zimmerman, 2008). Furthermore, competitive divers (Rymal, Martini, & Ste-Marie, 2010) and gymnasts (Ste-Marie, Rymal, Vertes, & Martini, 2011) have acknowledged using such processes and beliefs following the use of a feedforward self-modeling video during competition. This study also examined gymnasts' self-regulation, but with a specific interest in how self-modeling, alone or paired with psychological skills training, was used as a strategy to influence self-regulation. Ten gymnasts were divided into two groups; Group 1 partook in a four week psychological skills training workshop; Group 2 did not. Immediately following a competition in which gymnasts viewed their feedforward self-modeling video, they were asked a set of interview questions that were developed based on Zimmerman's (2000) model of self-regulation. The questions were specific to the use of the video. Analysis of the transcripts suggested that the video was used as a task analysis strategy to influence processes and beliefs that occur in all phases described in Zimmerman's model; i.e., before, during, and after the competitive event.

Gymnasts' Self-Regulatory Processes and Beliefs in Competition: Examining the Impact of a Feedforward Self-Modeling Video

Research has shown that athletes, coaches, and practitioners use observation as a means to convey information for assisting in the learning of motor skills (see McCullagh, Law, & Ste-Marie, in press; McCullagh & Weiss, 2001; Williams, Davids, & Williams, 1999 for reviews). More recently, observation of the self has been shown to be effective in another motor environment; that of competitive performance (Rymal & Ste-Marie, submitted; Ste-Marie, Rymal, Vertes, Martini, 2011). The particular observation technique used by these researchers was self-modeling.

Dowrick (1999) refers to self-modeling as the observation of oneself on video that shows only desired performance behaviour. Self-modeling is divided into two categories; positive self-review and feedforward techniques (Dowrick). An example of a positive self-review would be a highlight video of an athlete's best performances. A feedforward self-modeling video, however, is an edited version of the athletes' performances spliced together in a new sequence of skills or in a new context (Dowrick). For example, in gymnastics, an athlete may be able to perform individual skills in her bar routine with perfect execution when practiced alone, but, when placed in a routine, execution errors arise. Through video editing though, the best individual skill performances could be spliced together to create a near to perfect bar routine. The feedforward technique of self-modeling has been suggested to produce greater behaviour change than positive self-review (Dowrick), consequently, we used this technique in the described research.

When examining research on self-modeling, the majority has been within the motor skill acquisition literature with very few researchers investigating the use of self-modeling as a competitive performance enhancement technique (see McCullagh, Law, & Ste-Marie, in press

for review). Although Ives, Straub, & Shelley (2002) have noted the increase in the use of videos in a sport settings, the majority relate to the use of highlight videos (i.e., positive self-review; e.g., Halliwell, 1990; Leavitt, Young, & Connelly, 1989; Templin & Vernacchia, 1995) and not feedforward videos, likely due to the amount of time needed to create an edited version of the athletes performance.

To our knowledge, only two empirically based research projects have investigated the use of self-modeling as a possible competitive performance enhancement technique (Rymal, 2007; Ste-Marie, et al., 2011); and these found equivocal results. Rymal's (2007) research with divers found no significant results for the effectiveness of a self-modeling video whereas Ste-Marie and colleagues (2011) showed that self-modeling had a positive effect on gymnasts' competitive beam performance scores. Moreover, Ste-Marie et al.'s findings have been reinforced with further research on gymnasts using a feedforward self-modeling to enhance competitive bar performance (Rymal & Ste-Marie, submitted). In that research, benefits were again found for competitive performance with imagery ability as a moderating variable across time. That is, those who were high in imagery ability did not obtain performance gains from the modeling intervention, but those lower in imagery ability yielded gains later in the competitive season.

In addition to the examination of physical performance benefits, the research by Rymal and colleagues (Rymal, Martini, & Ste-Marie, 2010; Ste-Marie et al, 2011) has addressed an important weakness in most research on self-modeling. Namely, researchers have noted that very little theoretical development of the underlying processes responsible for the benefits of self-modeling has been conducted (e.g., Starek & McCullagh, 1999; Dowrick, 1999). To address this, Rymal and colleagues have examined possible self-regulatory influences for performance enhancement as a result of self-modeling and used Zimmerman's (2000, 2004) self-regulated

learning model in this line of investigation. We continue to adopt Zimmerman's model given the success with that previous research. Another reason for its use is that the model falls within Bandura's (1986, 1997) Social Cognitive Theory; a theory that has long-standing support in observational research (McCullagh, Law, & Ste-Marie, in press; McCullagh & Weiss, 2001). Before moving into the research which has encompassed self-regulation within self-modeling for performance enhancement, a brief description of Zimmerman's model will be presented (see Table 1 for breakdown of processes).

Table 1

Description of the Self-Regulatory Processes within the Phases of Zimmerman's Model of Self-Regulation.

Forethought Phase	Consists of the processes and motives to self-regulate before the behaviour
Task Analysis	
Goal Setting	Stating specific intentions or outcomes to learning or performance.
Strategic Planning	Choosing or creating strategies to direct cognitions, motor execution, and/or affect
SP: Self-Instruction	Self-verbal/non-verbal instructions
SP: Imagery	Creating or recalling mental images (visual/kinesthetic)
SP: Task Strategies	Analysis of task subcomponents by breaking down the behaviour into specific parts
SP: Attention Focus	Concentrating or avoiding distractions
Self-Motivational Beliefs	Beliefs in the capability to self-regulate
Self-Efficacy	Beliefs in specific capabilities to learn or perform effectively
Outcome Expectations	Beliefs about the ultimate benefits or liabilities about learning or performance
Task Interest/Value	The value (intrinsic/extrinsic) given to the task
Goal Orientation	The rationale for learning or performing (learning, mastery, task, or ego orientation).
Performance Control Phase	Processes involved during the performance of the behaviour
Self-Control	Specific method and strategies to direct cognitions, motor execution, and affect
Strategic Planning	Choosing or creating strategies to direct cognitions, motor execution, and/or affect
SP: Self-Instruction	Self-verbal/non-verbal instructions
SP: Imagery	Creating or recalling mental images (visual/kinesthetic)
SP: Task Strategies	Analysis of task subcomponents by breaking down the behaviour into specific parts
SP: Attention Focus	Concentrating or avoiding distractions
Self-Observation	Observing and keeping track of learning processes and performance
Self-Recording	Keeping a physical record of performance
Metacognitive Monitoring	Keeping track of learning or performance mentally
Self-Reflection Phase	Processes involved after the performance of the behaviour
Self-Judgement	Judgements related to learning or performing
Self-Evaluation	Using self-monitored information and comparing them with a standard or a goal (self-criteria, social criteria, mastery criteria)
Causal Attribution	Reasons given to performance outcomes (controllable/uncontrollable)
Self-Reaction	Reaction toward learning or performance
Self-Satisfaction	Satisfaction/dissatisfaction of prior learning or performance
Adaptive/Defensive Inference	Reactions related to the effectiveness of prior strategies and decision to retain/adapt a new strategy or to avoid a strategy

Note: SP = Strategic Planning.

The first phase of Zimmerman's (2000, 2004) model is the forethought phase. It is related to the thoughts, feelings, beliefs, and cognitions used to prepare the individual before the behaviour (Zimmerman, 2004). This phase consists of task analysis strategies related to directing cognitions, controlling affect, or controlling motor execution (e.g., strategic planning). Also within this phase are self-motivational beliefs, such as the belief in one's capabilities to manage thoughts, feelings, and actions (i.e., self-efficacy) (Bandura, 1997). It is the task analysis processes related to strategic planning that is of most interest because it refers to strategies used or created to enhance skill learning (Zimmerman, 2004). From this definition, we would argue that a self-modeling video is a planning strategy used to prepare for performance (i.e., during the forethought). Further, we contend that this strategy can foster the use of other self-regulatory strategies and beliefs (see also, Ste-Marie et al., 2011).

The performance control phase involves those processes used while physically attempting the skills. This phase is argued to improve the quality of mental and physical activities (Zimmerman, 2004). There are two components; self-control and the self-observation. The self-control component consists of strategies similar to that found in the forethought phase, but they are employed during the execution of the skill and not before the skill (e.g., self-instruction). As for the self-observation component, these processes involve self-observing and monitoring performance (e.g., self-recording).

The third phase is self-reflection. Here, the processes refer to the reflections of a learner toward his or her performance after the skills were attempted. The purpose of this phase is to influence the learners' reactions to their mental and physical efforts as well as influence following efforts that could occur in the forethought phase (Zimmerman, 2004). This phase

consists of self-judgements, such as evaluating one's performance based on standards (i.e., self-evaluations), and self-reactions, such as feeling satisfied or dissatisfied with one's performance.

Despite the fact that Zimmerman's (2000, 2004) model was developed for the learning context, Rymal, et al., (2010) argued that many self-regulatory beliefs and processes described for learning (e.g., imagery, self-evaluation, self-efficacy, goal setting, and strategic planning) also occurred in a competitive environment. As an example, Monsma and Feltz (2006) contended that figure skaters should develop the ability to effectively self-evaluate, self-monitor, set goals, and attribute their results; all processes that exist within Zimmerman's model. Consequently, Rymal and colleagues examined the self-regulatory processes that were used by divers who viewed a feedforward self-modeling video within the competitive environment. In their research, a semi-structured interview session was conducted with the athletes directly after their competitions. The results suggested that participants engaged in a number of self-regulatory processes while using a self-modeling video. Particularly, the majority of the themes were representative of the processes and beliefs within the forethought and self-reflection phases, while very few reflected those found in the performance control phase. The authors suggested, however, that the lack of representation of the performance control processes may have been because their interview questions were not designed to address all the phases of Zimmerman's model. As a result, the researchers suggested that athletes should be questioned separately for each self-regulatory phase.

Ste-Marie and colleagues (2011) attempted to overcome some of the limitations of Rymal et al.'s (2010) research by developing a more elaborate interview questionnaire and increasing the sample size of the population studied. Twenty competitive gymnasts viewed a feedforward self-modeling video at competition and answered seven questions relating to how the gymnasts

used the video prior to, during, and after competing their beam routine. Zimmerman's (2000, 2004) self-regulation model was used for a deductive analysis of gymnasts' transcripts. The results were similar to that of Rymal et al.'s research. Specifically, most of the statements were related to processes and self-beliefs within the forethought phase (75%) and self-reflection phase (23.5%). The majority of the themes related to only specific processes or beliefs in the two phases. For example, 50% of the themes in the forethought phase were represented by strategic planning (i.e., controlling affect, directing cognitions, and directing motor execution) while outcome expectations, task interests, and goal orientations were not represented.

Although the above research on divers and gymnasts support that self-regulatory processes and beliefs do occur during a competitive performance when accompanied by a feedforward self-modeling video, probing questions were not used. Moreover, even though Ste-Marie and colleagues (2011) attempted to address all three phases of Zimmerman's (2004) model, the majority (i.e., four) of the questions still revolved around the forethought phase whereas only one of the questions was related to the performance control phase; perhaps contributing to the lack of themes in the performance phase. In both, Rymal et al., (2010) and Ste-Marie et al.'s, (2011) analysis of the interview questions, they have suggested that future research should develop a more extensive interview guide and incorporate probing techniques in order to obtain more detailed responses of the self-regulatory processes involved with the use of a self-modeling video.

Also, within Rymal and Ste-Marie's (submitted) investigation of self-modeling on gymnasts' competitive bar routines, they investigated whether psychological skills coupled with a self-modeling intervention would increase the videos effectiveness on physical performance. Possible group differences between gymnasts who partook in psychological skills training

workshops and gymnasts who did not take part were examined. Many of the gymnasts in Rymal and Ste-Marie's (submitted) research were also involved in another component related to this paper. Group differences, however, were not evident with the physical performance data. The described research here involves a qualitative component of that same investigation with emphases on the self-regulatory processes and beliefs of the gymnasts in competition. Despite no differences in physical performance, differences in self-regulation between those who participated in the psychological skills training workshops and those who did not may still occur due to the increased awareness of these processes gained through the training workshops.

Evidently, research has not only provided evidence that a self-modeling video can be implemented in a competitive environment to yield performance advantages (Rymal & Ste-Marie, submitted; Ste-Marie et al., 2011); some insight to the self-regulatory processes used during such an intervention has been provided. The qualitative methodologies used in those studies, however, were somewhat limited. Specifically, the interview guide in both Rymal and Ste-Marie (2010) and Ste-Marie and colleagues (2011) consisted of no more than six questions where the researcher did not probe gymnasts' responses. Thus, the brief nature of the interview and the lack of probing questions still limit our understanding of the extent in which a self-modeling video is used to self-regulate. Thus, this study is unique for the following reasons: Not only have we incorporated probing questions into the interview, the interview questions themselves have been developed based on the processes and self-beliefs found in all three phases of Zimmerman's (2000, 2004) model of self-regulation. Moreover, each phase consisted of one to two specific questions relating to the use of the video. Within each question, an additional two to four probing questions were asked that encouraged gymnasts to elaborate on their responses. Finally, this is the first study to explore whether the self-regulatory processes engaged in differ

when gymnasts are exposed to psychological skills training workshops prior to the use of the self-modeling intervention.

Method

This research was part of a larger research project investigating the combination of feedforward self-modeling with psychological skills training on physical performance and self-regulation in competitive gymnasts¹. The specific focus of this manuscript is the self-regulatory processes engaged in as a result of the self-modeling video and whether these processes were influenced by a psychological skills training provided to a subset of the gymnasts. Thus, the focus of this method section will be on the qualitative interview questions related to the self-regulatory processes and beliefs and the psychological skills training component of the research.

Participants

Ten female competitive gymnasts between the ages of 9 and 16 years old (M age = 11.33, $SD = 2.29$), selected from the 18 participants in Rymal and Ste-Marie's (submitted) research, were involved. The gymnasts were recruited through convenience sampling and word of mouth from a local gymnastics club in Ottawa, Ontario, Canada. Table 2 provides information concerning various descriptors of the population sampled in this research. As an overview, the gymnasts' competitive levels ranged from provincial level five to provincial level eight and the majority of gymnasts were within their first year competing at their current competitive level, although the total years of competitive experience ranged from two to five years. Gymnasts trained between 17-22 hours a week depending on competitive level.

¹ The results of the physical performance data is presented in a manuscript submitted to the *Journal of Sport and Exercise Psychology*.

Table 2

Descriptive of Gymnasts' Age, Competitive Level, Years of Experience Competing at that Level, Total Years of Competitive Experience, Number of Training Hours per week, and Visual Imagery Ability Scores.

Participant	Age	Group	Comp Level	Year at Comp Level	Total Comp Years Experience	Hours of Training / Week
1	10	SMO	5	1st	3	17
2	15	SMO	6	1st	5	17
3	11	SMO	7	1st	3	17
4	15	SMO	7	1st	5	17
5	9	SMO	5	1st	2	17
6	11	PST+SM	5	1st	2	17
7	10	PST+SM	5	1st	2	17
8	12	PST+SM	5	1st	3	17
9	9	PST+SM	7	1st	2	18
10	13	PST+SM	8	3rd	5	18-22

Note: SMO = Gymnasts who were put in the self-modeling only group. PST+SM = gymnast who were administered psychological skills training in addition to a self-modeling video. Comp = Competitive.

Materials

A Sony video Handycam camera (model number DCR-HC65/HC85), mounted on a tripod, was used to film the gymnasts during training to gather footage for the construction of the feedforward self-modeling videos. The Dartfish Pro Software (version 4.5.1.0) was used to edit the footage and construct the videos. Two portable Sony DVD players were used during the competitions and the addition of two Toshiba Satellite laptop computers with 15" x 16" screen sizes were used during the psychological skills training workshops. A Sony tape recorder (TCM-450DV) was used to record the responses of the interview questions.

Measures

Given that the focus of this manuscript is on the qualitative interview, the other measures used will not be described, and only the semi-structured interview will be presented. To note is

that the researcher adopts a post positivist paradigm, as such the semi-structured interview was developed based on Zimmerman's (2000, 2004, 2008) self-regulation model. When developing interview questions examining self-regulatory processes and beliefs, Zimmerman (2008) suggests that one should incorporate questions relating to all the phases of self-regulation (see also Rymal et al., 2010; Schmitz & Wiess, 2006). Thus, the interview consisted of questions referring to the thoughts, processes, and self-beliefs involved in the forethought, performance control, and self-reflection phases associated with a gymnast competing her bar routine, and having had the opportunity to use a self-modeling video. Of note is that the interview also consisted of general questions that were not specific to the self-regulatory processes involved while using a self-modeling video. For the purpose of this paper, however, only those questions specific to the use of the self-modeling video will be addressed.

An example of a forethought question used in the interview is "what did you use the video for right before you competed?" If the gymnast said she used it for task analysis, a probe might have been "can you tell me how watching the video helped with task analysis". Probes for specific components of any of the phases were only used if the gymnast first stated that the video was used for that particular process or self-belief. For the performance control phase a sample question is "did the video help with any strategies while competing?" If the athlete said yes and that it helped with self-instructions, this could be followed by "was there a key part of the video that helped with your self-instructions while you were competing?" as a probe. A self-reflection example question is "do you think your video had an influence on what you did after?" The gymnast may respond that it made them feel good after they competed an example probe is "why did it make you feel good?" (See Appendix A for self-modeling questions interview guide).

Worth mentioning is the procedure taken to develop these interview questions. The questions were initially developed by two researchers familiar with Zimmerman's (2000, 2004) model who have also had experience in qualitative methodologies. To ensure proper terminology, clarity of the questions, and the credibility of each question, three separate pilot interviews were conducted. The gymnasts' ages for these pilot interviews were, ten, twelve, and fourteen; none of whom were involved in the research (see Appendix B for pilot procedure). Between each pilot interview, four researchers met and discussed any issues that arose from the gymnast's transcripts and revised the questions accordingly. For example, after the first pilot interview, the researchers decided that a definition sheet of the terms related to Zimmerman's model should be explained and given to gymnasts to look back on for clarity throughout the interview (see Appendix C for Definition Sheet). Another result of the pilot interviews was the refinement of the probing questions to ensure that they were appropriate and clear.

Procedures

Pre-intervention. Permission to approach the gymnasts was granted from the gymnastics club and informed assent and consent from their parents was obtained. The original 18 gymnasts were placed into a self-modeling plus psychological skills training (PST+SM) or a self-modeling only group (SMO). Five of the gymnasts that were involved with the psychological skills training and five that were not were randomly chosen to be interviewed. For full details of the experimental procedures related to the creation and implementation of the self-modeling videos, the reader is directed to Rymal and Ste-Marie (submitted). A brief overview of the procedures is provided here, but with special emphasis on the interview and psychological skills training.

In order to construct the self-modeling videos, multiple attempts of each gymnast's bar routine were videotaped to obtain footage to create a feedforward self-modeling video. When constructing the video, the best performances of each skill that comprised the bar routine were chosen and edited together to create as near perfect a routine as possible. For example, if a gymnast had footage from ten full bar routines; the researcher could have selected the sixth routine's mount, the tenth routine's middle portion, and the second routine's dismount for the self-modeling video construction.

Intervention. The two groups underwent slightly different procedures within this phase of the research. The PST+SM group participated in a four week psychological skills training workshop one month prior to the competitive season, in which the SMO group did not attend. During the competition, both groups followed the same procedure. A brief description of the experimental intervention procedures for the psychological skills component will be discussed first and then the self-modeling intervention component will be presented.

Before the psychological skills training workshop, each participant's self-modeling video was constructed. The athletes then participated in six to eight 30 minute workshops that incorporated the self-modeling video. The number of workshops varied as a result of the size of the group, but the content of the workshop remained the same. The number of gymnasts partaking in a given workshop ranged from two to six and thus those in a larger group (e.g., a group of six) would have to wait to use either the DVD player or lap top. As such, these workshops would require two sessions to complete the material. This resulted in two sessions on imagery, two focus sessions, one to two sessions on goal-setting, and one to two sessions on self-talk. Thus, a total of four mental skills were involved in the research; that of, imagery, goal setting, focus, and self-talk. During these training workshops, the participants viewed their self-

modeling videos on either portable DVD players or lap top computers and were informed of ways in which the self-modeling video could assist in their learning of the mental skill. A description of the four week psychological skills training workshops is presented in the following paragraphs.

The first week of the workshops consisted of material related to focus/attention control. Within the first session, athletes were informed of the concept of attention focus and the four focusing styles described by Nideffer and Sagal (1998). Following this was a discussion of the possible ways in which their self-modeling video could help in controlling their focus/attention. As an example, the video could be used as a simulation training technique to highlight relevant performance cues that could be used to develop strategies during their competition and in turn encourage mindfulness. The second session consisted of athletes viewing their video and identifying where they believe they should focus their attention demands throughout the bar routine. This is thought to be a useful tool to develop focus strategies (Durand-Bush, 2010). For example, an athlete may believe that her attention demands should be narrow-internal when feeling the timing of her swing during a release move. The gymnasts then partook in a distraction control activity where their teammates attempted to distract them as they watch their video by calling her name, making noise, playing floor music as in competitions all while she attempted to stay focused.

