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The Effects of Strategic Self-Talk on Concurrent Training Exercise Performance

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Self-talk is a multidimensional construct comprised of self-statements that provide instruction or motivation to complete a task. The matching hypothesis suggests that instructional cue words are beneficial for tasks involving precision and accuracy, whereas motivational cue words are effective for tasks involving endurance, strength, and power (Theodorakis et al., 2000). Exploring the effects of strategic self-talk through concurrent training (i.e., a combination of endurance and precision exercise tasks) provides a unique opportunity to test the differential predictions of the matching hypothesis. The purpose of the present study was to analyze the effects of instructional and motivational cue words during concurrent exercise training on a task that consisted of running and overhead squatting. Thirty participants were divided into three groups (i.e., control, instructional, and motivational) and examined across two exercise sessions. A 3 x 2 repeated measures ANOVA revealed a significant interaction for overhead squat mechanical scores and group. Post hoc testing revealed the instructional cue words group performance improved and the control group's performance declined, all other analyses were not significant. The results provide minimal support for the matching hypothesis, with instructional cue words benefiting the precision motor task. A unique finding was that participants in the control and strategic self-talk groups reported using organic self-talk during the training task that served either motivational or instructional functions, despite not being directed to do so. Further research is needed to examine the interaction between strategic and organic self-talk during concurrent training tasks.

Keywords: endurance exercise, sport psychology, human performance

Over the past several decades the effects of self-talk have been examined on motor learning, sports performance, and the psychological variables (e.g., confidence, anxiety, arousal regulation, etc.) associated with effective sports performance. The results of these investigations have shown that self-talk can effectively enhance motor learning, performance, and critical psychological characteristics associated with motor performance (see Hatzigeorgiadis et al., 2011; Hardy et al., 2018; Tod et al., 2011; Van Raalte et al., 2016). Self-talk has been defined as the overt or covert verbalizations made to oneself that are motivational or instructional, and occur either organically or strategically (Latinjak et al., 2019).

Organic self-talk (i.e., talk that occurs naturally) can be further broken down into spontaneous self-talk or goal-directed self-talk. Spontaneous self-talk consists of statements that occur unintentionally that are linked to the task at hand (Latinjak et al., 2019). For example, a golfer might unintentionally say, "what a stupid mistake" after hitting the ball into a sand bunker or, "great shot" after hitting the green from the fairway. Goal-directed self-talk refers to intentional statements that are used to self-regulate, enhance performance, solve a problem, or make progress on a task (Latinjak et al., 2019). An example would be a pitcher saying, "relax, be patient" during their pitch sequence during a game, or "I am going to throw this fast, high, and inside" while facing a batter during a game. Organic self-talk can serve multiple functions during motor task performance. For example, Latinjak et al. (2018) collected questionnaire data examining organic self-talk in novice ultimate frisbee players and found that the players provided self-instruction prior to task performance, pointed out technical errors and gave self-adjustments during task performance, and purposefully used negative reinforcement self-talk to improve performance. Despite the recent growth of organic self-talk research, more is known about strategic self-talk.

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Strategic self-talk is a mental strategy consisting of pre-determined self-statements that serve two primary purposes, to enhance motivation (i.e., motivational self-talk) or provide instructions (i.e., instructional self-talk) to improve motor performance (Hatzigeorgiadis et al., 2014). Instructional self-talk refers to cues that provide direction to an action or technique, and motivational self-talk pertains to cues that build confidence or 'psych up' an individual (Hatzigeorgiadis et al., 2014; Theodorakis et al., 2012). For example, a coach might have an athlete strategically say, "elbow up" when shooting a free throw, or "I can do this" before walking onto the court to start the game. The provision of strategic self-talk cue words can be used both before and during task performance. Previous research indicates that strategic self-talk enhances important psychological variables associated with effective performance, such as confidence, arousal regulation, concentration, and motivation (Tod, 2014; Williams & Hacker, 2021).

Historically, much of the self-talk research has centered on strategic self-talk, or cue word interventions (Latinjak et al., 2019). For instance, positive cue words have enhanced performances in cross-country skiing (Rushall et al., 1988), dart throwing (Dagrou et al., 1992; Van Raalte et al., 1995), and field hockey penalty shots (Wrisberg & Anshel, 1997). Instructional cue words improved forehand ground strokes in novice tennis players (Ziegler, 1987), lowered elite sprinters' times (Mallet & Hanrahan, 1997), and improved the volleying skills of collegiate tennis players (Landin & Herbert, 1999). This initial research indicated that self-talk with specific cues benefitted both skilled and novice motor performance (Theodorakis et al., 2000). As a result, Theodorakis et al. (2000) proposed the matching hypothesis which suggests that motivational cue words are effective for gross motor tasks involving endurance, strength, and power, and instructional cue words are beneficial for fine motor tasks involving precision and accuracy.

Research examining the matching hypothesis has provided mixed results. For instance, consistent with the matching hypothesis, instructional cue words have been shown to benefit certain throwing and accuracy tasks (Boroujeni & Shahbazi, 2011; Hatzigeorgiadis et al., 2004; Theodorakis et al., 2000), whereas motivational cue words have benefitted power and endurance tasks (Chang et al., 2014; Kolovelonis et al., 2011; Tod et al., 2009). However, research has also found that instructional and motivational cue words equally benefit power, accuracy, and endurance tasks (Chang et al., 2014; Edwards et al., 2008; Hatzigeorgiadis et al., 2004; Theodorakis et al., 2000). A meta-analysis conducted by Hatzigeorgiadis et al. (2011) revealed that instructional cue words were more effective for precision motor tasks than gross motor tasks, and that both instructional and motivational cue words were effective for gross motor tasks. Alternatively, a systematic review conducted by Tod et al. (2011) found no consistent evidence to support the differential effects of motivational and instructional cue words. The benefits of instructional cue words over motivational cue words in precision motor task performance have been ambiguous. Similarly, motivational cue words did not outperform instructional cue words in endurance-based tasks (Tod et al., 2011). Despite the mixed results there is sufficient evidence that strategic self-talk, either motivational or instructional, benefits motor task performance (Hatzigeorgiadis et al., 2011). Moreover, the current body of evidence suggests that instructional cue words may be more beneficial for precision motor tasks. However, further examination of the matching hypothesis is needed.

