The Effects of Motivational and Instructional Self-talk on Cross-Training Exercise Performance

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Abstract

Self-talk is a multi-dimensional construct comprised of self-statements that provide instruction, or motivation, for successful task completion. Instructional self-talk has been shown to be more effective during precision tasks, and motivational self-talk has been shown to be more effective during gross motor and exercise tasks. The effects of self-talk on task performance have not been explored through a combination of endurance and precision exercise, or cross-training. The purpose of the present study was to analyze the effectiveness of instructional and motivational self-talk during a cross-training exercise task of running and overhead squatting. 30 participants were evenly divided into three groups (i.e., control, motivational, and instructional), and were examined across three exercise trials. Two 3 x 3 factorial ANOVAs comparing exercise time and mechanical score revealed no significant differences between groups across exercise trials. The results of the present study provide a potential starting point for future self-talk studies analyzing the combination of exercise tasks.

Preface

Introduction

Throughout my high school athletic career, there was a little voice in the back of my head during practice and competition. This voice would guide me through competition by helping me stay focused on the game plan or increasing my effort when I was feeling lethargic. As my athletic career progressed, I would use this internal dialogue to prepare myself for upcoming games. I began to use this dialogue outside of competition to analyze the previous game and identify areas on which I could improve. At the time, I had no idea that I was engaging in self-talk. It would not be until my third year of university when I would first hear the term "self-talk." Self-talk was first brought to my attention during my undergraduate sport psychology course. The professor gave a lecture on self-talk, explaining what it is and how it can be applied to athletic competition and preparation. I began reflecting on my own use of self-talk during my athletic career, in which I did not know what self-talk was, or if I was using it correctly. From this moment, I began applying self-talk back into my training and it carried over into my day to day life.

Fast forward to the first year of my master's studies and I had no clue what area of sport psychology I wanted to research. I knew the exercise I wanted to research was cross-training, as I utilize this methodology and there is very little published research regarding cross-training available. I read into several areas of sport psychology to see if anything sparked my interests, but nothing kept me interested. When I began consulting with a few athletic teams at Brock University, I noticed a trend. I would often implement self-talk into the lessons that my colleagues and I would teach. Noticing this trend, my supervisor had me present to my colleagues on self-talk. It was at this time with my new knowledge of self-talk, my experience of using and teaching other athletes the benefits of self-talk, the lack of research involving cross-training and my personal interest in the training methodology, I decided that self-talk would be the topic of my master's thesis.

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Chapter 1: Review of Literature

Defining Self-Talk

Self-talk is when an athlete engages in a personal dialogue to him/herself, either out loud or internally for a specific purpose (Tod, 2014). This definition is vague, as it can be referring to any form of self-talk an athlete may engage in, and in any context. Self-talk is included within a set of psychological skills alongside imagery, relaxation and goal setting that help the athlete develop the psychological characteristics of self-confidence, arousal regulation, concentration, and motivation/determination, which are associated with enhanced performance (Krane & Williams, 2010; Tod, 2014). Krane and Williams (2010) developed a model indicating that these psychological characteristics can help contribute to the ideal performance state, which is the state in which both physical and mental components are optimal, allowing the athlete to perform their best. The ideal performance state, from a psychological perspective, is when the athlete is focused, confident and energized (Tod, 2014). An athlete can reach the ideal performance state with the help of training the aforementioned psychological characteristics, however, this training will take a significant amount of time, as these skills are difficult to master.

A framework developed by Hardy, Oliver, and Tod (2009) offers a better understanding of self-talk and the possible antecedents and consequences of self-talk. Self-talk can be affected by situational (e.g., task difficulty, match circumstances, coaching behaviours, competitive setting) and personal factors (e.g., cognitive processing preferences, belief in self-talk content, personality traits). Self-talk influences cognitive mechanisms (e.g., concentration and attention), motivational mechanisms (e.g., self-confidence, motivation), behavioural mechanisms (e.g., technique), and affectual mechanisms (e.g., affect, anxiety). Self-talk has been proposed to affect performance-based outcomes (e.g., enhanced skill execution, strength), and is the key element of this model. This model also outlines the possible underlying mechanisms that may explain the self-talk and performance relationship (see Appendix A).

Self-talk as an area of research, is somewhat limited and is currently underdeveloped within sport psychology literature. Although there is a body of literature available, as this study will outline, self-talk may be overlooked as a stand-alone practice in relation to other mental skills (i.e., imagery, goal setting, and relaxation) (Hardy, 2006). An avenue to consider is that self-talk has not been explored across a wide array of exercise tasks, which could indicate a potential lack of certainty as to if, how, or why self-talk may assist in athletic or exercise performance. Another consideration could be the potential lack of an encompassing definition of self-talk as a construct. This underdevelopment has resulted in researchers using several different definitions throughout the literature that may not capture the breadth of the self-talk construct (Hardy, 2006). Previously used self-talk definitions vary between solely cognitive aspects to a combination of cognitive and behavioral aspects (Hardy, 2006). Chroni (1997) theorized that self-talk can be manifested in verbal or non-verbal ways, in the form of a word, a thought, a smile, a frown, etc. This definition takes into consideration the behavioral implications and manifestations that self-talk can help produce, which can be an indication that self-talk can influence an athlete's body language and in research terms, can help make self-talk measurable. Bunker, Williams, and Zinsser (1993) applied a more cognitive definition as they stated that anytime you think about something, you are engaging in self-talk. Hardy, Jones, and Gould (1996) deemed this definition too vague as it emphasizes thought content and general thoughts, which can make measuring self-talk difficult. Hardy, Gammage, and Hall (2001) narrowed down the cognitive-oriented definition by Bunker et al. (1993) which included daydreams, imagery and self-statements (e.g., "I can do this"). The all-inclusive thought process definition by Bunker et al. (1993) makes it difficult for self-talk researchers to discern what exactly an athletes' self-talk would sound like. Hardy (2006) indicated that placing a greater emphasis on the self-statements that athletes' use would allow researchers to have a deeper understanding of the nature of self-talk.

Theodorakis, Weinberg, Natsis, Douma, and Kazakas (2000) utilized a self-statement approach when they defined self-talk as what a person says to him/herself, either internally or out loud. This definition brings attention to two important components of self-talk: that it can be said out-loud or internally and that statements are directed towards oneself (Hardy, 2006). The self-statement approach is more applicable to self-talk research than the strictly cognitive approach, in that it allows researchers to have a better understanding of what self-talk is and allows for the differentiation of thought content for the athlete. Hardy et al. (2001) and Hardy (2006) developed guidelines and a working definition of self-talk from Hackfort and Schwenkmezger (1993), who defined self-talk as "a dialogue where the individual interprets feelings and perceptions, regulates and changes evaluations and convictions, and gives themselves instructions or reinforcement" (p. 355). The importance on the thought content and language of self-talk is outlined with this definition, which would influence an athlete's thoughts and actions (Rubenstein, 1973).

Hardy (2006) provided a working definition of self-talk through a set of guidelines: statements should be directed towards oneself, should be multidimensional in nature, should have interpretations associated with content employed, are somewhat dynamic, and should serve two functions: instructional and motivational. Hardy (2006) noted that these guidelines should be open to modification, as the content of the athletes' self-talk may change as they progress through, either their season or their skill development. Based on the guidelines Hardy (2006) developed, Hardy et al. (2009) defined self-talk as "multidimensional in nature (e.g., frequency, valence), referring to verbalizations or statements addressed to oneself, and not others (i.e., social speech), has interpretive elements associated with the content of the words employed and can serve at least two functions, including motivation and self-instruction" (pp. 38-39). This definition will be used for the proposed study.

The definition of self-talk has evolved to become more precise and applicable for future research directions. Athletes may not always be aware that they are engaging in self-talk; similarly, they may not be aware of the effect self-talk can have on their performance. There are four types of self-talk dialogue that an athlete can engage in and each has their own unique function. These types of self-talk are: motivational, instructional, positive and negative (Tod, 2014). Each of these types has a separate function for the athlete to utilize, however, most self-talk is a combination of these categories as they tend to overlap and serve multiple functions (Tod, 2014).

Types of Self-Talk

Instructional self-talk allows the athletes to redirect their focus on the technical aspects of the skill or movement being performed and the strategy they are implementing during competition (Zinsser, Bunker, & Williams, 2010). When implementing an instructional self-talk strategy, it is vital for the cue words to be centered on the desired outcome of the skill, rather than on what the athlete is trying not to do (Zinsser et al., 2010). An example of an instructional self-talk strategy is when a player is shooting a free throw during a basketball game and uses the cue "high elbow," as opposed to "don't shift your weight backwards." This narrows the focus of the athlete on a positive aspect of their shooting mechanics and removes their attention from the negative shifting of weight. This focus will help the athlete hone in on what they need to do to be successful at shooting free throws in front of a large crowd. This self-talk strategy can be applied in any sport context that contains an intricate mechanical component.

Motivational self-talk is designed to help improve an athlete's motivation, confidence and effort (Zinsser et al., 2010). An example of a motivational self-talk strategy is when a football player utilizes the cue "come on, you can do this" before the ball is snapped, or "keep pushing," during a play. Motivational self-talk can help the athlete "psych up," before a game, or it can help them relax before a free throw or penalty shot (Hatzigeorgiadis, Theodorakis, & Zourbanos, 2004). Motivational self-talk will allow the athlete to shift their focus to their own effort or to the objective that they are trying to complete. Motivational self-talk can be used to direct action and maintain effort throughout the competition (Zinsser et al., 2010). Examples of cues include: "keep going," "don't stop" and "pick up the pace," and display the outcomes that an athlete may be striving to achieve, which is to maintain a strong effort during the competition. This form of self-talk can be utilized in all aspects of the athletic context, regardless of the technical aspects of the sport.

Positive self-talk will allow an athlete to stay focused and present in the moment by not dwelling on past mistakes or getting too far ahead of themselves (Weinberg, 1988; Zinsser et al., 2010). Positive self-talk can also help reduce anxiety, increase effort and enhance self-confidence (Finn, 1985; Weinberg, 1988; Zinsser et al., 2010). Several examples of positive self-talk statements for a tennis player would be "you can do this," "stay focused," "keep your eye on the ball," and "this match is not over" (Van Raalte, Brewer, Lewis, Linder, Wildman, Kozimor, 1995; Weinberg, 1988). These cues are inherently multidimensional, as there is a noticeable overlap between positive self-talk cues and motivational or instructional self-talk cues.

Negative self-talk is a form of self-talk in which athletes are highly critical of themselves and their performance. Negative self-talk can hinder athletic performance as it produces anxiety and is typically inappropriate, distracting, irrational, and counterproductive (Hatzigeorgiadis et al., 2004; Weinberg, 1988; Zinsser et al., 2010). Several examples of negative self-talk statements are: “I am an idiot-I’ll never win now,” “that was terrible,” “you should just quit” and “you cannot do it” (Van Raalte et al., 1995; Weinberg, 1988). These cues are different from positive self-talk cues, in that they do not clearly contain an instructional or a motivational component, they are seemingly negative towards all aspects of the performance.

Athlete Use and Interpretation of Self-Talk

The previously mentioned forms of self-talk can be effective modes for improving performance. However, athletes are typically unaware of their own thoughts and the effects these thoughts may have on their performance (Zinsser et al., 2010). The coach, or a sport psychology consultant, can help athletes become aware of their use of self-talk and the effect that it can have on their performance. Then the athlete can recognize when they use self-talk, what form they use, and which form is the most effective for them (Zinsser et al., 2010). When implementing a self-talk intervention, the first session should help the athletes become aware of their current self-talk habits and the program should build from this starting point. A successful self-talk intervention is centered around the appropriate use of cue words or phrases that hold a significance to the athlete in the sport or activity being performed. These cues are dictated by the activity that the athlete is performing, meaning that the cues should be directly related to the outcome that the athlete is trying to achieve, with respect to instructional self-talk (Zinsser et al., 2010). Each sport or activity will inherently have different self-talk cues, placing an important emphasis on the relevance of the cues pertaining to the activity.

Once an athlete becomes aware of their self-talk, it is logical for he/she to progress onto learning how to control their self-talk. Hardy et al. (2001) examined four aspects of athletes' self-talk, or the 4 W's: where, when, what, and why. These four aspects represent where the athlete uses self-talk, when they use self-talk, what their self-talk content is, and why they use self-talk. Gammage, Hardy, and Hall (2001) performed an identical study in which they studied the 4 W's of self-talk, but in an exercise setting. The combination of where and when they used self-talk was noted, with athletes most often using self-talk at their sports related venues (e.g., practice field, locker room, on the bench) either before, or during, practice and competition. Gammage et al. (2001) found similar results with exercisers using self-talk the most during their workouts (e.g., during the hardest part of their workout, when they wanted to quit, or near the end of their workout) at their exercise location (e.g., weight room, gym, track, pool). When considering that participation in these sporting activities takes place at these venues, this makes perfect sense. Hardy et al. (2001) noted that athletes reported a high use of self-talk during practice, which is reasonable considering that practice facilities are primary locations for skill development and competition preparation. It was also indicated that self-talk was used prior to competition as equally as during competition, which displays the importance of preparation time prior to competition.

Hardy et al. (2001) and Gammage et al. (2001) performed analyses on the content of self-talk that athletes and exercisers, respectively, used, which was divided into the physical characteristics and the content of the self-talk. Hardy et al. (2001) found that athletes commonly used short phrases of positive self-talk in the first- and second-person context equally. Similarly, Gammage et al. (2001) indicated that exercisers used short phrases of positive self-talk more than single word cues or full sentences. Exercise participants were found to use self-talk in the second person more than the first-person context. Gammage et al. (2001) theorized that the second person narrative is more authoritative than the first person, giving the self-talk content a higher importance. Hardy et al. (2001) and Gammage et al. (2001) indicated that athletes and exercisers would give themselves task instructions related to their sport or exercise. The task instruction content included skill specific and general self-talk, with skill specific self-talk being related to the technique of the skills (e.g., 'tackle low,' 'keep my head up,' 'stride longer') and general self-talk being related to the overall goal of the task (e.g., 'get there faster,' 'stay tough during the race'). Gammage et al. (2001) reported that exercisers used skill specific self-talk (e.g., instructions on proper technique), more than general self-talk. Similarly, Hardy et al. (2001) reported the athletes indicated a high importance of task execution, which could explain the importance of task instructional self-talk in competition. Gammage et al. (2001) provided an analysis on three additional categories of self-talk used by exercisers: results of their exercise (e.g., feelings, appearance and health benefits), amount of exercise remaining (e.g., how many reps or time remaining in their workout), and goals (e.g., reps set for a movement, distance set for a run). Exercisers reported engaging equally in all three of these additional self-talk categories. These categories could add a different dynamic for the use of self-talk during exercise compared to its use during athletic performance. This could be due to athletes using self-talk to improve their performance and their position specific skills within their sport. The athlete's goals could be more closely related to their team's success, or process oriented, rather than individually based. Similarly, exercisers use self-talk to learn and maintain proper form during exercise execution. They also use self-talk to help achieve their individual goals of an improved appearance, feeling better, and getting into better general shape. An athletes' use of self-talk is related to an exerciser's, with the exerciser's individual self-talk content employed being the major difference (Gammage et al., 2001).

The function that self-talk serves is of equal importance to the content of the self-talk that the athlete engages in (Hardy et al., 2001). The final aspect of self-talk Gammage et al. (2001) and Hardy et al. (2001) analyzed was why athletes and exercisers use self-talk, with both studies indicating that self-talk serves two functions: cognitive and motivational. The cognitive function was divided into two aspects: skill-specific and general. The motivational function was divided into three aspects: mastery, arousal and drive. Hardy et al. (2001) reported that athletes used cognitive self-talk to learn and execute specific skills (e.g., "to improve my skills" and "keep reminding myself of common mistakes") and develop and execute new strategies of play (e.g., "to pick up my play" and "execute a game-plan properly"). Similarly, Gammage et al. (2001) indicated that exercisers used cognitive self-talk to maintain correct posture (e.g., "keep abs tight"), work on proper technique (e.g., "work the muscle properly"), program strategies (e.g., "for more effective workouts") and aid in improvement performance (e.g., "to try and outdo my last workout session"). With respect to motivational self-talk, Hardy et al. (2001) reported that athletes used motivational self-talk to remain focused during competition (e.g., "keep a clear mind and focus on the task at hand"), to control their arousal level (e.g., get "psyched up" before competition, or stay relaxed during competition), and to maintain their drive (e.g., stay motivated and wanting to win, maintaining maximum effort, and keeping goals in mind). Gammage et al. (2001) broke down the use of motivational self-talk by exercisers in a similar fashion, indicating that exercisers used motivational self-talk to remain focused during their workout (e.g., "to stay on track" and "get through a long or intense workout"), to regulate their arousal level (e.g., "get motivated prior to exercise" or "to calm myself down"), to maintain their drive (e.g., "to keep going"), and to control effort level (e.g., "to put forth maximum effort") (Gammage et al., 2001). The results found by Hardy et al. (2001) indicated that athletes use motivational self-talk more frequently than cognitive self-talk. The same result was found by Gammage et al. (2001), with exercisers using motivational self-talk more frequently than cognitive self-talk.