During the second week, athletes were informed of how the self-modeling video could affect their imagery processes. In the first session, imagery modalities (visual and kinesthetic) and perspectives (first person and third person) were explained followed by a discussion on how the self-modeling video could be used as a means to provide a positive, controllable, vivid, external, visual image that could also lead to kinesthetic sensations. The Movement Imagery

Questionnaire-Revised (Hall & Martin, 1997; MIQ-R) was also administered in this session.

Within the second session, athletes viewed the self-modeling video and were able to slow it down, view it in real time, or the combination of both with the intent to help contribute to developing their ability to control the timing of their imagery. In addition, gymnasts were also encouraged to ‘feel’ their movements while they viewed their videos in order to experience both visual and kinesthetic imagery. The athletes then took part in self-directed imagery of their bar routine.

Within week three, the athletes were introduced to goal setting and how their self-modeling video could be used to develop appropriate goal setting strategies. The first session consisted of informing the gymnasts on how to set SMART goals (Durand-Bush, 2010), process, performance, and outcome goals. Session two consisted of viewing the self-modeling video and developing the types of goals that were explained in the first session. These goals were developed based on the proper form and techniques seen in their videos. For example, an athlete could set a short term process goal to keep her elbows straight in her kip mount on the bar, as seen in the video, at the next competition. Prioritizing and developing an action plan on how to implement their goals in training and competition also took place during the second session (see Durand-Bush, 2010, for workshop activities).

The fourth week consisted of the self-talk intervention where gymnasts were informed of how the self-modeling video could be used to help develop proper self-talk strategies. In the first session, self-talk was defined followed by an explanation of how the video could be used to create self-talk statements that may influence their belief system (e.g., self-efficacy statements), affect (e.g., mood words), and motor (e.g., instruction/technical self-talk). The second session consisted of athletes viewing their self-modeling video and developing positive instructional

self-talk statements relating to technical aspects of their skills seen in the video. Athletes also developed key words and trigger words to help direct their cognitions, affect, and motor execution.

Once the four week psychological skills training workshops were concluded, both groups underwent identical self-modeling intervention protocols during the competitive season. All gymnasts' self-modeling videos were constructed approximately one week prior to their competition and were updated throughout the competitive season. A within experimental design was used, thus gymnasts competed at four different competition sites and the self-modeling video was used at two of the four competitions in an alternating fashion. For half the participants, the video was observed at competition two and four and the other half it was used in competition one and three.

At the competitions where the self-modeling video was administered, gymnasts viewed their video on a portable DVD player immediately before competing on the event. At the conclusion of one of the experimental competitions, the gymnasts underwent a 20-30 minute interview related to the self-regulatory processes engaged in during the competition. The specific interview questions related to the self-modeling video were embedded within the entire interview guide; thus it is hard to specify the actual time for these questions, but an approximate time would be 5-10 minutes of the entire interview. The interview was conducted at the competition site directly after the gymnast competed her last event. Gymnasts compete on four events and each competition lasts approximately two hours. Therefore depending on when the gymnasts competed bars, the interview was conducted anywhere between a few minutes to one and a half hours after the event. Competitive gymnasts are used to the competitive environment

and thus this provided a comfortable environment to conduct the interviews; yet another factor decreasing response bias.

Analysis of Interview Questions

According to Creswell (1993), at least two verification procedures should be implemented when conducting a qualitative study. Taking this into account, an additional strength to this research is that the primary researcher involved in the data collection was a provincial competitive gymnast and a fully certified level two Canadian gymnastics coach, with more than 13 years of coaching experience. Furthermore, she has coached at the particular gymnastics club in which the gymnasts were recruited for six years. As a result, the gymnasts and researcher had developed a positive relationship of trust and respect over the time she has coached at the club. Therefore, we argue that the standard of prolonged engagement and persistent observation in the area of gymnastics has been met.

A second verification procedure performed was member checks. This procedure involved taking the data back to the participants for them to judge the accuracy and credibility of the conclusions/interpretations. Lincoln and Guba (1985) consider this to be “the most critical technique for establishing credibility” (p.314). Thus, member checks were performed with six of the ten participants, as the remaining four were unable to be contacted following the conclusion of the competitive season. During the member checks, the gymnasts were presented with their coded transcripts and the definition sheet that was used in the interview. Together, the primary researcher and the gymnast went over the entire transcript and discussed the codes given by the research to interpret the data. While discussing, the gymnasts confirmed or clarified whether the codes accurately represented what they had meant. All of six gymnasts confirmed the codes.

Therefore, it is our belief that the interpretations of the gymnasts' transcripts are representative of their thoughts, actions and beliefs.

In addition, we believe that we have provided a detailed and rich description of the participants and the research to allow the reader to understand the sample population and the constraints of the research implications (refer to Table 2). Taking these factors together, we have addressed three of the eight verification procedures put forth by Creswell, thus strengthening the standards of quality of our research.

Gymnasts' responses to the interview questions that were specifically related to the use of the self-modeling video were transcribed verbatim, with additional information related to such factors as the gymnast's tone of voice (joking or sarcasm) being kept in the first author's interview journal. General information to clarify when a gymnast got off topic and came back to their original discussion was also kept in this journal (see Hill, Thompsons, & Williams, 1997).

A content analysis was performed on the ten gymnasts' transcripts and were deductively coded using Zimmerman's (2000, 2004) model of self-regulation; therefore maintaining consistency with a post positivist paradigm. Although pre-existing codes based on Zimmerman's model were being used to guide this research, Creswell (2007) stated that researchers should still be open to additional codes during the analysis. Thus, we did not limit our coding to Zimmerman's model and we were open to creating new themes for any statements that were not defined within his model. Noteworthy is that despite being open to possible new codes outside of Zimmerman's model, this did not occur.

The analysis began with the identification of the broader self-regulatory codes described by Zimmerman and were grouped into components. For example, if an athlete commented on using many different strategies before she competed on the bars, this entire comment would be

coded as a Forethought Task Analysis. This resulted in three broad coding components for the forethought phase, six codes for the performance control phase, and three in the self-reflection phase. This was followed by a more in depth level of coding where the transcripts were scanned for specific processes and beliefs that were within the broader levels. Staying with the previous example, the gymnast's may have specifically stated the video encouraged the use of the strategies of self-talk and imagery before competing; thus creating a more extensive breakdown for each (i.e., Forethought-Task Analysis-Strategic Planning-Self Talk and Forethought-Task Analysis-Strategic Planning-Imagery). Lastly, the codes were examined as means to generate results related to the effects of a self-modeling video on gymnasts' self-regulatory processes. This included distinguishing whether statements related to influencing the gymnasts' motor execution, directing cognitions, or controlling affect.

In terms of the trustworthiness and credibility of the coding process, two researchers independently coded one of four randomly selected participant's transcripts. The coding was conducted based on definitions that had been prepared for each process and belief within Zimmerman's (2000, 2004) model (refer to Table 1 for an overview). These researchers were both very knowledgeable concerning Zimmerman's model and with qualitative coding, having been involved in publications related to the model in previous research. Following the coding of that individual, the two researchers met to compare their results, discuss terms and definitions, and make adjustments to the original coding criteria they were following. At this point, a third knowledgeable researcher in the area became involved to ensure the coding descriptions were clear and met with the terms and definitions from Zimmerman's model. During this step of the process, the three researchers spoke in an alternating fashion to limit the effect of power relationships within the group (Hill et al., 1997). From this interaction, it was decided that one

figure for each phase of Zimmerman's model that represented all possible components of coding would be developed. With these figures developed, the two researchers returned to coding the remaining three participants, meeting after each individual was coded. By the time these four interviews were coded, the two researchers were in full agreement of the definitions used to code the transcripts. Once inter-coder agreement was satisfied, the lead author coded the remaining six interviews.

Results

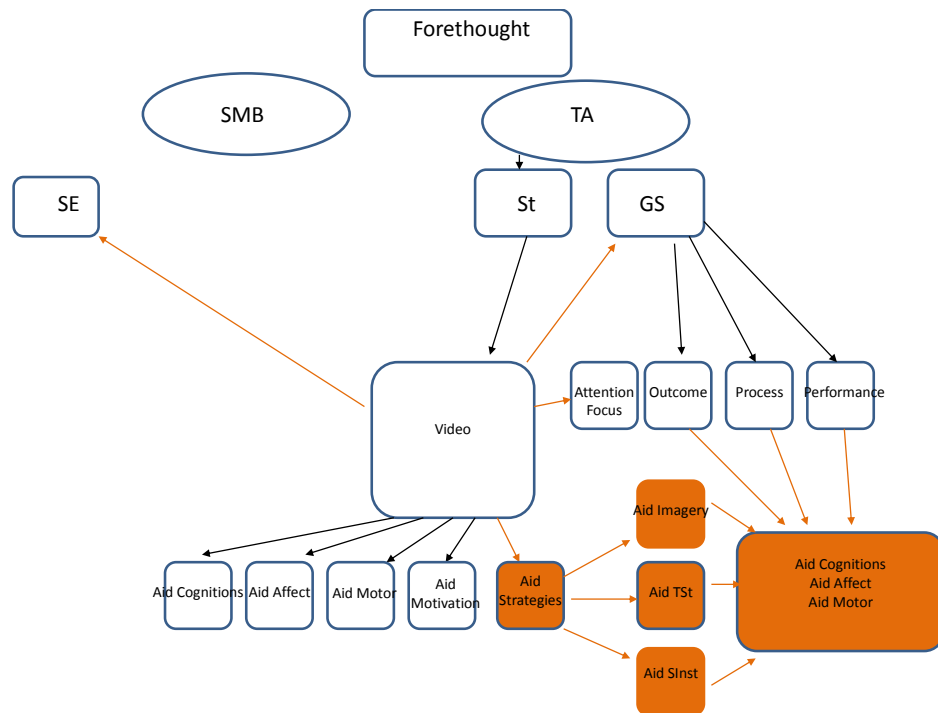
Before speaking directly to the results, it is interesting to note that a post-experiment examination concerning data saturation of the themes was met. Data saturation relates to the point in the analysis of interviews at which any new information produces little or no change in the codes (Guest, Bunce, & Johnson, 2006). Guest and colleagues explored the question of how many interviews are enough to get a reliable sense in terms of whether the themes and variability in the data set have been exhausted. They found that saturation occurred in the first twelve interviews but was also seen with higher order themes with as few as six interviews. In order to determine if saturation was met, each participant's transcript was coded using the coding templates that had been developed based on Zimmerman's (2000, 2004) model.

As a result of the coding, there were no codes that emerged outside of Zimmerman's (2000, 2004) model. There were, however, occurrences of codes related to self-regulatory processes or beliefs found within a phase that Zimmerman did not identify in his model. For example, Zimmerman does not have self-efficacy within the performance control phase, however, a gymnast did speak to the feelings of confidence in her ability to do a skill while actually executing the routine; thus we added self-efficacy as a concept in the performance control phase in our coding template. Moreover, Zimmerman (2000, 2004) puts forth that only

the strategic planning strategies are broken down to influence motor execution, directing cognitions, and controlling affect. During the analysis, however, we realized that this could be applied with other processes or beliefs within all three phases. For example, it was thought that a gymnast may remove herself from the other competitors to watch her video so she can concentrate on her skills for her upcoming event; thus she is avoiding being distracted from the other girls to focus on her routine to aid motor execution. As we expected, certain self-regulatory processes were in fact implemented, beyond just strategic planning, that were directed towards controlling affect, motor execution, or directing cognitions. As another example of this, the video could increase self-efficacy for the purpose of controlling motor execution. These final coding templates are seen in Figures 1, 2, and 3. To note is that these figures are set up slightly different than Zimmerman's (2000, 2004) description of the self-regulatory processes and beliefs. Specifically, many of the codes in the forethought and performance control phase went through the 'video' box as a result of the specific questions relating to the self-modeling video. Thus, these figures were developed in order to gain a clear picture of the self-regulatory processes and beliefs when accompanied with a self-modeling video. The highlighted areas are those self-regulatory processes or self-beliefs that emerged in a phase distinct from that described by Zimmerman, or directed motor, cognitive, or affective factors that were not defined by Zimmerman. These figures showed no changes following the coding of the seventh interview, showing data saturation had been met.

Figure 1

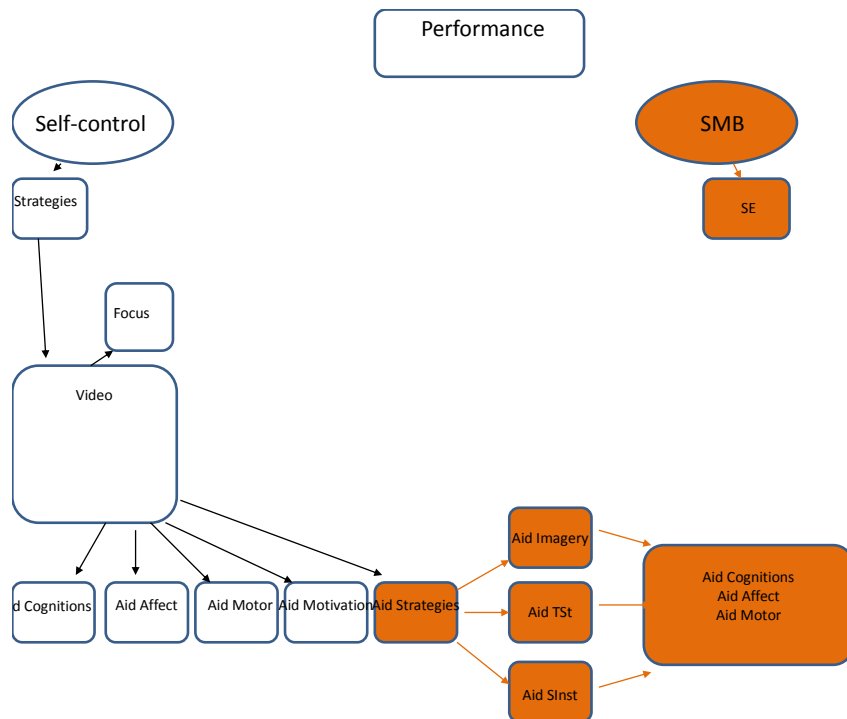
Final forethought self-regulatory components coding template



Note: This figure represents the coding template related to the interview questions relating specifically to the self-modeling video. Highlighted areas represent coding concepts that were added to Zimmerman's phases. Highlighted arrows acknowledge how processes can be used to influence other processes that were not originally described in Zimmerman's model.

Figure 2

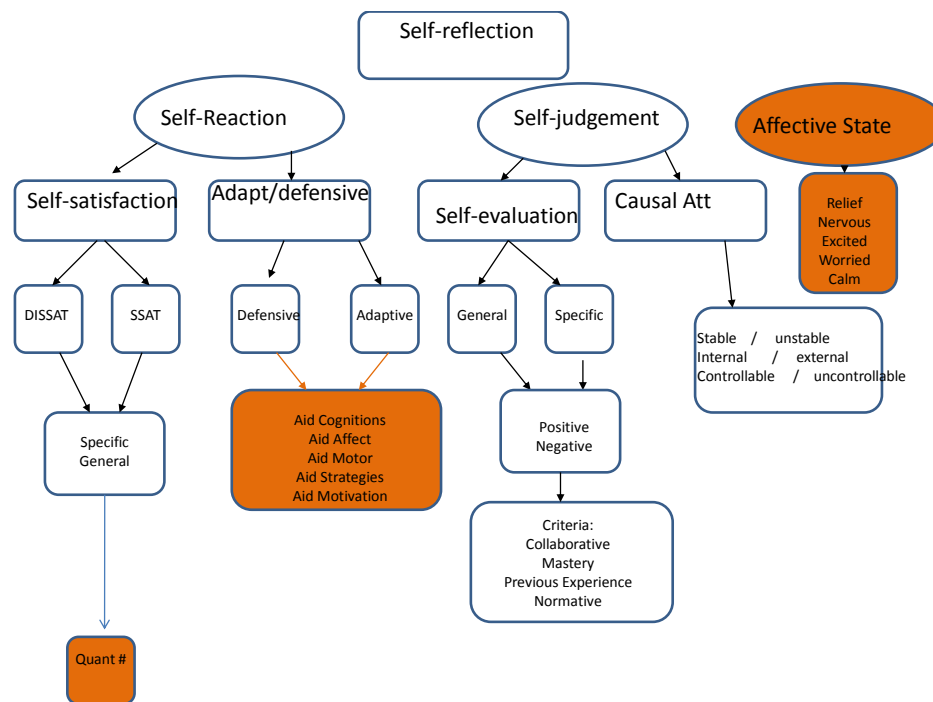
Final performance control self-regulatory components coding template



Note: This figure represents the coding template related to the interview questions relating specifically to the self-modeling video. Highlighted areas represent coding concepts that were added to Zimmerman's phases. Highlighted arrows acknowledge how processes can be used to influence other processes that were not originally described in Zimmerman's model.

Figure 3

Final self-reflection self-regulatory components coding template



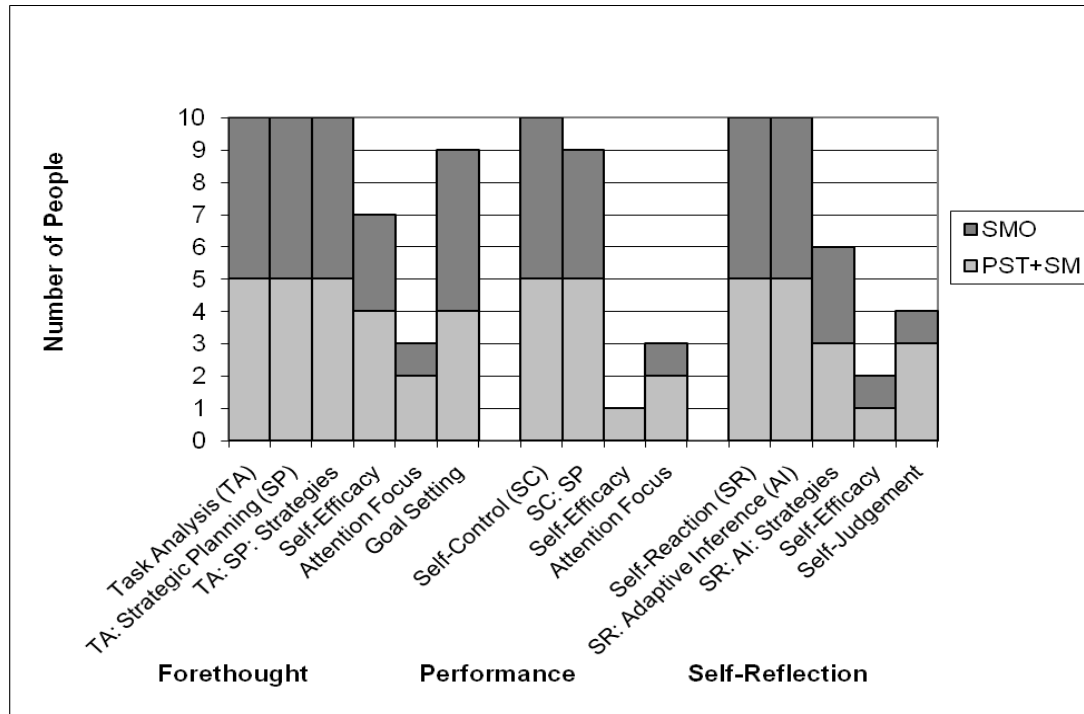
Note: This figure represents the coding template related to the interview questions relating specifically to the self-modeling video. Highlighted areas represent coding concepts that were added to Zimmerman's phases. Highlighted arrows acknowledge how processes can be used to influence other processes that were not originally described in Zimmerman's model.

For the remaining description of the results, the following decisions were made. First, we used the number of gymnasts that expressed the code, rather than the frequency of that code, to convey the data. Second, to determine if there were any difference between the gymnasts that were administered the psychological skills training and those that were not, the self-regulatory processes from each group were compared based on certain criteria. These were (a) in order for a self-regulatory process or self-belief to be compared it had to be represented by more than 33.3% of the sample, (b) for a difference to be identified there had to be at least a differential of three individuals between the two groups. For example, if six gymnasts commented on attention focus and five of the comments were from gymnasts in the psychological skills training group,

and only one from the other group, this would be identified as a self-regulatory process that distinguished the two groups. It is our belief that these criteria allow us to distinguish the self-regulatory processes engaged in with a self-modeling video and thus also addresses whether gymnasts use their video differently as a means to self-regulate during a competitive event based on the psychological skills training.

While there were a number of self-regulatory processes and beliefs that met the first criterion, none of those had a differential of greater than three across the two groups. Thus, there were no differences in the gymnast's responses to the interview questions as a consequence of the psychological skills training sessions (see Figure 4). To further confirm the lack of differences in the two groups, the researcher investigated the gymnasts' transcripts and differences were not found with respect of meaning/depth of responses between the two groups. Consequently, the results of these two groups (PST+SM and SMO) will be combined together in the subsequent sections of the results.

Figure 4. Self-regulatory processes and beliefs represented in the forethought, performance control, and self-reflection phases of gymnasts in the PST+SM and SMO groups.



Note: SMO = Self-modeling only. PST+SM = Psychological skills training plus self-modeling

Table 3 presents an overview of each participant's final coding. It is clearly evident from this overview that the self-regulatory processes and beliefs engaged in by the gymnasts involved all three phases of Zimmerman's model. For ease of organization, the results will be presented according to the three phases of Zimmerman's (2000, 2004) model.