To date less research has been conducted investigating the effects of strategic self-talk on exercise tasks. One study investigating self-talk on a cycling ergometer task found that both positive and negative cue words improved power output (Hamilton et al., 2007). Likewise, motivational cue words were shown to reduce time-to-exhaustion (TTE), reduce perceived rate of exertion, increase executive functioning, increase power output, and increase VO2 peak (Barwood et al., 2015; Blanchfield et al., 2014; Hatzigeorgiadis et al., 2018; Wallace et al., 2017). These results suggest that strategic self-talk benefits aerobic exercise by decreasing time to complete performance and lowering perceived exertion. However, prior research did not systematically base their strategic self-talk interventions on the matching hypothesis (Theodorakis et al., 2000), varied in strategic self-talk content (e.g., motivational vs neutral, positive vs negative), and duration (e.g., five weeks, three weeks, two weeks). This lack of consistency indicates that further research is needed to better understand the relationship between strategic self-talk and its impact on various exercise tasks.

Given that prior research has been limited to examining exercise tasks involving endurance and has not used conceptual frameworks to guide intervention research on different types of exercise tasks, using strategic self-talk based on the matching hypothesis seems warranted. Specifically, it appears that a fruitful line of research to further explore is how strategic self-talk moderates exercise performance on concurrent training exercises involving endurance and precision.

Concurrent training involves a combination of strength (e.g., snatch, clean and jerk, overhead squats) and endurance (e.g., running, rowing, exercise biking) movements. Such training incorporates a combination of resistance training, for muscular strength, power, hypertrophy, and endurance exercise (Wilson et al., 2012). Concurrent training has become a popular training mechanism for beginner and experienced exercisers, with over 11,000 gyms worldwide and well over 400,000 members (Schlegel, 2020). Given the unique combination of endurance and strength tasks present within concurrent training it provides an opportunity to directly test the differential effects of the matching hypothesis with each task theoretically benefitting from self-talk that serves a different function (e.g., instructional or motivational). Thus, the purpose of the current experiment was to examine the matching hypothesis on a concurrent training task. Based on the matching hypothesis (Theodorakis et al., 2000), it was hypothesized that strategic self-talk would have a positive effect on concurrent training exercise performance in comparison to a control group. Specifically, that motivational cue words would be more effective on overall exercise time through increasing effort to complete the task and instructional cue words would be more beneficial for precision task performance through directed attentional focus on the correct mechanical aspects of the precision movement.

Method

Participants

To calculate sample size, a power analysis using a medium effect size (f = 0.25; Cohen, 1992), with an alpha level set to .05 and power set to .95 was conducted. This suggested a sample of 30 participants was needed. Thirty male (N = 12) and female (N = 18) adults from the university community (M = 25.7 years, SD = 5.31) were recruited and volunteered to participate in the study. During the recruitment phase participants were informed about the exercise task they would be completing (i.e., overhead squat and running). If a participant was physically unable to perform the overhead squat movement (e.g., they were not flexible enough, not strong enough) or were unable to complete the 400-meter run, they were excluded from the study. No other participant demographics were collected. Prior to any data collection or participant recruitment, approval from a university research ethics board was granted in accordance with the declaration of Helsinki (IRB #17-367).

Task

Participants were required to complete five rounds of a 400-meter run directly proceeded by 15 overhead squats (OHS) with a 6-lb bar, within a 20-minute time limit. Participants first completed a 400-meter run followed by 15 OHS, immediately followed by another 400-meter run and 15 OHS. This sequence was repeated until the participants completed it five times. The 6-lb weight was chosen to allow the participants focus on proper form of the OHS. The exercise sequence was taken directly from previous concurrent exercise research (Dexheimer et al., 2019), and the 20-minute time limit was selected to make the exercise current with ACSM guidelines of 20 minutes of vigorous aerobic exercise three days per week (ACSM, 2020). No participant exercised longer than 20 minutes. If a participant reached the 20-minute threshold, they were instructed to stop. The exercise sessions took place in an air-conditioned indoor track facility to control for environment. Each participant's set of 15 OHS was recorded with a Sony HDR-XR500V High Definition Handycam Camcorder to reduce real time scoring errors through video review. Each exercise session was observed by the principal investigator in a one-on-one setting to reduce distractions from other participants or researchers.

Measures

Performance Measure

Time of completion of the concurrent training sequence was recorded to the hundredths of a second, with the maximum time being 20-minutes. Participant's mechanical OHS score was measured on a numerical scale evaluating six components of the movement: (1) hold weighted bar overhead with arms straight, (2) descend to appropriate depth without losing balance or dropping bar, (3) descend to appropriate depth without rounding back or tucking hips under, (4) maintain upright torso throughout the movement, (5) able to keep heels on floor and weight evenly distributed, (6) able to keep knees from moving laterally during movement. The rating scale was adopted from the Canadian Weightlifting Federation and Coaching Association of Canada (Coach Workbook, 2006). Each participant's set of 15 OHS repetitions was filmed over two exercise sessions (i.e., baseline and intervention). Videos were reviewed by two trained coders. An intraclass correlation coefficient (ICC) was calculated to assess consistency between the coders (Field, 2018). The ICC estimate was above 0.9 for each exercise session, indicating excellent reliability between the two coders. The score for each set of OHS was between 0-6, with a maximum possible score of 30 across five sets. Scores were given based on the criteria participants were able to fulfill during their OHS performance. If a participant fulfilled four of the six criteria for a given set of OHS, their score would be 4, or if a participant fulfilled all six criteria their score would be 6. This scoring was used for all five sets of OHS across both exercise sessions.