Hardy, Hall, and Hardy (2004) noted that the previous studies on athletes' and exercisers use of self-talk (Gammage et al., 2001; Hardy et al., 2001) were missing one important aspect, which is how athletes use self-talk. Hardy et al. (2004) proposed a study to find quantitative data on how athletes use self-talk, specifically, if self-talk was consistently used throughout the season and to assess if sex, type of sport and skill level made a difference in how they utilized self-talk. It was found that the use of self-talk increased throughout the duration of the season starting with the offseason, increasing in frequency throughout the competitive season. They also found that individual sport and higher skilled athletes used self-talk more frequently than team sport and less skilled athletes. These results similarly relate to the results from Hardy, Hall, and Hardy (2005), in which they set out to find quantitative data on the content of athletes' self-talk, note differences on the general use of self-talk, determine the function self-talk serves in practice and competition, taking athletes' sex, sport type and skill level into consideration. Hardy et al. (2005) found that athletes used mostly positive self-talk and said their self-talk cues internally in short abbreviations. The differences between sex and sport type were noted, with male athletes using predominantly negative, out-loud self-talk in comparison to female athletes and individual sport athletes using self-talk more than team sport athletes. This result differs from Hardy et al. (2004), in which they observed no differences in the use of self-talk between male and female athletes and yielded similar results to Hardy et al. (2004), with individual sport type athletes using more self-talk than team sport athletes. Hardy et al. (2005) also found that athletes use self-talk more during competition than practice, and they use self-talk more during practice than before or after practice. There were no differences observed for the use of self-talk between highly skilled and less skilled athletes, which differs from Hardy et al. (2004), in which they found that higher skilled athletes use self-talk more frequently.

The results of these studies help researchers get a better understanding of the content and the uses of self-talk from the perspective of an athlete or exerciser. Gammage et al. (2001) and Hardy et al. (2001) yielded similar results with both groups indicating a heavier use of motivational self-talk than cognitive self-talk, however, the cues used by each group were different. This is consistent with Landin (1994) who determined that the effectiveness of self-talk depends on the nature of the task. Johnson, Hrycaiko, Johnson, and Halas (2004) suggested that self-talk is a personal instruction to initiate a desired action or action sequence, to achieve a desired outcome. In relation to these notions, Hatzigeorgiadis et al. (2004) argued the importance of the relationship between the task performed and self-talk content is vital for determining the effectiveness of self-talk on each task, suggesting that not all types of self-talk are equally effective for all tasks. This relationship was explored by Hatzigeorgiadis, Zourbanos, and Theodorakis (2007), who examined if different types of self-talk serve different functions. They used two different self-talk cues (e.g., attentional control and anxiety control) on a water polo target throwing task, similar to the task used by Hatzigeorgiadis et al. (2004), which was throwing a water polo ball at a target in the goal. Hatzigeorgiadis et al. (2007) indicated that the anxiety self-talk cue had a greater effect on anxiety control than the attentional self-talk cue, whereas the effects for attention, effort, confidence and automaticity were similar between the anxiety and attention control cues employed. Furthermore, both anxiety and attentional control cues had an equal effect on the participants' concentration of the task. These results partially support the notion that different forms of self-talk can serve different functions depending on the content of the cues employed. This notion was taken into consideration for the current study, with the content of the self-talk manipulation being directly related to the task being performed.

Despite the content differences, the uses of self-talk appear to be similar, with self-talk being used more during their workouts, or competition, and used more frequently during the difficult movements or a critical time in the game (Hardy et al., 2005). This would allow for a successful self-talk integration across multiple sports or activities, with the self-talk manipulation employed being directly related to the task performed and having a planned set of self-talk ready to use when the competition is at its peak in competition, or during a difficult point during exercise.

The studies Hardy et al. (2004) and Hardy et al. (2005) conducted focused on the content of self-talk, how often athletes used self-talk during practice and competition, with an analysis of sex, sport type and athlete skill level. These two studies had similar, yet, somewhat conflicting results, differing in gender and skill level and similar with individual sport athletes using self-talk more than team sport athletes. Hardy et al. (2005) noted that males use out-loud negative self-talk more than female athletes, which differs from Hardy et al. (2004), who found no gender differences in the uses of self-talk. This could have several implications for male athletes. They could be more positively motivated by negative self-talk, they may get frustrated easier, or they may vocalize their emotions more during competition. There could also be implications for female athletes with females being motivated more by positive self-talk; they may not get as frustrated during competition and they may keep their self-talk more internal. The differences observed between men and women in both studies are an indication of the variability that a self-talk intervention can have between athletes of both genders. Hardy et al. (2004) found that higher skilled athletes employed self-talk consistently, deliberately and had a greater belief in self-talk; the opposite was found among less skilled athletes. This could be an indication that the skilled athletes had training in the content and use self-talk, or they used trial and error on their own until they discovered which self-talk cues worked the best for them (Hardy et al., 2004). This finding also implies that higher skilled athletes used preconceived self-talk cues, rather than reactionary self-talk cues. This supports the findings of Mahoney and Avener (1977), who found that gymnasts who qualified for the Olympics reported using self-talk significantly more in practice and competition than gymnasts who did not qualify. Another explanation is that when an athlete is learning a movement, they talk themselves through it with explicit instruction, as this learning progresses; the athlete uses less instruction as their skills become more automatic (Coker & Fischman, 2010; Fitz & Posner, 1967). Based on these outcomes, novice athletes may experience greater effects from the use of instructional self-talk than skilled athletes (Tod, Hardy, & Oliver, 2011). These findings bring evidence to the positive effects that self-talk can have on athletic performance and enhance the importance of a coach, or consultant, educating their players on these effects (Hardy et al., 2004).

The ways that athletes use self-talk are different for each individual athlete, whether they are an individual competitor, or on a competitive team. The findings from these studies allow a better insight into how athletes perceive their self-talk and when they utilize it during competition and practice (Gammage et al., 2001; Hardy et al., 2001). These studies also give a better indication of the types of self-talk that are employed and how often athletes use them (Hardy et al., 2004; Hardy et al., 2005). These studies did not include any interventions; instead they looked at how and what the athletes self-talk use looked like. Athletes are susceptible to the effects of self-talk whether they are aware of their usage or the content they employ (Bunker et al., 1993). Williams and Leffingwell (2002) suggested that despite athletes not being aware of their self-talk, it can directly affect their actions during competition because of the effect self-talk can have on their feelings. Zinsser, Bunker, and Williams (2006) indicated that the first step to gaining control of self-talk is to develop an awareness that self-talk is being used.

This awareness, of negative self-talk specifically, was explored in a study by Hardy, Roberts, and Hardy (2009), in which they set out to analyze the effectiveness of two intervention techniques used to assess the use of and to increase the awareness of self-talk, along with the motivation to change negative self-talk. The two techniques analyzed were the logbook and the paperclip. The logbook technique refers to a journal in which participants answer open ended questions, record when they use negative self-talk statements during training, record what happened to initiate this negative self-talk and offer insight into what the consequences where resulting from negative self-talk. The paperclip technique is when participants have 50 paperclips in their right pocket at the beginning of their training. Whenever they use a negative self-talk statement, they move one paperclip to their left pocket and the total number of paperclips in their left pocket at the end of their training is counted. Hardy et al. (2009) offered a differentiation for two types of self-talk awareness; the awareness of the use of self-talk and the awareness of the content of self-talk, as both are necessary for an effective intervention. Three groups were monitored: control, paperclip and logbook.

There were no differences between the groups for the motivation to change and the awareness of the negative self-talk content, however, the logbook group’s awareness of their use of negative self-talk was significantly higher than the control group. A qualitative analysis of the logbook provided details on three aspects: the situation and triggers during training that initiated the use of negative self-talk, the content of negative self-talk during training, and perceived feelings and outcomes from the use of negative self-talk. The use of negative self-talk, with regards to the situation and triggers, was associated with the onset of physical discomfort (e.g., pain and tiredness), task-related cues (e.g., increased task difficulty), negative performance cues (e.g., underperforming and unsuccessful task execution), and being near the end of the workout. It was also reported that negative self-talk was used during a loss of task application (e.g., wanting to stop or loss of focus), a negative attitude (e.g., poor self-expectations), and negative emotions (e.g., anger). The content of negative self-talk was reflective of performance (e.g., not meeting expectations and performance criticisms), a lack of ability (e.g., criticisms of ability), a lack of task application (e.g., lack of motivation or effort), and bodily discomfort (e.g., reflecting pain and tiredness). Regarding the feelings and outcomes of the use of negative self-talk, the data indicated that regardless of whether the outcome was positive or negative, affective, behavioral, cognitive, and motivational aspects were observed. For example, the negative outcome cluster contained several aspects: negative emotions (e.g., frustration and annoyance), reduced performance (e.g., reduced pace), decreased psychological control (e.g., loss of focus), and a reduction in motivation (e.g., less determined to continue). The positive outcome cluster included: positive affect (e.g., feeling more positive), application of effort (e.g., increased effort), the use of cognitive strategies (e.g., increased focus), and elevated motivation (e.g., motivation to continue).

This analysis provides information that athletes who monitor their self-talk are much more aware of it than those that do not. This also indicates that using a logbook approach could offer better reflective self-talk information from the participants involved. Although, there were no differences in the motivation to change negative self-talk, the logbook approach is an effective measure to increase an athlete's awareness of their use of self-talk. This study analyzed negative self-talk specifically, but the logbook also provided insight into the positive and neutral self-talk that was employed by the participants. This insight adds to the notion that the logbook approach is effective for analyzing self-talk content in future studies and effectively increases the awareness of the athlete on their self-talk usage.

Effects of Self-Talk on Athletic Performance

The evolution of self-talk research has better allowed researchers to develop appropriate interventions that are focused on improving athletic skills. Zinsser et al. (2010) proposed that self-talk can affect sport performance by causing emotional (e.g., mood, motivation, anxiety) and/or cognitive (e.g., self-instruction, reduce distractions) changes. Van Raalte (2010) explained that emotional changes may help athletes stay motivated, reduce negative emotions, reduce negative self-talk and increase self-confidence, whereas cognitive changes can direct athletes' attention to the proper movement, correct errors and focus on the task at hand. The main challenge with implementing self-talk strategies is knowing how much self-talk athletes need and what type is the most effective for each athlete, under the circumstances they find themselves in during competition.

Instructional self-talk has been explored through an attentional focus lens, providing experimental evidence that instructional self-talk can improve a novice athlete's performance and hinder a skilled athlete's performance. Beilock, Carr, MacMahon, and Starkes (2002) performed two experiments testing the impact of attentional control on golf putting and soccer slalom dribbling performance in novice and experienced athletes. The first experiment compared experienced golfers through two conditions: skill focused and dual task. The skill focused condition directed the participants' attentional focus to the step-by-step execution of the golf putt and consisted of the participants using the cue word "stop" at the end of their follow through.

The dual-task condition divided the golfer's attention between the putting task and listening for a specific target tone being played on a tape recorder; when they heard the target tone they said, "tone" audibly. The golfers completed the task under both conditions with a short break between each. The golfer's putting performance was better during the dual task condition than the skill specific condition. The second experiment compared novice and skilled soccer players during the skill focused and dual task conditions. The soccer players completed a dribbling slalom course with their dominant and non-dominant foot. The experienced soccer players' slalom performance was better under the dual task condition with their dominant foot and their slalom performance under the skill specific condition was better with their non-dominant foot. The novice soccer players performed better under the skill specific condition, regardless of which foot they used. These comparisons provide evidence to show that novice athletes benefit from step-by-step attentional monitoring (i.e., instructional self-talk) but for experienced athletes this same level of monitoring hinders skill execution. These two experiments were not specific self-talk interventions; however, they do contain a component of instructional self-talk with their use of verbalized cue words and the focus of the cue words on the golf swing and dribbling mechanics.

The experimental results of instructional self-talk being beneficial for novice athletes and harmful for skilled athletes were supported by Ford, Hodges, and Williams (2005) with their attentional focus comparison of novice and skilled soccer players. The research task involved an athlete dribbling a soccer ball through a slalom course with his/her dominant foot, under one of the four conditions. The effects of attentional focus were tested under three manipulations: an internal, skill-relevant function (e.g., foot), an internal, skill-irrelevant function (e.g., arm), and a skill-irrelevant task (e.g., word-monitoring). Skill-relevance refers to an athlete dribbling a soccer ball through a slalom course focusing on his/her feet. Skill-irrelevance pertains to an athlete dribbling while focusing on his/her arm. The word-monitoring manipulation relates to the dual-task condition used by Beilock et al. (2002), except the athlete listens for a target word instead of a target tone while he/she completes the slalom dribbling course. These manipulations were compared against a non-attentional-focus control condition. Each participant was tasked with completing the course under each of the four conditions two times, meaning each participant had eight experimental trials. Skilled soccer players performed worse while focusing on their hands and feet. Novice soccer players performed better while focusing on their feet and worse while focusing on their hands and during the word-monitoring trial. These results indicate that the same level of instructional self-talk is beneficial for novice athletes and harmful to skilled athletes, matching the results found by Beilock et al. (2002).

Beilock et al. (2002) and Ford et al. (2005) examined the effect that direct attentional focus would have on novice and skilled athletes, partially analyzing an instructional self-talk component through an attentional focus lens. Their findings provide evidence that self-talk can affect performance through an increase in attentional focus by allowing an athlete to focus on the task at hand and ignore outside distractions. These results may also indicate that shifting an athlete’s attentional focus to an irrelevant task, or movement pattern, is detrimental to skilled athletic performance resulting from a potential paralysis by analysis effect. Considering these findings, instructional self-talk can be introduced to an athlete of any skill level if: it is catered to his/her specific needs, appropriate to his/her skill level, and evolves as his/her skill develops. (Hardy, 2006).

The ways that athletes and exercisers use self-talk has been analyzed and noted (Gammage et al., 2001; Hardy et al., 2001). The implication of these findings is that athletes already use self-talk and these findings allow for a better understanding of the role self-talk can have in athletics. These studies are missing an important aspect however, as they do not analyze the effectiveness of self-talk interventions regarding athletic performance, task execution or skill acquisition. These interventions showcase the array of uses and functions that self-talk can serve, along with the relationship that positive and negative self-talk has with performance. The effectiveness of self-talk interventions has been primarily explored through a positive versus negative comparison (Hardy et al., 2001). Highlen and Bennett (1983) explored the self-talk and performance relationship in wresters and divers who qualified for the Pan American Games. Wrestlers who qualified for the games were found to use negative self-talk more than the wrestlers that did not qualify. Divers that qualified were found to use more instructional self-talk and less positive self-talk than the divers who did not qualify. Rotella, Gansneder, Ojala, and Billing (1980) examined self-talk use in elite skiers and found that successful and less successful skiers did not differ between the positive and negative self-talk they used. Considering these reported findings, Highlen and Bennett (1983) suggested that negative self-talk is related to better, or at least no worse, performance than positive self-talk.

Dagrou, Gauvin, and Halliwell (1991) supported this suggestion when they interviewed elite Ivory Coast athletes regarding their self-talk use prior to and immediately after their best and worst performances. The athletes indicated that they used the same forms of self-talk during their best and worst performances. It is important to note that these studies were not self-talk interventions, they were self-report studies, in which the athletes report their self-talk usage and content before and after their performance. These studies only involved elite level athletes, offering support to the suggestions from Hardy et al. (2004), that elite level athletes may be familiar with mental skills training and may have pre-determined self-talk cues and timing.

The suggestion that negative self-talk is related to better performance from Highlen and Bennet (1983) was met with conflicting research. Van Raalte, Brewer, Rivera, and Petitpas (1994) monitored the relationship between observable self-talk and competitive junior tennis players' match performances. There was no intervention involved; the tennis players' self-talk that could be heard was observed by researchers. The players' observable self-talk, gestures and points were recorded, and they described their positive, negative and related thoughts in a post-match questionnaire. It was observed that negative self-talk was associated with losing and players who reported a belief in the value of self-talk won more points than players who did not, suggesting that self-talk influences competitive sport outcomes. The observable self-talk result refutes the suggestion from Highlen and Bennet (1983) with negative self-talk being associated with worse performance. The results also indicated there was no relationship between positive self-talk and winning, forming a lack of support for an association between positive self-talk and winning.

Dagrou, Gauvin, and Halliwell (1992) performed an intervention examining the effects of positive and negative self-talk, compared to a control condition, on a dart throwing accuracy task. Participants were tasked with throwing darts at a dart board and their dart's distance from the bullseye was measured. The participants threw 10 darts over five trials, totaling 50 throws. The experimental groups were tasked with using their positive or negative cues in-between each trial, while the control group rested between trials. The positive self-talk group's performance increased more than the control groups over the five trials and the negative self-talk group did not significantly improve over the five trials. It was suggested that positive self-talk has a stronger relationship to an improved performance than negative self-talk. Van Raalte et al. (1995) replicated this intervention by comparing dart throwing accuracy between a control group and two experimental groups (i.e., positive and negative self-talk). Participants were randomly assigned into one of the three conditions and tasked with completing 15 practice dart throws and 15 experimental dart throws. The experimental groups were instructed to use their positive or negative cues prior to each individual throw. The positive self-talk group performed significantly better than the control and negative self-talk groups, with there being no differences between the negative and control groups accuracy. These findings matched those of Dagrou et al. (1992) and support the suggestion that positive self-talk is beneficial for sport performance. The results from Dagrou et al. (1992) and Van Raalte et al. (1995) provide experimental evidence refuting the suggestion that negative self-talk is associated with improved performance proposed by Highlen and Bennet (1983).