Table 3

Self-regulatory processes and beliefs represented by each gymnast

Codes	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	Total
Forethought											
Task Analysis	x	x	x	x	x	x	x	x	x	x	10
Strategic Planning (SP)	x	x	x	x	x	x	x	x	x	x	10
SP: Strategies (St)	x	x	x	x	x	x	x	x	x	x	10
SP-St: Imagery	x	x	x	x		x			x	x	7
SP-St: Task Strategies	x		x		x			x	x	x	6
SP-St: Self-Instruction			x	x	x		x	x			5
SP: Focus		x				x				x	3
Goal Setting	x	x	x	x	x	x		x	x	x	9
Self-Efficacy	x	x		x			x	x	x	x	7
Performance											
Self-Control	x	x	x	x	x	x	x	x	x	x	10
Strategic Planning (SP)	x	x	x	x	x		x	x	x	x	9
SP: Strategies (St)	x		x				x	x		x	5
SP-St: Imagery	x		x								2
SP-St: Task Strategies			x				x				2
SP-St: Self-Instruction			x				x			x	3
SP: Focus		x				x	x				3
Self-Efficacy								x			1
Self-Reflection											
Self-Reaction	x	x	x	x	x	x	x	x	x	x	10
Adaptive Inference (AI)	x	x	x	x	x	x	x	x	x	x	10
AI: Strategies (St)			x	x		x	x	x	x		6
AI-St: Imagery			x	x		x	x		x		5
AI-St: Self-Instruction			x								1
AI-St: Task Strategies			x								1
Self-Efficacy		x						x			2
Self-Judgment					x		x	x		x	4
Self-Evaluation					x			x			2
Causal Attribution							x			x	2
Affective State										x	1

Note: P = Participant number. SP = Strategic planning. St = Strategies. AI = Adaptive inference. When reading the table, the video is seen as a strategy used by gymnasts to influence the self-regulatory processes and beliefs in each phase. For example, in the self-reflection phase the self-modeling video was used as an adaptive inference to help with other strategies such as imagery.

Forethought Phase

The self-regulatory processes and beliefs that gymnasts commented upon in relation to the forethought phase were related to both components of task analysis strategies as well as self-motivational beliefs. In relation to the task analysis strategies, comments were made in relation to strategic planning and goal setting. Under strategic planning, all ten participants stated that they used their video as a strategic planning process to help with other strategies (i.e., other mental skills). The most spoken about strategy involved the video influencing imagery. Seven gymnasts asserted that they used their video to help them visualize their routine before they competed. Participant 3, for example, stated that “the video helped me get a clearer image of what I was imagining”. While the video enriched the use of visual imagery for all seven gymnasts, one gymnast also mentioned that she used the video to help her both see and feel her movements during the bar routine. When asked what the video helped with, Participant 6 replied:

So I could see myself doing an almost perfect routine and so that I could like, while I am watching the video, I could like almost feel myself doing it so I know I can do it in my routine. Ya, because that way I know what it feels like to do an almost perfect bar routine.

The second highest represented strategy was task strategies. Six gymnasts used their video to help break down their skills into specific components. For example, one gymnast stated that “ok, so while I was doing my free hip I was thinking like I have to do it like that [the video] I have to go under the bar and then up” (P 10). Self-instruction was another strategy impacted upon by the use of the video according to five of the participants. Participant 7 discussed that the video helped her with “key words because if I say them when I am doing, or when I am watching the

video, then I know when to say them when I am actually going” she confirmed it again with “if I forgot about one key word I usually said in the gym and then when I watch the video it sort of reminded me”. The final strategy influenced by the video was focus. The video helped three gymnasts maintain a narrow, internal focus before competing on the bars. Participant 10 commented that the video “...helped with attention focus because it helped me think about what I am just about...well what I am about to do and not going off and that sort of thing”.

The video was also used as a strategy to help goal setting. Nine gymnasts mentioned that they used the video to set goals where eight set process goals and four used the video to set performance goals. As examples, participant’s goal was related to her “pike-on and the landing, and how I need to go up now, like in video, and not straight down for my pike off” (P 5) and another participant’s goal was “on my pike-on, to do more of a pike or else [there] would be deductions” (P1). Participant 4 used the video to set a performance goal such as “to do the bar routine just like in the video”.

With respect to self-motivational beliefs, seven gymnasts said that they used the video as evidence to increase their beliefs in their ability to perform the routine. When Participant 8 was asked what she used the video for right before she competed she answered “I just used it to prove to myself that I could do everything. To reassure myself” and confirmed later that she thought it helped because; “I could do everything in my routine really well and that I have done it more than once so I could do it again”.

Also, these processes and beliefs can be used to aid motor execution, direct cognitions, and control affect. Within this phase, only controlling motor execution and directing cognitions were represented. All ten participants at some point suggested using the video as a strategy to aid motor execution. This is seen in a variety of ways, whether it is through the use of the video

on its own, through goal setting, or through other strategies previously mentioned. An example of how the video was used as a strategy to control motor execution is seen within a participant's response to how she used the video; she replied that the video was used "for my casts and stuck landings because usually in competitions I don't usually get them" (P7). The video was also used as a strategy to help with the gymnasts' thoughts about their routine before competition (i.e., directing cognitions); however this was only specified by three gymnasts. When Participant 10 was informed that she was going to be asked questions about how her video helped, she said "it helped me think of how other people would see it and not just me, because I can't see my routine". As another example, a participant who was asked if the video had an influence on anything she did after mentioned that the video influenced her thoughts after her previous event (i.e., vault). Specifically, it helped her forget about her previous event and think about her next event, which was bars, "it doesn't matter what happened before just think of it done". When asked if what she meant was that it helped her forget of vault and think about bars she confirmed, "ya".

Performance Control Phase

In relation to the performance control phase, all ten gymnasts reported that they used the video for self-control strategies while competing their bar routine. Specifically, the video was used only to help with strategic planning. The dominant strategic planning processes in this phase was that the video was used to help with self-instructions, and four also said it was used to stay focused. As examples for each, Participant 10 pointed out that there was a key part in the video that helped her with self-instruction: She said "it helped me a lot because sometimes I miss it [free hip skill] and I just have to say 'do the video and go under the bar'". The researcher asked her to clarify if she had actually said 'do it like the video and go under the bar' while

completing and the gymnast confirmed that the video did in fact influence her to say it while she was competing.

The only other strategy the video was used for was attention focus. A participant (P6) supported that the video helped her to stay focused by saying “because when I view my video I could, well in my video I looked focused when I was doing my bar routine, and I was focusing when I was watching my video so when I did my bar routine I was focused on my bar routine just like in the video”. This was confirmed in one participant’s member check; she confirmed that she saw how focused she was in the video which, in turn, helped her stay focused while competing her routine (P6).

Similar to the forethought phase, the strategies used by the gymnasts could be seen to direct motor execution and cognitions, but not affect. In fact, the video could be seen to affect both cognitions and motor execution in a chain reaction kind of mode. As an example of this, Participant 7 stated that a sequence in her routine that went from the low bar to the high bar was of particular interest to her. Her comment was referring to how the video helped her connection from “the low bar to the high bar because sometimes [name of coach] says I arch my back when I jump to the high bar”. She was then asked to confirm if it helped you not arch and she replied “ya, so it helped me think of that because like before I didn’t think about that”; thus suggesting that she was using her video for breaking down her jump to the high bar (task strategies) which made her aware that she arched her back and therefore got her to think about not doing the arch during competition (i.e., directing cognitions). She did confirm in her member check that this process also helped her not arch her back while she was executing the jump during competition (i.e., directing motor execution). Another participant (P1) mentioned that the video served as a

strategy for her to remember what corrections her coach told her, thus showing another example of cognitions being directed via the video.

Self-Reflection Phase

When asked questions about how the self-modeling video may have been used after they competed, the statements made by the gymnasts were represented by self-reactions processes, all of which were related to adaptive inferences. Specifically, nine gymnasts reported on using adaptive inferences, with six of these nine gymnasts stating they would use the video to continue to assist with other strategies. The majority of these strategies were related to using the video to help with imagery ($n = 5$). For example, when asked if she would prepare differently or the same next competition Participant 4 stated “probably the same” and when asked if she would use the video again, either the same or differently, she said “ya the same, like for imagery and that kind of stuff”. This suggests that she would use the video to help her imagery next time, similar to the way to which she used her video to help her imagery this time: this is confirmed by her answers to other questions confirming that she did in fact use the video to help with her imagery; “The video helped with like imagery I guess because I could like see the video in my head. I already said this but it helps you like see yourself doing it”. Another gymnast (P7) who had not used the video for imagery the first time it was seen commented that she “would try some other things...I would try it with imagery”. These examples show that the gymnasts reflected upon the use of the video for future competitions.

Similar to the other phases, the comments provided showed that the video was being used as an adaptive inference to help with motor execution. This is seen in one participant’s comment “well if I could watch the video at every competition, I would definitely do that and ya to help my skills” (P2).

Discussion

The purpose of this study was to examine ten gymnasts' self-regulatory processes when administered a feedforward self-modeling video during a competitive event. We also examined whether differences in self-regulatory processes exist when gymnasts had been made aware of how the self-modeling video could affect other psychological skills through a specific training program that occurred throughout the month before the competitive season began.

Before moving into the discussion, there are two points noteworthy to mention. First, the ten gymnasts are representative of the entire sample involved in Rymal and Ste-Marie's (submitted) research. That is, the descriptive data from their competitions scores showed the same pattern of results; those who were high in visual imagery ability did not significantly benefit from the self-modeling video, but those who were low in visual imagery ability benefited from the self-modeling video later in the season. Second, it is our belief that the pilot interviews resulted in a clear script that the researchers followed and therefore increased the controllability of response bias of the gymnasts. Specifically, the questions were clear and concise to eliminate leading questions as well as to ensure that the gymnasts could interrupt the questions exactly the way they were meant. Further confirmation was seen when gymnasts clearly stated that they did not use specific self-regulatory processes or engage in specific beliefs: They were comfortable enough with the researcher to say 'no' when answering the questions.

In respect of the influences of the psychological skills training program, examination of the coding from participants' transcripts showed that no differences in self-regulatory processes and beliefs were found. This is somewhat surprising considering each of the workshops involved a psychological skill (attention focus, imagery, goal setting, and self-talk) that aligned directly with Zimmerman's (2000, 2004) self-regulatory processes. Moreover, the workshops

consisted of information on how one can use the self-modeling video to help engage in these processes. A potential reason for the lack of group difference could be related to the gymnastics training environment. Specifically, gymnasts train in groups of six to eight and socializing between athletes does occur. Therefore, gymnasts who partook in the workshops may have shared the information with those who were not in the workshops. In this case, one group would not have an advantage over the other.

Another possible reason may be related to how the coaches in this particular gymnastics club encourage their athletes to use psychological skills such as imagery, goals, self-talk, and focusing strategies. Therefore, these skills may have already been in the gymnasts' repertoire and the psychological skills training workshops did not provide further advantage. Evidence from the athletes' closing questions regarding the psychological skills training workshops, however, suggested that gymnasts felt it provided them with a more in depth understanding of how to use each psychological skill with the video. When asked if the workshops helped, one athlete said, "ya, because before that I wasn't really good at imageries but then after you told us like see yourself doing it, see your hands in a handstand... and then it helped me actually see that" (P9) while another gymnast said "it helped me understand what was going on...like how I could control things around me by saying what you want to do and doing it [self-talk]". Given these comments, we continue to be perplexed by the lack of differences between the two groups. A last possibility is that after the completion of the one month workshops, the gymnasts fell back into their usual self-regulatory behaviours and therefore did not retain or know how to transfer the extra advantages that they spoke about during the closing interview into the competition. Future research should consider incorporating psychological skills training workshops alongside a self-modeling video throughout the entire competitive season so gymnasts have consisted

exposure and reminders of how the self-modeling video and each skill can benefit one another (see also Rymal & Ste-Marie, submitted).

It is clear that this examination of the gymnasts' use of a self-modeling video during a competitive event has shown that self-regulatory processes and self-beliefs are engaged in all three phases of Zimmerman's (2004, 2008) model. It is our belief that having specific questions relating to each phase with the addition of probing questions was a major contribution from this research. That is, the appearance of self-regulatory processes found in the performance control phase which were lacking in previous research within a competitive sport environment (e.g., Rymal et al., 2010; Ste-Marie et al., 2011) is now evident. Furthermore, the nature of the interview questions provided a clear picture of how the video was used as a strategy to influence other processes and beliefs. Thus it is not that remarkable that the majority of the codes were representative of task analysis strategies in the forethought phase, self-control strategies in the performance control phase and adaptive inferences in the self-reflection phase; all of which are components associated with the use of a strategy. It is also understandable that many of the strategies evident in the forethought phases were carried through to the performance control phase, and then into the self-reflection phase as adaptive inferences. Such results coincide with Zimmerman's contentions of the cyclical nature of tri-phase self-regulation. To our knowledge, this is the first research to directly show this cyclical tri-phase occurrence of self-regulation in a sport environment.

In terms of the specific self-regulatory processes and beliefs used by the gymnasts, a number of gymnasts spoke about using the video for goal setting, task strategies, self-instruction, and attention focus. Their use of these reinforces the notion that feedforward self-modeling videos are showing the desired target behaviours. That is, the video is illustrating the proper

form and technique that they are able to do for all the individual skills in their routine. This in turn seems to be enabling them to use it to set goals related to their bar routine; specifically, process and performance goals. It was also used to provide the correct information to breakdown their skills and recognize proper technique, as well as to help them make self-talk/instructional statements associated with what they should do in their upcoming event. As for attention focus, the self-modeling video may have been the external stimulus gymnasts needed to prevent them from getting distracted while directing their attention to the proper form and technique seen in the video.

Gymnasts were also using the video with imagery. Imagery is of particular interest as many researchers have shown a strong similarity between observation techniques and imagery (e.g., Holmes, Cumming, & Edwards, in press). It was apparent that the video encouraged the use of imagery by helping the gymnasts create clear and controlled images of their bar routine. Furthermore, this was one process that was carried throughout all three phases of Zimmerman's (2004, 2008) model. A clear example of this was found in the transcript of Participant 3. She commented on using the video to help her with her with imagery before she competed, while bringing that image with her to the bar, and stated that she would use the video again in a similar manner with imagery in the future.

Self-efficacy was the only self-motivational belief that the gymnasts spoke of in the forethought. Their quotes made it quite obvious that viewing a video of the desired performance increased the gymnasts' beliefs in their abilities to perform their bar routine. Other qualitative examinations with divers, as well as gymnasts, have also shown that a self-modeling video makes them feel as though they can perform to the level seen in the video (Rymal et al., 2010; Ste-Marie et al., 2011). Bandura (1986, 1997) also supports this notion in that enactive mastery

experience and vicarious experience, which can be represented in a feedforward self-modeling video, are the two most powerful means to influence one's self-efficacy. Previous research using quantitative measures, however, has not found support for the effectiveness of a self-modeling video on one's self-efficacy (Rymal, 2007; Ste-Marie et al., in 2011). These conflicting findings point to the value of using qualitative methods and also suggest that further research should try to better understand the role of self-efficacy and self-modeling for performance enhancement.

At this point, the findings have not diverged greatly from Ste-Marie et al.'s (2011) research, yet there were some noted differences. One concerns the large number of goal setting comments made by gymnasts in this research ($n = 9$) whereas Ste-Marie and colleagues showed only a few goal statements (e.g., 3.4 %). We do recognize however, that we did have a specific question directed towards goal setting whereas in Ste-Marie et al.'s interview questions were open ended. Thus, a more directed interview strategy appears to have allowed us to gain a greater understanding of the extent of other processes used. Another contrary finding to Ste-Marie et al.'s research is that the majority of codes in the self reflection phase in that study were related to self-judgements, specifically self-evaluation; however in this study self-reaction statements were more prevalent. This could be related to the phrasing of the question in the self-reflection phase. Specifically, it states "knowing that you saw your video, do you think that the video had an influence on what you did after". It is possible that this could have been leading gymnasts towards thoughts of adaptive inferences; thus limiting the availability of gymnasts to make comments related to evaluations as seen with gymnasts on beam.

A further difference was the lack of support for the video being used to control affect. Only one gymnast's mentioned that she felt calmer after watching the video. This again differs to Ste-Marie and colleagues (2011) research where many of the statements by gymnasts

related to controlling their affect when administered a self-modeling video. However, in their research they had asked gymnasts how the video made them feel before competing and although we attempted to have the gymnasts also incorporate their feelings related to the video, a specific questions using the words “how did the video make you feel” was not asked. The word ‘feel’ may have been needed as a trigger word to tap into the gymnasts affective states during the bar event.

In conclusion, the use of a more in depth interview guide which involved all three phases of Zimmerman’s self-regulation model has provided a greater understanding of the processes and beliefs engage in before, during, and after competing on the uneven bars when administered a self-modeling intervention. Some unique findings of this study were that gymnasts were all engaging in some form of strategic planning as a means to self-regulate during the performance control phase. An interesting question in this regard arises, however; is it strategic planning in the performance phase or is it more an implementation of a plan that had been set earlier, and thus described better as strategic ‘doing’? While we do argue that one can strategically plan while competing a bar routine, for example, if a gymnast misses a required skill on the low bar she may instantly make a plan to incorporate an additional skill on the high bar to make up for her loss. However, the comments by gymnasts in this research suggest that they are using their forethought strategies and implementing (i.e., ‘doing’) them during their routine. This occurrence of strategic plans yielding strategic doing supports the cyclical nature of the model described by Zimmerman (2000, 2004). Not only did processes and beliefs emerge in other phases, it is now evident that many strategic planning strategies are not the only methods for influencing motor execution, directing cognitions, and controlling affect (e.g., goal setting). The information gained from this content analysis stresses the importance of qualitative research

methods when exploring complex processes such as self-regulation in a competitive context. It is our belief that integrating questions relating to all three phases of Zimmerman's model followed by probes has allowed us to gain a greater understanding of the gymnasts' competitive self-regulatory mechanisms.

Another point is related to the importance of choice of words in interview questions. For example, the word 'feel' may trigger more elaborate responses relating thoughts, feeling, actions, and beliefs from athletes. Future researchers adopting Zimmerman's model should consider incorporating the use of the exact words defined in his model.

This research is beneficial both practically and theoretically. At a practical level, athletes, coaches, and practitioners could incorporate a feedforward self-modeling video during a competitive event as a strategy for athletes to use to self-regulate their thoughts, beliefs, and behaviours. Theoretically, Zimmerman's (2000, 2004) model of self-regulated learning seems to be a good starting point when exploring competitive self-regulatory processes and beliefs. Clearly, the results support the cyclical fashion of Zimmerman's (2000, 2004) model however, the processes and beliefs are not restricted to the phases described by Zimmerman (2000, 2004). As such researchers should remain open to emerging processes and beliefs in all phases. This study does not, however, allow us to make any causal relationships about self-modeling video increasing self-regulatory processes. The question remains whether the self-regulatory processes and beliefs are increased when a video is administered compared to when athletes do not have a self-modeling video. Thus, an analysis that compares competitive self-regulation with and without a self-modeling video would be fruitful.

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Appendix A

Forethought questions (before competing)

To get started, I would like you to think about the time from when you started walking to the bars after the last event you just competed to just before you presented to the judge to compete bars. Is it clear what time frame I mean (clarify if needed). Now we are going to talk about things that you did, your thoughts and your feelings and that sort of thing before you competed, so think about that time

- 1) I know you viewed your video to help you prepare for your bar routine, so now I am going to ask you questions related specifically to the video
(*this question will only be asked if they do not spontaneously mention the video-we will keep track of whether the info came up spontaneously or had to be asked*)
 - a. What did you use the video for right before you competed. What did you do exactly?
 - i. Why did you use it?
 - b. Why did you decide to do that? (repeat what they said if needed)?
 - c. How exactly did you use the video, can you give me a few examples?

So you found the video useful for ...(REPEAT)
 - a. Do you think it helped you with any of the strategies you said you used
(*referring back to Q2 here*)?
 - i. Can you tell me how watching the video helped you with those strategies (*repeat strategies*)
 - ii. If you look at the SHEET here do you think the video helped you with anything else when getting ready to compete bars?
 - iii. How exactly did the video help you with those strategies?
 - d. Now, did the video help you set goals?
 - So specific for your bar routine, what goals did the video help you set?

Performance control questions (while competing)

Now that you have just told me a lot about what was happening before you did your bar routine, we are going to move on to talk about while you were on the bars ok? So for the next few questions I want you to think about the time from when you did your mount, so when you

touched the bars, to the time you did your dismount and landed your competition bar ...so this is while you are actually on the bars. Is this time frame clear to you?

- 1) Again, knowing that you saw the video, did the video help with these strategies while competing?
 - a. Was there a key part in the video that helped ? (repeat if anything was said)—while competing
 - b. So would you say that, while you were competing, the video helped...(repeat what they said and relate it to the video)
 - c. Any other strategies? You can look at your sheet

Self-reflection questions (after competing)

Now that we have talked about all the interesting things about before going to bars and about while you were on the bars during your bar routine, I would now like to know more the time from when you landed your bar routine to the time you moved to your next gymnastic event.