Self-Talk

The Self-Talk Usage Questionnaire (STU-Q) was derived from a similar questionnaire developed by Hardy et al. (2001) and was used to obtain participants' organic self-talk during their regular exercise routines. The STU-Q contained four parts: (1) demographic information (e.g., age, sex, frequency and type of exercise), (2) a definition of self-talk from Hardy et al. (2009), (3) a question asking participants to rate their organic self-talk use during exercise on a 7-point Likert scale, with "1" indicating "never" and "7" indicating "every time", and (4) four questions regarding participants' organic self-talk use: (a) Where do you typically use self-talk? (b) When do you use self-talk? (c) What do you say to yourself when you exercise? (d) Why do you use self-talk during exercise?

The Post-Exercise Self-Talk Questionnaire (PEST-Q) was created specifically for the current study as a manipulation check to ensure participants adhered to their self-talk manipulation, along with obtaining self-talk information from the control group. The PEST-Q consisted of three questions: (1) Did you use self-talk during the exercise routine? (2) If yes, what was the cue used? (3) How often did you use this cue? There was additional space provided for elaboration of self-talk content with respect to the manipulation groups. The manipulation groups were asked how they felt having to say self-talk cues verbally. The PEST-Q allowed participants to reflect on their self-talk use and provide specific information regarding their selected cue words (i.e., if they used a different cue than the cue they were instructed to say verbally).

Mental Skills Questionnaire

The Mental Skills Questionnaire (MS-Q) was created specifically for the current study and asked participants how frequently they engaged in mental skills (e.g., goal setting, self-talk, imagery, and relaxation techniques) during their regular exercise routines. The MS-Q was given to participants prior to the first exercise session as a deceptive piece, with participants under the assumption they would receive one of the four mental skills previously mentioned during the intervention, or that their use of these mental skills was somehow being measured. The sole purpose of this questionnaire was to protect the control group.

Physical Activity Readiness

To assess participants physical activity readiness, the Physical Activity Readiness Questionnaire (PAR-Q+) was given to participants prior to the intervention as a screening tool to ensure participants were safe to take part in physical activity. The PAR-Q+ has seven general health questions in which a participant must answer 'no' to be cleared to participate in physical activity. If a participant answered 'no' to all seven questions, they were invited to participate in the study. If a participant answered 'yes' to any of the questions they were excluded from taking part in the study. No participants answered 'yes' to any of the questions in the PAR-Q+.

Procedures

The current study consisted of three sessions, familiarization, baseline, and intervention, over a five-to-six-day period. The five-to-six-day period was to account for the 24–48-hour recovery time between sessions, with each session occurring at the same time of day for each participant across all three sessions (Barwood et al., 2015). The familiarization and baseline sessions were implemented to account for any potential learning effects, or neural adaptations, that might have occurred. A learning effect may ensue after initially performing a task, in which performance of the task may increase when performed a second time (Gabriel et al., 2006). This was an attempt to reduce the possibility of performance increases inadvertently being attributed to the self-talk manipulation. For each session, participants were taken through a dynamic warm-up followed by a demonstration and explanation of the OHS. Participants then performed five repetitions of the OHS to show they were warmed up and could safely complete the OHS. If a participant was unable to perform the OHS, that participant was excluded from the study. Participants were given 'do your best' instructions for each session to encourage participants to give their maximal effort (Theodorakis et al., 2000).

Participants started the familiarization session by completing the informed consent, PAR-Q+, and MS-Q. They were then guided through a dynamic warm-up and OHS demonstration, after which they completed the concurrent training task for the first time. Specifically, participants engaged in the concurrent training sequence (i.e., 400 m run followed by 15 OHS) to gain experience with the exercise sequence in its' entirety. Once the exercise was complete, participants were asked to walk around the 200-meter indoor track for one lap to 'cool down.'

The first exercise session established the participant's baseline. Similar to the familiarization session, participants were taken through the dynamic warm-up and OHS demonstration. After completing the warm-up and demonstration participants completed the concurrent training sequence for the second time. Upon completion of the baseline session, participants were randomly assigned into one of three manipulation groups: (a) instructional, (b) motivational, or (c) control. The random assignment of groups was established using a random number generator (Google). Each group was assigned a number: control = 1, instructional ST = 2, and motivational ST = 3. Whichever number was selected by the program was the group each participant was assigned to. The group assignment was unknown to the participants until they arrived for the intervention session.

In the intervention session, participants were instructed to execute their assigned self-talk manipulation. Participants assigned to the instructional and motivational groups began the intervention session with a meeting about self-talk (e.g., what it is and how to use it). Each intervention group was given a definition and examples of self-talk cues specific to their manipulation and were asked to reflect on their organic self-talk cues they may use during their normal exercise routines. Participants were then given the option to choose one of the cues presented to them or use a self-talk cue they normally use if it coincided with their group assignment (Blanchfield et al., 2014; Hardy, 2006). The manipulation groups were instructed to overtly say their self-talk cue prior to beginning their 15 OHS repetitions for all five sets of 15 repetitions (Hatzigeorgiadis et al., 2004; Ming & Martin, 1996; Theodorakis et al., 2000). Specifically, after completing the 400-meter run, participants would approach the 6-lb. bar, say their cue word, and perform the 15 OHS repetitions. Requiring participants to say their cue word out loud enabled the researchers to assess if the participants remembered the self-talk cue and provided a manipulation check. The participant recited the self-talk instructions at the beginning of the OHS because the researchers could ensure this was done. The control group was given no self-talk manipulation and was simply instructed to complete the concurrent training exercise sequence a third time.