The suggestion that self-talk is beneficial for sport performance by Van Raalte et al. (1995) was explored in a discontinuous sport setting. Wrisberg and Anshel (1997) performed an intervention involving skilled field hockey players warming up and taking penalty shots. Three groups were analyzed: control, negative worded self-talk (e.g., "don't rush the shot," "don't take my eyes off the ball"), and positive worded self-talk (e.g., "watch the ball," "relax, let it happen"). Each group was instructed to complete three trials of seven penalty shots with each trial using a different target, totaling 21 penalty shots. After the 21 shots were completed three additional trials were completed, with a seven-minute intervention in-between these trials. During the first five minutes of the rest period, the groups were instructed to read an excerpt from a field hockey book regarding game strategies. The final two minutes of the rest period for the experimental groups were used for the self-talk intervention, while the control group kept reading from the field hockey book. The negative framed self-talk group and control group showed a reduction in shot accuracy and player movement form, where the positively worded self-talk group showed no reductions in either category. Wrisberg and Anshel (1997) concluded that using positively worded self-talk reminders may be an effective warm-up activity for non-continuous sport performance, as they shift the athlete's focus to what they need to do in a positive manner. This result provides a new dynamic regarding the utility and effectiveness of positive self-talk, with it assisting in maintaining a high-level of performance during penalty shots. The effectiveness of positive self-talk in this intervention further disputes the suggestion by Highlen and Bennet (1983), as negative self-talk was associated with worse performance.

The experimental research involving positive versus negative self-talk has shown that positive self-talk is beneficial for performance, whereas negative self-talk is associated with reduced performance, or no difference (Dagrou et al., 1992; Van Raalte et al., 1995; Wrisberg & Anshel, 1997). These experimental studies provide evidence that dispute the suggestion that negative self-talk is associated with improved performance by Highlen and Bennet (1983), although at the time of their publication there was no experimental evidence to support their suggestion. Although positive self-talk has been related to improved skill execution in these previous experimental outcomes, it should be considered that positive self-talk may not always be associated with enhanced performance and negative self-talk may not always be detrimental to performance (Tod, 2014; Zourbanos, 2013). Zourbanos, Hatzigeorgiadis, Tsiakaras, Chroni, and Theodorakis (2010) indicated that when an athlete engages in negative self-talk the situation, nature of the sport, and the athlete's competitive nature should be taken into consideration, as their negative self-talk may provide motivation and help facilitate performance.

The effectiveness of self-talk is not exclusively measured through a positive versus negative comparison. Theodorakis, Chroni, Laparidis, Bebetsos, and Douma (2001) analyzed the effectiveness of two-different types of self-talk cues on basketball shooting performance. Two experimental groups were compared to one control group on a 3-minute stationary shooting time trial. Participants performed an initial baseline measure, rested for 20-minutes, then completed an intervention measure. The experimental groups were divided into a relax group, which used the cue word "relax" prior to every shot, and a fast group, which used the cue word "fast" prior to every shot, with the control group receiving no intervention. The experimental group using the cue "relax" performed significantly better on their intervention trial in comparison to the other groups. Theodorakis et al. (2001) concluded that self-talk can positively affect performance if the content is relevant to the task being performed. The task being a basketball shooting time trial, the cue "relax" helped calm the participants and assisted in keeping their focus on proper shooting mechanics instead of the running clock. The cue "fast" initiated a faster shot, shifting the participants' focus from proper shooting mechanics to the running clock. The conclusion of task relevance that Theodorakis et al. (2001) found provides experimental evidence to the notion suggested by Hatzigeorgiadis et al. (2007) that different forms of self-talk perform different functions and that self-talk cues may be most effective if they are relevant to the task being performed.

Johnson, Hrycaiko, Johnson, and Halas (2004) designed a self-talk strategy to improve low drive shot performance in female soccer players under 14 years old. The purpose was to examine the effectiveness of a self-talk intervention for improving soccer shooting performance during practice and competition, analyzing the effects of self-talk on skilled athletic performance. There was a significant increase across all participants during their practice sessions and during competitive games. The participants scored all their low-drive shot goals, with an increase in low-drive goals from previous intervention games. Post-intervention surveys indicated that players were more confident in taking low-drive shots than pre-intervention, their low-drive shot frequency and perceived low-drive shot effectiveness increased from pre-intervention. It was concluded that self-talk is an effective measure for enhancing youth soccer player performance (Johnson et al., 2004). Similarly, Thelwell, Greenlees, and Weston (2006) tested the effects of a position-specific psychological skills program on university soccer midfielders throughout the competitive season. The psychological skills package included: relaxation, imagery and self-talk. This study also aimed to develop an understanding and knowledge of psychological interventions within a team-sport setting. The results showed that for a position-specific intervention, there were minor improvements in first touch, passing accuracy and tackling success. The social validation data displayed that the participants perceived the intervention to be beneficial and appropriate to their midfield skill improvement. Although there was an increase in performance, it was not definitive enough to have resulted from the intervention. This data indicates that a position-specific psychological skills package, including self-talk, may be effective for improving performance, albeit slightly (Thelwell et al., 2006).

The results from Johnson et al. (2001) and Thelwell et al. (2006) support the contention that self-talk is effective for improving sport performance. This belief is derived from the previously discussed experimental studies, which indicate that self-talk positively influences sport performance. These results provide further experimental evidence contradicting Highlen and Bennet (1983) who suggested self-talk was not associated with increased performance, or that negative self-talk does not hinder sport performance. Despite the experimental results, it is argued that there is limited evidence regarding the effectiveness of self-talk, or that self-talk can improve competitive performance (Gardner & Moore, 2006; Martin, Vause, & Schwartzman, 2005).

Recently, Tod et al. (2011) wrote a systematic review analyzing the relationship between self-talk and performance with an examination of “second-generation questions,” referring to the potential moderators and mediators of the self-talk and performance relationship. The moderators were derived from Hardy, Oliver, and Tod (2009) who argued that to definitively determine the effect self-talk may have on performance, the moderating effects of other variables must be taken into consideration (e.g., certain types of self-talk may be more effective than others, self-talk is subjective to each athlete individually). Tod et al. (2011) analyzed two variables: athlete skill level and type of self-talk, with the possible moderating effect on the self-talk-performance relationship. Athlete skill level and type of self-talk were chosen as potential moderators due to the previous research regarding the effect that self-talk may have on performance (e.g., Highlen & Bennett, 1983; Mahoney & Avener, 1977). This evidence made it possible to outline a theoretical rationale for their moderating potential. The moderators affected the self-talk-performance relationship by shifting the direction of self-talk (e.g., positive or negative) and/or by varying the intensity of belief in self-talk. The type of self-talk employed was predicted to have a moderating effect on the self-talk-performance relationship. Self-talk has been categorized as positive, negative, instructional, or motivational (Tod, 2014). Hypothetically, positive self-talk can improve performance, whereas negative self-talk has been predicted to hinder performance (Zinsser et al., 2010). It has been hypothesized that motivational and instructional self-talk have different effects, relative to the task being performed (Hatzigeorgiadis et al., 2004).

The potential mediators of the self-talk-performance relationship analyzed were cognitive, motivational, behavioral, and affective mechanisms (Tod et al., 2011). These mechanisms were derived from Hardy et al. (2009) who proposed that they would help explain the self-talk-performance relationship. The cognitive mechanism refers to the progression of information processing, concentration, attentional control, and attentional style. The motivational mechanism is directly related to the motivation of the athlete, with a focus on self-efficacy and persistence to achieve long term goals (Bandura, 1997). The behavioral aspect, as suggested by Hardy et al. (2009), is a sub-class of the self-talk-performance relationship, meaning, that any alterations in task execution resulting in performance improvements could be the result of self-talk. The behavioral mechanism is related to the theory that novice athletes may talk themselves through the movement during the early stages of learning the movement (Coker & Fischman, 2010; Fitts & Posner, 1967). The affective state of an athlete was proposed to influence the self-talk-performance relationship and was the final mechanism analyzed. The mediating influence that affective states can have on performance refers to an athletes' affect, emotion, mood, and anxiety (Hardy et al., 2009).

Tod et al. (2011) reviewed the experimental literature regarding the influence of self-talk on sporting performance and analyzed the potential effects that the previously described mediators and moderators can have on the self-talk-performance relationship. It was found that positive self-talk had a positive effect on athletic performance and negative self-talk had neither a positive nor a negative influence on performance. Instructional and motivational self-talk had a positive relationship with improving the performance of precision-oriented tasks, with instructional self-talk being more effective than motivational self-talk. Regarding gross motor skills, instructional and motivational self-talk were effective for improving performance, with motivational self-talk being more effective than instructional self-talk. These results support the idea that self-talk is effective for improving performance under certain conditions. An analysis of the mediators showed that cognitive and behavioral factors had the strongest relationship with self-talk and performance; all other factors were inconclusive.

These results provide support to the self-talk-performance relationship with instructional, motivational and positive self-talk having the greatest effect on performance (Tod et al., 2011). Tod et al. (2011) concluded that self-talk is beneficial for improving performance and is task specific, meaning that the type of self-talk should be directly related to the nature of the task being performed (e.g., gross motor tasks/precision motor tasks, motivational/instructional self-talk).

A meta-analysis by Hatzigeorgiadis, Zourbanos, Galanis, and Theodorakis (2011) reviewed the effects of self-talk interventions on task performance and provided an analysis of potential moderators related to the effectiveness of self-talk. This meta-analysis relates to Tod et al. (2011) as it examines the self-talk literature to better understand the nature of self-talk and help expand the possible avenues for future research on self-talk. The possible moderating factors for the effectiveness of self-talk were the tasks that were used, participant characteristics, specifics of self-talk, and characteristics of the intervention. Motor demands and novelty were used as the distinctions for sport task characteristics. The motor demands of a task refer to the requirement of fine motor skills centered on precision and accuracy (e.g., dart throwing, golf-putting, shooting a basketball), or gross motor skills requiring physical conditioning, endurance, strength, and power (e.g., cycling, long-distance running, shot put, long jump). The task distinction used was either novel or well-learned, with novel meaning the participant has no prior experience before performing the skill and well-learned referring to the participant having mastered the skill prior to participating in the study. Hatzigeorgiadis et al. (2011) hypothesized that a self-talk intervention would have a greater influence on novel tasks than well-learned tasks and that novice athletes will benefit more from the use of self-talk than experienced athletes.

There were four self-talk characteristics analyzed: content, overtness, selection and training. The content of self-talk is the first aspect discussed. The distinction of effects between instructional and motivational self-talk was proposed by Theodorakis, Weinberg, Natsis, Douma, and Kazakas (2000), in which they claimed that motivational and instructional self-talk had different effects on performance, relative to the task being performed. Theodorakis et al. (2000) put forth the matching hypothesis, speculating that motivational self-talk should be more effective for gross motor tasks involving endurance, strength, and power, and instructional self-talk should be more effective during fine motor tasks involving precision and accuracy (i.e., different forms of self-talk may serve different functions relative to the task being performed). Hatzigeorgiadis et al. (2011) tested this hypothesis within the current literature review. Self-talk cue selection was analyzed in the form of assigned or self-selected self-talk cues. Assigned cues are given to the athlete by the researcher to use during their task performance, whereas self-selected cues are chosen by the athlete and later reported to the researcher. The third aspect analyzed was the overtness of self-talk, which refers to the self-talk cues being said out-loud by the participant or internally to themselves. Hatzigeorgiadis et al. (2011) tested these notions with their hypothesis that self-selected, out-loud cues will be more effective than assigned, internal cues. The final aspect analyzed was training the participants in the uses of self-talk. This training refers to the participants being given information regarding the uses of self-talk and having time to practice their self-talk before participating in the intervention, as opposed to not having any formal training. Hatzigeorgiadis et al. (2011) hypothesized that self-talk interventions providing formal training for the participants would be more effective than interventions that provided no training. This literature review primarily focused on the effectiveness of self-talk on performance, meaning that studies using a mental skills training package (e.g., Thelwell & Greenless, 2003) were not included in the meta-analysis. These studies were still included in the study overall, but they were not weighed as heavily as self-talk interventions exclusively.

Hatzigeorgiadis et al. (2011) found that self-talk interventions provide a valuable contribution to skill acquisition, learning, and task performance enhancement in sport. An analysis of the potential self-talk moderators showed that the effectiveness of a self-talk intervention may vary, based on matching the task and type of self-talk, novelty of the task, and self-talk training implementation. Instructional self-talk was found to be more effective for precision motor tasks than gross motor tasks and was more effective than motivational self-talk during the same precision motor tasks. Although there was no significant interaction, motivational self-talk was more effective than instructional self-talk in gross motor task performance. This result supports the hypothesis by Theodorakis et al. (2000), with different forms of self-talk serving different functions. Regarding task novelty, it was found that self-talk interventions were moderately more effective during novel task performance than well-learned task performance. The result was not significantly in favor of novel task performance in comparison to well-learned task performance. This is an indication that self-talk can be an effective strategy throughout the stages of skill acquisition and improving performance. The self-talk interventions that included training were more effective than interventions that offered no training. However, the interventions that did not contain training were still significant for improving performance. These results suggest two things: that self-talk is a strategy that is relatively easy to learn and apply, and that self-talk can provide immediate increases in performance. Hatzigeorgiadis et al. (2011) recommended that a self-talk training program be provided, as it can increase the overall effectiveness of the intervention. It was noted that immediate intervention effects are encouraging for athletes using the strategy, to enhance their belief in self-talk and help them continue using self-talk in the future. There were no significant effects between the cue selection and the overtness aspects, as they were equally effective in the interventions analyzed. Overall, these results establish the effectiveness of a self-talk strategy and encourage using self-talk to facilitate learning a skill and to increase performance.

Hatzigeorgiadis, Galanis, Zourbanos, and Theodorakis (2014) analyzed the effectiveness of a self-talk intervention on competitive swimming performance in young athletes. A control group and a self-talk group were analyzed. There was no differentiation between instructional and motivational self-talk; they only looked at the effectiveness of a self-talk intervention on competitive performance. The competitive performance of the swimmers was measured over a 10-week period in between two competitions, with the first competition being the baseline measure. The intervention group was given a self-talk training program, specific to each athlete. The program consisted of information on what cue word to use, when to use it, how often to use it and what the purpose of each cue word was. This was to ensure the athletes had a solid understanding of learning and practicing self-talk, and to promote the development of their own competitive self-talk plan. The intervention group was given this information and practice schedule during the time in-between competitions, with the second competition being the second measure of the data. The results indicated that the self-talk intervention group significantly improved their competitive performance in comparison to the control group. This study provided experimental evidence that self-talk can improve competitive performance if it is learned and used properly. This experimental result supports the analysis from Hatzigeorgiadis et al. (2011), indicating that self-talk should be practiced and implemented into a mental skills training program, as it has a positive effect on athletic performance.

Effects of Instructional and Motivational Self-talk on Sport Performance

Throughout previous research, self-talk had a significant effect on the skill performance outcomes of athletes in several different activities. Some of these studies explore the differences between instructional and motivational self-talk on precision and gross motor tasks. Theodorakis et al. (2000) compared motivational and instructional self-talk across four different precision and gross motor movements. They found that instructional self-talk was significantly more effective during the precision motor movements (e.g., soccer passing accuracy and badminton serve accuracy), than motivational self-talk, whereas both self-talk strategies were effective during the gross motor movements (e.g., a sit-up endurance test and a leg extension strength test). Based on these results, Theodorakis et al. (2000) hypothesized that instructional self-talk should be more effective for tasks involving timing, precision, and accuracy, whereas motivational self-talk should be more effective for strength, endurance, and power tasks (i.e., matching hypothesis).

Hatzigeorgiadis et al. (2004) performed a self-talk intervention during a water polo throwing task. Instructional and motivational self-talk were compared with a control group in a precision motor skill and a gross motor skill (e.g., throwing at a target and throwing for maximum distance). The groups completed a baseline and an intervention trial, with the control group having no self-talk for either trial. Instructional self-talk was found to be more effective while performing the precision throwing task, whereas both self-talk strategies were effective while performing the gross motor task, with motivational self-talk being slightly more effective than instructional self-talk. It was suggested that because both self-talk interventions were successful, the differentiating effects of self-talk provide support for the matching hypothesis that Theodorakis et al. (2000) proposed.

Chang et al. (2014) found that instructional and motivational self-talk were effective for increasing the softball accuracy performance over an unrelated self-talk control group. They also found that motivational self-talk was more effective than instructional and unrelated self-talk in throwing a softball for maximum distance. Boroujeni and Shahbazi (2011) analyzed the effectiveness of motivational and instructional self-talk on basketball pass skill (e.g., pass speed and pass accuracy) and shot performance (e.g., shot accuracy). A control group, motivational self-talk group and instructional self-talk group were compared. It was found that all aspects of the tested skills improved across all groups, but the results were not significant. The comparisons between the groups were significant with instructional self-talk being more effective for improving shot and pass accuracy and motivational self-talk being more effective for improving pass speed. The result of this intervention provides further support for the matching hypothesis by Theodorakis et al. (2000), with instructional self-talk being more effective for improving skills that involve precision and timing, and motivational self-talk being more effective for improving skills that require speed. A similar study by Boroujeni, Zourbanos, and Shahbazi (2014) found less convincing results with their analysis of motivational and instructional self-talk interventions on basketball passing (e.g., pass speed and pass accuracy) and shooting tasks (e.g., shooting accuracy) in novice students. A control group was compared with an instructional self-talk group and motivational self-talk group. Only the instructional self-talk intervention yielded significant results with an improvement in passing accuracy, otherwise there were no significant results from this intervention.

