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Effects of self-talk on perceived exertion during moderate intensity exercise

by

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Declaration by Author

The present thesis is a result of my original work and does not include any material that was previously written or published by another person. In such a case, the relevant references are included. I have clearly stated the contribution by others to jointly-authored works that I have included in my thesis.

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None

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The author of the thesis had a great help from Dr. Antonis Hatzigeorgiadis.

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None

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We the undersigned, certify that this thesis has been approved and that is adequate in scope and methodology for the degree of European Masters in Sport and Exercise Psychology.

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Abstract

The purpose of the study was to examine the effectiveness of self-talk on the perception of exertion during moderate exercise on a cycloergometer. Participants were 85 healthy physical education and sport science students (60 males, 41 females) with an average age of 20.99 (± 2.19). Participants were divided into two groups, control and experimental, with the experimental group receiving a short self-talk intervention before the onset of the experimental task. The experimental task involved cycling for 20 minutes on a cycloergometer at about 50% (45%-55%) of heart rate reserve. During cycling heart rate, power output (Watt) and distance covered were recorded, and addition participants' perceived exertion was assessed every 4 minutes. The results revealed that there were no difference on heart rate, power output and distance covered throughout the cycling period; however, participants of the experimental group reported lower ratings of perceived exertion for the second half of the cycling period. The results suggest that self-talk can help performance and support the tenets of the psychobiological model of endurance performance for moderate intensity exercise.

Key words: self-talk strategies, intervention, psychological model of endurance performance, RPE

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INTRODUCTION

Self-talk is an integral part of our everyday life regardless if we notice it or not. All human beings talk to themselves. Self-talk, refers to what people say to themselves either silently or loud, inherently or strategically and is used to serve purposes like stimulation, direction, reaction, evaluation of events and actions and of course the sense of exertion (Hatzigeorgiadis, Zourbanos, Latinjak, & Theodorakis, 2014). From this short definition alone we can understand how important its application is. Self-talk is a multidimensional element that affects not only cognitive but also physical aspects of the person that applies it. Its positive contribution is apparent in every aspect. Self-talk, in brief, is one of the most influential psychological techniques in the field of sports and it is widely used in various athletic settings.

It is widely accepted that psychological training programs are of significant importance for athletes in particular. Psychological training programs consist of psychological techniques such as relaxation techniques, imagery, self-talk, goal-setting, attention, concentration, which athletes or exercisers use to assist learning or improve their performance. Self-talk strategies have been receiving a steadily increasing attention over the last years. Self-talk strategies are cues or statements that are used based on a pre-determined plan serving specific performance purposes. Athletes apply these strategies in order to be more competent in a task and at the same time feel mentally strong and able to surpass every stressful or highly intense situation. They make use of cue words aiming at enhancing performance through the activation of appropriate responses. Numerous studies have been conducted in order to evaluate the results of self-verbalization to athletes after their training routine. Overall, self-talk strategies have proved effective in enhancing performance (Hatzigeorgiadis, Zourbanos, Galanis & Theodorakis, 2011; Tod, Hardy, & Oliver, 2011). Recently,

researcher have now turned their attention in exploring the mechanisms explaining the facilitating effects of self-talk on performance (Galanis, Hatzigeorgiadis, Zourbanos, & Theodorakis, 2011; Hardy, Oliver, and Tod, 2009). In the literature there are indications that self-talk strategies may have help regulating cognitive and emotional reactions. Furthermore, the effectiveness of self-talk hs been also attributed in emotional psych-up, positive mood, anxiety reduction and improvement of attention (Galanis et al., 2016). Of particular interest for the purposes of his study, it has been suggested that self-talk cues have a great influence in reducing the sensation of exhaustion and act towards the prevention of the accumulation of progressive muscle fatigue (Blanchfield et al., 2013). The purpose of this study was to explore the effects of self-talk strategies on perceptions of exertion during moderate intensity aerobic exercise.

LITERATURE REVIEW

Definition and conceptualization of self-talk

Different researchers have formed a number of definitions for self-talk. It is defined as something "that people say to themselves out loud, or it can be defined as a small voice in their own heads" (Kahrović et al, 2014). In simple terms, self-talk is described as a multi-dimensional phenomenon concerned with athletes' verbalizations that are addressed to themselves and can be automatic and spontaneous, or planned and strategic (Hatzigeorgiadis et al, 2014). Self- talk strategies essentially involve the use of cues that aim at facilitating learning and enhancing performance, through the activation of appropriate responses (Hatzigeorgiadis et al, 2014). Essentially, these verbalizations are crucial in that they allow athletes to interpret feelings and conceptualizations, instruct themselves and reinforce their effort as well as regulate the different cognitions and perceptions (Hardy, 2006) This definition accentuates the fact that language is an essential element in self-talk and an irreplaceable component of thought and cognition until these become actual physical activity.