Self-Talk Manipulation

The motivational and instructional cue word examples presented to 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." Participants were presented with the cues with respect to their manipulation group, that is, the instructional group received instructional cue words and the motivational group received motivational cue words. After being presented with their respective cues, the manipulation group participants were allowed to choose which cues they were most comfortable using. It has been suggested that allowing the freedom of cue word choice may increase participants' self-determined motivation to use self-talk (Hardy, 2006). The control group received no self-talk cues, or instruction.

After being introduced to their respective intervention, participants completed the dynamic warm-up and OHS demonstration. Participants then performed the concurrent training sequence for the third time. After completing the concurrent training sequence each participant was informed about the nature of the study. Each manipulation group received the self-talk information from the other manipulation group, and the control group was given the self-talk information from both manipulation groups. The self-talk information acted as a primer for the participants, ensuring they were aware of the types and functions of self-talk so they could accurately complete the questionnaire. The participants then filled out the PEST-Q and the STU-Q and were asked if they had any additional questions. The STU-Q was given after the intervention to ensure the control participants were naïve to the purpose of the study and that the intervention groups were not thinking of other types of self-talk.

Data Analysis

Each dependent variable (total exercise time and overhead squat performance) was analyzed using separate 3 (group) x 2 (session) mixed factors repeated measures ANOVAs. The groups served as the between-subjects factor while session was the within-subjects factor. For all analyses, alpha was set to .05. The PEST-Q and STU-Q provided descriptive information of the self-talk participants used during the intervention and the self-talk participants used during their regular fitness routines, respectively.

Results

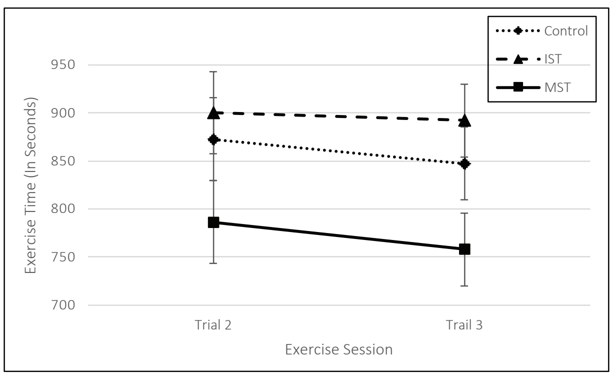
Exercise Time

Changes in overall exercise time are presented in Figure 1. Mean exercise time differed between baseline (M = 853.13 *sec*, SD = 150.31), and intervention (M = 832.45 *sec*, SD = 144.31). The 3 x 2 (Group x Session) repeated measures ANOVA revealed no significant main effect of session, F (1, 26) = 3.967, p = 0.057, η_p^2 = 0.132" . Similarly, there was no main effect of condition, F (2, 26) = 2.531, p = 0.099, η_p^2 = 0.163 or significant group by session interaction, F (2, 26) = 0.758, p = 0.479, η_p^2= 0.055" .

Overhead Squat

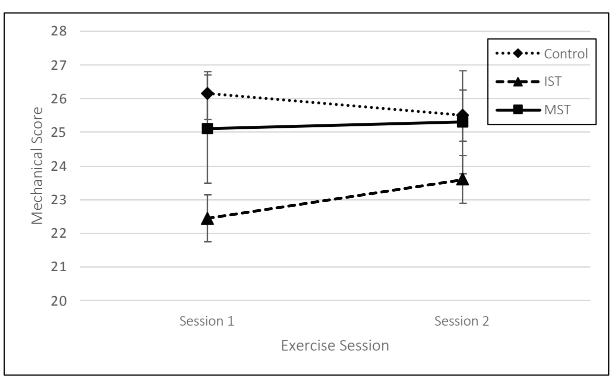
Changes in OHS mechanical scores are presented in Figure 2. Mean OHS scores slightly differed between baseline (M = 24.57, SD = 3.67) and intervention (M = 24.82, SD = 3.37), however, the 3 x 2 (Group x Session) repeated measures ANOVA revealed no significant main effect of session, F (1, 26) = 1.066, p = 0.311, η_p^2= 0.039. Likewise, there was no significant main effect of group F (2, 26) = 1.880, p = 0.173, η_p^2 = 0.126. The ANOVA did reveal a significant group by session interaction F (2, 26) = 4.025, p = 0.03, η_p^2= 0.236. Pairwise comparisons revealed the interaction was between the instructional self-talk and control groups. The control group's OHS score statistically insignificantly decreased from baseline to intervention, p = 0.216, while the instructional self-talk group's OHS score statistically significantly increased from baseline to intervention, p = 0.012.

Figure 1. ANOVA Output for Overall Exercise Time



Note. This figure shows the changes in overall exercise time from baseline to intervention sessions.

Figure 2. ANOVA Output for OHS Mechanical Score



Note. This figure shows changes in mechanical score from baseline to intervention sessions.