- 1) Knowing that you saw your video, do you think that the video had an influence on what you did after?
(prompts will be given if answers are brief)
 - a. What did it have an influence on?
 - b. Why do you think it influenced what you did?
- 2) Overall, did you find the video helped/did not help you do your bar routine?
 - i. How? Or why not?
- 3) Would you prepare differently or keep things the same at the next competition?
 - a. Would you use the video again?
 - i. Would you use it in the same way or differently? How?

Appendix B

Pilot procedures

In the first pilot, the gymnast was asked to think back to a previous competition and was asked general questions about processes and beliefs that may have occurred at the competition. This pilot interview, however, did not incorporate specific questions relating to the use of a self-modeling video. During the second and third pilot interviews, however, the video was administered to gymnasts. The gymnasts were videotaped performing their bar routine during training hours, viewed their video three times, and then followed a simulated competition procedure in front of their coach and teammates. Following this, the gymnasts were asked both general self-regulation questions as well as specific questions relating to the self-modeling video. The interview was conducted approximately ten minutes after the gymnasts did their bar routine. Between each pilot interview, four researchers met and discussed any issues that arose from the gymnast's transcripts and revised the questions accordingly. For example, after the first pilot interview the researchers decided that a definition sheet of the terms related to Zimmerman's (2000, 2004) model should be explained and given to gymnasts to look back on for clarity throughout the interview. Another result of the pilot interviews, which is also a uniqueness to this research, was the addition of appropriate probing questions in order to gain an in depth knowledge of the processes engaged in during a competition. Once the adjustments based on the pilot studies were made, the definition sheet and the interview questions were sent to two additional researchers familiar with qualitative interviewing methodologies as well as Zimmerman's (2000, 2004) self-regulation model. The two researchers' final comments were addressed.

Appendix C

Thoughts: Examples:

I think I can get an A in math

Thinking about how to solve specific math problems, like the formulas you use or what numbers I need to add together to get the correct answer.

Feelings: Examples:

I would be happy if I got an A in math

I'm nervous when the test is a hard one

Actions: Examples:

I reviewed my notes before going in to write the test

I wrote out the formulas I would need or the seven times table on the top of the test as soon as I got it because I find those hard to remember

Strategies

Imagery: visualizing, seeing movements, feeling movements in side your head.

For example, "I imagined myself sitting at my desk writing the math test, feeling the pencil in my hand, and seeing my notes in my head"

Self-instructions: instructions you may give to yourself (internal or out loud), usually inside your head, that help you to do the skills or make yourself feel a specific way.

For example, "I am going to do the more difficult math questions on the test first and then I will go back to the easier questions after"

Attention focus: thinking about things that are important at that time (relevant) or ignoring or eliminate distractions. Staying in the moment.

For example, "I kept my eyes on my paper so I could concentrate on my test"

Task Strategies: breaking your skills down to specific parts.

For example, "I broke the math problem down to look at each part separately in order to get the final answer". "To add three numbers, I began by adding the first two, got an answer and then added the third one"

Goal setting: making goals or setting objectives to achieve a task.

For example, "I am going to get higher than a B on this math test".
"I am going to start studying a week before the test"

Planning: making the choice to do something to complete the task or do something different next time; making a plan to be able to complete the task successfully or to change something, or avoid something.

For example, “Next time I am going to start studying for my math test three days earlier” or “Next time I am going to avoid studying with a group of people”.

Article 3: Does Feedforward Self-Modeling Influence Competitive Gymnasts' Self-Regulatory Processes and Beliefs?

Abstract

Competitive athletes have been shown to employ self-regulatory processes and beliefs during competition when accompanied with a self-modeling video (e.g., Ste-Marie, Rymal, Vertes, & Martini, 2011). This study was interested in examining whether the administration of a self-modeling video influenced self-regulation more than no self-modeling video. Nine gymnasts underwent two interview sessions; one at a competition where they viewed their self-modeling video and the other at a competition in which they did not. A content analysis was performed on the gymnasts transcripts using Zimmerman's (2000, 2004) model of self-regulation. The findings suggested that the video influenced processes and beliefs that are represented in the forethought (i.e., before) phase related to self-motivational beliefs and task analysis strategies as well as the self-reflection (i.e., after) phase linked to adaptive inferences.

Does Feedforward Self-Modeling Influence Competitive Gymnasts' Self-Regulatory Processes and Beliefs?

There has been a growing interest in the use of video technology in the sport environment, with it being used by athletes, coaches, and other practitioners for a variety of reasons (Ives, Straub, & Shelley, 2002). Recently, the use of feedforward self-modeling has been shown to have a positive impact on competitive performance for gymnasts (Rymal & Ste-Marie, submitted; Ste-Marie, Rymal, Vertes, & Martini, 2011). Feedforward self-modeling is one of two categories of self-modeling; a modeling technique that only allows observers to see desired performance outcomes (Dowrick, 1999). The feedforward technique of self-modeling is distinguished by the fact that observers have the opportunity to view them self on an edited video performing a skill that they have not yet achieved in a specific sequence or context (Dowrick). This is accomplished by editing video footage from previous performances to show the best behaviours/skills together to create a new skill sequence or context. In the gymnastic setting, for example, gymnasts can often perform individual gymnastic skills flawlessly on their own, but when connected with other skills, may have some execution problems. To create a feedforward video, footage from training can be used to select out the best performances of individual skills that can then be seamlessly edited together to make it appear that the entire routine is being performed to the best level possible. In this research, our interest is in understanding why feedforward self-modeling videos enhance competitive performance.

Although research has shown positive effects of a self-modeling video on competitive performance, a noted weakness is the limited understanding of the underlying psychological mechanisms that may have contributed to the effectiveness. Researchers in this area have proposed that self-regulatory beliefs and processes should be examined to help tease out such

mechanisms when investigating advantages related to self-modeling (Dowrick, 1999; Ferrari, 1996; Starek & McCullagh, 1989). Rymal, Martini, and Ste-Marie (2010) heeded that advice and examined the self-regulatory processes and beliefs of divers who were provided with a feedforward self-modeling intervention before competition. Although they started with an inductive qualitative methodology, they determined that the comments of the divers coincided with the concepts presented in Zimmerman's (2000, 2004) self-regulation model. Zimmerman's model is situated within Bandura's (1986, 1997) Social Cognitive Theory which has been shown to be a valuable framework in which to understand observational benefits (McCullagh, Law, & Ste-Marie, in press; McCullagh & Weiss, 2001). For these reasons, we continue to use Zimmerman's model of self-regulated learning as our theoretical framework in which to understand the benefits of self-modeling. Given its importance in our research, Zimmerman's model will be outlined next (see Table 1 for an overview of all processes and beliefs within his model).

Table 1

Description of the Self-Regulatory Processes and Beliefs within the Phases of
Zimmerman's Model of Self- Regulation.

Forethought Phase	Consists of the processes and motives to self-regulate before the behaviour
Task Analysis	
Goal Setting	Stating specific intentions or outcomes to learning or performance.
Strategic Planning	Choosing or creating strategies to direct cognitions, motor execution, and/or affect
SP: Self-Instruction	Self-verbal/non-verbal instructions
SP: Imagery	Creating or recalling mental images (visual/kinesthetic)
SP: Task Strategies	Analysis of task subcomponents by breaking down the behaviour into specific parts
SP: Attention Focus	Concentrating or avoiding distractions
Self-Motivation Beliefs	Beliefs in the capability to self-regulate
Self-Efficacy	Beliefs in specific capabilities to learn or perform effectively
Outcome Expectations	Beliefs about the ultimate benefits or liabilities about learning or performance
Task Interest/Value	The value (intrinsic/extrinsic) given to the task
Goal Orientation	The rationale for learning or performing (learning, mastery, task, or ego orientation).
Performance Control Phase	Processes involved during the performance of the behaviour
Self-Control	Specific method and strategies to direct cognitions, motor execution, and affect
Strategic Planning	Choosing or creating strategies to direct cognitions, motor execution, and/or affect
SP: Self-Instruction	Self-verbal/non-verbal instructions
SP: Imagery	Creating or recalling mental images (visual/kinesthetic)
SP: Task Strategies	Analysis of task subcomponents by breaking down the behaviour into specific parts
SP: Attention Focus	Concentrating or avoiding distractions
Self-Observation	Observing and keeping track of learning processes and performance
Self-Recording	Keeping a physical record of performance
Metacognitive Monitoring	Keeping track of learning or performance mentally
Self-Reflection Phase	Processes involved after the performance of the behaviour
Self-Judgment	Judgments related to learning or performing
Self-Evaluation	Using self-monitored information and comparing them with a standard or a goal (self-criteria, social criteria, mastery criteria)
Causal Attribution	Reasons given to performance outcomes (controllable/uncontrollable)
Self-Reaction	Reaction toward learning or performance
Self-Satisfaction	Satisfaction/dissatisfaction of prior learning or performance
Adaptive/Defensive Inference	Reactions related to the effectiveness of prior strategies and decision to retain/adapt a new strategy or to avoid a strategy

Note: SP = Strategic Planning.

Zimmerman (2000, 2004) proposed that one regulates performance through three cyclical phases; forethought, performance control, and self-reflection phase. The first phase of Zimmerman's model is the forethought phase and thus relates to the thoughts, feelings, and beliefs used to prepare the individual in advance of the behaviour. This phase is divided into task analysis and self-motivational beliefs. Task analysis involves strategic plans chosen by the individual for directing cogitations, controlling affect, or controlling motor execution (Zimmerman, 2000). In fact, Zimmerman only mentions the use of strategic planning as a means to effect these three variables (cognitions, affect and motor execution); but in this paper, we argue that these three variables can influence performance through many of his other processes and beliefs in the model. For example, if we consider goal setting, the other sub-component with task analysis, we argue that the gymnast could set a goal that deals directly with each of these variables. A gymnast whose goal is to keep calm before she competes, for instance, is using a self-regulatory process to control affect. Alternatively, her goal may be to maintain her attention focus and not be distracted by the crowd; an example for directing cognitions. Indeed, research by Rymal and Ste-Marie (in preparation) supports this contention as they showed that other self-regulatory processes and beliefs outside of the category of strategic planning could be used to direct cognitive, affective, and motor aspects of performance.

Self-motivation beliefs are the next component within the forethought phase and relates to the beliefs in one's capabilities to manage thoughts, feelings, and actions (Bandura, 1997). There are four sub-components within self-motivational beliefs; self-efficacy, outcome expectations, goal orientation and intrinsic interest. It is thought that these beliefs interact with the choice of strategies used by individuals. For example, if a gymnast has high beliefs in her

ability to perform her skills she is more likely to implement positive self-instructions which in turn could also be used to aid motor execution.

The second phase of Zimmerman's (2000, 2004) self-regulated learning model is the performance control phase. The processes and beliefs in this phase occur while physically attempting the skills as a means to improve the quality of mental and physical activities (Zimmerman, 2004). There are two components; the self-control component and the self-observation component. Similar to the task analysis processes in the forethought phase, self-control processes consists of strategies used by the individual to direct cognition, control affect, or control motor execution. To note, is that these strategies differ from those in the forethought phase in that they are employed during the execution of the skill and not before the skill. As for the self-observation component, these processes involve keeping track of specific aspects of the behaviour either by physically recording or mentally monitoring the behaviour.

Self-reflection is the third phase within the model. These beliefs and processes refer to the individuals' self-judgments and self-reactions in regard to their previous behaviour. Self-judgments relate to evaluating and giving reason to performance (e.g., causal attributions). Self-reactions are feelings of satisfaction or dissatisfaction in relation to the behaviour, and, in turn, making decisions of future self-regulatory efforts to adapt, retain, or avoid previous strategies.

To our knowledge, only three studies have examined the self-regulatory processes engaged in when administered a self-modeling intervention during a competition (Rymal, et al., 2010; Rymal & Ste-Marie, in preparation; Ste-Marie et al, 2011). In each of these examinations of self-regulation in relation to a self-modeling video, it was clear that a number of self-regulatory processes were employed. In Rymal, et al., (2010) and Ste-Marie, et al., (2011) the majority of the athletes' verbalizations related to the processes and beliefs found within the

forethought phase and self-reflection phase. Particularly, the dominant themes in the forethought phase were related to task analysis strategies and self-efficacy beliefs. The self-reflection phase was represented mostly by causal attributions. The performance control phase was rarely represented in either study. Of note, however, is that there were no interview questions related to the performance control phase in Rymal, et al. and only one question simultaneously queried its influences in the performance control and self-reflection phases in Ste-Marie, et al. As a result, the development of a more extensive interview guide consisting of questions relating to the possible processes and beliefs within all phases of self-regulation was suggested in both papers.

Given this, Rymal and Ste-Marie (in preparation) developed an interview guide based on Zimmerman's (2000, 2004) model of self-regulatory processes and beliefs that consisted of questions related to all three phases of Zimmerman's model. Moreover, each question was followed up with probes that enabled a more in depth understanding of these processes. A final unique aspect of their research was that they included a psychological skills training program one month prior to the competitive season for half of the gymnasts. Each of these training sessions was accompanied by a personal feedforward self-modeling video. Rymal and Ste-Marie questioned whether this psychological skills program would enhance the self-regulatory processes engaged in on the part of the gymnasts. Although there were no differences between those who partook in the workshops, all gymnasts stated they used the video as a strategy in the forethought, performance control, and self-reflection phase. The gymnasts commented that they used the video in the forethought phase to help with other strategies such as creating clear images, producing self-instructions or key words, and breaking the skills in their routine down to essential parts (i.e., task strategies). The video was mainly used for creating self-instructions in the performance control phase and it was used as an adaptive inference in the self-reflection

phase. It is clear that the specific questions related to the use of the self-modeling video followed by probing questions showed a more comprehensive understanding of the self-regulatory processes and beliefs when administered a self-modeling video. Although all three phases of Zimmerman's model was addressed, the authors noted that the specific questions related to the use of the self-modeling video did not contain questions related to all possible processes and self-beliefs. For example, *how did the video make you feel*, a question that would tap into affective states, was not asked. This interview, however, does include a question on feelings, therefore providing more opportunity to gain an understanding of the affective components associated with the self-modeling intervention.

In Rymal and Ste-Marie's (in preparation) paper, however, the focus was only on the use of the self-modeling video and did not consider the self-regulation of gymnasts in general. Moreover, we still do not know whether self-modeling in fact encourages more self-regulation than no self-modeling. To date, no research has compared self-regulatory processes and beliefs found in the self-modeling intervention to the control intervention. Consequently, it is still unknown whether the administration of a self-modeling video influences self-regulatory processes and beliefs more than no self-modeling video. Thus, the unique contribution of this study is that interview sessions were conducted with gymnasts both when they viewed their self-modeling video and when they did not; enabling us to contrast the use of self-regulatory processes and beliefs under these two conditions.²

² Rymal and Ste-Marie (submitted) and Rymal and Ste-Marie (in preparation) compared the effects of psychological skills training on performance and self-regulation; their results did not show benefits of psychological skills training. Therefore, this examination will focus on the differences between the self-regulatory processes and beliefs engaged in with and without the self-molding video.

Method

This research was part of a research project that included examining the effects of the feedforward self-modeling video, alone or combined with other psychological skills, on physical performance³, and self-regulatory processes engaged in as a results of viewing the video⁴. For this paper, the focal research question is whether a feedforward self-modeling video enhances self-regulation. Hence, the method section will emphasize these components (see Rymal & Ste-Marie, submitted for other details).

Participants

Nine female competitive gymnasts who were members of a local gymnastics club in Ottawa, Ontario, Canada participated in the study. Their ages ranged between 9 and 16 years old (M age = 11.33, SD = 2.29). These nine gymnasts were in Rymal and Ste-Marie's (in preparation) study concerning the self-regulatory processes and beliefs when administered a self-modeling video. One gymnast had to be excluded because she was not able to participate in an interview following the competition where no feedforward self-modeling video was provided. The gymnasts' competitive experience, levels, and hours of training per week varied within the sample (see Table 2). Specifically, the competitive levels ranged from provincial level five to provincial level seven, all of whom were in their first year of competing at that level. The total years experienced ranged from two to five years and gymnasts train between 17 and 18 hours a week.

³ The results of the physical performance data is presented in a manuscript submitted to the *Journal of Sport and Exercise Psychology*.

⁴ The results related to the self-regulatory processes and beliefs specific to the self-modeling video are presented in an in-preparation manuscript.

Table 2

Gymnasts' Descriptive Data of Age, Competitive Level, Year of Competitive experience at that Level, Total Years of Competitive Experience, and Number of Training Hours per Week.

Participant	Age	Comp Level	Year at Comp Level	Total Comp Years Experience	Hours of Training / Week
1	10	5	1st	3	17
2	15	6	1st	5	17
3	11	7	1st	3	17
4	15	7	1st	5	17
5	9	5	1st	2	17
6	11	5	1st	2	17
7	10	5	1st	2	17
8	12	5	1st	3	17
9	9	7	1st	2	18

Note: Comp = Competitive.

Materials

Participants' feedforward self-modeling videos were constructed using the Dartfish Pro Software (version 4.5.1.0). In order to gather the footage to create the videos a tripod was set up from the side angle of the uneven bars and a Sony video Handycam camera (model number DCR-HC65/HC85) was used to film the gymnasts during training. Gymnasts viewed their videos on two portable seven inch screen Sony DVD players during the competitions and the psychological skills training workshops. Two Toshiba Satellite laptop computers with 15" x 16" screen sizes were also used during the workshops. A Sony tape recorder (TCM-450DV) was used to record the responses of the interview questions.

Measures

To situate the reader to the means by which the interview guides were developed, and the data later analyzed, the research adopts a post positivist perspective. As such, two semi-structured interview questions were developed based on Zimmerman's (2000, 2004, 2008) self-

regulation model: One set of interview questions was used after those competitions in which the self-modeling intervention was used (experimental interview; EI), while the second interview was conducted when no self-modeling video was provided (control interview; CI). The differences between these two interviews resided in the addition of questions relating to the specific use of the self-modeling video in each phase of Zimmerman's (2000, 2004) model. Precisely, the specific self-modeling interview questions from Rymal and Ste-Marie's (in preparation) study were embedded within the experimental interview questions but all other questions remained the same between the two interviews. Specific to this paper, only the questions that were the same in both interviews are analyzed as we are exploring possible similarities and difference in the self-regulatory processes engaged in when administered a self-modeling intervention and when a video was not viewed. The choice for removing the self-modeling questions from this analysis was to ensure that comments relating to the use of the video were not inflated because a greater number of questions were asked during that interview that were specific to the use of the video. With the same, and equal, number of questions we can accurately determine if the video does in fact influence self-regulation. When developing the interview questions, the experimental interview was developed first and once the final version was achieved, the questions specific self-modeling video were removed; thus resulting in the control interview questions. Therefore, the development of the interview questions will be discussed as one procedure for the entire interview set (i.e., all questions involved).

When developing interview questions examining self-regulatory processes and beliefs, Zimmerman (2008) suggests that one should incorporate questions relating to all the phases of self-regulation (see also Rymal et al., 2010; Schmitz & Wiess, 2006). Thus, the interview consisted of questions referring to the thoughts, processes, and self-beliefs involved in the

forethought, performance control, and self-reflection phase. An example of a forethought question is “now tell me anything that you did to prepare you for your bar routine?” This would be followed by a probe such as, “do you think that (answer) helped you think about other or different strategies you wanted to do?” For the performance control phase a question would ask “while you were on the bars were you focusing on anything specific?” A probe could be “why do you think you chose to focus on those things?” A self-reflection question was “what kind of thoughts did you have after you competed?” A probe such as, “how would you explain your performance. Why do you think you did it the way you did it?” would be asked following the question (see Appendix A for Interview guide). Also worth mentioning is that before the questions within each phase were asked, participants were first situated to the time frame that represented each phase. For example, to situate gymnasts to the period of time related to the performance control phase, the researcher said;

Now that you have just told me a lot about what was happening before you did your bar routine, we are going to move on to talk about while you were on the bars ok? So for the next few questions I want you to think about the time from when you did your mount, so when you touched the bars, to the time you did your dismount and landed your competition bar. This is while you are actually on the bars. Is this time frame clear to you?

A three step procedure was used to develop these interview questions. First, a set of questions were developed by two researchers, with experience in qualitative methodologies, who also were very knowledgeable on the topic of Zimmerman’s (2000, 2004) model. Second, three pilot interviews were conducted in order to ensure proper terminology, clarity, and credibility of each question. The gymnasts’ ages were ten, twelve, and fourteen; none of whom were involved in the total research program. The second step occurred after each pilot interview. Four

researchers would examine the gymnast's transcript and revise the questions or make other suggestions when issues or uncertainties arose. For example, after the first pilot interview the gymnast expressed she didn't know what was meant by strategies, thus the researchers decided that a definition sheet of the terms related to Zimmerman's (2000, 2004) model should be explained and given to gymnasts to look back on for clarity throughout the interview (see Appendix B for Definition sheet). Another result of the pilot interviews, which is also a uniqueness to this research, was to ensure appropriate probing questions were used at appropriate times in order to gain an in depth knowledge of the processes engaged in during a competition. Following this iterative pilot testing process, the final step followed involved the four researchers giving approval to the final interview questions that were completed.

Procedures

Pre-intervention. Permission to approach the gymnasts was granted from the gymnastics club and informed assent was obtained from the gymnasts, along with informed consent from their parents. Again, this is part of a larger research project and therefore the number of gymnasts in each group pertains to the nine participants who were involved in both the experimental and control interview sessions of the research.