A commonality in the intervention studies above is the differences between novice and skilled athletes. Hatzigeorgiadis et al. (2011) suggested that novice athletes may benefit more from instructional self-talk than skilled athletes. Hardy, Begley, and Blanchfield (2015) analyzed this notion by comparing the effectiveness of instructional and motivational self-talk in skilled soccer athletes. Participants were tasked with comparing their shooting accuracy during a dominant and non-dominant foot shooting condition. The results showed that during the dominant foot condition motivational self-talk was significantly more effective than instructional self-talk during the accuracy test. No differences were found between instructional and motivational self-talk during the non-dominant foot condition. These results offer conflicting data on the notion that instructional self-talk is more effective than motivational self-talk during precision task performance. Hardy et al. (2015) suggested that the skill level of the athlete be taken into consideration when constructing a self-talk intervention.

Kolovelonis, Goudas, and Dermitzaki (2011) analyzed the effectiveness of instructional and motivational self-talk on motor task performance (e.g., chest pass and modified push-ups) in sixth grade students. Three conditions were compared: control, instructional self-talk and motivational self-talk. Three hypotheses were tested: both self-talk intervention groups would improve task performance, instructional self-talk would be more effective during the chest pass, and motivational self-talk would be more effective during the modified push-up test. The results indicated that both instructional and motivational self-talk were effective for improving the performance of both tasks, in comparison to the control group. Motivational self-talk had a greater effect on the modified push-up test than instructional self-talk, whereas both forms of self-talk were equally effective for improving the performance of the chest pass. These results relate to those from Hatzigeorgiadis et al. (2004), in which both forms of self-talk were beneficial for improving precision task performance. These results provide further experimental evidence that self-talk is an effective way to improve performance and it supports the notion that motivational self-talk is more effective during gross motor tasks. Regardless of the instructional self-talk outcome, partial support is given to the matching hypothesis by Theodorakis et al. (2000) with different forms of self-talk serving different functions.

Regarding the matching hypothesis, Hatzigeorgiadis, Zourbanos, and Theodorakis (2007) set out to test if different forms of self-talk serve different functions. The intervention began with participants completing a water polo throwing accuracy test with no self-talk use. Participants then practiced a self-talk program for three-days, after which they performed the throwing accuracy test using anxiety and attentional control self-talk cues. The analysis revealed that the anxiety control cue had a greater effect on anxiety than the attentional control cue, while the effects for attention, effort, confidence, and automaticity were similar for both cues. A further analysis revealed that each cue was most effective for task concentration. The researchers suggested that if different self-talk cues have different effects on performance, different types should serve different functions. The differing effects of self-talk were explored by Hatzigeorgiadis, Zourbanos, Mpoumpaki, and Theodorakis (2009), who studied the effects of motivational self-talk on confidence and anxiety. An experimental and control group were compared through a baseline and post-intervention measure. There were three training sessions in-between the two tests, with the experimental group using self-talk during the training sessions and the post-intervention measure. Task performance improved for the experimental group and stayed consistent for the control group. The experimental group experienced an increase in self-confidence and a decrease in cognitive anxiety, whereas the control group experienced no changes in either measure. A further analysis of these results revealed that the changes in performance were related to an increase in self-confidence. These results indicate that self-talk can facilitate changes in cognitive anxiety and self-confidence, with the changes in self-confidence being a feasible explanation regarding the effects of self-talk on performance.

These research findings outline the variety of functions that a self-talk intervention can serve. There is an abundance of evidence in support of the matching hypothesis with instructional self-talk being more effective for increasing precision motor task performance and gross motor tasks, with motivational self-talk being slightly more effective than instructional self-talk during gross motor tasks (Boroujeni & Shahbazi, 2011; Boroujeni et al., 2014; Chang et al., 2014; Hardy et al., 2015; Hatzigeorgiadis et al., 2004; Hatzigeorgiadis et al., 2009; Hatzigeorgiadis et al., 2007; Kolovelonis et al., 2011; Theodorakis et al., 2000). An athlete's skill level will influence the effectiveness of a self-talk intervention with novice athletes benefitting from instructional self-talk and skilled athletes being negatively affected by the same level of instruction (Hardy et al., 2015). It can be concluded that when developing an effective self-talk intervention, the nature of the task and the skill level of the athlete must be taken into consideration.

The effects of self-talk interventions have also been explored during endurance performances. Thelwell and Greenlees (2001) built their study from the results of Bull (1989) and Patrick and Hrycaiko (1998), both of which implemented mental skills training programs in ultra-distance runners and 1600-meter runners, respectively, and found them to beneficial for performance. Thelwell and Greenlees (2001) noted that there were some missing components from the previous mental skills implementations. Bull (1989) found that a mental skills training program comprised of imagery, self-talk and relaxation was effective for enhancing performance. However, no rationale was offered as to why they chose these specific mental skills, the benefits of mental skills on performance and how these skills were employed. Patrick and Hrycaiko (1998) had a similar issue with their mental skills program consisting of relaxation, goal setting, self-talk and imagery with 1600-meter runners. Their study did not include an explanation for why they chose these mental skills or how they were administered. Thelwell and Greenlees (2001) implemented self-talk within a mental skills training package during gymnasium triathlon performance. The mental skills package included self-talk, goal setting, imagery and relaxation. The mental skills training package was derived from Taylor (1995), which was a recommendation outline for mental skills during endurance activities. Taylor (1995) specifically outlined that a mental skills training program for endurance activities be based around motivation, maintaining focus, and pain management. Self-talk was included within the Thelwell and Greenlees (2001) mental skills training package because self-talk can help maintain or enhance effort and focus, increase or decrease arousal, help focus on relevant tasks, focus on process goals, and help fight pain, boredom and fatigue (Hardy et al., 2001). Thelwell and Greenlees (2001) examined five participants during a gymnasium triathlon of running 3000-meters, rowing 2000-meters and cycling 5000-meters. Participants were offered prizes for finishing with the best time, compared to the other participants, with each participant completing the triathlon alone. It was found that all participants' times improved post-mental skills intervention, along with their mental skills usage rate. It was also found that participants would utilize different strategies for their mental skills before and during competition, which was not a focus of this study. This supports a mental skills package, which offers more autonomy for the participants after all the mental skills were introduced to them.

Thelwell and Greenlees' (2003) study was a direct continuation of Thelwell and Greenlees (2001) that aimed to test the effectiveness of a mental skills training package of goal setting, imagery, relaxation and self-talk during a competitive gymnasium triathlon. The second part of the study looked at how the athletes utilized their mental skills prior to and during their performance. Looking specifically at self-talk, it was found that participants used self-talk equally prior to competition as compared to their regular exercise routine. Participants reported using self-talk to serve different functions: to motivate to achieve, to enhance confidence, and provide instructions (e.g., stick to the race game plan, focus on process goals, use different psychological skills). During the triathlon, self-talk was reportedly used in a similar fashion regarding cues and function, but with less frequency. During the later stages of the triathlon, self-talk usage was reported higher by the participants. Two main functions of self-talk were used: motivational (e.g., to maintain motivation until the end, to fight through pain, and to increase confidence through achieving) and instructional (e.g., focus on their process goals and block out irrelevant feelings or thoughts, maintain focus on proper form when the pain or fatigue set in). The performers had an increased self-belief due to the positive effects that motivational and instructional self-talk were having on their performance.

Thelwell and Greenlees (2001, 2003) analyzed the effectiveness of self-talk within the context of a mental skills training program, which displayed positive results in each study, respectively. Experimental studies focusing strictly on self-talk exclusively utilized motivational self-talk and examined its effectiveness during a difficult endurance task. Wallace et al. (2017) analyzed the effectiveness of a 2-week motivational self-talk intervention, specific to heat tolerance, on endurance capacity and cognitive function. The results indicated that the motivational self-talk group had a significant increase in time to exhaustion from pre-to post-test, while the control group showed no significant changes between pre-and post-test measures. It was also found that speed and accuracy of executive function significantly increased within the motivational self-talk intervention group.

Hamilton, Scott and MacDougall (2007) performed an intervention in which they compared modes of self-talk delivery (i.e., organic self-talk cue use, prompted self-talk cue use) and the effectiveness of three different self-talk interventions on endurance performance with those interventions being self-regulated positive self-talk, assisted positive self-talk, and assisted negative self-talk. The researchers used a multiple baseline design, in which they had the participants perform a 20-minute cycling ergometer test twice per week with one-day in-between sessions, for five weeks in total. The results of this intervention showed an increase of performance in all interventions with the greatest increase being within the assisted positive self-talk group. These results add to the notion that both positive and negative self-talk, regardless of how it is delivered, can lead to enhanced performance.

Blanchfield, Hardy, De Morree, Staiano, and Marcora (2014) analyzed the effect of a motivational self-talk intervention on participants' rate of perceived exertion in a time-to-exhaustion cycle ergometer trial. Their results indicated that the motivational self-talk intervention group had a significantly higher time-to-exhaustion during the pre-vs post-test than the control group, and the motivational self-talk group's rate of perceived exertion was reduced by 50% compared to that of the control group. Similar results were indicated by Barwood, Corbett, Wagstaff, McVeigh, and Thelwell (2015), in which it was theorized that motivational self-talk could influence rate of perceived exertion and pacing strategy in comparison to neutral self-talk during a 10-km cycling time trial. The results revealed that the post-intervention motivational self-talk group had decreased time trial times, a higher power output, a higher VO_2 peak and the rate of perceived exhaustion was closely related to the pre-intervention measures.

Based on the outcomes of the studies previously mentioned, it can be concluded that self-talk interventions can have a positive effect on the performance of any physical activity. It can also be assumed that outcomes may be different depending on the form of self-talk, (i.e., motivational or instructional), utilized during the intervention, based on the differentiation of effects matching hypothesis (Theodorakis et al., 2000). Therefore, it is important for the researcher to determine which form of self-talk would best fit the parameters of their study to achieve significant results, just as it is equally important for the athlete or coach to determine which form of self-talk would be the most effective for increasing their athletes' performance. Hardy et al. (2015) brought athlete skill level into consideration when implementing a self-talk strategy, which indicates that skilled athletes do not receive the same benefits from an instructional self-talk intervention as a novice athlete would. This further increases the importance of the coaches' or consultants' knowledge of which form of self-talk would best work for their athletes. Despite the conflicting results previously discussed, self-talk is an effective strategy for increasing performance and should be implemented and practiced, especially during the early stages of learning, to get the best results (Hatzigeorgiadis et al., 2011; Tod et al., 2011).

Chapter 2: Rationale, Purpose and Hypotheses

Rationale

The experimental research outcomes from the previous chapter have provided some interesting findings. Theodorakis et al. (2000) hypothesized that different forms of self-talk would serve different functions, relative to the task being performed. Theodorakis et al. (2000)'s proposal became known as the matching hypothesis, and has gained support in experimental studies (i.e., Boroujeni et al., 2014; Chang et al., 2014; Hatzigeorgiadis et al., 2004; Theodorakis et al., 2000). These experimental studies examined the differences between motivational and instructional self-talk during different precision and gross motor task performances. The functions that self-talk serve during endurance performance was also previously examined (i.e., Barwood et al., 2014; Blanchfield et al., 2013; Hamilton et al., 2007; Wallace et al., 2017). The endurance self-talk interventions focused exclusively on motivational self-talk, whereas the experimental studies compared instructional and motivational self-talk on task performance outcomes. Currently, no studies have examined the possible differences between instructional and motivational self-talk during the combination of a precise mechanical skill and an endurance component. There is a lack of literature on the effects of a self-talk intervention during highly precise mechanical gross motor movements (e.g., Olympic weightlifting). Regarding endurance performance interventions, motivational self-talk is the focus, creating a lack of literature on the effectiveness of instructional self-talk interventions during the same activities. The potential differences between motivational and instructional self-talk during endurance performance is also a neglected area of self-talk research. The basis of this study was derived from these gaps within the self-talk literature.

These gaps within the literature can partially be addressed with the help of cross-training, an all-encompassing training methodology that combines precision mechanical gross motor movements (e.g., Snatch, Clean and Jerk, overhead squats) and different endurance components (e.g., running, rowing, exercise biking).

Cross-training is a relatively new exercise activity with an inherit uniqueness, as most workouts are a combination of these precision mechanical movements and endurance components. Cross-training has received limited sport psychology related research, with no previous self-talk interventions conducted. Hak, Hodzovic, and Hickey (2013) performed an injury rate analysis during cross-training, which indicated that cross-training had similar injury rates to Olympic Weightlifting, power lifting and gymnastics, but less than contact sports (e.g., rugby). Fletcher (2010) wrote a literature review supporting the importance of a cross-training mental skills manual including imagery, goal setting, focus and self-talk. This review was written analyzing previous research outcomes, unrelated to cross-training, and was promoting the development of a mental skills training program with these skills at the heart. Currently, there are no mental skills training programs for cross-training athletes and no self-talk effectiveness interventions have been performed. The lack of sport psychology research in cross-training is a gap within the literature that researchers should begin to explore and will partially be filled with this manipulation study. This manipulation will provide tangible evidence to support the use of self-talk during cross-training exercise training and will offer insight into the potential development of a cross-training mental skills training program.

Purpose

The purpose of this study was to analyze the potential effects of a self-talk manipulation on athletic performance during cross-training exercise. Being that there is a lack of research on cross-training and self-talk interventions during cross-training exercise. This study was considered a manipulation rather than an intervention, as the study parameters did not cover a long time period or implement a long-term self-talk program.

Hatzigeorgiadis et al. (2004) and Theodorakis et al. (2000) have outlined the positive effects that self-talk can have during the execution of precision and gross motor movements. The proposed study was a continuation of the literature examining the effects of a self-talk manipulation, while comparing motivational and instructional self-talk during the combination of precision and gross motor movements. The idea that different forms of self-talk will serve different functions, (i.e., matching hypothesis), during a combination exercise activity was also examined (Theodorakis et al., 2000).

The positive effects that motivational self-talk can have during endurance exercise performance outlined by Blanchfield et al. (2013) and Hamilton et al. (2007) are relevant to cross-training, as an endurance component is regularly included. The proposed study built on the previous self-talk endurance exercise research with motivational self-talk being implemented. Additionally, the inclusion of instructional self-talk compared against motivational self-talk, was to enhance the endurance exercise research. The self-talk literature was expanded through the testing of a self-talk manipulation during the endurance performance of weightlifting movements, rather than stationary biking (Barwood et al., 2015; Blanchfield et al., 2013), thus adding a new activity to the self-talk endurance manipulation literature.

Research Questions and Hypotheses

The proposed study attempted to help bridge the previously discussed gaps within the literature by answering the following questions:

1. What effect would self-talk have on cross-training exercise performance?
2. Which form of self-talk would be more effective during the performance of each exercise component?

The hypotheses for the proposed study predicted that self-talk would have a positive effect on cross-training exercise performance in comparison to a non-self-talk condition, and that different forms of self-talk would be more effective relative to the task being performed (i.e., motivational would be more effective on overall exercise time and instructional would be more effective on overhead squat mechanical scores).

Chapter 3: Methodology

Participants

Cohen (2008)'s power analysis formula using Theodorakis et al. (2000)'s effect size of 1.26, an alpha of 0.05 and power of 0.80 resulted in a sample size of 9.74, or 10, per group. With an estimate of 10 participants for each research group, 30 participants were recruited for the study. Brock University students were primarily recruited, with Brock University faculty and alumni eligible for participation. Participants were recreationally active (i.e., consistently engaged in regular exercise), but exercise experience was not necessary. Participants were recruited with research flyers displayed throughout the Brock University campus, through word of mouth and snowball recruitment. This recruitment method primarily focused on University aged individuals between 18-25 years old, which was ideal as they were easily accessible and consistent with Gammage et al. (2001) and Hatzigeorgiadis et al. (2004). Recruitment was eventually opened to Brock University faculty and alumni to increase sample size. This allowed for a greater age range to examine the potential effects of the intervention.

Thirty Brock University students and alumni (12 males and 18 females) volunteered to participate in the current study. Their ages ranged from 18-43 years old, with a mean age of 25.7 years old (SD = 5.31). The participants exercised between two and seven days per week, with a mean exercise frequency of 4.4 days per week (SD = 1.3). All 30 participants reported engaging in self-talk during their regular fitness routines with a Likert Scale rating measure. They had a mean self-talk frequency rating of 5.3 (SD = 1.4), which indicated participants reported, on average, to frequently use self-talk.

The 30 participants were randomly assigned into of one three groups: control, instructional self-talk or motivational self-talk. Each group contained 10 participants, with instructional self-talk having 6 females and 4 males, motivational self-talk having 7 females and 3 males, and control having 5 females and 5 males. Each group's age, exercise frequency, and self-talk frequency were compared using a One-Way ANOVA analysis, along with a Levene's test for variance, to ensure the groups were relatively equal prior to the manipulation (Field, 2018). The analysis for age provided a variance of $F(2, 27) = 1.02$, $p > .05$ and an ANOVA result of $F(2, 27) = 2.21$, $p > .05$. The analysis for exercise frequency provided a variance of $F(2, 27) = .18$, $p > .05$ and an ANOVA result of $F(2, 27) = 1.1$, $p > .05$. The analysis for self-talk frequency provided a variance of $F(2, 27) = .86$, $p > .05$ and an ANOVA result of $F(2, 27) = .70$, $p > .05$. The Levene's tests for homogeneity of variance indicated that each group was of equal variance across conditions for each measure, with no significant difference being observed. The One-Way ANOVA tests indicated that each group was similar for each measure, with no significance being observed.