Descriptive Findings

Reported participant self-talk use is presented in Table 1. Responses from the PEST-Q indicated that four of the twenty participants who were assigned to a self-talk cue indicated that saying the cues out loud was awkward. Five indicated the cues provided a reminder to focus on the task. Specific to the ten instructional self-talk participants, four reported engaging in motivational self-talk during the running portion of the exercise routine. Three indicated the cues were helpful with maintaining proper OHS form, with one claiming to feel more balanced during the OHS portion, and one reporting the self-talk cue did not help. Specific to the ten motivational self-talk participants, two claimed the cue was a good distraction from fatigue. Two reported using the cue more frequently near the end of the exercise session to avoid walking, another two claimed the cue was a good reminder for the task, one reported having better control over their breathing, and another individual indicated to have a burst of energy during the run after using the cue. One reported the cues provided were better than the cues they normally used. Regarding the control group participants, nine of the ten reported using self-talk during the manipulation despite not receiving any instructions to do so. Of those nine, seven reported specifically using motivational self-talk, with two of the nine using both motivational and instructional self-talk.[1]

According to the STU-Q, participants self-reported engaging in moderate levels of exercise from two to seven days per week (M = 4.4, SD = 1.3). To assess participants' organic self-talk during their regular exercise routines, they were asked to rate how frequently they used self-talk during exercise using a seven-point Likert Scale (1 = never and 7 = every time). No differentiation between self-talk types was made here so, theoretically, participants could organically be using strategic self-talk that serves either an instructional or motivational

Table 1. Reported Participant Self-Talk Use (PEST-Q)

Self-Talk Feedback	Frequency
General Feedback	
Saying the cues felt Awkward	4
Cues provided a good reminder of the task	5
Cues were better than their normal cues	1
Instructional self-talk participants	
Used motivational self-talk on the run	4
Cues were helpful in maintaining OHS form	3
Felt more balanced during the OHS	1
Cues did not help	1
Motivational self-talk participants	
Cues were a good distraction from fatigue	2
Used the cue more frequently near the end of the session to avoid walking	2
Experienced better control of breathing	1
Experienced a burst of energy after using the cue	1
Control participants	
Used self-talk during the intervention	9
Used solely motivational self-talk	7
Used instructional and Motivational self-talk	2

Note. This figure shows changes in mechanical score from baseline to intervention sessions.

function. The results indicated that participants used self-talk frequently during their regular exercise routines (*M* = 5.3, *SD* = 1.4). Additionally, all thirty participants in the study reported using organic self-talk during their regular fitness routines. Twenty-three participants reported using exclusively motivational self-talk, while seven reported using both motivational and instructional self-talk. 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 to 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") see Footnote 1.

Discussion

The current research examined the effects of instructional and motivational cue words on a concurrent training task requiring participants to run a 400-meter distance and perform 15 overhead squats (OHS) for 5 rounds. Individuals had a maximum time limit of 20-minutes to complete the entire exercise routine and were randomly separated into either a motivational self-talk group, instructional self-talk group, or control group. Performance for both the mechanical score for OHS and total exercise time was collected during two exercise sessions (i.e., a baseline and intervention). It was hypothesized that strategic self-talk would have a positive effect on the concurrent training exercise routine in comparison to a control group based on Theodorakis et al. (2000) matching hypothesis. Specifically, motivational cue words would be more effective on overall exercise time through increasing effort to complete the task and instructional cue words would be more beneficial for the precision motor task through a directed attentional focus on the correct mechanical aspects of the movement.

The present results provided minimal support for the investigation's hypothesis. Specifically, a significant group-by-session interaction for OHS was revealed, with the instructional self-talk group improving from baseline to intervention, while participants in the control group did not demonstrate significant changes in performance. Additionally, the results provide minimal support for one aspect of the matching hypothesis, that instructional cue words benefit tasks requiring precision movements (Hatzigeorgiadis et al., 2004; Hatzigeorgiadis et al., 2011; Theodorakis et al., 2000). Based on the current findings it is possible that the instructional cue words in the present study directed participants' attentional focus to the most salient aspect of the movement for completing the OHS and thus improved their performance. This interpretation would be consistent with other findings which have demonstrated that instructional cue words enhanced the execution of movements such as free-throw shooting, badminton serving, soccer passing, water polo throwing, tennis forehand groundstrokes, and tennis forehand cross-court shots (Boroujeni & Shahbazi, 2011; Boroujeni et al., 2014; Hatzigeorgiadis et al., 2004; Hatzigeorgiadis et al., 2011; Kolovelonis et al., 2011; Latinjak et al., 2011; Latinjak et al., 2010; Theodorakis et al., 2001; Theodorakis et al., 2000). Overall, the current findings indicate that instructional cue words may be effective for aspects of the concurrent training exercise that involve precision. The current finding contributes to prior research by demonstrating this effect using a novel task involving motor precision and accuracy.

The other half of the matching hypothesis (Theodorakis et al., 2000) suggests that motivational cue words are effective for motor tasks requiring endurance, strength, and power. Based on this hypothesis it was anticipated that the motivational self-talk group would demonstrate superior total exercise time compared to the other two groups. This hypothesis was put forward based on the belief that motivational cue words increase an individual's confidence and effort to complete a task. However, the current experiment failed to find a significant effect for the motivational self-talk group on overall exercise time when compared to the instructional self-talk or control group. This result differs from previous interventions where motivational cue words have demonstrated benefits to power and endurance tasks (Blanchfield et al., 2014; Hamilton et al., 2007; Hatzigeorgiadis et al., 2018; Tod et al., 2009; Wallace et al., 2017). One potential explanation for the lack of motivational self-talk effectiveness is the emergence of organic self-talk. The descriptive results from the questionnaire (PEST-Q) found that 90% of the control group used organic self-talk during their performance despite receiving no instructions to do so. Seven control participants specifically used organic self-talk that served motivational functions while two used organic self-talk that served both motivational and instructional functions. These results indicate that participants may use organic self-talk for various functions during the concurrent training exercise. Overall, current result of motivational cue words did not support the matching hypothesis that motivational self-talk benefits tasks involving endurance, strength, and power (Theodorakis et al., 2000).