To construct the self-modeling videos, video footage of the gymnasts' bar routines during training sessions in which they wore their competitive attire was recorded. The video was constructed using the best performances of each skill within the bar routine and edited together to create as near perfect a routine as possible. For example, if a gymnast had footage from eight full bar routines the researcher could have selected the first routine's low bar sequence, the sixth routine's high bar sequence, and the second routine's dismount for the creation of the self-modeling video.

Intervention. Approximately one week prior to the first competition, all the gymnasts' feedforward self-modeling videos were constructed and these were updated throughout the competitive season. The gymnasts participated at four competitions where two of the four competitions they received the self-modeling intervention and the other two acted as a control (i.e., no video provided). The administration of the video was counterbalanced throughout the competition season. Specifically, half the gymnasts viewed their self-modeling video at competitions two and four where the others viewed their video at competitions one and three.

At the competitions where the self-modeling video was administered, approximately five minutes prior to their competitive warm up on the uneven bars the gymnasts viewed their video three times. The video was viewed once again after warm up before competing. After one of these competitions, the gymnasts were asked the experimental interview questions related to the self-regulatory processes engaged in with respect to their competitive bar routine. The interview lasted approximately 20-30 minute. Although the specific questions relating to the self-modeling video were embedded within the entire interview guide, they only took up approximately 5-10 min; thus the general questions related to this study were about 20 minutes.

At the control competitions, gymnasts were not administered the self-modeling video and instead followed their own typical preparation for the event. Similar to the competition where the self-modeling video was administered, the gymnasts' underwent the self-regulation interview questions at the conclusion of one of the control competitions (i.e., control interview questions).

Although the interview questions were asked directly after the competition, gymnasts compete on four events and the competition lasts approximately two hours. Therefore depending on when the gymnasts competed bars, the interview was conducted anywhere between a few minutes to one and a half hours after the event.

Analysis of Interview Questions

When examining the standards of quality and verification in qualitative research, Creswell (1998) suggests that at least two verification procedures should be implemented. In this study, we have attempted to strengthen our research by implementing three of the eight standards suggested. Standard one involved doing member checks. These were performed on six of the nine participants' transcripts for both the experimental and control interview questions; the remaining three gymnasts were unable to be contacted. Lincoln and Guba (1985) consider this to be "the most critical technique for establishing credibility" (p.314). Member checks involved the data being given back to the participants for them to judge the accuracy and credibility of the conclusions/interpretations. Therefore, within the member checks, each gymnast was given her coded transcript for both the experimental interview and the control interview along with the definition sheet that was used during the actual interviews. The researcher and the gymnast went over both transcripts and discussed whether the codes given by the researcher were in fact representative of her responses. Within this discussion, the gymnast was able to confirm or clarify whether the codes accurately represented what she had meant. No major changes were made during the member check. Two of the six gymnasts, however, offered slight changes and these were made at the final coding level. For example, the researcher coded a comment as a self-instruction strategy used in the forethought phase to help control affect, but during the member check, the participant clarified that she used the self-instruction to help her stay focused. Due to the fact there were very few changes to the codes, we believe that we have provided valid interpretations of the gymnasts' transcripts related to their self-regulatory processes; which leads into standard two. Along with concise interpretations of the transcripts, a detailed and rich description of the participants and the research has been provided and thus the reader is informed

of the sample population and the constraints of the research implications (refer to Table 2). That is, we believe that we have allowed the reader to make decisions about transferability, constraints, and implications of the study by providing a detailed and rich description of the participants and the research.

The third standard addressed is that we believe that prolonged engagement and persistent observation within the sport of gymnastics has been met. That is, the primary researcher involved in the data collection is a fully certified Canadian Provincial Level Two artistic gymnastics coach who has been coaching at the particular gymnastics club for over six years. Therefore, she has developed a positive report of trust and respect between herself and the gymnasts. The researcher also has previous experience competing in gymnastics as she was a competitive gymnast's for seven years.

Gymnasts' responses to the control and experimental interview questions were transcribed verbatim. In addition, the lead researcher kept a journal and documented changes in the gymnast's tone of voice (joking or sarcasm) during interviews, and general information to clarify when a gymnast got off topic and came back to their original discussion.

A content analysis was performed on both of the interview transcripts of the nine gymnasts. Therefore, a total of 18 interviews were analyzed. The transcripts were deductively coded using Zimmerman's (2000, 2004) model of self-regulation; thus staying consistent with a post positivist paradigm. As suggested by Creswell (2007) we remained open to additional codes that may not exist within Zimmerman's model throughout the analysis. Thus, the coding process was not limited to Zimmerman's model and we were open to creating new themes for any statements that were not defined within his model. Noteworthy is that despite being open to possible new codes outside of Zimmerman's model, this did not occur.

To analyze the gymnasts' transcripts, we started with the identification of broader self-regulatory codes and grouped them into components based on Zimmermans's (2000, 2004) descriptions. Again, the gymnasts were oriented to the time frame associated with the questions before going into the levels of coding. As an example, a comment would be coded as 'Self-Reflection, Self-Judgement' if within an entire response the gymnast made evaluations (i.e., self-evaluation) of her performance and gave reasoning's for why she did what she did (i.e., causal attributions). This broader level of coding resulted in three codes for the forethought phase, six codes for the performance control phase, and three in the self-reflection phase. Once the broader codes were completed they were then broken down further based on the processes and beliefs that fell within that code. Working with the previous example, the gymnast's may have stated that she thought her bar routine was better than her typical performance during practice and that she thought she did better because she was able to see herself perform on the video. Therefore, this code was then broken down into two separate codes such as Self-Reflection-Self-Evaluation-General-Positive and Self-Reflection-Causal Attribution-External (Video). The last level of coding was used to generate results related to self-regulatory processes engaged in with the administration of the self-modeling video. Within this last level, statements were distinguished based on whether they related to influencing motor execution, directing cognitions, or controlling affect. Distinguishing whether codes were related to motor, cognitions, or affect was applied throughout the gymnasts' entire transcripts; however only those that could be clearly distinguished were classified at this final level.

To ensure credibility and trustworthiness of the coding process, two researchers, that have been involved in qualitative methodologies using Zimmerman's model, and thus were knowledgeable on the topic, independently coded one of four randomly selected participant's

experimental interview transcripts. When coding the transcripts Zimmerman's (2000, 2004) definitions for each process and belief was used (refer to Table 1 for an overview). Once the researchers completed coding the first gymnast's transcript, they met and discussed their results based on the terms found within the responses and the definitions used in Zimmerman's model. Adjustments to the original coding criteria were made when needed. A third researcher then joined to ensure the coding descriptions were clear and met with the terms and definitions from Zimmerman's model. To limit the effects of power relationship during these discussions, the researchers spoke in an alternating fashion (Hill et al., 1997). At the conclusion of this meeting, the three researchers thought it would be easier to develop three figures/templates related to each of the phases which represented all possible components of coding when analyzing the gymnasts' transcripts. The two original researchers then continued this process for the remaining three participants. By the end of the four independent coding sessions, both researchers were in full agreement of the definitions used to code the transcripts and all coding categories being used. Given that we satisfied the inter-coder agreement criteria, one researcher coded the remaining interview data.

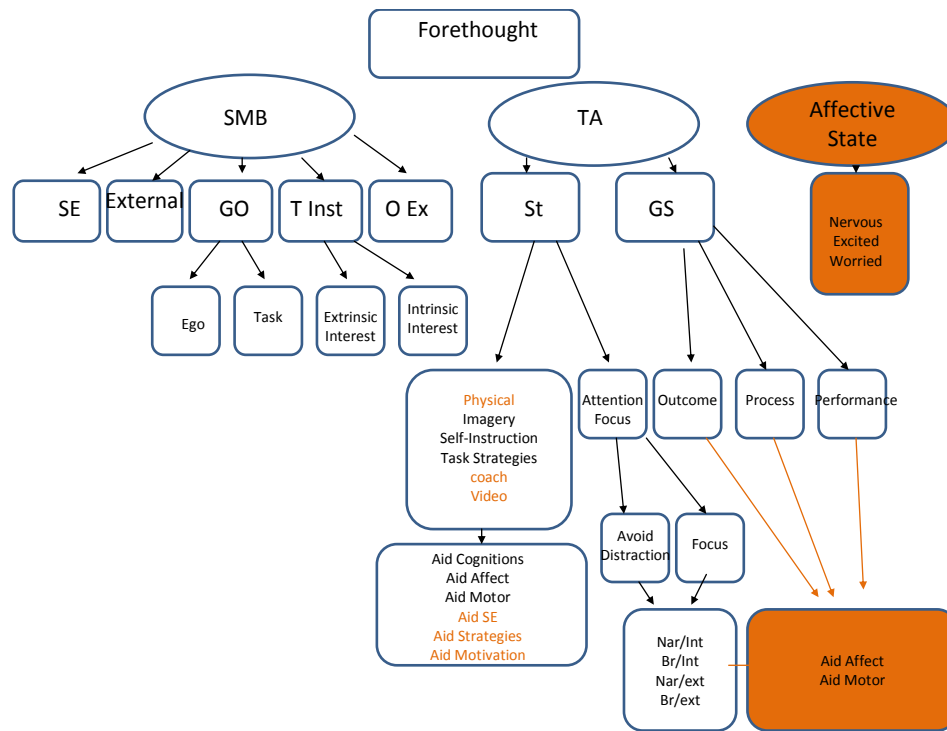
Results

Prior to discussing the results, we would like to acknowledge that although the gymnasts were not recruited based on purposive sampling techniques for the purpose of reaching data saturation, we examined the coding procedure and found that data saturation was in fact met (see Guest, Bunce, & Johnson, 2006 for review). We determined whether saturation was met by coding each participant's transcript using the coding templates that had been developed during the first four interview coding procedures. Therefore, the three templates were used to code the gymnasts' responses. A point of interest in the development of this coding template concerns

our openness to the idea that any of the self-regulatory processes or beliefs found within this model could exist in any of the three phases of self-regulation. That is, when a gymnast mentioned a process or belief that was not represented in that phase according to Zimmerman's (2000, 2004) model we placed it as a concept that could occur within that phase. As an example, according to Zimmerman, self-satisfaction is found within the self-reflection phase, however, a gymnast mentioned a feeling of satisfaction when performing her routine; therefore this was added as a concept in the performance control phase in our coding template. Furthermore, changes in the coding templates were also based on Rymal and Ste-Marie's (in preparation) findings suggesting many processes and beliefs found within all three phases can be related to directing motor execution, cognitions, and controlling affects. By completion of the seventh gymnasts' transcript, no new codes were added to the coding template. The remaining two participants could be coded completely within the developed coding template (see highlighted areas in Figures 1, 2, and 3 for processes and beliefs that go beyond that presented in Zimmerman's model).

Figure 1

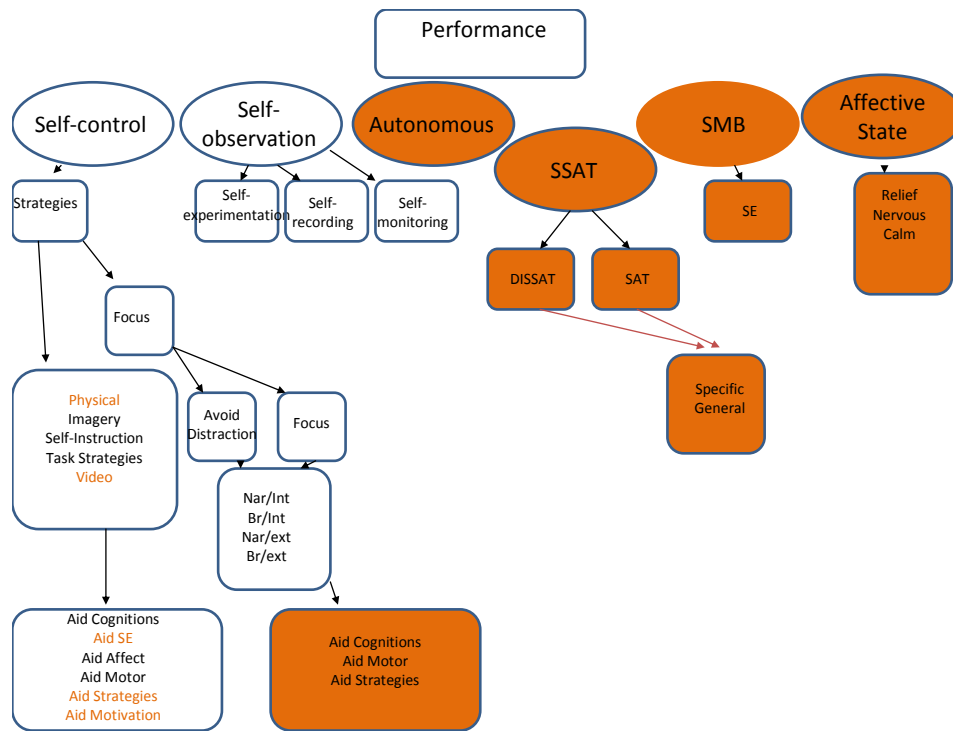
Final forethought self-regulatory component coding template



Note: Highlighted areas represent coding concepts that were added to Zimmerman's phases. Highlighted arrows acknowledge how processes can be used to influence other processes that were not originally described in Zimmerman's model.

Figure 2

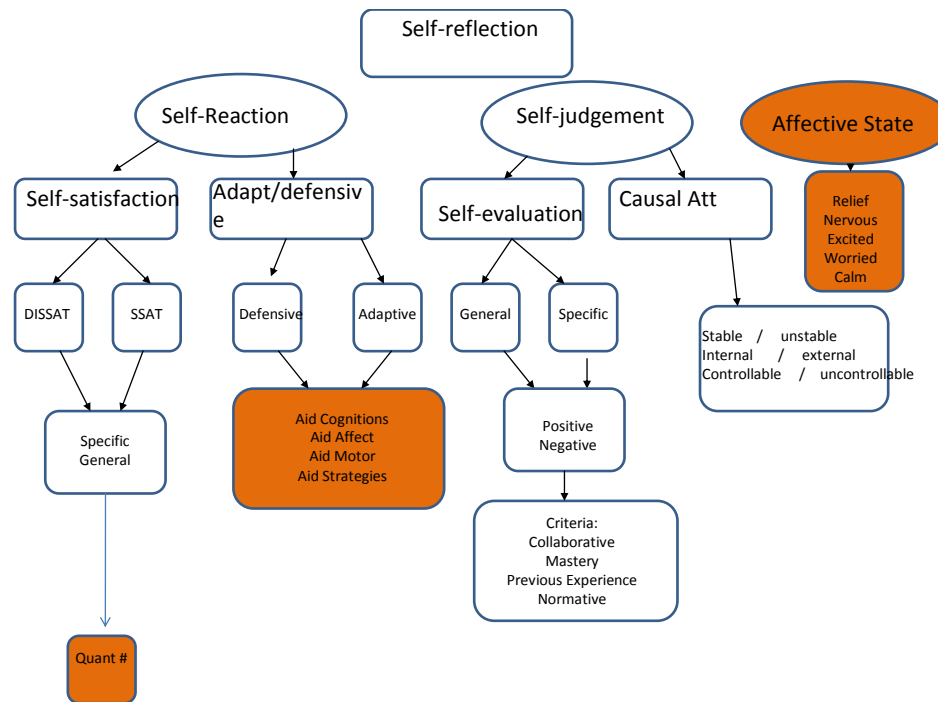
Final performance control self-regulatory component coding template



Note: Highlighted areas represent coding concepts that were added to Zimmerman's phases. Highlighted arrows acknowledge how processes can be used to influence other processes that were not originally described in Zimmerman's model.

Figure 3

Final self-reflection self-regulatory component coding template



Note: Highlighted areas represent coding concepts that were added to Zimmerman's phases. Highlighted arrows acknowledge how processes can be used to influence other processes that were not originally described in Zimmerman's model.

The presentation of the results was based on the following criteria; first, the analysis of transcripts was based on the number of gymnasts that expressed the code. Codes that were identified by at least 1/3 of the gymnasts were defined as meriting inclusion in the results. As well, the defined criteria for a difference between the experimental and control conditions were a difference of at least three persons for any particular code. The results will be presented based on the three phases of Zimmerman's (2000, 2004) model of self-regulated learning. Within each phase, both similarities and differences will be presented.

Forethought Phase

Similarities between the self-regulatory processes and beliefs concerning the availability of the video are seen within both the components of self-motivational beliefs and task analysis. The comments related to self-motivational beliefs were related to task interest beliefs, specifically intrinsic interest. Here, both with and without the administration of the video, gymnasts valued performing their routine for its intrinsic properties and not for any external rewards (EI; $n = 9$, CI; $n = 7$). As an example, one gymnast said “I just wanted to do my best and have a good competition” (P3), when asked what motivated her to compete.

Also, it would appear that gymnasts used many task analysis strategies the same when viewing their video and not viewing their video. Specifically, all nine gymnasts used strategic planning strategies. When strategies were examined, similarities were within self-instructions (EI; $n = 7$, CI; $n = 8$), task strategies (EI; $n = 5$, CI; $n = 4$), and physically preparing (EI; $n = 5$, CI; $n = 3$) for their bar routine. An example of self-instruction is seen when Participant 8 was asked what she did to prepare for her bar routine and why she chose to do that. She stated:

I said the key words over and over again. Like ‘keep my feet at the bar’, faster with my leg lift for kip, shoulders in front, and then open hips on up rise, and then big cast for straddle off, and just hollow and stick.

Gymnasts also seem to be breaking their skills down into essential parts (i.e., task strategies), one gymnast (P6) commented that she used task strategies to break down the execution of her mount (i.e., kip); she used it “to stretch my kip, kip extension then I have to use my heels to do a high cast”. Preparing physically for their bar routine was another strategy used by gymnasts before they competed. An example of an athlete physically preparing for her routine is she warmed up

on the floor bar, “because I could jump up to handstand as if I was doing kip cast to handstand on the low bar...” (P3).

Goal setting was another self-regulatory process among the gymnasts that the administration of the video did not seem to influence (EI; n = 9, CI; n = 7). Specifically, gymnasts seem to be setting process goals related to the skills in their bar routine (EI; n = 5, CI; n = 6). For example, Participant 1 stated that her goal was for, “my cast. To get my cast up really high”. This clearly shows that she was setting a goal about a specific behaviour within her performance (i.e., process goal).

Comments related to affective states did not seem to differ either (EI; n = 9, CI; n = 7). When affective states were broken down further to specify how gymnasts were feeling, feelings of nervousness (EI; n = 3, CI; n = 3) and excitement (EI; n = 7, CI; n = 7) were expressed. Participant 4 stated that she felt “nervous because my warm-up wasn’t very good. It’s normal for a competition anyways because I usually am”. Of note is that all comments related to feeling nervous were described as being a normal feeling, and not linked to negative or unusual feelings during competition. Statements were also made about feeling excited before competing. An example of feeling excited was seen in a participant’s comment, “I was excited to get everything started and stuff” (P2). Similar to feelings of nervousness, excitement was also seen as a normal feeling before competing.

Although many processes and beliefs were not influenced by the self-modeling video, differences did exist in the self-motivational belief of self-efficacy (EI; n = 4, CI; n = 1), imagery as a task analysis strategy (EI; n = 4, CI; n = 7), and attention focus (EI; n = 6, CI; n = 3). Furthermore, the reason for using strategies varied; directing cognitions (EI; n = 5, CI; n = 2) and controlling affect (EI; n = 1, CI; n = 4) were different between the two interview transcripts.

Within self-motivational beliefs, gymnasts reported being more efficacious in their ability to perform the bar routine. For example, Participant 1 commented “I felt pretty confident that I could do it. I felt confident because I know I can do it. I felt confident to go to the high bar”. Another participant (P2) was surprised how confident she felt when she stated, “kind of confident actually”; she later confirmed that she is not usually confident on bars but at that competition she was.

The differences found within task analysis strategies were associated with imagery and attention focus. With respect to imagery, gymnasts used imagery more at the competition than the video was not administered. When asked what she did to prepare for her bar routine at the competition that the video was not administered, Participant 7 mentioned “I visualized...because sometimes it just helps me see what I am doing so I think about it”. As for attention focus, however, it was at the competition that the video was seen that gymnasts used focusing strategies to a greater extent. One gymnast (P8) said that she was thinking about “stay[ing] focused, take one thing at a time and that to not, well to stay focused and not think about anything else except bars”. This is a clear example of how she attempted to stay focused on her event and to avoid the environment around her.

In addition, many of the processes used as strategies by gymnasts were broken down further into helping motor execution and influencing their beliefs. All nine participants mentioned that they used a self-regulatory process to help with their motor execution before competing their bar routine; this, however did not depend on whether the video was administered. For example, Participant 8 stated that her goal was to, “to make sure I tried to get the same amount of swing for my up rise in the front and the back”; clearly a goal related to her

motor execution. Another example involved self-instruction being used as a strategy to break down skills (i.e., task strategies) with the intent to influence motor execution. Participant 5 said;

I think I used the one where you say it in your head...I said to myself in my head like ‘... Kip, but make sure you open it and stretch out and then do this cast, and you should have a good cast because you stretched it out, back hip circle then flip both hands so that it’s not too late.