According to Kahrović et al (2014), there is differentiation between positive and negative self-talk. Expressions such as "I can surely do it", "I will do my best" and "I am ready" are examples of positive statements that facilitate and book self-esteem and give motive to the athlete to improve themselves and focus on the task at-hand rather than past errors. In contrast, expressions such as "I am so bad, I will certainly fail" or "There is no possible way I can do this" are negative statements and they increase stress and anxiety as well as lower levels of efficiency and general performance. Hardy (2006) has also made a further distinction on the types of self-talk which define the type of self-talk being either instructional or motivationals. The former includes key words,

phrases or sentences that are designed to “improve the performance of athletes by providing a focus on the technical aspects of training skills as well as providing instructions relating to strategy, technique or kinaesthetic skills characteristics”. The latter comprises of a set of positive statements that aim at boosting the athlete’s confidence and drive.

In Puchalska-Wasyl (2015), there are some more alternative terms given for self-talk such as “inner speech”, “private speech”, “auditory imagery”, “interior monolog”, “self-statements” all of which, nonetheless, suggest full realization of who the speaker and the addressee are, both being the same individual. Cognitivists have approached the addressed. of the utterances of self-talk as the actual self, the ideal self, the ought self, the undesired self, the possible self and the working self, just to name a few. Examples of self-talk include phrases such as “You cannot give up now” which could be addressed to the actual self-deriving from the ought self. However, it does not “exclude distinguishing between the speaker and the recipient”. This idea of self-multiplicity is what has set the basis for distinguishing between the different types of selves (Puchalska-Wasyl, 2015).

Nature of Self-talk

Having defined self-talk and analyzed the particularities of the addressee or the recipient of self-verbalization, light should also be shed on the nature of self-talk in order to fully understand its potential and application on sports performance. As Hardy writes (2006), the dimension which are to be further defined include valence, overtness, self-determination, motivational interpretation, functions and frequency.

With regard to valence, it is concerned with “the content of self-talk and is anchored with the bi-polar descriptors of positive and negative self-talk”. According to

Hardy, emphasis on performance might not constitute the most appropriate way in order to assess positive and negative self-talk as it has been focused on in numerous studies. In his view, it is not a matter of positive versus negative self-talk which should be the focus of research but rather, the these should be referred to as facilitative and debilitative self-talk. Overtness as a dimension of self-talk deals with the externalization of self-talk utterances and co-exists with covertness as some athletes prefer inner speech rather than self-talking out loud. The relevant literature had not yet yielded results as to which of the two is most effective when it comes to athletic performance which again emphasizes the need for further research.

Self-determination or in other words, the degree in which the athlete decides upon the statements employed in their self-talk practice is another dimension worth examining in research. Hardy argues that although there has not been a definitive answer as to how self-determination influences enhancement of athletic performance, it can be deducted that freely chosen self-talk statements might have greater motivational impact according to Deci and Ryan's Cognitive Evaluation Theory (1985). Motivational interpretation dimension actually involves the scope under which self-talk is seen by the athlete, that is as being motivational or de-motivational for themselves. More research is cardinal though to facilitate the better understanding of the relation between motivation and self-talk and thus assist in its implementation into training routines and sports practices.

As far as functions are concerned, that is the reasons why an athlete would resort to self-talk strategies, there has been qualitative research which has shown that athletes employ self-talk in order to maintain or increase their motivation or drive regarding a particular sport task. Moreover, as Hardy states "athletes utilizing self-talk in order to offer additional guidance and motivation when their cognitive resources are reduced in

association with the competitive setting". Finally, frequency is set on a spectrum ranging from 'never' to 'always' and refers to how often athletes employ self-talk. Previous research has connected the high frequency of self-talk with the athletes' elevated performance skills.

The importance of self-talk

Yogi Berra, an infamous baseball player once said "Baseball is 90 per cent mental. The other half is physical". In this phrase Berra has summed up the essence of mental preparation that athletes have to go through before any major sporting event not just for the participation part but also to be able to succeed either in their personal goals or to achieve the maximum result plausible. Many a time, athletes have not been able to accomplish their personal goals or build a successful career in spite of their aptitude for the sport or their optimal conditions for success such as good training conditions, talent, hard work and a team of accomplished professionals backing them up. They have passed on to oblivion and given the ever-changing conditions and constantly rising challenges, the stress that is burdening the athletes has become unprecedented.