Measurement

The Self-Talk Usage Questionnaire (STU-Q) (see Appendix B) was given to participants following the completion of the manipulation to protect the study's true nature and to attain demographic information, including the participants self-talk use during their normal fitness routines outside of the intervention. The STU-Q was derived from Gammage et al. (2001), and was modified with an updated description of the self-talk definition: "self-talk should be directed towards oneself, be multidimensional in nature, have interpretations associated with content employed, is somewhat dynamic, and serves two functions: instructional and motivational and should be open to modification" (Hardy, 2006). This definition is the most recent within the literature and encompasses all aspects of the self-talk construct. The STU-Q asked participants for their descriptive information: age, gender, frequency of exercise, and type of exercise activity. The STU-Q then provided the previous description of self-talk and asked the participants if they had ever used it during sport or exercise. Participants rated how often they used self-talk on a 7-point Likert scale, with (1) being never and (7) being every-time. The last part of the STU-Q asked participants four questions regarding their self-talk usage outside of the intervention: where do you typically use self-talk? (e.g., at home, the gym, at school), when do you use self-talk? (e.g., before, during or after exercise), what do you say to yourself when you exercise? (e.g., "let's go" cue prior to leg pressing), and why do you use self-talk during exercise? (e.g., to provide motivation or instruction). Aside from obtaining the participants' demographic information, this questionnaire allowed participants to reflect on their current self-talk use and content, thus increasing their self-talk awareness.

The Physical Activity Readiness Questionnaire (PAR-Q+) (see Appendix C) was used as a screening tool to ensure the participants were safe to begin physical activity. The PAR-Q+ was given to participants prior to participating in the intervention. The Mental Skills Questionnaire (MS-Q) (see Appendix D) was used as a manipulation check for the self-talk manipulation to assist in protecting the true nature of the study. This questionnaire asked participants how frequently they engaged in several mental skills (goal setting, self-talk, imagery, and relaxation techniques) in relation to exercise. Each participant was asked to rate their use of these skills on a Likert scale with (1) being never, and (7) being every time. The MS-Q was given to every participant prior to the first exercise trial for the sole purpose of protecting the control group, to dissuade them from engaging in self-talk without instruction. The Post-Exercise Self-Talk Questionnaire (PEST-Q) (see Appendix E) was given to each participant following the third exercise trial. The PEST-Q asked participants if they used self-talk during the manipulation trial, what their self-talk consisted of, and how often they used their cue, with extra space provided to elaborate on their use and if they felt awkward having to say their cue out-loud. This questionnaire allowed the manipulation groups to reflect on their self-talk usage and provide information regarding their cue words (i.e., if they used a different cue during the exercise trial that they didn't say out-loud). This also allowed the control group to describe their self-talk use during the third exercise trial, despite not having any self-talk instructions. The PEST-Q was a manipulation check to ensure that the manipulation groups were using the correct cues, but also as a primer for the control group to get the same self-talk information as the manipulation groups.

The experimental measures were the time to completion of the cross-training exercise task with a cap of 20:00 minutes, split-times of each 400-meter run and 15-overhead squat (OHS) repetitions, and OHS mechanical accuracy. The time to completion was recorded as how long it took to complete the exercise task. The split-time measurement was used to determine specific differences between the control and experimental groups during each exercise component. The OHS mechanical accuracy measure is a number point scale that breaks down the OHS movement into six parts: hold weighted bar overhead with arms straight, descend to appropriate depth without losing balance or dropping the weighted bar, descend to appropriate depth without rounding back or tucking hips, maintain an upright torso throughout movement, keep heels on floor and weight evenly distributed, and keep knees from moving laterally during movement (Canadian Weightlifting Federation & Coaching Association of Canada). The participants were filmed on camcorder while they performed the OHS movements and were scored on these six-parts during the duration of the five rounds of the exercise trials. This was for the primary researcher to accurately measure and score each participants OHS performance. The highest score a participant can achieve for these six-parts is 30, with each part being rated on a six-point scale across all five rounds for a total of 30 points (Canadian Weightlifting Federation & Coaching Association of Canada). The scoring measure was obtained by the primary researcher reviewing each of the participants' videos and giving a rough estimate within the six-point scale for each set of overhead squats. The recording and scoring review limited the subjectivity that scoring this movement in real time could contain. This recording method provided the primary researcher a visual reference and ample time to ensure the scores were accurate. The six-part scale and recording measure are primarily used in Olympic Weightlifting training to ensure that a novice athlete can perform the OHS movement adequately prior to learning the snatch movement, and in advanced lifters to help improve technique. These measures are applicable to the OHS movement, as learning the movement is a pre-curser to learning the Olympic Weightlifting movement of snatching.

Self-Talk Manipulation

The instructional and motivational cues given to the participants were derived from Theodorakis et al. (2000). The motivational cues included "you can do it," "hang in there," "strong," and "get tough" (Theodorakis et al., 2000). The instructional cues included "elbow straight," "reach," "stay low," and "move your feet" (Theodorakis et al., 2000). The participants were exposed to these cues and were asked to think about their current self-talk cues, they were then given the option to choose one of the cues given or use the cue that they normally use. This basis was derived from Blanchfield et al. (2013) in which they offered the participants their own choice of cues to use for their endurance study. The manipulation participants were instructed to say their cues overtly to ensure they were using the correct cue. The overt use of self-talk is derived from Ming and Martin (2006). The control group was given no self-talk instruction; they were given the self-talk information following the completion of the third exercise trial.

Procedures

A flow chart visually outlining the procedures of the manipulation is located at the end of the document (see Appendix G). The current manipulation was three exercise trials over the span of five to six days, depending on participant schedules, with each exercise trial being 24-48 hours apart. Participants could maintain their current fitness routines during the manipulation; as there was no limitation on physical activity during the manipulation. The exercise task was a cross-training routine consisting of an intricate mechanical movement (i.e., OHS) and an endurance movement (i.e., running). This cross-training routine consisted of a 400-meter run immediately followed by 15 repetitions of OHS, being performed sequentially until five rounds of running and OHS were completed (e.g., complete 400-meters of running followed by 15 OHS, 400-meters of running followed by 15 OHS, etc.). This cross-training routine had a time-cap of 20 minutes, with any participant unable to complete the routine within the time cap being given a time of 20 minutes. The time cap gave participants ample time to complete the routine, as no participant exercised for longer than 20-minutes. The weight used for the OHS was uniform across all participants with a 6-lb. bar. This weight was used to minimize the risk of injury for all participants, and the likelihood of the participants having performed the OHS movement prior to the study was low.

Approval from the Brock University Research Ethics Board was obtained (see Appendix F), and the primary researcher began recruiting around Brock University campus. The initial meeting involved the participant completing the informed consent form, PAR-Q+, and the MS-Q. The researcher then tasked the participant with a dynamic warm-up consisting of hip stretches, glute stretches, hamstring and quad stretches, calf stretches, high knees, butt kicks, karaoke, and chest stretches. Following the warm-up, the researcher demonstrated and explained the OHS movement, after which the participant was tasked with adequately completing the movement for five-repetitions to show he/she was warmed up and could complete the exercise task. If any participant was unable to demonstrate the movement properly and safely, he/she was excluded from the study, as the safety of the participant was of the utmost concern.

Following the completion of the warm-up, the participant completed the first exercise trial. This trial was used as an initiation of the exercise task to familiarize the participant with the movements and the procedures of the cross-training sequence. The inclusion of the initiation/familiarization trial was to account for a potential motor learning effect, or neural adaptation, that may have taken place. A motor learning effect may occur after performing a task for the first time, in which upon performing the task a second time, performance may increase (Gabriel, Kamen, & Frost, 2006). The addition of the initiation trial was to account for this potential learning effect and to reduce the possibility that potential performance improvements resulting from the learning effect were not falsely attributed to the self-talk manipulation. Another reason for the inclusion of the initiation exercise trial was to expose the participants to the entire exercise sequence and allow them to experience the exercise sequence in its entirety. The participant was instructed to perform the sequence of a 400-meter run and 15 OHS until five-rounds were completed. Each participant was instructed to do his/her best during each exercise trial. The do your best instruction was to encourage each participant to give his/her best effort during all three exercise trials (Theodorakis et al., 2000). With respect to the OHS movement, the do your best instruction was meant to ensure each participant was maintaining proper mechanics during the OHS movement (i.e., he/her was not sacrificing proper mechanics for speed). Upon completion of the initiation exercise trial, each participant was informed that the next two exercise trials would follow the same protocol, with each exercise trial being 24-48 hours apart to allow for adequate recovery between exercise trials (Theodorakis et al., 2000).

The second exercise trial was the same procedure as the first. This trial was used for the baseline as the participant was acclimated to the movements and the sequence, he/she was performing. The warm-up from the initiation trial was used again, with the participant demonstrating the OHS movement prior to the exercise trial. The participant was tasked with completing the sequence of a 400-meter run and 15 OHS for five rounds, or the 20-minute time cap was reached. Following the completion of the baseline trial, the researcher randomly assigned each participant into the control, instructional, or motivational condition. This assignment was unknown to the participant until he/she came in for his/her third exercise trial. The instructional and motivation condition participants were instructed to meet with the researcher five-minutes prior to their third exercise trial. The control group participants were instructed to meet with the primary researcher and walk over to the track, with no self-talk meeting prior.

The third exercise trial began with an informational session lasting five-minutes and consisted of the basis of self-talk (e.g., what it is and how to use it). The instructional and motivational manipulation groups were given information relevant to their specific condition and told that is what self-talk is (i.e., instructional cues were given to the instructional group under the guise that self-talk was only for instruction, and motivational cues were given to the motivational group with the notion that self-talk was only for motivation). The manipulation participants were given the example cues previously mentioned and were asked if they had any self-talk cues they currently use or used in the past. The participants ultimately decided what their cue would be during the third exercise trial. The manipulation groups were instructed to only use their selected self-talk cue overtly, to ensure they were using the correct cue they selected (Ming & Martin, 2006).

The participants completed the warm-up from the initiation trial and were instructed to use their selected self-talk cue overtly prior to beginning the set of 15 OHS repetitions (i.e., upon finishing the 400-meter run the participant was asked to say his/her cue overtly prior to picking up the bar and beginning the set of 15 OHS). The participants were asked to say their cue each time they began a set of 15 OHS repetitions, meaning they would overtly say their self-talk cue a minimum of 5 times. The participants were tasked with completing the sequence of a 400-meter run and 15 OHS for five-rounds, or reaching the 20-minute time cap. The control group was tasked with completing the exercise routine with no self-talk instructions.

Following the third exercise trial each participant was informed of the true nature of the study. Each manipulation group was informed about the other form of self-talk used in the study, and the control group was given information regarding both forms of self-talk used. The researcher and the participant then walked back to Welch Hall 140 and the participant was asked to complete the PEST-Q and the STU-Q. There was some time for the researcher to answer any questions that the participant may have had. This ensured that all the participants left the study knowing what self-talk was, how to use it, when to use it, what types of self-talk there are, and understand how and why they use self-talk during exercise and physical activity.

Data Analysis

The design of this study was a repeated measures comparison between the three research groups (i.e., instructional, motivational and control). One 3 x 3 (Group x Trial) repeated measures ANOVA compared the total exercise time of the groups across three trials. The other 3 x 3 (Group x Trial) repeated measures ANOVA compared the mechanical score of the groups across three trials. This analysis was derived from Hatzigeorgiadis et al. (2004) and was implemented within the proposed study. This design totaled three trials with the first being an initiation trial to familiarize the participants with the movements. The second trial was the baseline, and the third trial was the manipulation. This was due to the potential learning effect that may have occurred with the participants likely never having performed the overhead squat movement prior to this study.

Chapter 4: Results

Assumptions

Intraclass correlation coefficient.

The videos were analyzed by two coders and scored appropriately for mechanical accuracy. Prior to checking the assumptions, an intraclass correlation measure was performed. The intraclass correlation measure assesses the consistency between two coders ratings of a set of scores (Field, 2018). The ICC statistics are presented in Table 1. The ICC estimate was above .9 for all three trials, which indicates excellent reliability between the two coders.

Table 1

Intraclass Correlation Coefficient for Mechanical Accuracy Scores

Mechanical Score		ICC	Sig.
Trial 1	30	.942	.000
Trial 2	30	.945	.000
Trial 3	30	.932	.000

Normality.

The descriptive statistics for exercise time across conditions is presented in Table 2.

Table 2

Descriptive Statistics of Total Exercise Time (In Seconds)

		Trial 1		Trial 2		Trial 3	
Group		M	SD	M	SD	M	SD
Control	10	876.37	166.25	859.26	172.19	832.06	159.10
Instructional	10	881.30	128.18	900.25	144.06	892.14	136.55
Motivational	10	811.32	156.71	799.88	129.35	773.16	123.60

The assumption of normality was examined using the Kolmogorov-Smirnov (KS) test. This test compares the manipulation times to a set of normally distributed times with the same means and standard deviations (Field, 2018). The normality statistics for exercise time across conditions are presented in Table 3. Given the $p > .05$ for all conditions across three trials, the assumption of normality was satisfied.

Table 3

Normality Statistics of Total Exercise Time

		Trial 1		Trial 2		Trial 3	
Group		KS	Sig.	KS	Sig.	KS	Sig.
Control	10	.208	.200	.214	.200	.199	.200
Instructional	10	.184	.200	.202	.200	.183	.200
Motivational	10	.244	.093	.176	.200	.177	.200

The descriptive statistics for mechanical scores across conditions are presented in Table 4.

Table 4

Descriptive Statistics of Mechanical Score Accuracy

		Trial 1		Trial 2		Trial 3	
Group		M	SD	M	SD	M	SD
Control	10	25.40	2.18	26.20	2.10	25.60	2.40
Instructional	10	21.65	3.51	22.45	2.20	23.60	2.22
Motivational	10	23.75	6.26	25.10	5.10	25.30	4.85

The normality statistics for mechanical score across conditions are presented in Table 5. The control condition trial 1 had a $p < .05$ and the instructional condition trial 2 had a $p < .05$, indicating they are not normally distributed. Given the $p > .05$ for the remaining mechanical scores across conditions, the assumption of normality was satisfied.

Table 5

Normality Statistics of Mechanical Score Accuracy

		Trial 1		Trial 2		Trial 3	
Group		KS	Sig.	KS	Sig.	KS	Sig.
Control	10	.273	.034	.208	.200	.191	.200
Instructional	10	.230	.143	.268	.041	.194	.200
Motivational	10	.240	.106	.181	.200	.177	.200

Homogeneity of variance.

The variance for exercise time across conditions was assessed using the Levene's test. This test ensures that variances in different groups are equal (Field, 2018). The variance for exercise time trial 1 was $F(2, 27) = .183$, $p = .834$; for exercise time trial 2 was $F(2, 27) = .575$, $p = .569$; for exercise time trial 3 was $F(2, 27) = .361$, $p = .700$. Given the $p > .05$ across all conditions, the assumption of equal variance was satisfied.

The variance for mechanical scores across conditions was assessed using the Levene's test, ensuring that variances in different groups were equal (Field, 2018). The variance for mechanical score in trial 1 was $F(2, 27) = 8.42$, $p < .05$; for mechanical score trial 2 was $F(2, 27) = 5.27$, $p < .05$; for mechanical score trial 3 was $F(2, 27) = 2.94$, $p = .07$. The variances for mechanical scores in trials 1 and 2 were unequal $p < .05$, and the equal variance assumption was satisfied for mechanical score in trial three $p > .05$.

Sphericity.

Sphericity of exercise time across trials was examined using Mauchly's test of sphericity, which tests the homogeneity of covariances (Field, 2018). The assumption of sphericity was violated (*Mw* (2) = .729, $p < .05$).

Sphericity of mechanical score across trials was examined using Mauchly's test of sphericity, testing the homogeneity of covariances (Field, 2018). The assumption of sphericity was violated (*Mw* (2) = .542, $p < .05$).

ANOVA

One 3 x 3 (Group x Trial) repeated measures ANOVA compared three groups (control, instructional, and motivational) across three trials comparing exercise time. Because Mauchley's test of sphericity indicated the assumption of sphericity was violated, the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity ($\varepsilon = .79$ for the main effect of exercise time). This ANOVA revealed no significant interaction effect for groups across trials for exercise time $F(3.15, 42.48) = 2.10$, $p > .05$. There was no significant main effect for condition $F(2, 27) = 1.14$, $p > .05$. There was a significant effect for exercise time across trials $F(1.57, 42.48) = 4.56$, $p < .05$. Post-hoc analyses of within-subjects contrasts indicated there was no significant difference between trials 1 and 2, $F(1, 27) = .672$, $p > .05$. However, there was a significant difference between trials 2 and 3, F(1,27) = 7.89, $p < .05$. The interaction effects are visible in Figure 1.