In relation to processes used as strategies to influence gymnasts’ belief system, specifically self-efficacy, more comments were made when the video was administered (EI; n = 5, CI; n = 2).

When asked what she did to prepare for her bar routine, Participant 3 said “I did imagery as well” and when probed why she said “well right before my routine on bars, like my actual showing routine, I do it [imagery] to show me that I can do it...a good routine”. Thus, the gymnast has chosen to use imagery as a strategy to increase her beliefs in her ability to do a good routine.

Performance Control Phase

All of the codes represented by gymnasts were similar between the experimental and control interviews for the performance control phase. Namely, at both competitions gymnasts’ remarks were associated with self-control strategies, attention focus, autonomous behaviours, and comments related to their affective states. The self-control strategies used were task strategies (EI; n = 5, CI; n = 6) and self-instructions (EI; n = 5, CI; n = 5). For task strategies, after being asked what was happening during her bar routine, Participant 9 responded “I was thinking about blocking my handstand... and bending my knees for my landing”, showing that she was breaking down elements in her routine. As for self-instruction comments, Participant 7 indicated that she used key words such as “stretch kip and shoulders over”. When asked why she

chose to use key words she stated “because you can’t really visualize while you are on the bars so using key words is easier”.

Gymnasts were also directing their attention to aspects of their performances during their bar routine (EI; $n = 8$, CI; $n = 9$) regardless of the self-modeling video. One participant mentioned that;

I was focusing on certain moves in my routine... if I rush ahead too far I’ll be thinking about what comes after instead of what I’m doing now, so chances are that I won’t do my skill as well as if I’m thinking about what I’m doing now and not what comes after (P3).

For autonomous behaviours, gymnasts mentioned not remembering what they were doing while competing and that some of their behaviours came automatically (EI; $n = 4$, CI; $n = 4$). As stated by Participant 4, “nine times out of ten I don’t think it’s kind of like auto pilot or something”.

Furthermore, another participant (P1) said “sometimes you just think of nothing”.

In relation to comments made about affective state while competing, gymnasts reported feeling calm. For example, when asked what her feelings were while she was competing, Participant 2 responded “I am more calm as soon as I touch the bars, I don’t know I am more accustomed to that feeling”

Similar to the forethought phase, these processes can be broken down for the purpose of motor execution, directing cognitions, and controlling affect. Here, however, for those statements that were clear for classification, it was only motor execution emerged as the primary goal. Participant 4, for example, remarked “I was thinking for the take off to squeeze my bum and keep my abs tight...”

Self-Reflection Phase

Once again, mainly similarities were noted for this phase analysis; with the exception of one process of adaptive inferences showing differences between the two conditions. Similarities in the processes and beliefs of gymnasts that were representative of the self-reflection phase found in the component of self-reactions relating to self-satisfaction and adaptive inferences, as well as the self-judgement category describing evaluations and causal attributions, and comments about affective states. Within self-reactions, all gymnasts identified either feelings of general satisfaction about their performance (EI; $n = 9$, CI; $n = 8$) and/or feeling satisfied about specific skills in their routines (EI; $n = 5$, CI; $n = 7$). A general satisfaction statement was seen with Participant 5 when she was asked if she was satisfied with her routine, she replied “ya, well I thought it was actually a really good routine”. An example of specific self-satisfaction comment was “I had done my goals, I got my handstands and I stuck it [dismount]” (P9). Some gymnasts, however, expressed feeling dissatisfied with specific (EI; $n = 3$, CI; $n = 4$) aspects of their performance. Participant 8 was dissatisfied about specific skills she had performed in her routine, she mentioned “I was a bit disappointed after my uprise because I knew I could have had straighter arms”.

Another self-reaction commented on by gymnasts was adaptive inferences (EI; $n = 9$, CI; $n = 8$). Specifically, gymnasts were making similar adaptive inferences after both competitions (EI; $n = 3$, CI; $n = 4$); that of adapting the strategy to prepare physically. As an example, when asked if she would prepare differently or the same at the next competition, Participant 4 replied “I would like to have a little bit more preparation, a little bit more floor work and stuff before my bar routine”. For clarity, floor work for the bar event consists of physically going through movements on the mats or floor bar such as handstands or handstand pirouettes.

In relation to self-judgment statements, gymnasts evaluated their performance positively in comparisons to previous performances (EI; $n = 3$, CI; $n = 4$). Participant 1 commented that “I’ve improved more on I think my kip, like my long kip from the high bar to the dismount, and also improved my kip cast”. Causal attributions were also reactions gymnasts noted; all of which were stable, internal, and controllable factors explaining their performances (EI; $n = 8$, CI; $n = 6$). One participant explained her performance was good “because I got my cast, I got my tuck on... and I think I stuck the landing. Ya, I did...and because I warmed up really well” (P6).

Similar comments for affective states were also noted. Specifically, gymnasts expressed feelings of relief after they had competed (EI; $n = 5$, CI; $n = 5$). A statement made by one gymnast’s was, “I’m glad I’m finished my competition, my bars, I’m just glad I’m just done” (P5) while Participant 1 also articulated feeling “kind of relieved that it is over”.

As a final point, the self-modeling video appeared to affect the use of imagery and use of the video differently between the two conditions. Seven of the gymnasts’ adaptive inferences commented they would use imagery ($n = 4$) or the video ($n = 3$) in the next competitions, however, no comments were made during the control interview in relation to implementing imagery or the video for future performances. The use of imagery as a strategy to use in the future can be seen in a comment made by Participant 6; “I probably keep things the same and use imagery again”. Participant 2 explained she would also keep things the same “if I could watch the video at every competition I would definitely do that”.

Discussion

This aim of this study was to examine whether a self-modeling video influenced the self-regulatory processes and beliefs of gymnast during a competition differently than when no video was provided. Although research to date has shown self-regulatory processes are engaged in

conjunction with a self-modeling video, no one has tested whether increased self-regulation occurs as a consequence of the video. Here, we were able to directly compare the self-regulation of gymnasts under the condition of viewing a feedforward self-modeling video or not viewing a video, thus enabling an investigation into SM causing a change in self-regulation.

Before discussing the results, we would like to point out that the gymnasts who participated in the interviews were representative of the entire sample in Rymal and Ste-Marie's (submitted) research. Specifically, the descriptive pattern of their competitive bar scores showed that those who were high in visual imagery ability did not significantly benefit from the self-modeling video, but those who were low in visual imagery ability did later in the season (see Rymal & Ste-Marie, submitted). Thus, I believe the interview data speaks directly to the results of that research which showed enhanced competitive performance outcomes late in the season for gymnasts who were low in imagery ability.

Additionally, I would argue that the development of the interview guide further supports the data speaking directly to the results. Specifically, it has strengthened the ability to control response bias of the gymnasts. Not only was there a definition sheet for gymnasts to refer back to, the interview questions were designed in a clear and concise way as to not confuse the interviewee and interrupt the questions as they were meant. Thus, the researcher followed a clear script and therefore decreased possible response biases on the part of the gymnasts. The responses by the gymnast during the interview also confirm limited response bias. Specifically, gymnasts responded 'no' to some of the questions; suggesting that, for the most part, questions were not leading and thus did not have to answer in desirable way.

In turning to the question related to whether self-regulatory processes and beliefs contribute to the competitive performance enhancement effects previously identified (Rymal &

Ste-Marie, submitted; Ste-Marie et al, 2011), we argue that differences that emerged between the control interview and the experimental interview provides evidence of such contributions. In this regard, we focus on three key differences that were found within the forethought and self-reflections phases of Zimmerman's (2000) self-regulation model. First, gymnasts reported feeling more self-efficacious when administered the video at competition. This gives support to the idea that a self-modeling video provided both mastery and vicarious experiences during the forethought phase; the two most powerful sources of self-efficacy (Bandura, 1986, 1997). This finding only adds to the existing evidence that a self-modeling video can increase an athlete's self-efficacy and in turn improve performance (Feltz, Short, & Sullivan, 2008).

In regards to the self-reflection phase, there were two important differences that became apparent. First, there was greater emphasis on adaptive inferences on the part of the gymnasts when they viewed the self-modeling video. They thought more about how they would implement the strategies at the next competition, specifically using imagery again, and commenting on using the video again if it could be available. This finding is congruent with Rymal and Ste-Marie (in preparation). That is, the video is thought to increase the use of other strategies, such as imagery, as well as confirming that gymnast believed the video to be helpful and would in fact use it again if given the opportunity. Another difference in the self-reflection phase was associated with the self-evaluations made by gymnasts. Gymnasts stated more positive self-evaluations after the competition in which they observed their self-modeling video. Taken together, the differences do show that a feedforward self-modeling video can influence gymnasts' self-regulatory processes and beliefs; specifically, their self-efficacy beliefs, decision to use imagery in future competition, and positive self-evaluations concerning their performance all surfaced as being positively impacted by the video.

In addition to these differences, numerous similarities were noted in terms of the self-regulatory processes and beliefs used by the gymnasts throughout the competitive season, regardless of the use of the video. These findings are also of interest. As seen with previous research conducted with divers (Rymal, et al., 2010) and gymnasts (Rymal & Ste-Marie, in preparation; Ste-Marie et al., 2011) such findings continue to support the idea that self-regulation not only occurs in a learning environment but also in competition. As well, using a more in depth interview guide provided unique insights concerning additional processes and beliefs that were not evident in past research. Specific to the forethought phase, it is only in this examination that task interest materialized as a factor, with the majority of gymnast intrinsically valuing the performance of the routine (i.e., wanting to do their best) versus winning the event. Such findings are in line with others that have shown that elite athletes value internal properties of their performance more than external reward (Clearly & Zimmerman, 2001; Zimmerman, 2008).

Additional codes that became evident were related to gymnasts' comments regarding physical preparation before their event and also as an adaptive inference strategy for the future competitions. It is not uncommon for gymnasts to physical prepare before competing on the uneven bars. In fact, physical preparation is required as a part of the competition procedures. Gymnasts warm up on each event before competing that event. In support of this, Holland and colleagues (2010) indicated that physical preparation is a well know technique used by higher level athletes to both mental and physical preparations (e.g., Holland, Woodcock, Cumming, and Duda, 2010)

Other new information concerned the variety of self regulatory processes used during the performance control phase. Rymal et al, (2010) and Ste-Marie et al., (2011) reported no self-

regulatory processes in this phase and proposed that athletes may not comment on performance control processes because they may be at the autonomous stage of learning. While there were four gymnasts that mentioned instances during their routine that they couldn't remember, they still reported using self-instructions, task strategies, and attention focus while competing. Further, the remaining five gymnasts all reported using similar processes during this phase. Thus, the gymnast may in fact be on auto pilot for certain skills within their routine but still need to self-regulate at key points in the routine. This is consistent with attention theory (Kahneman, 1973) and other research that show that elements in movement sequences can be chunked together and triggered at critical points in the movement output sequence (Schmidt & Wrisberg, 2008). Such results also suggest that the gymnasts were within the fourth stage of self-regulation that is characterized by movements being performed automatically with little intentional thoughts (Zimmerman, 2004).

Another point of interest was the finding that imagery was used more often when the participants were not administered the video, although it was still being used in conjunction with the administration of the self-modeling video (see also, Rymal & Ste-Marie, in preparation). Unfortunately, we only noted this after data analysis, and therefore were unable to probe this finding. It would be interesting to understand if the increased imagery use was to compensate for the lack of external stimulus provided by the self-modeling video. That is, the gymnasts had spontaneously begun to image the self-modeling video to compensate for its lack of availability. Moreover, it would be worth determining whether the images created were those of the self-modeling video, or related to other uses of imagery. Further research on learning of the interactions between imagery and observation as a result of the use of a feedforward self-modeling video would be fruitful.

Also worth mentioning are the few responses that fell within self-reflection phase. Gymnasts were generally satisfied about their performance as well as specific skills, and they also attributed how they performed internally. This is not surprising as we are aware that high level athletes tend to take ownership for their performances and with this ownership comes feelings of self-satisfaction for their efforts (e.g., Zimmerman, 1998, 2004).

There were codes that were represented by less than 1/3 of the participants when examining whether the self-modeling video had an influence on self-regulatory processes and beliefs in the three phases of Zimmerman's (2000, 2004) model. As such, I believe they are worth mentioning and will be discussed. Of the codes representative of the forethought phase gymnasts mentioned using the coach as a strategy. Although this has not been acknowledged by previous research on self-modeling and competitive performance (e.g., Ste-Marie et al., 2011), it is not surprising that gymnasts would go to their coach for advice, or think about what their coach had told them. In support of this, Zimmerman (2000, 2004, 2008) does state that learners will seek help from others when self-regulating. Also within this phase, fewer than three gymnasts mentioned setting outcome and performance goals as well as using strategies to avoid distractions. Lastly, one comment was related to feelings of worry before she competed.

Within the performance control phase, gymnasts mentioned using the video, imagery, and attempting to avoid distractions while physically performing on the uneven bars. Also, fewer than three gymnasts mentioned feelings of general or specific satisfaction while competing as well as general and specific feelings of dissatisfaction. A general statement would be related to the routine as a whole where as a specific statement would be associated with a certain skill in the routine. Gymnasts also commented on other feelings such as self-efficacy and affective states aligned with feeling nervousness and relief while competing. Zimmerman (2000, 2004)

does support the use of strategies (e.g., imagery) while physically performing skills, however, the later beliefs such as self-satisfaction, self-efficacy, and affective states were not originally described in the performance control phase. Therefore, it is still questionable if these beliefs do in fact occur throughout the performance phases.

There were also some beliefs and processes associated with the self-reflection phase that were mentioned by fewer than three gymnasts. Two gymnasts mentioned negatively evaluating their performance compared to previous performances. Within these negative evaluations, one comment referred to a specific skill in the routine while the other was a general evaluation of the routine as a whole. Moreover, gymnasts positively evaluated their performance based on mastery experience in which the video was thought to reflect the mastery criteria; both instances were related to comparing specific skills to the video. Along with evaluating their performance based on what was seen in the video, gymnasts also thought the video attributed to their performance outcomes. One gymnast, however, attributed her performance to her coach when the video was not viewed. Furthermore, affective states referring to feeling calm and excited were stated after competing by gymnasts. Another discussion point within this phase is that gymnasts stated that they would either adapt or retain inferences such as task strategies, self-instructions, and attempting to maintain focus when administered their self-modeling video.

In conclusion, the administration of a self-modeling video at a competitive event did influence differences in gymnasts' self-regulation processes and beliefs residing in the forethought and self-reflection phases of Zimmerman's (2000, 2004) model. However, many similarities between the two conditions exist. Important to consider, though, is that Rymal and Ste-Marie's (in preparation) examination of specific questions related to the self-modeling video indicated that the use of a feedforward self-modeling video engaged a wide gamut of self-

regulatory processes and beliefs. Those questions, however, were not included in this analysis as it was believed that it would have confounded the results because we would have been comparing two different interview guides; that is the experimental interview guide would have a greater number of questions related to the use of the video; thus favoring the outcome of differences. Thus, the use of quantitative measure of self-regulation may be a better method for investigating differences between gymnasts' self-regulation when a self-modeling video is available compared to when it is not.

Our concluding comments concerns the fact that individuals self-regulate in different ways and that future research should consider this fact. To further explain, Zimmerman (2004) indicates that there are proactive and reactive self-regulators. Proactive self-regulators are considered to be more effective than reactive self-regulators for behavioural change. Specifically, a proactive self-regulator engages in higher quality self-regulation because they take ownership and initiative when implementing strategies within the forethought phases which later enforces more effective regulation throughout all the phases. A reactive learner is one who focuses on reflection of behaviours with little initiative in the forethought phase; thus are less effective in their regulation throughout all the phases. In saying this, the use of a measure to distinguish types of regulators prior to interventions could also contribute to the understanding of differing processes and beliefs of individual when administered a self-modeling video. In conclusion, the use of a feedforward self-modeling video contributed to gymnasts increased use of certain self-regulatory processes and beliefs, although the similarities far outweighed those differences. As such, it is doubtful that advantages gained in competition from this intervention were solely due to self-regulation. Future research should consider other informational and psychological mechanisms.

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Appendix A

Forethought questions (before competing)

To get started, I would like you to think about the time from when you started walking to the bars after the last event you just competed to just before you presented to the judge to compete bars. Is it clear what time frame I mean (clarify if needed). Now we are going to talk about things that you did, your thoughts and your feelings and that sort of thing before you competed, so think about that time

- 2) First, can you tell me about your motivation to do your bar routine?
(prompts below will occur only if gymnast is not clear with her answer)
 - a. What motivated you?
 - b. So your motivation was to...(REPEAT)
 - c. Anything else? So was it to win bars or was it just to have fun or do your best?
- 3) Now tell me about anything you did to help you prepare for your bar routine performance?
(for each of the different strategies mentioned, the probes below can be used)
 - a. Why did you use it? Why did you decide to...
 - b. Do you think that _____ helped you think about other or more strategies that you wanted to do?
 - c. Any other strategies? (SHEET)
(what ever was said here will be reiterated below)
 - i. Could you be more specific, how exactly did it help you with these things?
 - ii. Which strategies (imagery, SI, attention, TS) did it help with?
 - iii. Can you give a specific example?
 - iv. So you said that you used _____ (e.g. TS) _____, would you also say that TS help with pointing your toes...?
 - e. Now, did the video help you set goals?
 - Did you have other goals with respect to your bar routine?

Ok good, so now I am going to ask questions about your thoughts and feelings before you competed bars.

4. So let's start with what kind of thoughts you were having? Can you tell me what you were thinking about before you competed your bar routine (ideas or things)?
(*probe would be given only if the answer was very brief*)
 - a. So those were your only thoughts?
5. How about your feelings? What kind of feelings did you have?
 - a. Why do you think you felt that way?
(*next probe would be given only if answer was brief*)
 - b. Anything else? Did you have any other feelings?

Performance control questions (while competing)

Now that you have just told me a lot about what was happening before you did your bar routine, we are going to move on to talk about while you were on the bars ok? So for the next few questions I want you to think about the time from when you did your mount, so when you touched the bars, to the time you did your dismount and landed your competition bar ...so this is while you are actually on the bars. Is this time frame clear to you?

1. What was happening during your bar routine?
2. What strategies, if any, did you use while you were competing.?
(*prompt to look at sheet for strategies if nothing is forthcoming*)
 - a. Why did you use that strategy?
3. So while you were actually doing the moves in your bar routine, while you were on the low bar, or high bar, or the entire routine in general, did you keep track of what you were doing in anyway?
(*prompts below to be used only if needed*)
 - a. So while you were competing would you say that you were monitoring, keeping track of, or taking like a mental note of how things felt, or what you looked at?
 - b. Which one did you use?
 - c. How exactly did you do this while competing?

Ok good, so now I want to know more about your thoughts, and feelings while you were on the bar

1. What were you thinking about while you were competing bars?
(*prompts below to be given if no info is forthcoming*)
If participant says she does not remember—that's ok.

Do you remember what I mean by thoughts? If we think back to the math example, it would be the things you were thinking about while you were actually writing the test. For example, “I was thinking I could get an A while writing the test” For your bar routine, it would be what you were thinking about (or what was going through your head) when you were actually doing the moves in your bar routine. So, can you tell me what you were thinking about while you were doing your bar routine?

- a. While you were on the bars, were you focusing on anything specific?
 - b. Any general things you were focusing on?
 - c. Can you be more specific? Was there certain skills you were focusing on? (content of task and what was it related to)
 - d. Why do you think you choose to focus on those things (*repeat skills*)
 - e. So would you say it was the more difficult or easy skills that you were thinking about?
2. What were your feelings while you were competing?
- a. Do you remember what I mean by feelings? Remember in the math example, it was “I felt nervous because the test seemed hard while I was writing it”
 - b. So can you tell me how you felt?
 - c. Why do you think you felt that way?

Self-reflection questions (after competing)

Now that we have talked about all the interesting things about before going to bars and about while you were on the bars during your bar routine, I would now like to know more the time from when you landed your bar routine to the time you moved to your next gymnastic event.

- 1) Were there any actions that you did right after you competed?
 - b. Why did you decide to do that?
- 2) So let’s talk about your thoughts. What kind of thoughts did you have after? (*prompts will be given if needed*)
 - a. How do you think you performed?
 - b. Why do you think you performed that way?
 - c. Any other thoughts about how you performed?

- d. How would you explain your performance? Why do you think you did it the way you did it?
(*prompts will be given*)
 - i. Would you compare it to anything?
 - ii. So would you compare it to previous performances, standards like something that your coach had said to you before, like what she expects from you?, or goals
 - iii. ok if I asked you how exactly would you compare it you would just say...(repeat)
- 3) What are your feelings now after you have competed bars?
- a. Why do you think you felt like that?
 - b. Were you satisfied with your bar routine
 - iv. What satisfied you the most?
 - v. Overall, on a scale of 1-10 what was your satisfaction, with 10 being the most satisfied you could be.
 - c. Were you dissatisfied with any part of your bar routine?
 - vi. What dissatisfied you the most?
- 4) Would you prepare differently or keep things the same at the next competition?
- a. Would you prepare in the same way or differently?
 - i. And how exactly?