Similarly, the instructional cue words had no significant effect on overall exercise time compared to the motivational self-talk and control groups. This finding is consistent with the matching hypothesis, with the prediction being that instructional self-talk is more effective than motivational self-talk for motor tasks involving precision and accuracy (Theodorakis et al., 2000). Despite this consistency, the lack of instructional self-talk effectiveness on overall exercise time differs from a prior meta-analysis and literature review research suggesting that both instructional and motivational cue words improved performance in gross motor tasks (Hatzigeorgiadis et al., 2011; Tod et al., 2011). One explanation for the lack of instructional self-talk effectiveness may also be due to the emergence of organic self-talk, as some individuals that were assigned a strategic self-talk intervention used organic self-talk during the intervention. Specifically, 40% of the instructional self-talk group reported using organic self-talk that served a motivational function while running (see Table 1). This finding indicates that although participants in the instructional self-talk groups were strategically assigned cues, they used organic self-talk that served motivational functions during concurrent training exercise. In addition, all participants reported using organic self-talk in their regular fitness routines which may account for participants spontaneous use of self-talk. Based on this interpretation, it is possible that the control participants spontaneously engaged in organic self-talk without instruction because they organically use goal-directed self-talk during exercise already as part of their fitness routine. It is also possible that participants in the motivational and instructional self-talk groups may have reverted to using organic self-talk because of personal preference. Additionally, it is plausible that during intense aerobic exercise or states of fatigue, an individual will revert to the organic self-talk they are comfortable using in their daily exercise routine.

Based on the descriptive findings, one suggestion might be to eliminate organic self-talk in the control group altogether. However, we suggest a more appropriate course of action might be allowing a group to choose between instructional and motivational self-talk cue words for concurrent training tasks. This manipulation would be in-line with the motor learning literature on self-control (Chiviacowsky, 2014) and may serve as a way to investigate organic self-talk based on participant cue selection. There is also the finding of organic self-talk appearing within the strategic self-talk intervention. The emergence of organic self-talk is important to consider not only when interpreting the results of the current study, but also when developing future self-talk interventions. It is possible that organic self-talk can override strategic self-talk during motor task performance, potentially undermining a strategic self-talk intervention. One suggestion might be to include some form of manipulation check in future strategic self-talk interventions (e.g., follow up questionnaire) to better understand why organic self-talk use occurs during strategic self-talk interventions where participants are instructed to use one cue and instead use another.

Another potential explanation for the lack of self-talk effectiveness on exercise time is that participants were only instructed to use their strategic self-talk cue prior to performing the OHS movement. The current strategic self-talk intervention was not systematically implemented during the 400-meter run and given the questionnaire data (PEST-Q) we can speculate that the organic self-talk that served a motivational function was used during the run. It is possible that the strategic self-talk manipulations did not affect the run since there were no strategic self-talk cues specifically for the run. However, various strategic self-talk cues may be needed as the cues may change from one task to the next during concurrent training exercise. One suggestion is to provide strategic self-talk cues specific to each portion of a concurrent training task and require participants to say these cues out loud during task completion. Implementing these procedures may provide a clearer indication of how strategic self-talk influences concurrent training exercise performance.

One limitation of the current experiment was that the strategic self-talk manipulation was only applied prior to performance of the OHS portion of the concurrent training sequence. Implementing different strategic self-talk cue words for each portion of the concurrent training sequence might provide a clearer indication of how strategic self-talk impacts concurrent training exercise. Another limitation was the intervention took place over a one-week period (i.e., 5 – 7 days). It may be of benefit to have an intervention period over several weeks with the addition of a multiple baseline design where participants perform the exercise protocol over several days to establish a clear baseline. This would better control for potential performance and learning effects. This suggested methodological change may allow the self-talk manipulation to be implemented at a point where performance of the concurrent training task has plateaued, potentially enabling greater benefits of strategic self-talk to be observed. Future researchers should consider addressing these limitations in strategic self-talk experiments.

Taken together, the results suggest that instructional cue words benefit the precision portions of concurrent training, and motivational cue words may not benefit the endurance portions of concurrent training. However, the current study did not implement motivational cue words during the running portion of concurrent exercise, thus the potential effects of motivational cue words during the endurance portions of concurrent training are still unknown. Given the interplay observed between organic and strategic self-talk during the concurrent training routine, future research should examine the effects of strategic self-talk during concurrent training. The results provide minimal support for the matching hypothesis (Theodorakis et al., 2000), however, future research is needed to further explore the interaction between strategic self-talk and concurrent training. Given that participants appeared to have preferred organic self-talk during strenuous exercise, it would be important for future research to implement control protocols to ensure that assigned strategic self-talk cues are used consistently throughout their performance.

Footnote

[1] It should be noted that the self-talk descriptive frequency results will not add up to the exact number of participants in each group (i.e., 10), or the exact number of manipulation participants (i.e., 20). This is because some participants fall into multiple categories of responses, while some gave little information.