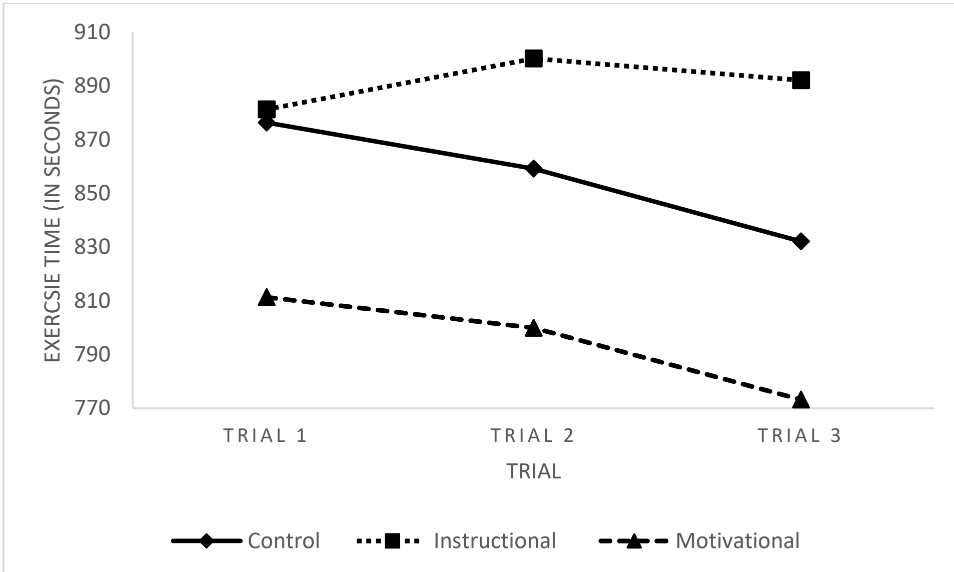

Figure 1. Group x Trial Interaction effects

The second 3 x 3 (Group x Trial) repeated measures ANOVA compared three groups (control, instructional, and motivational) across three trials comparing mechanical score. Because Mauchley's test of sphericity indicated the assumption of sphericity was violated, the degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity (ε = .69 for the main effect of mechanical score). This ANOVA revealed no significant interaction effect for groups across trials for mechanical score F(2.74, 37.04) = 1.95, $p > .05$. There was no significant main effect for condition F(2, 27) = 1.98, $p > .05$. There was a significant effect for mechanical score across trials F(1.37, 37.04) = 8.20, $p < .05$. Post-hoc analyses of within-subjects contrasts indicated a significant difference between trials 1 and 2, F(1, 27) = 12.78, $p < .05$, and no significant difference between trials 2 and 3, F(1,27) = 1.03, $p > .05$. The interaction effects are visible in Figure 2.

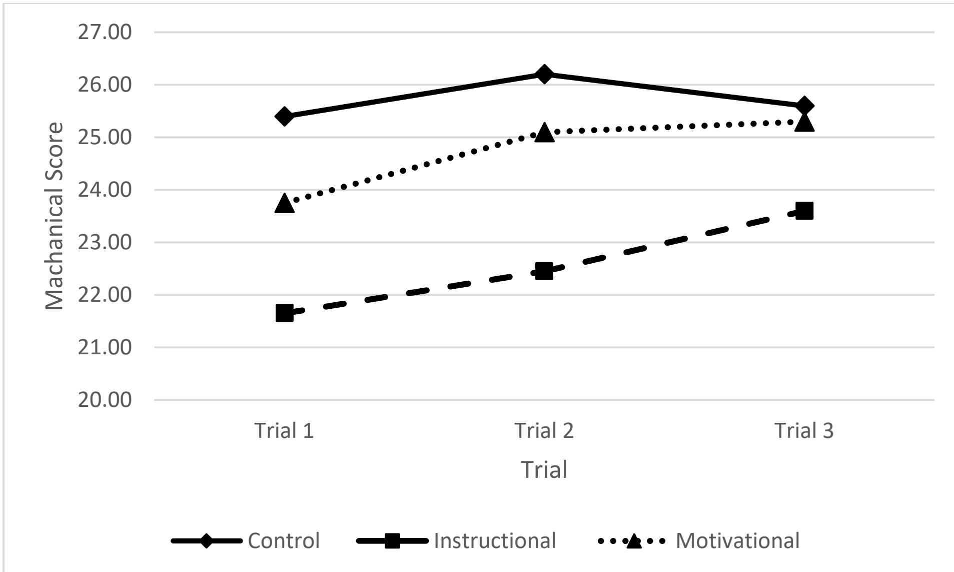

Figure 2: Group x Trial Interaction Effects

Chapter 5: Discussion

This study examined the potential effects self-talk may have on cross-training exercise performance. Motivational and instructional self-talk were compared, alongside a control condition, during the exercise combination of running and overhead squatting. Conditions were compared for exercise time and mechanical score across three exercise trials. The results showed no significant effect for the self-talk conditions during exercise time or mechanical score. There was a significant main effect between trials two and three for exercise time, and between trials one and two for mechanical score. These results contradict those of the influential studies this manipulation was based on (Blanchfield et al., 2013; Hamilton et al., 2007; Hatzigeorgiadis et al., 2004; Theodorakis et al., 2000).

Hypotheses Testing

The first hypothesis predicted that self-talk would have a positive effect on cross-training exercise performance in comparison to a non-self-talk condition. It was found that self-talk had no overall effect on cross-training performance, differing from Theodorakis et al. (2001), in which a self-talk intervention group in a relax condition significantly improved their free throw shooting performance in comparison to a fast condition and a control group. Hatzigeorgiadis et al. (2004) found self-talk positively influenced precision and power task performances in comparison to a control condition. Hatzigeorgiadis et al. (2014) found that a self-talk intervention group improved their performance against a control group over a 10-week intervention period. These studies offer support for the effectiveness of self-talk interventions, which is contradicted with the results of the current manipulation, with no overall effect being observed.

The second hypothesis predicted that different types of self-talk would be more effective relative to the tasks being performed (i.e., instructional self-talk would be more effective on overhead squat mechanical scores and motivational self-talk would be more effective on overall exercise time). Theodorakis et al. (2000) put forth the matching hypothesis, in which they claimed that different forms of self-talk serve different functions relative to the task being performed. The current manipulation found that instructional self-talk had no significant effect on precision task performance (i.e., overhead squat) in comparison to motivational self-talk and a control condition, and motivational self-talk had no significant effect in comparison to instructional self-talk and a control condition on overall exercise time. This contradicts Theodorakis et al. (2000) who found instructional self-talk to be more effective than motivational self-talk during the precision tasks of soccer passing and badminton serving accuracy, with both forms of self-talk being effective during the power task of knee extensions on an isokinetic dynamometer. This manipulation also contradicts Hatzigeorgiadis et al. (2004), who found that motivational and instructional self-talk were effective against a control condition for improving precision task performance, with instructional being significantly effective. Motivational self-talk was significantly effective during the power task performance of throwing a ball for a maximum distance compared against instructional self-talk and a control condition. The current manipulation provided no support for the matching hypothesis with there being no differentiation of effects on performance between the tasks and types of self-talk observed.

Within the current manipulation there was no interaction between self-talk and cross-training performance observed. One potential reason for the lack of observed interaction could be the use of self-talk during the manipulation. The purpose was to examine any differences, if any, between self-talk and non-self-talk conditions, and the exercise tasks involved. The PEST-Q provided qualitative feedback from all thirty participants and their self-talk use. Participants in the self-talk manipulation conditions were instructed to use either instructional or motivational self-talk during the third exercise trial, which was reported in this questionnaire. However, nine participants within the control condition reported using self-talk during the manipulation (3^{rd}) exercise trial, despite not receiving any instructions to do so. This use of self-talk by the control condition may have offset the current manipulation, potentially indicating that twenty-nine of the thirty participants were using some form of self-talk during the manipulation (3^{rd}) exercise trial. This may have negated the effectiveness of the current self-talk manipulation with twenty-nine participants using self-talk regardless of the manipulation protocol, which highlights the issue of monitoring the thoughts of the participant. There may not have been a true control condition within the current manipulation to compare with the self-talk conditions. This may also indicate that regardless of the cues they selected and said verbally, they may have been using different internal cues which may have affected the manipulation results. This use of self-talk could also indicate that the exercise task may be irrelevant, given twenty-nine participants reported using self-talk during the manipulation and all thirty reported using self-talk outside the manipulation, self-talk may be used consistently across exercise tasks regardless of what it is, or whether or not they have experience in the task.

A second potential reason for the lack of effectiveness could be that the overhead squat task may have had a learning effect associated. This learning effect could have been highlighted with the addition of the initiation (1^{st}) exercise trial prior to the baseline (2^{nd}) exercise trial. The inclusion of the initiation (1^{st}) exercise trial differs from that of previous interventions with Theodorakis et al. (2000) having participants perform the baseline and intervention trials 10-minutes apart and Hatzigeorgiadis et al. (2004) having participants perform the baseline and intervention trials two-weeks apart. The current manipulation's use of an initiation (1^{st}) exercise trial may have inadvertently enabled a learning effect to take place, given the lack of self-talk effectiveness. The initiation (1^{rd}) exercise trial provided an opportunity for participants to become familiar with the exercise tasks and perform them safely, but it also could have negated the potential results of a self-talk manipulation. The presence of the initiation (1^{st}) exercise trial may still have been a responsible decision, as without it the significant difference between exercise trials one and two for mechanical score could have falsely been attributed to self-talk, when they may have been the result of a learning effect.

A third potential reason for the lack of effectiveness is the exercise task itself. The overhead squat has previously been discussed as being potentially associated with a learning effect. This being the first manipulation to utilize it, there is no basis for what to expect with regards to improvements or results. When discussing the running aspect, previous interventions found that self-talk had a positive effect during triathlon performance, which included a running component (Thelwell & Greenlees, 2001; 2003). This was the basis for the current manipulation's inclusion of a running component to mix with the overhead squat movement. The exercise task of the current manipulation was the first time cross-training was examined within the confines of a self-talk manipulation. The lack of self-talk effectiveness could have been due to the participants being less physically sore from exercise trials one to three, which may have offset the manipulation in such a way that it may not have mattered what form of self-talk they used, if any, they may have improved regardless. This ties into the learning effect with the mechanical score, as combining running and overhead squatting may have allowed two potential learning effects to take place, with mechanical score improving between exercise trials one and two, and exercise time improving between exercise trials two and three, respectively. In other words, exercise time may have improved between exercise trials two and three because the participants may have been less physically sore, which, along with the familiarity with the exercise task, could potentially be an indication that the participants may have been in slightly better fitness 'shape,' possibly negating the self-talk manipulation. The participants potentially being less physically sore may not be an indication of improved fitness, however it may provide a possible explanation for the performance reduction in exercise time from exercise trial one to two and the increased performance in exercise time from exercise trial two to three.

A fourth potential reason for the lack of interaction effects could be the effort of the participants throughout the testing period. The current manipulation did not implement any specific effort manipulation checks, with each participant being instructed to do his/her best. This instruction was an attempt to encourage the participants to maintain their effort across all three exercise trials, there was no further instruction beyond this as the difficulty of the exercise trials was left up to the participants. In other words, the participant was instructed to do his/her best, but he/she controlled how fast or slow he/she went throughout each exercise trial. The idea being the faster they go, the faster they get done, otherwise they will be exercising for twenty minutes (i.e., if a participant chooses to give less effort he/she will exercise for twenty minutes, but if he/she gives good effort they will be finished sooner than twenty minutes). This lack of effort manipulation may have potentially influenced the results as some participants may not have tried as hard as others during the manipulation trials. This could also indicate that some participants may have given more, or less, effort depending on which exercise trial they were performing. It is possible that a participant may have taken his/her time during the first and second exercise trials and then gave full effort for the third exercise trial. It may also be an explanation for the reduction in exercise time from exercise trials one to two, as a participant may have given full effort during the first exercise trial, then gave less effort during the second exercise trial, and then gave full effort again during the third exercise trial. Another potential factor regarding effort levels could be that during and after the first exercise trial the participants may have developed a pacing strategy for the second and third exercise trials, which may have allowed them to better manage their energy. This could indicate that after completing the first exercise trial and realizing how difficult the exercise task was, the participant may have performed the second exercise trial and went slower as they were pacing themselves. This may have impacted the third exercise session as they may have been able to better pace themselves and perform better during the third exercise session. The absence of an effort manipulation check could be a potential reason for the lack of significant interaction effects, given the amount of potential possibilities associated with effort levels during the testing period.

A fifth potential reason for the lack of significant findings could be the influence of outside exercise. The participants were able to continue their regular fitness routines outside of the study parameters; one reason for this was participant retainment and the other was to make it as close to regular cross-training exercise as possible. The thought process behind retaining participants was that the data was collected primarily during the summer months, which could potentially lead to participants dropping out/forgetting sessions for any number of reasons. The idea was to integrate the testing trials as closely into their daily exercise routine as possible to prevent them from dropping out or missing sessions. Regular cross-training exercise is typically done five to six days per week, keeping them free to exercise outside of the manipulation which could have allowed them to participate in the manipulation without them having to sacrifice their regular fitness routine. While this may have helped make the manipulation more appealing, it also could have increased the odds that a participant may have been tired, or sore, from their regular fitness routine, which would impact the manipulation's effectiveness as previously discussed. Limiting the amount of physical activity outside of the manipulation could have allowed for potential significance within the manipulation, but it may have deterred some individuals from participating if they were determined to maintain their regular fitness routine.

A sixth potential reason for the lack of self-talk effectiveness could have been that the running task overshadowing the overhead squat task, given the participants spent more time running than squatting. This could have been a factor as the running component may have forced participants to focus on maintaining their running effort, or breathing, rather than proper squatting mechanics. This could have led to the instructional cues being negated with participants potentially utilizing motivational cues to maintain effort for the endurance component, which could indicate the instructional condition used a mixture of instructional and motivational self-talk, rather than solely instructional self-talk. The weight of the overhead squat may have also been a factor, with the weight being a 6-lb. bar it may not have put enough emphasis on proper mechanics, which could have allowed participants to complete the overhead squat movement without having to focus on their mechanics (i.e., it could have been light enough where proper form was not necessary to complete the task adequately, or the task was not difficult enough). This lack of challenge could be an indication that the instructional self-talk cues were not entirely relevant given the participants may not have needed to focus on the instructional cue to be successful (i.e., a cue of "chest up" may have been a good reminder, but given the weight was so light they may not have needed to focus on keeping their chest up, as they were unlikely to be crushed by the weight).

Task Type

Precision Task.

The effectiveness of self-talk during precision task performance has been documented (Boroujeni & Shahbazi, 2011; Boroujeni et al., 2014; Harvey et al., 2002; Hatzigeorgiadis et al., 2004; Kolovelonis et al., 2011; Theodorakis et al., 2001). Theodorakis et al. (2000) and Van Raalte et al. (1995) found that instructional self-talk cues had a significant effect on precision task performance outcomes. The precision tasks used in these previous studies were dart throwing, badminton serve accuracy, soccer passing accuracy, free throw shooting, golf shot consistency, water polo target throwing, and basketball passing accuracy. The current manipulation used the overhead squat exercise to help introduce self-talk manipulations into Olympic weightlifting and cross-training tasks, and to expand the self-talk intervention literature into a wider range of exercises. The current manipulation's results contradicted the results from previous interventions with no significant effect being observed between instructional self-talk and overhead squat performance.

The lack of evidence regarding the effectiveness of instructional self-talk during overhead squat performance can be explored further as there were significant results within the exercise trials. Regarding mechanical score, there was a significant effect as all three groups improved between exercise trials one and two. However, between exercise trials two and three the instructional self-talk group improved, the motivational self-talk group slightly improved and the control group decreased. Although the manipulation groups' performance improved, the increase was not significant. Given the unique nature of the overhead squat task, this significant performance improvement between exercise trials one and two, and the improvement/reduction in performance between exercise trials two and three could be attributed to a motor learning effect, as previously discussed. The improvement between exercise trials one and two may have been due to 14 of the 30 participants having never performed an overhead squat, making the improvement more likely being the potential motor learning effect. Another factor could be that the overhead squat task may not have required as much precision as the tasks from previous interventions. The overhead squat requires accuracy to be successful, but also involves a gross motor aspect as it can be considered a total body movement. A greater emphasis may have been placed on the gross motor aspect rather than the precision motor aspect. Despite the overall insignificance, the between trials significance and the improvements in the manipulation groups may provide some evidence that self-talk has a place in this type of exercise, with the instructional self-talk group improving slightly across all three trials.

Endurance Task.

The effectiveness of self-talk during endurance exercise performance has been noted with Blanchfield et al. (2014), Hamilton et al. (2007), Thelwell and Greenlees (2001), Thewell and Greenlees (2003), and Wallace et al. (2017) implementing motivational self-talk during different endurance exercises such as running, rowing, and cycling. Each of these studies found evidence of motivational self-talk being effective during endurance exercise performance resulting in either a faster exercise time, or a longer exercise time. The current manipulation implemented running as the endurance component in combination with the overhead squat to ensure the cross-training nature of the task. The current manipulation found no significant interaction effect between the self-talk groups and the control group. This result contradicts the previous endurance exercise literature with motivational and instructional self-talk yielding similar results to the control group.

This lack of effectiveness on exercise time can be explored further as there was a significant effect for exercise time from exercise trials two to three, with all three groups improving between exercise trials two and three. The instructional self-talk group's exercise time decreased from exercise trial one to two and increased from exercise trial two to three, although their improvement in exercise trial three was not as good as their time in exercise trial one. The control and motivational self-talk groups improved from exercise trial one to two and improved further from exercise trial two to three. The potential reasons for these changes were previously discussed, however regarding the endurance task, the results of the current manipulation contradict previous interventions with both self-talk groups and the control group improving from the baseline (2^{nd}) exercise trial to the manipulation (3^{rd}) exercise trial. Despite the lack of overall self-talk effectiveness observed, the motivational self-talk and control group improved more than the instructional self-talk group, which may provide some evidence that, at the very least, motivational self-talk may be more effective during endurance exercise than instructional self-talk. This could be further evidence that self-talk has a place in cross-training exercise, with the current manipulation being, to date, the first self-talk manipulation to implement cross-training as the research task.