CONTROL

Forethought questions (before competing)

To get started, I would like you to think about the time from when you started walking to the bars after the last event you just competed to just before you presented to the judge to compete bars. Is it clear what time frame I mean (clarify if needed). Now we are going to talk about things that you did, your thoughts and your feelings and that sort of thing before you competed, so think about that time

- 1) First, can you tell me about your motivation to do your bar routine?
(prompts below will occur only if gymnast is not clear with her answer)
 - a. What motivated you?
 - b. So your motivation was to...(REPEAT)
 - c. Anything else? So was it to win bars or was it just to have fun or do your best?
- 2) Now tell me about anything you did to help you prepare for your bar routine performance?
(for each of the different strategies mentioned, the probes below can be used)
 - a. Why did you use it? Why did you decide to...
 - b. Do you think that _____ helped you think about other or more strategies that you wanted to do?
 - c. Any other strategies? (SHEET)
(what ever was said here will be reiterated below)
 - i. Could you be more specific, how exactly did it help you with these things?
 - ii. Which strategies (imagery, SI, attention, TS) did it help with?
 - iii. Can you give a specific example?
 - iv. So you said that you used _____ (e.g. TS) _____, would you also say that TS help with pointing your toes...?
 - f. Now did you set goals?
 - So specific for your bar routine, what goals did you set?
 - Did you have other goals with respect to your bar routine?

Ok good, so now I am going to ask questions about your thoughts and feelings before you competed bars.

1. So let's start with what kind of thoughts you were having? Can you tell me what you were thinking about before you competed your bar routine (ideas or things)?
(probe would be given only if the answer was very brief)
 - a. So those were your only thoughts?
2. How about your feelings? What kind of feelings did you have?
 - a. Why do you think you felt that way?
(next probe would be given only if answer was brief)
 - b. Anything else? Did you have any other feelings?

Performance control questions (while competing)

Now that you have just told me a lot about what was happening before you did your bar routine, we are going to move on to talk about while you were on the bars ok? So for the next few questions I want you to think about the time from when you did your mount, so when you touched the bars, to the time you did your dismount and landed your competition bar ...so this is while you are actually on the bars. Is this time frame clear to you?

- 1) What was happening during your bar routine?
- 2) What strategies, if any, did you use while you were competing.?
(prompt to look at sheet for strategies if nothing is forthcoming)
 - a. Why did you use that strategy?
- 3) So while you were actually doing the moves in your bar routine, while you were on the low bar, or high bar, or the entire routine in general, did you keep track of what you were doing in anyway?
(prompts below to be used only if needed)
 - a. So while you were competing would you say that you were monitoring...keeping track of ...or taking like a mental note of how things felt, or what you looked at ?
 - b. Which one did you use?
 - c. How exactly did you do this while competing?

Ok good, so now I want to know more about your thoughts, and feelings while you were on the bar

- 1) What were you thinking about while you were competing bars?
(prompts below to be given if no info is forthcoming)

If participant says she does not remember—that's ok.

- a. Do you remember what I mean by thoughts? If we think back to the math example, it would be the things you were thinking about while you were actually writing the test. For example, "I was thinking I could get an A while writing the test" For your bar routine, it would be what you were thinking about (or what was going through your head) when you were actually doing the moves in your bar routine. So, can you tell me what you were thinking about while you were doing your bar routine?
 - i. While you were on the bars, were you focusing on anything specific?
 - ii. Any general things you were focusing on?
 - iii. Can you be more specific? Was there certain skills you were focusing on ? (content of task and what was it related to)
 - iv. Why do you think you choose to focus on those skills (*repeat skills*)
 - v. So would you say it was the more difficult or easy skills that you were thinking about?
- 2) What were your feelings while you were competing?
 - a. Do you remember what I mean by feelings? Remember in the math example, it was "I felt nervous because the test seemed hard while I was writing it"
 - b. So can you tell me how you felt?
 - c. Why do you think you felt that way?

Self-reflection questions (after competing)

Now that we have talked about all the interesting things about before going to bars and about while you were on the bars during your bar routine, I would now like to know more about the time from when you landed your bar routine to the time you moved to your next gymnastic event.

- 1) Were there any actions that you did right after you competed?
 - a. Why did you decide to do that?
- 2) So let's talk about your thoughts. What kind of thoughts did you have after? (*prompts will be given if needed*)
 - a. How do you think you performed?
 - b. Why do you think you performed that way?

- c. Any other thoughts about how you performed?
 - d. How would you explain your performance? Why do you think you did it the way you did it?
(prompts will be given)
 - i. Would you compare it to anything?
 - ii. So would you compare it to previous performances, standards like something that your coach had said to you before, like what she expects from you?, or goals
 - iii. ok if I asked you how exactly would you compare it you would just say...(repeat)
- 3) What are your feelings now after you have competed bars?
- a. Why do you think you felt like that?
 - b. Were you satisfied with your bar routine
 - i. What satisfied you the most?
 - ii. Overall, on a scale of 1-10 what was your satisfaction, with 10 being the most satisfied you could be.
 - c. Were you dissatisfied with any part of your bar routine?
 - i. What dissatisfied you the most?
- 4) Would you prepare differently or keep things the same at the next competition?
- a. Would you prepare in the same way or differently?
 - i. And how exactly?

Appendix B

Thoughts: Examples:

I think I can get an A in math

Thinking about how to solve specific math problems, like the formulas you use or what numbers

I need to add together to get the correct answer.

Feelings: Examples:

I would be happy if I got an A in math

I'm nervous when the test is a hard one

Actions: Examples:

I reviewed my notes before going in to write the test

I wrote out the formulas I would need or the seven times table on the top of the test as soon as I got it because I find those hard to remember

Strategies

Imagery: visualizing, seeing movements, feeling movements in side your head.

For example, "I imagined myself sitting at my desk writing the math test, feeling the pencil in my hand, and seeing my notes in my head"

Self-instructions: instructions you may give to yourself (internal or out loud), usually inside your head, that help you to do the skills or make yourself feel a specific way.

For example, "I am going to do the more difficult math questions on the test first and then I will go back to the easier questions after"

Attention focus: thinking about things that are important at that time (relevant) or ignoring or eliminate distractions. Staying in the moment.

For example, "I kept my eyes on my paper so I could concentrate on my test"

Task Strategies: breaking your skills down to specific parts.

For example, "I broke the math problem down to look at each part separately in order to get the final answer". "To add three numbers, I began by adding the first two, got an answer and then added the third one"

Goal setting: making goals or setting objectives to achieve a task.

For example, "I am going to get higher than a B on this math test".
"I am going to start studying a week before the test"

Planning: making the choice to do something to complete the task or do something different next time; making a plan to be able to complete the task successfully or to change something, or avoid something.

For example, “Next time I am going to start studying for my math test three days earlier” or “Next time I am going to avoid studying with a group of people”.

Chapter 3: General Discussion

General Discussion

The purpose of this research was to investigate the effect of a feedforward self-modeling video on gymnasts' physical performance and self-regulatory processes. Also of interest was whether psychological skills training workshops would increase the effectiveness of the self-modeling video. The results have been presented in three articles in which findings suggested that the benefits of a self-modeling video on competitive performance scores were dependent on one's visual imagery ability. Specifically, those low in imagery ability benefitted from the self-modeling video later in the competitive season. The results of articles two and three indicated that not only do gymnasts engage in many self-regulatory processes and beliefs related to the use of the self-modeling video, but the video influenced some of these processes and beliefs beyond the typical self-regulation of gymnasts. The presentation of the data in article format, however, limited the page number when presenting the results; thus some material was not discussed. As such, this section will be used to present research findings not represented in the articles in the following manner; first, imagery ability and vividness were also measured at pre and post competitive season and therefore the results of those measures will be mentioned; second, additional information from both the qualitative examinations of the self-regulatory processes and beliefs of gymnasts will be discussed together; and third, future directions and limitations of the research will be presented.

Imagery Ability and Vividness

Not only was I interested in whether imagery ability acted as a moderating variable on gymnasts' physical performance but whether imagery vividness and ability could be increased through the administration of a feedforward self-modeling video was also of interest.

Furthermore, did the integration of psychological skills training have a greater influence on

imagery vividness and ability? From what I am aware, Rymal and Ste-Marie's (2009) research on divers is the only research project that has investigated the effects of a feedforward self-modeling video on imagery vividness and ability. Their results suggested improvement in vividness scores when imaging the self compared to imaging others after the administration of the video. The results however only approached significance and thus the authors concluded that continued investigation was needed on the topic. For this reason I continued to investigate the effects of a self-modeling video on imagery vividness and ability through the use of two measures; the Vividness of Movement Imagery Questionnaire-2 (Roberts, Callow, Hardy, Markland, & Bringer, 2008; VMIQ-2) and the Movement Imagery Questionnaire- Revised (Hall & Martin, 1997; MIQ-R) (see Appendix D and E for questionnaires).

The results of the VMIQ-2 indicated that the video had an influence on all perspectives of imagery vividness by providing the gymnasts with clear images of their bar routine. Similarly, in Rymal and colleagues (2010) study, gymnasts reported using their video to help 'see' and 'feel' images during their competition. For the MIQ-R, however, the results showed increased benefits for only the visual imagery perspective and not kinesethic imagery, suggesting that viewing a feedforward self-modeling video increases the ability for gymnasts to visually image the movements. Surprisingly, differences between those who partook in the psychological skills training workshops were not seen. It is my belief that it is the interaction between an external stimulus such as a feedforward self-modeling video and imagery that has an influence on imaging that action. This is also supported in the motor control literature suggesting that imagery and observation have similar neural activities (Holmes & Camels, 2008).

Another noteworthy point for imagery vividness and ability was that I found results for visual imagery ability on the MIQ-R subscale but only the total vividness of one's imagery

increased as a result of the viewings. That is, the VMIQ-2 did not show differences with external, internal or kinesthetic imagery vividness separately. I would like to acknowledge that the duration of the imagery and self-modeling sessions in the psychological skills training workshops lasted only one of the four weeks. In fact, researchers have suggested that imagery interventions should range between four and six weeks to increase its effectiveness (see Callow & Hardy, 2005). Thus, I suggest that a longer self-modeling and imagery intervention period may help tease out possible differences between external, internal, and kinesthetic imagery perspectives and modalities. Additionally, the Movement Imagery Questionnaire-3 (MIQ-3; Williams, Cumming, & Edwards, in press) could be more informative than the MIQ-R. That is, the MIQ-3 separates visual imagery into external and internal perspectives; but these are not separated in the MIQ-R. One can question whether the self-modeling video, because it is stimulus provided from an external perspective benefits those who image from an external perspective more than an internal. Thus, there may be even further mediation as a function of imagery perspective.

Self-Regulatory Processes and Beliefs

Within the second article, there were processes and beliefs that were represented by less than three gymnasts in the performance control and self-reflection phases related to the specific use of the self-modeling video (i.e., response associated with the self-modeling questions only). Because these did not meet the criteria of being represented by more than 1/3 of the gymnasts, no mention was made in the article. In this general discussion, however, I believe they merit mention. The codes that fell within the performance control phase were related to the video being used as a means to influence one's self-efficacy, imagery, and task strategies. With respect to the self-reflection phase, gymnasts commented on using self-instructions and task strategies

for future competitions as well as expressed self-judgment comments related to self-evaluations and causal attributions.

Limitations and Future Directions

As with any research, it is important to identify limitations of the research that often lead to recommendations for further research. One limitation of this investigation is that I did not control for whether the gymnast had a ‘good’ or ‘bad’ bar event when conducting the interviews. As a result, none of the gymnasts were interviewed at a competition where they had performed poorly (e.g., fall) and therefore there was no reason to imply dissatisfaction during either interview. Future research, should consider conducting multiple interviews following both good and poor performances; thus contributing to a richer understanding of the influence of self-modeling video.

At a general level, gymnasts’ self-regulatory processes were consistent with previous research on divers and gymnasts (Rymal et al., 2010; Ste-Marie et al., 2011) where the majority of codes were related to directing motor execution with fewer codes associated with cognitions and controlling affect. As mentioned by Zimmerman (2000, 2004) this process is cyclical and therefore directing motor execution may be the most dominant because gymnasts are first focusing on their form and technique which may be indirectly influencing the gymnast cognitions and affect.

Another limitation to take into consideration is that even though I attempted to counterbalance the order in which the interview was administered based on condition, it was only after data collection that we realized that all gymnasts had been exposed to their video at a previous competition before the interviews began. Thus, the control interviews were potentially “contaminated” in the sense self-regulatory processes and beliefs engaged in as a result of the

video may have been carried over to other competitions. This might explain the many similarities between the two conditions. I recommend two different groups be examined within a competitive environment; one that receives a video and one that does not. This will then allow for a clearer comparison between the two groups.

Further future directions should consider the idea that positive cueing embedded within a self-modeling video may increase its effectiveness during competition. Evidence from the motor learning literature suggests that observational learning is enhanced when videos are used in conjunction with verbal cues that highlight correct performances (Bandura 1986; Franks & Maile, 1991; Rose & Christina, 2006). Additionally, skill acquisition has also been increased when a modeled performance was accompanied with verbal feedback (McCullagh & Caird, 1990). Therefore, it would be interesting for future researchers to investigate the effectiveness of the combination of self-modeling and verbal cues outside of the motor learning context and into a competitive environment.

Furthermore, those low in visual imagery ability are benefiting from the self-modeling video later in the season but their performance is hindered early in the season. There may be a proper time to transition the administration of a self-modeling video from training into a competitive context. Also, why is it that those low in imagery ability gaining more from viewing a video than those who are high in imagery ability? Is it because those who can produce controlled images rely on their self-generated images for performance increases and thus do not need an external representation? Perhaps low imagers are not able rely on generating proper images and need an external stimulus to increase performance? Possible explanations for these finding are still unknown and thus a greater understanding of the best method to use for high and low imagers when implementing a self-modeling video is required.

As a final point, the way in which I analyzed the qualitative data may have also limited our results. Specifically, I did not take into account the frequencies of the codes that were represented by individuals. In saying this, the weight the gymnasts used certain processes and beliefs remains uncertain. Also, much of the data related to the self-modeling video was lost when comparing the self-regulatory processes and beliefs between the two competition conditions. That is, the specific questions relating to the video were removed, resulting in no probes relating to the video, from the general interview guide in order to maintain consistency in the two measures. Perhaps, restricting data collected methods to only qualitative measures may not be the most effective methods. As such the addition of a quantitative measure may be more useful or this comparison. In fact, a mixed method design using both qualitative and quantitative measures of one's self-regulation would strengthen the analysis related to whether a self-modeling video increases self-regulation (see Hansen, Creswell, Plano, Petska, & Creswell, 2005 for discussion on mixed methods designs). In this case, the results may be enriched in ways that the use of one form of data does not allow.

Conclusion

Taken together, this research has provided further evidence that a self-modeling video could increase competitive gymnastics performance (see Ste-Marie et al., 2011). This performance increase, however, is dependent on one's imagery ability. I have also supported the notion that a self-modeling video can be used as a precursor to create controlled and vivid images (see also Williams et al., in press). Based on the increasing evidence linking observation and imagery, continued research would contribute to further understanding how one intervention affects the other, or if one has a greater influence on performance. I also believe that I have provided a greater understanding of the processes and beliefs of gymnasts' competitive self-

regulation; however, based on the variety of comments that were underrepresented by gymnasts there are many processes and beliefs that should be probed further. As such, we encourage future researchers to continue to examine self-modeling and self-regulatory processes and beliefs within a competitive environment.

Chapter 4: Statement of Contributions

Statement of Contributions

This research project could not have been completed without the assistance of many individuals. As such, in order to be systematic, this section presents individuals' contributions to the order in which the thesis was completed.

I have contributed to this research in the following ways; first, the development of the research questions originated from my thoughts and ideas that had arisen from my master's experience and comprehensive exam readings. That is, research had not yet investigated feedforward self-modeling, alone or combined with psychological skills, on gymnasts' competitive performance. Also, research had not yet explored how self-modeling has been used to self-regulate and whether a self-modeling video increases self-regulation. Second, I completed the thesis proposal and presented it to my committee members. Third, I was involved in generating all the paper work for ethics approval. Fourth, I undertook all of the data collection. This consisted of administrating the psychological skills training workshops, gathering video footage, editing video footage for the creation of the feedforward self-modeling videos, and collecting the physical performance and interview data at competition sites. Fifth, I participated in all data entry and transcriptions of participant's interview responses. Sixth, I was involved in all the steps pertaining to the quantitative and qualitative data analysis. Seventh and the final step, I have written the dissertation and prepared for the thesis defense.

My supervisor, Dr. Diane Ste-Marie provided feedback and guidance throughout these varied steps. She has worked alongside me in refining the research questions, methodologies, analysis, and written sections of the proposal and dissertation. Specifically, Dr. Ste-Marie and I collaborated steadily on research questions and methodological protocol. Diane also contributed to ideas related to the development of the interview questions for the qualitative portion of this

research. Furthermore, she gave advice when I was analyzing the quantitative and qualitative portions of the thesis. She also continuously provided feedback in all of the written sections, including articles for submission, of my dissertation.

My committee members, Dr. Natalie Durand-Bush and Dr. Rose Martini, were involved in refining the research project at the proposal stage by providing guidance to data collection and analysis. Specifically, both members gave advice for the format and structuring of the interview questions as well as the quantitative data analysis.

Kelly Vertes, a former undergraduate student and now a master's student, contributed in the transcription and coding of four of the gymnasts' responses for the comparison of self-regulatory processes and beliefs between the self-modeling condition and control condition. During the coding, she not only helped develop the coding template, she also acted as my inter-rater agreement researcher.

Lastly, Andrea Billings, who is also former undergraduate student in Dr. Ste-Marie's laboratory, contributed by gathering video footage and video editing the gymnasts feedforward self-modeling videos. She also participated in two of the six competition data collection sites. Andrea also took part in some of the entry and analysis of the physical performance data.

Chapter 5: References and Appendix for Chapters 1 and 4

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Appendix A

File Number: H08-09-06

Date (mm/dd/yyyy): 10/20/2009



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

Ethics Approval Notice Health Sciences and Science REB

Principal Investigator / Supervisor / Co-investigator(s) / Student(s)

<u>First Name</u>	<u>Last Name</u>	<u>Affiliation</u>	<u>Role</u>
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File Number: H08-09-06

Type of Project: PhD Thesis

Title: The Effects of Different Self-modeling Interventions on the Performance and Self-regulatory Processes and Self-beliefs of Competitive Gymnasts

Approval Date (mm/dd/yyyy)	Expiry Date (mm/dd/yyyy)	Approval Type
10/20/2009	10/19/2010	Ia

(Ia: Approval, Ib: Approval for initial stage only)

Special Conditions / Comments:
N/A

Appendix B

Interview guides

Forethought questions (before competing)

To get started, I would like you to think about the time from when you started walking to the bars after the last event you just competed to just before you presented to the judge to compete bars. Is it clear what time frame I mean (clarify if needed). Now we are going to talk about things that you did, your thoughts and your feelings and that sort of thing before you competed, so think about that time

- 4) First, can you tell me about your motivation to do your bar routine?
(prompts below will occur only if gymnast is not clear with her answer)
 - a. What motivated you?
 - b. So your motivation was to...(REPEAT)
 - c. Anything else? So was it to win bars or was it just to have fun or do your best?
- 5) Now tell me about anything you did to help you prepare for your bar routine performance?
(for each of the different strategies mentioned, the probes below can be used)
 - a. Why did you use it? Why did you decide to...
 - b. Do you think that _____ helped you think about other or more strategies that you wanted to do?
 - c. Any other strategies? (SHEET)
(what ever was said here will be reiterated below)
 - i. Could you be more specific, how exactly did it help you with these things?
 - ii. Which strategies (imagery, SI, attention, TS) did it help with?
 - iii. Can you give a specific example?
 - iv. So you said that you used____(e.g. TS)____, would you also say that TS help with pointing your toes...?
- 6) I know you viewed your video to help you prepare for your bar routine, so now I am going to ask you questions related specifically to the video
(this question will only be asked if they do not spontaneously mention the video-we will keep track of whether the info came up spontaneously or had to be asked)
 - g. What did you use the video for right before you competed. What did you do exactly?

- i. Why did you use it?
- h. Why did you decide to do that? (repeat what they said if needed)?
- i. How exactly did you use the video, can you give me a few examples?

So you found the video useful for ...(REPEAT)

- a. Do you think it helped you with any of the strategies you said you used (*referring back to Q2 here*)?
 - i. Can you tell me how watching the video helped you with those strategies (*repeat strategies*)
 - ii. If you look at the SHEET here do you think the video helped you with anything else when getting ready to compete bars?
 - iii. How exactly did the video help you with those strategies?
- j. Now, did the video help you set goals?
 - So specific for your bar routine, what goals did the video help you set?
 - Did you have other goals with respect to your bar routine?

Ok good, so now I am going to ask questions about your thoughts and feelings before you competed bars.

- 6. So let's start with what kind of thoughts you were having? Can you tell me what you were thinking about before you competed your bar routine (ideas or things)? (*probe would be given only if the answer was very brief*)
 - a. So those were your only thoughts?
- 7. How about your feelings? What kind of feelings did you have?
 - a. Why do you think you felt that way? (*next probe would be given only if answer was brief*)
 - b. Anything else? Did you have any other feelings?