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References

Barwood, M. J., Corbett, J., Wagstaff, C. R., McVeigh, D., & Thelwell, R. C. (2015). Improvement of 10-km time-trial cycling with motivational self-talk compared with neutral self-talk. *International Journal of Sports Physiology and Performance, 10*(2), 166-171. https://doi.org/10.1123/ijspp.2014-0059

Blanchfield, A. W., Hardy, J., De Morree, H. M., Staiano, W., & Marcora, S. M. (2014). Talking yourself out of exhaustion: The effects of self-talk on endurance performance. *Medicine & Sciences in Sports & Exercise, 46*(5), 998-1007. https://doi.org/10.1249/MSS.0000000000000184

Boroujeni, S., & Shahbazi, M. (2011). The effect of instructional and motivational self-talk on performance of basketball's motor skill. *Procedia Social and Behavioral Sciences, 15*, 3113-3117. https://doi.org/10.1016/j.sbspro.2011.04.255

Boroujeni, S. T., Zourbanos, N., & Shahbazi, M. (2014). The effects of instructional and motivational self-talk on basketball shooting performance in novice students. *University of Thessaly Institutional Repository*. https://ir.lib.uth.gr/xmlui/handle/11615/26366

Chang, Y. K., Ho, L. A., Lu, F., Ou, C. C., Song, T. F., & Gill, D. (2014). Self-talk and softball performance: The role of self-talk nature, motor task characteristics, and self-efficacy in novice softball players. *Psychology of Sport and Exercise, 15*(1), 139–145. https://doi.org/10.1016/j.psychsport.2013.10.004

Chiviacowsky, S. (2014). Self-controlled practice: Autonomy protects perceptions of competence and enhances motor learning. *Psychology of Sport and Exercise, 15*(5), 505-510. https://doi.org/10.1016/j.psychsport.2014.05.003

Coach Workbook. (2006). Ottawa, ON. Canadian Weightlifting Federation & Coaching Association of Canada.

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112*(1), 155-159. https://doi.org/10.1037/0033-2909.112.1.155

Dagrou, E., Gauvin, L., & Halliwell, W. (1992). The effects of positive, negative and neutral self-talk on motor performance. *Canadian Journal of Sport Sciences = Journal Canadien des Sciences du Sport, 17*(2), 145-147.

Dexheimer, J. D., Schroeder, E. T., Sawyer, B. J., Pettitt, R. W., Aguinaldo, A. L., & Torrence, W. A. (2019). Physiological performance measures as indicators of CrossFit® performance. *Sports, 7*(4), 93. https://doi.org/10.3390/sports7040093

Edwards, C., Tod, D., McGuigan, M. (2008). Self-talk influences vertical jump performance and kinematics in male rugby union players. *Journal of Sports Sciences, 26*(13), 1459–1465. https://doi.org/10.1080/02640410802287071

Field, A. (2018). *Discovering statistics using IBMM SPSS statistics* (5th ed., North American Edition). SAGE.

Gabriel, D. A., Kamen, G., & Frost, G. (2006). Neural adaptations to resistive exercise. *Sports Medicine, 36*(2), 133-149. https://doi.org/10.2165/00007256-200636020-00004

Hamilton, R. A., Scott, D., & MacDougall, M. P. (2007). Assessing the effectiveness of self-talk interventions on endurance performance. *Journal of Applied Sport Psychology, 19*(2), 226-239. https://doi.org/10.1080/10413200701230613

Hardy, J. (2006). Speaking clearly: A critical review of self-talk literature. *Psychology of Sport and Exercise, 7*(1), 81-97. https://doi.org/10.1016/j.psychsport.2005.04.002

Hardy, J., Comoutos, N., & Hatzigeorgiadis, A. (2018). Reflections on the maturing research literature of self-talk in sport: Contextualizing the special issue. *The Sport Psychologist, 32*(1), 1-8. https://doi.org/10.1123/tsp.2017-0141

Hardy, J., Gammage, K., & Hall, C. (2001). A descriptive study of athlete self-talk. *The Sport Psychologist, 15*(3), 306-318. https://doi.org/10.1123/tsp.15.3.306

Hardy, J., Oliver, E., & Tod, D. (2009). A framework for the study and application of self-talk within sport. In S. D. Mellalieu & S. Hanton (Eds.), *Advances in Applied Sport Psychology: A Review* (1st ed., pp. 37-74). Routledge.

Hatzigeorgiadis, A., Bartura, K., Argiropoulos, C., Zourbanos, N., Galanis, E., & Flouris, A. (2018). Beat the heat: Effects of a motivational self-talk intervention on endurance performance. *Journal of Applied Sport Psychology, 30*(4), 388-401. https://doi.org/10.1080/10413200.2017.1395930

Hatzigeorgiadis, A., Theodorakis, Y., & Zourbanos, N. (2004). Self-talk in the swimming pool: The effects of self-talk on thought content and performance on water-polo tasks. *Journal of Applied Sport Psychology, 16*(2), 138-150. https://doi.org/10.1080/10413200490437886

Hatzigeorgiadis, A., Galanis, V., Zourbanos, N., & Theodorakis, Y. (2014). Self-talk and competitive sport performance. *Journal of Applied Sport Psychology, 26*(1), 82-95. https://doi.org/10.1080/10413200.2013.790095

Hatzigeorgiadis, A., Zourbanos, N., Galanis, E., & Theodorakis, Y. (2011). Self-talk and sports performance: A meta-analysis. *Perspectives on Psychological Science, 6*(4), 348-356. https://doi.org/10.1177/1745691611413136

Hatzigeorgiadis, A., Zourbanos, N., Latinjak, A. T., & Theodorakis, Y. (2014). Self-talk. In A. Papaioannou & D. Hackfort (Eds.), *Routledge Companion to Sport and Exercise Psychology* (pp. 372 – 386). Routledge.