Design and Limitations

The design of this manipulation followed a similar procedure to previous self-talk interventions with each participant performing the exercise task for a baseline measure and then performing the task again with a self-talk manipulation (Hatzigeorgiadis et al., 2004; Theodorakis et al., 2001; Theodorakis et al., 2000). However, the current manipulation differed from previous interventions with the addition of the initiation (1^{st}) exercise trial performed prior to the baseline (2^{nd}) exercise trial. The length of the current manipulation was five days between exercise trials one and three, with the potential to last six days depending on participant schedules. Each exercise trial was performed on a separate day, at least twenty-four hours apart and no more than forty-eight hours apart. This five-day period differs from Hatzigeorgiadis et al. (2004), whose intervention trial was two-weeks after the baseline trial. This also differs from Theodorakis et al. (2001) and Theodorakis et al. (2000), with their baseline and intervention trials being performed on the same day, with short bouts of rest between trials. This time frame was decided on for the current manipulation as the three exercise trials were divided into three categories: initiation (1^{st}), baseline (2^{nd}), and manipulation (3^{rd}). The use of the initiation (1^{st}) exercise trial was to familiarize the participants with the exercise tasks, which may have helped account for a potential motor learning effect associated with cross-training exercise.

The overall lack of significant interaction effects, along with the significant differences between trials, may have been the result of a motor learning effect, however, if the initiation (1^{st}) exercise trial was not implemented, the significant differences between trials could have been falsely attributed to self-talk. Another potential influence on the lack of significant differences may have been the communication between participants outside of the manipulation. Each participant performed the exercise trials in a one-on-one environment with the primary researcher. They were instructed not to speak with other participants regarding the manipulation protocol. This instruction could have been violated, as near the end of the data collection period several participants came expecting a self-talk cue or knew the third day self-talk procedure before the third exercise trial. Disguising the nature of the study was attempted with slight deception as self-talk was buried within a package of mental skills. The participants were led to believe they would receive one of four potential mental skills during the manipulation (i.e., self-talk, imagery, relaxation, and goal setting). This deception was potentially offset by the communication of participants between exercise trials.

The measurement scale used to score the overhead squat performance is something that should be considered. The six-point scale that was implemented was directly from the Canadian Weightlifting Federation and Coaching Association of Canada. This scale was used as the starting point as it provided a basic measure of how to accurately perform and score the overhead squat movement. This scale is used as a precursor for novice Olympic Weightlifters to ensure they can adequately perform the overhead squat movement prior to learning the snatch movement. The six components of this scale are: able to hold weighted bar overhead with arms straight, descend to appropriate depth without losing balance or dropping the weighted bar, descend to appropriate depth without rounding back or tucking hips, maintain an upright torso throughout movement, keep heels on floor and weight evenly distributed, and keep knees from moving laterally during movement (Canadian Weightlifting Federation and Coaching Association of Canada). The drawback with this scale was that it did not emphasize the potential skill differentiation between participants that would have allowed for a precise measurement. In other words, it was too uniform of a measure as evidenced in the video analysis with two participants performing the same movement and receiving a similar or exact score, yet one was visually more efficient than the other. This was the first time this scale was used in a manipulation, along with the exercise tasks, making it a natural starting point, but for future studies this scale should be modified to account for the skill differences between participants. This modification is necessary because of the potential ceiling effect observed in the current manipulation with participants able to score a maximum of 30 (i.e., they can only perform so well). The current scale also does not allow for potential improvement among the higher scoring participants, potentially indicating that a participant can score perfect during every trial even as they become fatigued. Modifying the scale and providing more differentiation between participants and more room for improvement across all skill levels may allow for more accurate and potentially significant data collection.

Another potential area of influence could be the bias of the raters when scoring the OHS video recordings. The videos were analyzed and scored by two different raters to establish a level of reliability. Although the scores were similar between the raters, the validity of those scores could have been a potential area of discrepancy. One rater had experience with Olympic Weightlifting movements and the other did not. Both raters were given the six-point scale breakdown and instructed to watch and score a practice video prior to the participants' videos within the current study. Following the completion of the practice video, each rater was tasked with reviewing and scoring the videos from each of the 30 participants. This could have been an area of potential discrepancy as there may have been a level of subjectivity associated with the mechanical score scale. This could indicate that some participants may have received higher or lower scores based on one of the raters' bias. Despite the raters scoring the videos similarly, it could be possible that the raters may have needed more practice when scoring the squat videos. This may have helped limit the potential level of subjectivity and bias within the scoring procedure. The score for each set of overhead squats was obtained through a rough estimate of each set, in other words, each rater watched a set of 15 OHS repetitions and estimated the score on the six-point scale. This scoring method may have allowed for more uniform results and could have enabled less differentiation between participants. This may have been a limitation as it did not address each OHS repetition individually and gave an overall score for the entire set, as opposed to giving each repetition a score on the six-point scale.

Self-Talk Cues

The participants in the manipulation groups were exposed to self-talk cues prior to participating in the third exercise trial. The self-talk cues originated from previous interventions with participants being exposed to the motivational cues of: "you can do it," "hang in there," "strong," "get tough," and the instructional cues being "elbow straight," "reach," "stay low," "move your feet" (Theodorakis et al., 2000). These cues were provided to familiarize the participants with their self-talk manipulation content. The primary researcher and the participant took the examples and brainstormed relevant cues to the exercise tasks being performed (i.e., instructional cues were specific to the overhead squat movement). The cues used ultimately were decided on by the participant, and they were instructed to say the cues overtly to ensure they were using the correct cue (Blanchfield et al., 2013; Ming & Martin, 2006). The instructional cues that the participants used in the current manipulation were: "core engaged," "weight in heels," "heels down," "straight elbows/elbows straight," "breathe," "knees back," and "chest out." The motivational cues that participants used were: "let's go," "you got this," "I got this," "get it going," "run your race," "keep going," "push the pace," and "keep moving."

The potential effects these cues may have had during the manipulation were not explicitly indicated within the exercise time and mechanical score measures of the manipulation, with no significant interaction being observed. However, in the PEST-Q, participants were able provide descriptive self-talk information. The PEST-Q was used to gather information specific to the current manipulation. The PEST-Q asked three questions: did you use self-talk during the exercise routine? If yes, what was the cue used? And how often did you use this cue? Using the information provided by the PEST-Q, four of the twenty manipulation participants claimed that saying the cues overtly was awkward. Five of the twenty manipulation participants claimed the cues provided a reminder as to what they were supposed to focus on. Specifically relating to instructional self-talk, four of the ten instructional cue participants reported engaging in motivational self-talk during the run. Three of the ten reported the cues were a helpful with maintaining proper form, with one participant feeling more balanced during the workout. One participant reported the cue did not help. Regarding motivational self-talk, two of the ten reported the cue was a good distraction from fatigue. Two of the ten reported using it more frequently near the end of the exercise trial to prevent walking. Two participants reported the cues being a good reminder for the task, or to breathe. One reported having better control of their breathing. One participant reported feeling a burst of energy during the run after using the cue. One participant reported the cues provided were better than the cues they normally used. Regarding the control condition, nine of the ten participants reported using self-talk during the manipulation despite not receiving any instructions. Seven of those nine specifically reported using motivational self-talk, with two of the nine using both motivational and instructional self-talk throughout the manipulation.

The STU-Q asked four questions regarding the participants self-talk use outside of the manipulation: where do you use self-talk? When do you use self-talk? What is your self-talk content? And why do you use self-talk? Using the information provided by the STU-Q, all thirty participants reported engaging in self-talk during their personal workout routines. Twenty-three of the thirty participants reported exclusively using motivational self-talk, with seven of the thirty reporting both motivational and instructional self-talk usage. The motivational self-talk reported centered around motivation to exercise (e.g., “get off the couch”), to maintain effort during exercise (e.g., “keep pushing”), and finish an exercise routine (e.g., “almost there,” “only 5 reps left”). The instructional self-talk reported was to maintain proper form (e.g., “keep weight balanced"), to ensure proper breathing was maintained (e.g., "keep breathing"), and to keep anxiety levels consistent (e.g., "I've been here before"). This descriptive information provides evidence that self-talk may be used during recreational exercise for a variety of motivational and instructional purposes. These descriptive results match those of Gammage et al. (2001) and Hardy et al. (2001), who found that exercisers and athletes reported using self-talk during their regular exercise routines. Despite the participants reporting different uses and effects of self-talk, with proper knowledge and manipulation they could learn to effectively control it and use it to their advantage during different motor tasks, potentially enhancing exercise performance.

The previously discussed descriptive information could be an indication that self-talk may influence exercise performance regardless of a measurable outcome (i.e., exercise time, mechanical score), with a perceived effect being reported. One participant stated, "after I used the motivational cue, I felt like I had a burst of speed during the run. I would use it once at the start and once part-way through and both times I felt like I was lighter on my feet. When I used it during the squats, I felt I could control my breathing better." Although this effect of enhanced performance was reported, it was not reflected in the measurable data, which provides an opportunity to discuss a perceived effect. This participant did not have a significant increase in exercise time or mechanical score during the manipulation exercise trial, however, given the cue provided a sense of effectiveness this could be enough evidence to promote the use of self-talk during exercise. If they are comfortable using a cue and they feel it makes a difference during their exercise routine, that could potentially be enough reason for them to use it despite it possibly having no effect on performance.

Future Directions

Future directions for this manipulation could be altering the overhead squat measurement scale, as it didn't provide enough differentiation between participants as previously noted. Some aspects of the six-point scale could be removed and replaced with more relevant points to help provide a more specific measurement and allow for the required differentiation. Implementing a different scoring method may also enable potentially more accurate scoring. Rather than using a rough estimate for each set of overhead squats, scoring each individual repetition for each set and using an average for each set across all five rounds may yield a more accurate measure for OHS performance. This manipulation could be solely looked at in a control versus motivational endurance comparison, with participants being instructed to perform the 400-meter run and 15 overhead squat sequence for as long as possible with there being no time-cap (i.e., the exercise trial would effectively end when they stopped exercising). This would limit the amount of exercise trials to one or two but may provide more significant endurance results and would help account for the potential ceiling effect that may have been observed in this manipulation (i.e., there would be no limit to how well, or how long, the participants could perform), whereas in the current manipulation the participants could only perform to a certain point where it would essentially 'max out.'

Future manipulations could make the deception more deceptive, as some participants easily figured the true nature of the study before the study concluded. Relating to this, restricting participant communication outside the manipulation could be better monitored, with some participants arriving for the manipulation trial expecting some form of self-talk. This could be achieved by better protecting the nature of the study, or by making it a point for participants not to speak with anyone else regarding the nature of the study, which may limit the word-of-mouth recruitment of participants. The study could also utilize a heavier weight on the overhead squat movement, which would put more emphasis on proper mechanics. However, this would require the recruitment and participation of experienced, and likely skilled, cross-training individuals. A potential modification for future manipulations could be to garner a larger sample of participants. The current manipulation used 30 participants, derived from Theodorakis et al. (2000)'s effect size of 1.26, using Cohen (2008)'s power analysis. The 30 participants met the power analysis's estimated sample size; however, 30 participants may not have been enough to achieve a necessary level of statistical significance. The number of participants may be offset by the mechanical score measurement scale, given the previously discussed inaccuracies of the scale, the increased number may lead to a more significant indication of a potential learning effect (i.e., the scale may need to be modified before testing a larger number of participants to avoid the same results of the current manipulation).

Future studies could implement a goal setting element into the exercise trials. The current manipulation prevented the participants from seeing their results until the manipulation was complete; however, this may have affected effort levels. As previously discussed, it is possible that the participants amount of effort may have changed between exercise trials. Allowing them to know their exercise time, or a time close to their exact time, and using that time as a target for the next two exercise sessions may help the participants maintain a consistent level of effort for the entirety of the manipulation. Another potential change could be to limit outside manipulation exercise. The current manipulation allowed participants to maintain their current exercise routine over the duration of the manipulation. This may have caused the participants to potentially be fatigued or sore, which may have affected the manipulations results. Limiting exercise outside of the manipulation may enable a more precise manipulation and may limit soreness and fatigue, as the participants would have 24-48 hours to rest and recover. Increasing the time between exercise trials could be implemented to allow more time for rest and recovery. Increasing the recovery time between sessions from 24-48 hours to 48-72 hours may negate soreness and fatigue almost entirely if done alongside limiting outside manipulation exercise. This may increase the manipulation time frame from five to seven days to seven to ten days, which may make it difficult to recruit and retain participants.

Conclusion

The data-analysis showed the manipulation had no effect on cross-training performance, which could indicate that self-talk is not an effective tool for use during this type of exercise. However, the descriptive data provided information that was critical to understanding the participants' point of view. Self-talk was used during the manipulation by twenty-nine of the thirty participants whether they were instructed to or not, which could be a strong indication that self-talk has a place in cross-training exercise, we just don't know where it is. Future studies should be done to determine where it is most effective during cross-training exercise.

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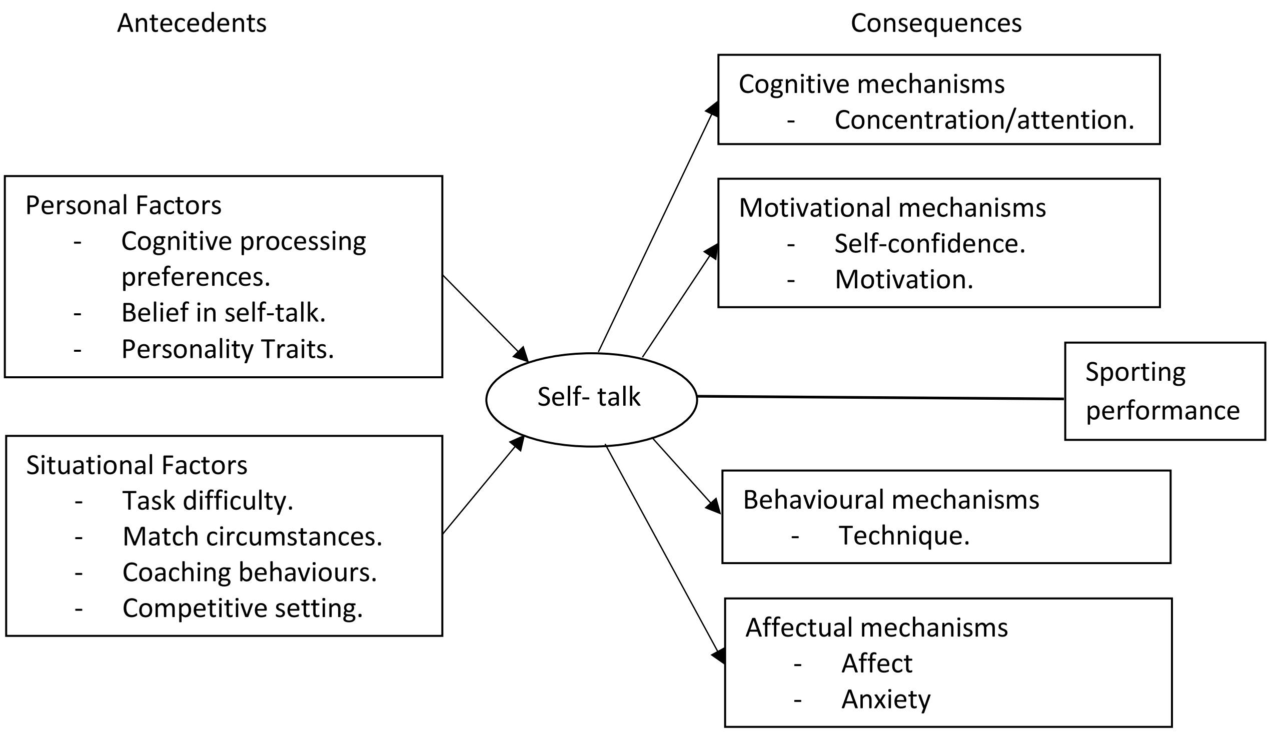
Appendix A: Self-talk Framework Model



Appendix B: Self-Talk Usage Questionnaire (STU-Q)

SELF-TALK USAGE QUESTIONNAIRE

Age:______

Gender:_______

Frequency of Exercise:_________________________________

Type of Exercise Activity:_______________________________

Description of Self-talk:

Self-talk is best described as what you deliberately say to yourself. This can be either out-loud or internally so only you can hear it. This study concerns the effect that self-talk may have on exercise performance. Self-talk may enhance motivation (e.g., "psych up"), may assist in attentional focus (e.g., staying focused throughout an exercise session), may help maintain motivation (e.g., keep pushing until the end of a workout), or for learning or improving exercise skills (e.g., maintaining correct form).

Regarding this description above, have you ever used self-talk during exercise/sport?

Circle One: Yes No

If yes, where would you rate the frequency of your self-talk usage during exercise/sport?

1	2	3	4	5	6	7
Never	Rarely	Occasionally	Sometimes	Frequently	Usually	Everytime

Where do you use exercise related self-talk? (*Provide examples if necessary)*

When do you use self-talk during exercise? (*Provide examples if necessary)*

What do you say to yourself during exercise? (*Provide examples if necessary)*

Why do you use self-talk during exercise? (*Provide examples if necessary)*

Appendix C: Physical Activity Readiness Questionnaire (PAR-Q+)

2018 PAR-Q+

The Physical Activity Readiness Questionnaire for Everyone

The health benefits of regular physical activity are clear; more people should engage in physical activity every day of the week. Participating in physical activity is very safe for MOST people. This questionnaire will tell you whether it is necessary for you to seek further advice from your doctor OR a qualified exercise professional before becoming more physically active.