Performance control questions (while competing)

Now that you have just told me a lot about what was happening before you did your bar routine, we are going to move on to talk about while you were on the bars ok? So for the next few questions I want you to think about the time from when you did your mount, so when you touched the bars, to the time you did your dismount and landed your competition bar ...so this is while you are actually on the bars. Is this time frame clear to you?

- 2) What was happening during your bar routine?
- 3) What strategies, if any, did you use while you were competing?
(prompt to look at sheet for strategies if nothing is forthcoming)
 - a. Why did you use that strategy?
- 4) Again, knowing that you saw the video, did the video help with these strategies while competing?
 - a. Was there a key part in the video that helped ? (repeat if anything was said)—while competing
 - b. So would you say that, while you were competing, the video helped...(repeat what they said and relate it to the video)
 - c. Any other strategies? You can look at your sheet
- 5) So while you were actually doing the moves in your bar routine, while you were on the low bar, or high bar, or the entire routine in general, did you keep track of what you were doing in anyway?
(prompts below to be used only if needed)
 - a. So while you were competing would you say that you were monitoring...keeping track of ...or taking like a mental note of how things felt, or what you looked at?
 - b. Which one did you use?
 - c. How exactly did you do this while competing?

Ok good, so now I want to know more about your thoughts, and feelings while you were on the bar

- 6) What were you thinking about while you were competing bars?
(prompts below to be given if no info is forthcoming)

If participant says she does not remember—that's ok.

- a. Do you remember what I mean by thoughts? If we think back to the math example, it would be the things you were thinking about while you were actually writing the test. For example, “I was thinking I could get an A while writing the test” For your bar routine, it would be what you were thinking about (or what was going through your head) when you were actually doing the moves in your bar routine. So, can you tell me what you were thinking about while you were doing your bar routine?
 - i. While you were on the bars, were you focusing on anything specific?
 - ii. Any general things you were focusing on?
 - iii. Can you be more specific? Was there certain skills you were focusing on? (content of task and what was it related to)
 - iv. Why do you think you choose to focus on those things (*repeat skills*)
 - v. So would you say it was the more difficult or easy skills that you were thinking about?
- 7) What were your feelings while you were competing?
- a. Do you remember what I mean by feelings? Remember in the math example, it was “I felt nervous because the test seemed hard while I was writing it”
 - b. So can you tell me how you felt?
 - c. Why do you think you felt that way?

Self-reflection questions (after competing)

Now that we have talked about all the interesting things about before going to bars and about while you were on the bars during your bar routine, I would now like to know more about the time from when you landed your bar routine to the time you moved to your next gymnastic event.

- 4) Were there any actions that you did right after you competed?
 - a. Why did you decide to do that?
- 5) Knowing that you saw your video, do you think that the video had an influence on what you did after?
(prompts will be given if answers are brief)
 - a. What did it have an influence on?
 - b. Why do you think it influenced what you did?
- 6) So let's talk about your thoughts. What kind of thoughts did you have after?
(prompts will be given if needed)
 - a. How do you think you performed?
 - b. Why do you think you performed that way?
 - c. Any other thoughts about how you performed?
 - d. How would you explain your performance? Why do you think you did it the way you did it?
(prompts will be given)
 - i. Would you compare it to anything?
 - ii. So would you compare it to previous performances, standards like something that your coach had said to you before, like what she expects from you?, or goals
 - iii. ok if I asked you how exactly would you compare it you would just say...(repeat)
- 7) What are your feelings now after you have competed bars?
 - a. Why do you think you felt like that?
 - b. Were you satisfied with your bar routine
 - i. What satisfied you the most?

- ii. Overall, on a scale of 1-10 what was your satisfaction, with 10 being the most satisfied you could be.
 - c. Were you dissatisfied with any part of your bar routine?
 - i. What dissatisfied you the most?
- 1. Overall, did you find the video helped/did not help you do your bar routine?
 - ii. How? Or why not?
- 3. Would you prepare differently or keep things the same at the next competition?
 - a. Would you prepare in the same way or differently?
 - i. And how exactly?
 - b. Would you use the video again?
 - i. Would you use it in the same way or differently? How?

SMT separate question

- 1) Do you feel that the training workshops helped your bar routine
 - How?
- 2) Did the workshops help you in any other way? (competition or training)
 - a. How? (please explain)
- 3) Do you think it would be helpful to have more or less training workshops?
 - a. Why
- 4) What did you enjoy the most about the workshops?

CONTROL

Forethought questions (before competing)

To get started, I would like you to think about the time from when you started walking to the bars after the last event you just competed to just before you presented to the judge to compete bars. Is it clear what time frame I mean (clarify if needed). Now we are going to talk about things that you did, your thoughts and your feelings and that sort of thing before you competed, so think about that time

- 1) First, can you tell me about your motivation to do your bar routine?
(prompts below will occur only if gymnast is not clear with her answer)
 - a. What motivated you?
 - b. So your motivation was to...(REPEAT)
 - c. Anything else? So was it to win bars or was it just to have fun or do your best?
- 2) Now tell me about anything you did to help you prepare for your bar routine performance?
(for each of the different strategies mentioned, the probes below can be used)
 - a. Why did you use it? Why did you decide to...
 - b. Do you think that _____helped you think about other or more strategies that you wanted to do?
 - c. Any other strategies? (SHEET)
(what ever was said here will be reiterated below)
 - i. Could you be more specific, how exactly did it help you with these things?
 - ii. Which strategies (imagery, SI, attention, TS) did it help with?
 - iii. Can you give a specific example?
 - iv. So you said that you used _____(e.g. TS)_____, would you also say that TS help with pointing your toes...?
- k. Now did you set goals?
 - So specific for your bar routine, what goals did you set?
 - Did you have other goals with respect to your bar routine?

Ok good, so now I am going to ask questions about your thoughts and feelings before you competed bars.

4. So let's start with what kind of thoughts you were having? Can you tell me what you were thinking about before you competed your bar routine (ideas or things)?
(probe would be given only if the answer was very brief).
 - a. So those were your only thoughts?
5. How about your feelings? What kind of feelings did you have?
 - a. Why do you think you felt that way?
(next probe would be given only if answer was brief)
 - b. Anything else? Did you have any other feelings?

Performance control questions (while competing)

Now that you have just told me a lot about what was happening before you did your bar routine, we are going to move on to talk about while you were on the bars ok? So for the next few questions I want you to think about the time from when you did your mount, so when you touched the bars, to the time you did your dismount and landed your competition bar ...so this is while you are actually on the bars. Is this time frame clear to you?

- 1) What was happening during your bar routine?
- 2) What strategies, if any, did you use while you were competing.?

(prompt to look at sheet for strategies if nothing is forthcoming)

 - a. Why did you use that strategy?
- 3) So while you were actually doing the moves in your bar routine, while you were on the low bar, or high bar, or the entire routine in general, did you keep track of what you were doing in anyway?

(prompts below to be used only if needed)

 - a. So while you were competing would you say that you were monitoring...keeping track of ...or taking like a mental note of how things felt, or what you looked at ?
 - b. Which one did you use?
 - c. How exactly did you do this while competing?

Ok good, so now I want to know more about your thoughts, and feelings while you were on the bar

- 4) What were you thinking about while you were competing bars?

(prompts below to be given if no info is forthcoming)

If participant says she does not remember—that's ok.

- a. Do you remember what I mean by thoughts? If we think back to the math example, it would be the things you were thinking about while you were actually writing the test. For example, "I was thinking I could get an A while writing the test" For your bar routine, it would be what you were thinking about (or what was going through your head) when you were actually doing the moves in your bar routine. So, can you tell me what you were thinking about while you were doing your bar routine?
 - i. While you were on the bars, were you focusing on anything specific?
 - ii. Any general things you were focusing on?

- iii. Can you be more specific? Was there certain skills you were focusing on ?
(content of task and what was it related to)
- iv. Why do you think you choose to focus on those skills (*repeat skills*)
- v. So would you say it was the more difficult or easy skills that you were thinking about?

5) What were your feelings while you were competing?

- a. Do you remember what I mean by feelings? Remember in the math example, it was “I felt nervous because the test seemed hard while I was writing it”
- b. So can you tell me how you felt?
- c. Why do you think you felt that way?

Self-reflection questions (after competing)

Now that we have talked about all the interesting things about before going to bars and about while you were on the bars during your bar routine, I would now like to know about more the time from when you landed your bar routine to the time you moved to your next gymnastic event.

- 1) Were there any actions that you did right after you competed?
 - a. Why did you decide to do that?
- 2) So let's talk about your thoughts. What kind of thoughts did you have after?
(prompts will be given if needed)
 - a. How do you think you performed?
 - b. Why do you think you performed that way?
 - c. Any other thoughts about how you performed?
 - d. How would you explain your performance? Why do you think you did it the way you did it?
(prompts will be given)
 - i. Would you compare it to anything?
 - ii. So would you compare it to previous performances, standards like something that your coach had said to you before, like what she expects from you?, or goals
 - iii. ok if I asked you how exactly would you compare it you would just say...(repeat)
- 3) What are your feelings now after you have competed bars?
 - a. Why do you think you felt like that?
 - b. Were you satisfied with your bar routine
 - i. What satisfied you the most?
 - ii. Overall, on a scale of 1-10 what was your satisfaction, with 10 being the most satisfied you could be.
 - c. Were you dissatisfied with any part of your bar routine?
 - i. What dissatisfied you the most?

2. Would you prepare differently or keep things the same at the next competition?
 - a. Would you prepare in the same way or differently?
 - i. And how exactly?

Appendix C

Timeline of psychological skills training workshops

Attentional focus

Session 1. Introduction to focus define: ability to direct and maintain attention on task-relevant cues while ignoring irrelevant and distracting cues.

Discussion on the interaction between focus and self-modeling

- SM may associate with all types of focus (internal/external/broad/narrow)- define theses (use my chart from workshops)
- SM may increase focus by representing simulated training (i.e., competitive experience)
- SM may be used as a pre-performance routine to help mindfulness (i.e., staying in the moment)
- Examples of 10.3 attentional demands needed.

Durnad-Bush (2010) exercise 10.2 in a multiple choice.

Session 2. Recap of the previous session (i.e., how SM interacts with focus)

Sit down with their self-modeling videos and then perform focusing strategies.

- View video with no distractions
 - View video focusing on relevant cues for that routine (identify the attentional demands of the skills in the routine- write them down)
 - Durand-Bush (2010) exercise 10.3 but write down each step in their bar routine and where their focus should be
 - View video with distractions and emphasize the attentional demands on the video (3 x, take note of when you got distracted). Therefore, using this exercise to practice a 'pre-performance routine' to help with mindfulness
 - Floor music (play music)
 - Cheering
- Use others to distract them while watching the video

Goal setting

Session 1. Introduction to goal setting and the types of goals (process, performance, outcome, SMARTTEST)

Discussion on the interaction between goal setting and self-modeling

- SM may provide a source of feedback for future goals
- SM may help the process of using effective goal setting strategies (specific and difficult---need to be the SMARTTEST goals)
- SM may help develop effective process, performance, outcome, short-term, and long term goals. Durand-Bush (2010) Table 2.1. Add in process, performance, and outcome goals)
- View video and set process, performance, and outcome goals (based on SMARTTEST goals)
- View video and break down the routine to set short-term goals and long term goals (use table).
- Devise an action plan on how to implement goals (training and competition) (e.g., have them prioritize their goals and have them write down "how will I achieve

them” beside each sheet- use Durnad-Bush (2010) exercise 2.7 page—in the same table as above)

Session 2. Recap of previous session (i.e., how SM interacts with goal setting)

Sit down with their self-modeling videos again and review from session ones effective goal setting

REVIEW and catch up if they did not get to finish

- View video and set process, performance, and outcome goals (based on SMARTTEST goals)
- View video and break down the routine to set short-term goals and long term goals (use table).
- Devise an action plan on how to implement goals (training and competition) (e.g., have them prioritize their goals and have them write down “how will I achieve them” beside each sheet- use Durnad- Bush (2010) exercise 2.7 in the same table as above)

Explain the importance of monitoring their goals. Go back after 7 days and re-evaluate your goals.

Imagery

Session 1. Introduction of imagery

Discussion on the interaction between imagery and self-modeling

- SM may increase imagery ability (controlled, vivid which can be transferred into imagery)
- SM may show all aspects of imagery timing (slow motion, speed up, real time)
- SM may produce visual and kinesthetic sensations (explain what 1st/3rd/K are)

*do imagery exercises (VMIQ-2 and the MIQ-R)

- Allows them to do V (internal / external= 1st and 3rd person) and K.

Session 2. Recap of the previous session (i.e., how SM interacts with imagery)

Sit down with their self-modeling videos and then perform imagery on their own.

- View video (3x) and try to create a controlled and vivid image while watching—image once on own focusing on controlled and vivid images
- View video (3x) and try to speed up easy skills, slow down difficult skills, and watch in real time.
- View video (3x) and try to generate kinesthetic sensations while watching the video.—Image once on own focusing on feeling your movements

*Direct an imagery session where they use their video to create an image of their bar routine.

- 3 breaths
- Listen to instruction first and then you can do your imagery “I want you to picture yourself performing your bar routine. Before you image your bar routine I want you to try to make it as clear and vivid as possible. Remember what it looked like in the video. Remember you can keep the routine in real time, slow difficult skills down, or even speed up the easier skills. Also, I want you to try to feel your body movements as you imagine the routine. When you are ready imagine the routine

three times. When you are done role on to your right side and wait until I ask you to get up.

I would like you to imagine performing your bar routine 3x. While you do this I will be talking and giving you little reminders but do not stop your imagery just listen to the reminders I give”

Do your imagery

Record on the sheet- Did you slow skills down? Which ones? Were they easier, difficult skill, neutral skills?

Did you “see” (1st person, 3rd person, or switch back and forth) or “feel” movements?

Self-talk

Session 1. Introduction to self-talk and the types of self-talk (positive, negative, motivational, and instructional)

Discussion on the interaction between self-talk and self-modeling

- SM may help increase one’s belief system which can be verbalized through self-talk. Also increases motivation.

*do the ST exercise like in workshop

- SM may help develop technical and instruction forms of self-talk (define)—say what you want...not what you don’t want (don’t fall...think stick)
- SM may help develop appropriate key words or trigger (could also include mood) words and when to implement them during a routine (use chart to write down examples like in workshop)

Session 2 Recap of previous session (i.e., how SM interact with self-talk)

Sit down with their self-modeling videos and develop effective self-talk strategies

- View video and develop ‘I’ statements that represent what they can accomplish (beliefs)—write on cue cards
- View video and determine technical and instructional words while implement them in the appropriate parts of their routine (use sheet to write this down---like in workshop)
- View video and develop key & trigger words relating to (use same sheet to write down)
 - affect (e.g., soft, breath, slow)
 - cognitive (e.g., nice toes, good body alignment)
 - motor (e.g., heels, hips, ribs in)

* watch video 3x and say some of these words out loud or in your head at the appropriate time in the video.

Appendix D

VMIQ-2

Vividness of Movement Imagery Questionnaire-2

Name:

Age:

Gender:

Sport:

Level at which sport is played at (e.g., Recreational, Club, University, National, International, Professional)

Years spent participating in this sport competitively:

Movement imagery refers to the ability to imagine a movement. The aim of this questionnaire is to determine the vividness of your movement imagery. The items of the questionnaire are designed to bring certain images to your mind. You are asked to rate the vividness of each item by reference to the 5-point scale. After each item, circle the appropriate number in the boxes provided. The first column is for an image obtained watching yourself performing the movement from an external point of view (External Visual Imagery), and the second column is for an image obtained from an internal point of view, as if you were looking out through your own eyes whilst performing the movement (Internal Visual Imagery). The third column is for an image obtained by feeling yourself do the movement (Kinesthetic Imagery). Try to do each item separately, independently of how you may have done other items. Complete all items from an external visual perspective and then return to the beginning of the questionnaire and complete all of the items from an internal visual perspective, and finally return to the beginning of the questionnaire and complete the items while feeling the movement. The three ratings for a given item may not in all cases be the same. For all items please have your eyes CLOSED.

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

RATING SCALE: The image aroused by each item might be:			
Perfectly clear and as vivid (as normal vision or feel of movement)			RATING 1
Clear and reasonably vivid			RATING 2
Moderately clear and vivid			RATING 3
Vague and dim			RATING 4
No image at all, you only "know" that you are thinking of the skill.			RATING 5

Item	Watching yourself performing the movement (External Visual Imagery)					Looking through your own eyes whilst performing the movement (Internal Visual Imagery)					Feeling yourself do the movement (Kinesthetic Imagery)				
	Perfectly clear and vivid as normal vision	Clear and reasonably vivid	Moderately clear and vivid	Vague and dim	No image at all, you only know that you are thinking of the skill	Perfectly clear and vivid as normal vision	Clear and reasonably vivid	Moderately clear and vivid	Vague and dim	No image at all, you only know that you are thinking of the skill	Perfectly clear and vivid as normal - feel of movement	Clear and reasonably vivid	Moderately clear and vivid	Vague and dim	No image at all, you only know that you are thinking of the skill
1. Walking	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
2. Running	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
3. Kicking a stone	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
4. Bending to pick up a coin	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
5. Running up stairs	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
6. Jumping sideways	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
7. Throwing a stone into water	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
8. Kicking a ball in the air	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
9. Running downhill	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
10. Riding a bike	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
11. Swinging on a rope	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
12. Jumping off a high wall	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5

Appendix E

MIQ-R

Instructions

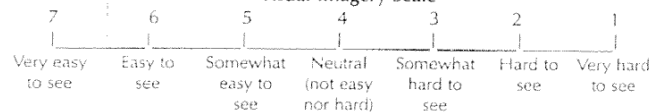
This questionnaire concerns two ways of *mentally* performing movements which are used by some people more than by others, and are more applicable to some types of movements than others. The first is attempting to form a visual image or picture of a movement in your mind. The second is attempting to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

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

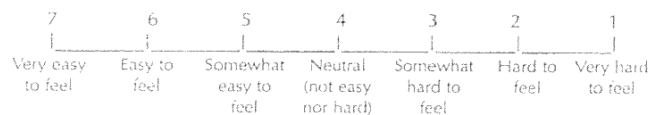
After you have completed the mental task required, rate the ease/difficulty with which you were able to do the task. Take your rating from the following scale. Be as accurate as possible and take as long as you feel necessary to arrive at the proper rating for each movement. You may choose the same rating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

RATING SCALES

Visual Imagery Scale



Kinesthetic Imagery Scale



- STARTING POSITION:**
Stand with your feet and legs together and your arms at your sides.
- ACTION:**
Raise your right knee as high as possible so that you are standing on your left leg with your right leg flexed (bent) at the knee. Now lower your right leg so that you are again standing on two feet. Perform these actions slowly.
- MENTAL TASK:**
Assume the starting position. Attempt to feel yourself making the movement just performed without actually doing it. Now rate the ease/difficulty with which you were able to do this mental task.
- RATING:** _____
- 5. STARTING POSITION:**
Stand with your feet slightly apart and your hands at your sides.
- ACTION:**
Bend down low and then jump straight up in the air as high as possible with both arms extended above your head. Land with your feet apart and lower your arms to your sides.
- MENTAL TASK:**
Assume the starting position. Attempt to feel yourself making the movement just performed without actually doing it. Now rate the ease/difficulty with which you were able to do this mental task.
- RATING:** _____
- 6. STARTING POSITION:**
Stand with your feet slightly apart and your hands at your sides.
- ACTION:**
Raise your right knee as high as possible so that you are standing on your left leg with your right leg flexed (bent) at the knee. Now lower your right leg so that you are again standing on two feet. Perform these actions slowly.
- MENTAL TASK:**
Assume the starting position. Attempt to see yourself making the movement just performed with as clear and vivid a visual image as possible. Now rate the ease/difficulty with which you were able to do this mental task.
- RATING:** _____
- 7. STARTING POSITION:**
Stand with your feet slightly apart and your arms fully extended above your head.
- ACTION:**
Slowly bend forward at the waist and try and touch your toes with your fingertips (or if possible, touch the floor with your fingertips or hands). Now return to the starting position, standing erect with your arms extended above your head.
- MENTAL TASK:**
Assume the starting position. Attempt to feel yourself making the movement just performed without actually doing it. Now rate the ease/difficulty with which you were able to do this mental task.
- RATING:** _____
- 8. STARTING POSITION:**
Extend the arm of your nondominant hand straight out to your side so that it is parallel to the ground, palm down.
- ACTION:**
Move your arm forward until it is directly in front of your body (still parallel to the ground). Keep your arm extended during the movement and make the movement slowly.
- MENTAL TASK:**
Assume the starting position. Attempt to see yourself making the movement just performed with as clear and vivid a visual image as possible. Now rate the ease/difficulty with which you were able to do this mental task.
- RATING:** _____
- STARTING POSITION:**
Stand with your feet slightly apart and your arms fully extended above your head.
- ACTION:**
Slowly bend forward at the waist and try and touch your toes with your fingertips (or if possible, touch the floor with your fingertips or hands). Now return to the starting position, standing erect with your arms extended above your head.
- MENTAL TASK:**
Assume the starting position. Attempt to see yourself making the movement just performed with as clear and vivid a visual image as possible. Now rate the ease/difficulty with which you were able to do this mental task.
- RATING:** _____