Kolovelonis, A., Goudas, M., & Dermitzaki, I. (2011). The effects of instructional and motivational self-talk on students' motor task performance in physical education. *Psychology of Sport and Exercise, 12*(2), 153-158. https://doi.org/10.1016/j.psychsport.2010.09.002

Landin, D., & Herbert, E. P. (1999). The influence of self-talk on the performance of skilled female tennis players. *Journal of Applied Sport Psychology, 11*(2), 263-282. https://doi.org/10.1080/10413209908404204

Latinjak, A. T., Hatzigeorgiadis, A., Comoutos, N., & Hardy, J. (2019). Speaking clearly…10 years on: The case for an integrative perspective of self-talk in sport. *Sport, Exercise, and Performance Psychology, 8*(4), 353-367. https://doi.org/10.1037/spy0000160

Latinjak, A. T., Masó, M., & Comoutos, N. (2018). Goal-directed self-talk used during technical skill acquisition: The case of novice Ultimate Frisbee players. *The Sport Psychologist, 32*(1), 60-65. https://doi.org/10.1123/tsp.2017-0047

Latinjak, A. T., Torregrosa, M., & Renom, J. (2011). Combining self-talk and performance: Their effectiveness with adult tennis players. *The Sport Psychologist, 25*(1), 18-31. https://doi.org/10.1123/tsp.25.1.18

Latinjak, A. T., Torregrosa, M., & Renom, J. (2010). Studying the effects of self-talk on thought content with male adult tennis players. *Perceptual and Motor Skills, 111*(1), 249-260. https://doi.org/10.2466/02.05.28.PMS.111.4.249-260

Linguori, G., & American College of Sports Medicine. (2020). *ACSM's guidelines for exercise testing and prescription*. Lippincott Williams & Wilkins.

Mallett, C. J., & Hanrahan, S. J. (1997). Race modeling: An effective cognitive strategy for the 100 m sprinter? *The Sport Psychologist, 11*(1), 72-85. https://doi.org/10.1123/tsp.11.1.72

Ming, S., & Martin, G. L. (1996). Single-subject evaluation of a self-talk package for improving figure skating performance. *The Sport Psychologist, 10*, 227-238. https://doi.org/10.1123/tsp.10.3.227

Rushall, B. S., Hall, M., Roux, L., Sasseville, J., & Rushall, A. (1988). Effects of three types of thought content instructions on skiing performance. *The Sport Psychologist, 2*(4), 283-297. https://doi.org/10.1123/tsp.2.4.283

Schlegel, P. (2020). CrossFit® training strategies from the perspective of concurrent training: A systematic review. *Journal of Sport Science & Medicine, 19*(4), 670-680.

Theodorakis, Y., Chroni, S., Laparidis, K., Bebetsos, V., & Douma, I. (2001). Self-talk in a basketball-shooting task. *Perceptual and Motor Skills, 92*, 309-315. https://doi.org/10.2466/pms.2001.92.1.309

Theodorakis, Y., Hatzigeorgiadis, A., & Zourbanos, N. (2012). Cognitions: Self-talk and performance. In S. M. Murphy (Ed.), *The Oxford handbook of sport and performance psychology* (pp. 191–212). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199731763.013.0010

Theodorakis, Y., Weinberg, R., Natsis, P., Douma, I., & Kazakas, P. (2000). The effects of motivational and instructional self-talk on improving motor performance. *The Sport Psychologist, 14*(3), 253-272. https://doi.org/10.1123/tsp.14.3.253

Tod, D. (2014). *Sport Psychology: The Basics* (1st ed.). Routledge.

Tod, D., Hardy, J., & Oliver, E. (2011). Effects of self-talk: A systematic review. *Journal of Sport & Exercise Psychology, 33*(5), 666-687. https://doi.org/10.1123/jsep.33.5.666

Tod, D., Thatcher, R., McGuigan, M., & Thatcher, J. (2009). Effects of instructional and motivational self-talk on the vertical jump. *Journal of Strength and Conditioning Research, 23*(1), 196-202. https://doi.org/10.1519/JSC.0b013e3181889203

Van Raalte, J. L., Brewer, B. W., Lewis, B. P., Linder, D. E., Wildman, G., & Kozimor, J. (1995). Cork! The effects of positive and negative self-talk on dart throwing performance. *Journal of Sport Behavior, 18*(1), 50-57. https://www.proquest.com/docview/215870420?pq-

Van Raalte, J. L., Vincent, A., & Brewer, B. W. (2016). Self-talk: Review and sport-specific model. *Psychology of Sport and Exercise, 22*, 139-148. https://doi.org/10.1016/j.psychsport.2015.08.004

Wallace, P., McKinlay, B., Coletta, N., Vlaar, J., Taber, M., Wilson, P., & Cheung, S. (2017). Effect of self-talk on endurance and cognitive performance in the heat. *Medicine & Science in Sports & Exercise, 49*(1), 191-199. https://doi.org/10.1249/MSS.0000000000001087

Williams, J. M., & Hacker, C. M. (2021). Cognitive techniques for building confidence and enhancing performance. In J. M. Williams & V. Krane (Eds.), *Applied Sport Psychology: Personal Growth to Peak Performance* (8th Ed., pp. 278–313). McGraw-Hill.

Wilson, J. M., Marin, P. J., Rhea, M. R., Wilson, S. M., Loenneke, J. P., & Anderson, J. C. (2012). Concurrent training: A meta-analysis examining interference of aerobic and resistance exercises. *The Journal of Strength and Conditioning Research, 26*(8), 2293-2307. https://doi.org/10.1519/JSC.0b013e31823a3e2d

Wrisberg, C. A., & Anshel, M. H. (1997). The use of positively-worded performance reminders to reduce warm-up decrement in the field hockey penalty shot. *Journal of Applied Sport Psychology, 9*(2), 229-240. https://doi.org/10.1080/10413209708406484

Ziegler, S. G. (1987). Effects of stimulus cueing on the acquisition of groundstrokes by beginning tennis players. *Journal of Applied Behavior Analysis, 20*(4), 405-411. https://doi.org/10.1901/jaba.1987.20-405