GENERAL HEALTH QUESTIONS

Please read the 7 questions below carefully and answer each one honestly: check YES or NO.	**YES**	**NO**
1) Has your doctor ever said that you have a heart condition ☐ OR high blood pressure ☐?	☐	☐
2) Do you feel pain in your chest at rest, during your daily activities of living, **OR** when you do physical activity?	☐	☐
3) Do you lose balance because of dizziness **OR** have you lost consciousness in the last 12 months? Please answer **NO** if your dizziness was associated with over-breathing (including during vigorous exercise).	☐	☐
4) Have you ever been diagnosed with another chronic medical condition (other than heart disease or high blood pressure)? **PLEASE LIST CONDITION(S) HERE:** ________________	☐	☐
5) Are you currently taking prescribed medications for a chronic medical condition? **PLEASE LIST CONDITION(S) AND MEDICATIONS HERE:** ________________	☐	☐
6) Do you currently have (or have had within the past 12 months) a bone, joint, or soft tissue (muscle, ligament, or tendon) problem that could be made worse by becoming more physically active? Please answer **NO** if you had a problem in the past, but it ***does not limit your current ability*** to be physically active. **PLEASE LIST CONDITION(S) HERE:** ________________	☐	☐
7) Has your doctor ever said that you should only do medically supervised physical activity?	☐	☐

If you answered NO to all of the questions above, you are cleared for physical activity.
Please sign the PARTICIPANT DECLARATION. You do not need to complete Pages 2 and 3.

- Start becoming much more physically active – start slowly and build up gradually.
- Follow International Physical Activity Guidelines for your age (www.who.int/dietphysicalactivity/en/).
- You may take part in a health and fitness appraisal.
- If you are over the age of 45 yr and NOT accustomed to regular vigorous to maximal effort exercise, consult a qualified exercise professional before engaging in this intensity of exercise.
- If you have any further questions, contact a qualified exercise professional.

PARTICIPANT DECLARATION
If you are less than the legal age required for consent or require the assent of a care provider, your parent, guardian or care provider must also sign this form.

I, the undersigned, have read, understood to my full satisfaction and completed this questionnaire. I acknowledge that this physical activity clearance is valid for a maximum of 12 months from the date it is completed and becomes invalid if my condition changes. I also acknowledge that the community/fitness centre may retain a copy of this form for records. In these instances, it will maintain the confidentiality of the same, complying with applicable law.

NAME ________________________ DATE ________________

SIGNATURE ________________________ WITNESS ________________

SIGNATURE OF PARENT/GUARDIAN/CARE PROVIDER ________________________

If you answered YES to one or more of the questions above, COMPLETE PAGES 2 AND 3.

Delay becoming more active if:

- You have a temporary illness such as a cold or fever; it is best to wait until you feel better.
- You are pregnant - talk to your health care practitioner, your physician, a qualified exercise professional, and/or complete the ePARmed-X+ at **www.eparmedx.com** before becoming more physically active.
- Your health changes - answer the questions on Pages 2 and 3 of this document and/or talk to your doctor or a qualified exercise professional before continuing with any physical activity program.

01-11-2017

Appendix C. Continued

2018 PAR-Q+

FOLLOW-UP QUESTIONS ABOUT YOUR MEDICAL CONDITION(S)

1. Do you have Arthritis, Osteoporosis, or Back Problems?

If the above condition(s) is/are present, answer questions 1a-1c — If **NO** ☐ go to question 2

1a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer **NO** if you are not currently taking medications or other treatments)	YES ☐ NO ☐
1b.	Do you have joint problems causing pain, a recent fracture or fracture caused by osteoporosis or cancer, displaced vertebra (e.g., spondylolisthesis), and/or spondylolysis/pars defect (a crack in the bony ring on the back of the spinal column)?	YES ☐ NO ☐
1c.	Have you had steroid injections or taken steroid tablets regularly for more than 3 months?	YES ☐ NO ☐

2. Do you currently have Cancer of any kind?

If the above condition(s) is/are present, answer questions 2a-2b — If **NO** ☐ go to question 3

2a.	Does your cancer diagnosis include any of the following types: lung/bronchogenic, multiple myeloma (cancer of plasma cells), head, and/or neck?	YES ☐ NO ☐
2b.	Are you currently receiving cancer therapy (such as chemotheraphy or radiotherapy)?	YES ☐ NO ☐

3. Do you have a Heart or Cardiovascular Condition? *This includes Coronary Artery Disease, Heart Failure, Diagnosed Abnormality of Heart Rhythm*

If the above condition(s) is/are present, answer questions 3a-3d — If **NO** ☐ go to question 4

3a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer **NO** if you are not currently taking medications or other treatments)	YES ☐ NO ☐
3b.	Do you have an irregular heart beat that requires medical management? (e.g., atrial fibrillation, premature ventricular contraction)	YES ☐ NO ☐
3c.	Do you have chronic heart failure?	YES ☐ NO ☐
3d.	Do you have diagnosed coronary artery (cardiovascular) disease and have not participated in regular physical activity in the last 2 months?	YES ☐ NO ☐

4. Do you have High Blood Pressure?

If the above condition(s) is/are present, answer questions 4a-4b — If **NO** ☐ go to question 5

4a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer **NO** if you are not currently taking medications or other treatments)	YES ☐ NO ☐
4b.	Do you have a resting blood pressure equal to or greater than 160/90 mmHg with or without medication? (Answer **YES** if you do not know your resting blood pressure)	YES ☐ NO ☐

5. Do you have any Metabolic Conditions? *This includes Type 1 Diabetes, Type 2 Diabetes, Pre-Diabetes*

If the above condition(s) is/are present, answer questions 5a-5e — If **NO** ☐ go to question 6

5a.	Do you often have difficulty controlling your blood sugar levels with foods, medications, or other physician-prescribed therapies?	YES ☐ NO ☐
5b.	Do you often suffer from signs and symptoms of low blood sugar (hypoglycemia) following exercise and/or during activities of daily living? Signs of hypoglycemia may include shakiness, nervousness, unusual irritability, abnormal sweating, dizziness or light-headedness, mental confusion, difficulty speaking, weakness, or sleepiness.	YES ☐ NO ☐
5c.	Do you have any signs or symptoms of diabetes complications such as heart or vascular disease and/or complications affecting your eyes, kidneys, **OR** the sensation in your toes and feet?	YES ☐ NO ☐
5d.	Do you have other metabolic conditions (such as current pregnancy-related diabetes, chronic kidney disease, or liver problems)?	YES ☐ NO ☐
5e.	Are you planning to engage in what for you is unusually high (or vigorous) intensity exercise in the near future?	YES ☐ NO ☐

01-11-2017

Appendix C. Continued

2018 PAR-Q+

6. Do you have any Mental Health Problems or Learning Difficulties? *This includes Alzheimer's, Dementia, Depression, Anxiety Disorder, Eating Disorder, Psychotic Disorder, Intellectual Disability, Down Syndrome*

If the above condition(s) is/are present, answer questions 6a-6b — If **NO** ☐ go to question 7

6a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer **NO** if you are not currently taking medications or other treatments)	YES ☐ NO ☐
6b.	Do you have Down Syndrome **AND** back problems affecting nerves or muscles?	YES ☐ NO ☐

7. Do you have a Respiratory Disease? *This includes Chronic Obstructive Pulmonary Disease, Asthma, Pulmonary High Blood Pressure*

If the above condition(s) is/are present, answer questions 7a-7d — If **NO** ☐ go to question 8

7a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer **NO** if you are not currently taking medications or other treatments)	YES ☐ NO ☐
7b.	Has your doctor ever said your blood oxygen level is low at rest or during exercise and/or that you require supplemental oxygen therapy?	YES ☐ NO ☐
7c.	If asthmatic, do you currently have symptoms of chest tightness, wheezing, laboured breathing, consistent cough (more than 2 days/week), or have you used your rescue medication more than twice in the last week?	YES ☐ NO ☐
7d.	Has your doctor ever said you have high blood pressure in the blood vessels of your lungs?	YES ☐ NO ☐

8. Do you have a Spinal Cord Injury? *This includes Tetraplegia and Paraplegia*

If the above condition(s) is/are present, answer questions 8a-8c — If **NO** ☐ go to question 9

8a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer **NO** if you are not currently taking medications or other treatments)	YES ☐ NO ☐
8b.	Do you commonly exhibit low resting blood pressure significant enough to cause dizziness, light-headedness, and/or fainting?	YES ☐ NO ☐
8c.	Has your physician indicated that you exhibit sudden bouts of high blood pressure (known as Autonomic Dysreflexia)?	YES ☐ NO ☐

9. Have you had a Stroke? *This includes Transient Ischemic Attack (TIA) or Cerebrovascular Event*

If the above condition(s) is/are present, answer questions 9a-9c — If **NO** ☐ go to question 10

9a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer **NO** if you are not currently taking medications or other treatments)	YES ☐ NO ☐
9b.	Do you have any impairment in walking or mobility?	YES ☐ NO ☐
9c.	Have you experienced a stroke or impairment in nerves or muscles in the past 6 months?	YES ☐ NO ☐

10. Do you have any other medical condition not listed above or do you have two or more medical conditions?

If you have other medical conditions, answer questions 10a-10c — If **NO** ☐ read the Page 4 recommendations

10a.	Have you experienced a blackout, fainted, or lost consciousness as a result of a head injury within the last 12 months **OR** have you had a diagnosed concussion within the last 12 months?	YES ☐ NO ☐
10b.	Do you have a medical condition that is not listed (such as epilepsy, neurological conditions, kidney problems)?	YES ☐ NO ☐
10c.	Do you currently live with two or more medical conditions?	YES ☐ NO ☐

PLEASE LIST YOUR MEDICAL CONDITION(S) AND ANY RELATED MEDICATIONS HERE: ______________________

GO to Page 4 for recommendations about your current medical condition(s) and sign the PARTICIPANT DECLARATION.

Appendix C. Continued

2018 PAR-Q+

If you answered NO to all of the FOLLOW-UP questions (pgs. 2-3) about your medical condition, you are ready to become more physically active - sign the PARTICIPANT DECLARATION below:

- It is advised that you consult a qualified exercise professional to help you develop a safe and effective physical activity plan to meet your health needs.
- You are encouraged to start slowly and build up gradually - 20 to 60 minutes of low to moderate intensity exercise, 3-5 days per week including aerobic and muscle strengthening exercises.
- As you progress, you should aim to accumulate 150 minutes or more of moderate intensity physical activity per week.
- If you are over the age of 45 yr and **NOT** accustomed to regular vigorous to maximal effort exercise, consult a qualified exercise professional before engaging in this intensity of exercise.

If you answered **YES** to **one or more of the follow-up questions** about your medical condition:

You should seek further information before becoming more physically active or engaging in a fitness appraisal. You should complete the specially designed online screening and exercise recommendations program - the **ePARmed-X+ at www.eparmedx.com** and/or visit a qualified exercise professional to work through the ePARmed-X+ and for further information.

Delay becoming more active if:

- You have a temporary illness such as a cold or fever; it is best to wait until you feel better.
- You are pregnant - talk to your health care practitioner, your physician, a qualified exercise professional, and/or complete the ePARmed-X+ **at www.eparmedx.com** before becoming more physically active.
- Your health changes - talk to your doctor or qualified exercise professional before continuing with any physical activity program.

- You are encouraged to photocopy the PAR-Q+. You must use the entire questionnaire and NO changes are permitted.
- The authors, the PAR-Q+ Collaboration, partner organizations, and their agents assume no liability for persons who undertake physical activity and/or make use of the PAR-Q+ or ePARmed-X+. If in doubt after completing the questionnaire, consult your doctor prior to physical activity.

PARTICIPANT DECLARATION

- All persons who have completed the PAR-Q+ please read and sign the declaration below.
- If you are less than the legal age required for consent or require the assent of a care provider, your parent, guardian or care provider must also sign this form.

I, the undersigned, have read, understood to my full satisfaction and completed this questionnaire. I acknowledge that this physical activity clearance is valid for a maximum of 12 months from the date it is completed and becomes invalid if my condition changes. I also acknowledge that the community/fitness center may retain a copy of this form for records. In these instances, it will maintain the confidentiality of the same, complying with applicable law.

NAME ______________________________ DATE ______________________________

SIGNATURE ______________________________ WITNESS ______________________________

SIGNATURE OF PARENT/GUARDIAN/CARE PROVIDER ______________________________

For more information, please contact

www.eparmedx.com
Email: eparmedx@gmail.com

Citation for PAR-Q+
Warburton DER, Jamnik VK, Bredin SSD, and Gledhill N on behalf of the PAR-Q+ Collaboration. The Physical Activity Readiness Questionnaire for Everyone (PAR-Q+) and Electronic Physical Activity Readiness Medical Examination (ePARmed-X+). Health & Fitness Journal of Canada 4(2):3-23, 2011.

The PAR-Q+ was created using the evidence-based AGREE process (1) by the PAR-Q+ Collaboration chaired by Dr. Darren E. R. Warburton with Dr. Norman Gledhill, Dr. Veronica Jamnik, and Dr. Donald C. McKenzie (2). Production of this document has been made possible through financial contributions from the Public Health Agency of Canada and the BC Ministry of Health Services. The views expressed herein do not necessarily represent the views of the Public Health Agency of Canada or the BC Ministry of Health Services.

Key References
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3. Chisholm DM, Collis ML, Kulak LL, Davenport W, and Gruber N. Physical activity readiness. British Columbia Medical Journal. 1975;17:375-378.
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Appendix D: Mental Skills Questionnaire (MS-Q)

Mental Skills Questionnaire

Have you ever used **Imagery** in relation to exercise?

1	2	3	4	5	6	7
Never	Rarely	Occasionally	Sometimes	Frequently	Usually	Every-time

Have you ever used **Goal-Setting** in relation to exercise?

1	2	3	4	5	6	7
Never	Rarely	Occasionally	Sometimes	Frequently	Usually	Every-time

Have you ever used **Self-Talk** in relation to exercise?

1	2	3	4	5	6	7
Never	Rarely	Occasionally	Sometimes	Frequently	Usually	Every-time

Have you ever used **Relaxation** in relation to exercise?

1	2	3	4	5	6	7
Never	Rarely	Occasionally	Sometimes	Frequently	Usually	Every-time

Appendix E: Post-Exercise Self-Talk Questionnaire (PEST-Q)

Post-Exercise Self-Talk Questionnaire

Did you use self-talk during the exercise routine?

If yes, what was the cue used?

How often did you use this cue?

Appendix F: Ethics certificate

Brock University
Research Ethics Office
Tel: 905-688-5550 ext. 3035
Email: reb@brocku.ca

Bioscience Research Ethics Board

Certificate of Ethics Clearance for Human Participant Research

DATE:	5/29/2018		
PRINCIPAL INVESTIGATOR:	SULLIVAN, Philip - Kinesiology		
FILE:	17-367 - SULLIVAN		
TYPE:	Masters Thesis/Project	STUDENT: SUPERVISOR:	Jack Sampson Philip Sullivan

TITLE: The Effects of a Self-Talk Intervention During CrossFit Exercise Performance

ETHICS CLEARANCE GRANTED

Type of Clearance: NEW   Expiry Date: 5/1/2019

The Brock University Bioscience Research Ethics Board has reviewed the above named research proposal and considers the procedures, as described by the applicant, to conform to the University's ethical standards and the Tri-Council Policy Statement. Clearance granted from **5/29/2018 to 5/1/2019**.

The Tri-Council Policy Statement requires that ongoing research be monitored by, at a minimum, an annual report. Should your project extend beyond the expiry date, you are required to submit a Renewal form before 5/1/2019. Continued clearance is contingent on timely submission of reports.

To comply with the Tri-Council Policy Statement, you must also submit a final report upon completion of your project. All report forms can be found on the Research Ethics web page at http://www.brocku.ca/research/policies-and-forms/research-forms.

In addition, throughout your research, you must report promptly to the REB:

a) Changes increasing the risk to the participant(s) and/or affecting significantly the conduct of the study;
b) All adverse and/or unanticipated experiences or events that may have real or potential unfavourable implications for participants;
c) New information that may adversely affect the safety of the participants or the conduct of the study;
d) Any changes in your source of funding or new funding to a previously unfunded project.

We wish you success with your research.

Approved:

Stephen Cheung, Chair
Bioscience Research Ethics Board

Note: Brock University is accountable for the research carried out in its own jurisdiction or under its auspices and may refuse certain research even though the REB has found it ethically acceptable.

If research participants are in the care of a health facility, at a school, or other institution or community organization, it is the responsibility of the Principal Investigator to ensure that the ethical guidelines and clearance of those facilities or institutions are obtained and filed with the REB prior to the initiation of research at that site.

Appendix G: Procedural Flow Chart

Participant Recruitment

First Exercise Trial

Primary researcher explained the study details and offered the informed consent, PAR-Q+, and MS-Q to be signed by participant.

Researcher then took the participant through the warm-up, and demonstrated the OHS movement

Exercise task was explained to participant as five rounds of 400-meter run and 15-OHS to be completed sequentially until all five rounds were completed, or the participant reached the 20-minute time cap.

Participant completed the exercise task and was reminded of their next exercise trial in 48 hours.

Second Exercise Trial

Followed the same exercise procedure as the first exercise trial.

Researcher took the participant through a warm-up and demonstrated the OHS movement.

Participant then completed the exact same exercise task as the first exercise trial.

Participants were then randomly assigned into one of three groups: control, IST and MST

Third Exercise Trial

Control Group

Performed the exact procedures as the previous two trials, with no self-talk instructions

Manipulation groups

Met with primary researcher prior to the 3rd trial and discussed the self-talk manipulations

Performed the same exercise tasks as the previous two sessions, except before performing the OHS movement they were tasked with saying their self-talk cue out loud.

This cue was either instructional or motivational, depending on their manipulation group.

Upon completion of the 3rd exercise trial, the true nature of the study was revealed with each participant being informed about each form of self-talk used in this manipulation. The researcher had the participants fill out the PEST-Q and the STU-Q and was available to answer any questions they may have had.