Therefore, what makes an athlete superior is having mental strength and competence in their arsenal which can be achieved through arduous mental training, a feature that is fundamental in sports psychology specialists and a growing number of sports professionals have included it in their practices realizing its importance and the potential it gives for improvement more and more at the present time. Bibliography has shown that successful athletes use positive self-talk in a number of occasions and with increased frequency than less successful athletes. (Kahrović et al, 2014) Given the definitions offered in section 1, self-talk helps athletes "improve their performances by controlling and organizing their thoughts, as well as keeping their focus on the technical

aspects of training skills". (Kahrović et al, 2014) It is easily understood then how positive an effect self-verbalizations have on an athlete's persistence to exercising, confidence on one's self making self-talk a mood-booster.

Limitations

The literature has presented itself with a number of limitations regarding the systematic study of self-talk. According to Hardy et al (2001), the first limitation is that the majority of research conducted on the matter revolves around the actual statements athletes say to themselves which narrows the study of the influence of positive and negative self-talk. In this respect, the study of the reasons why athletes employ self-talk in their practices has been touched upon but is still in infantile stages. Moreover, they have proposed that theories which are essential to the process of conceptualizing the idea behind self-talk are lacking and thus, research on the matter lacks systematicity and the formation of solid theories upon which science is grounded.

Another type of limitation would also include the self-talk techniques being viewed as a placebo effect, much like the place effect of medicine. Rationally and unavoidably, self-talk studies on the effectiveness of the method abound and concur that indeed self-talk is beneficial. It enhances performance much like medical placebo effect helps the body heal. The limitation of the research conducted thus far has to do with the lack of being familiar with the process and dynamics of self-talk which could be interpreted as having a placebo effect. (Eichner, 2015)

Even so, studies on self-talk done already or are undergoing currently give abundant information on the psychobiology of top athletic performance as well as powerful insight.

Evaluation of the effectiveness of self-talk

In this part, a number of studies have been summarized in order to evaluate the results of self-talk as regards the effectiveness on athletes' performance. In Kahrović et al (2014) adequate research has already been assessed and evaluated and put forward in this paper, thus this part will add to this evaluation in order to further facilitate the relevant literature on the matter. However, for a more analytical view on the matter, in "Self-talk and Sports Performance: A Meta-Analysis" by Hatzigeorgiadis, Zourbanos, Galanis and Theodorakis (2011) a total of 32 studies have been analysed on a secondary level regarding the effectiveness of self-verbalization. In that study, the results help establish the significance of self-talk during athletic activities thus promoting its incorporation into the training sessions and provide new research directions. A chronological order has been employed to clarify the development of the studies done on the particular matter.

As cited in Kahrović et al (2014), one of the first studies conducted by Mahoney & Avener (1977) showed that the use of self-talk strategies was significantly more present in those American gymnasts who qualified for the Olympics, than in those who were not able to do so. The higher frequency of the use of positive self-talk was expressed in these athletes not only when they competed, but also in everyday training sessions.

Rushall, Hall, Roux, Sasseville, & Rushall (1988) conducted a study in which they examined the effects of self-talk on task performance among elite cross-country skiers. The results showed that self-talk brought a significant improvement in the time of passing the ski slopes as compared to "normal" skiing where self-talk was not used. Finally, the authors conclude that for the cross-country skiers "control of the content of

thoughts is very important for improving the results" (p. 293) because it allows them to "run" the track significantly faster than in circumstances where the control of the content of their thinking is lacking.

Dagrou has explored the influence of self-talk in real conditions of sports-related events (1992). Participants were asked to execute five penalty shots and the results, as expected, were encouraging the idea that self-verbalization techniques are a positively-influencing factor in athletic performance of individuals. Interestingly enough, the study has also touched upon another factor which is the "cross-cultural generalization of the phenomenon" meaning that since the participants were not from the western world, the study has revealed that there is no preference in ethnicity when it comes to self-talk in relation to performance improvement.

Various aspects of psychological involvement play an important role in the biomechanical, physiological and neural control of movement. Mental training aims to develop the skills and psychological states of athletes that will lead to an improvement in physical performance over those achieved through physical and technical training (Driskell, Copper, & Moran, 1994).

Tennis is one of the sports in which a considerable number of studies have been conducted with the purpose to demonstrate a positive correlation between the performance on the field (improvements in performance) and the use of the self-talk strategy. One of the first studies of this kind was conducted by Van Raalte, Brewer, Rivera, & Petipas (1994). They investigated the effects of external, outward external self-talk (words that are spoken aloud) on the results achieved by 24 junior tennis players. In the end, it was concluded that the players who believed in the self-talk strategy, and therefore used it more frequently, won more points compared to the

players who did not practice this technique. In accord with this, players who have been winning matches were tennis players who recorded lower frequency of use of negative self-talk when compared to players who were losing. In addition, players who have continuously been using the self-talk strategy were unanimous in saying that it helped them to increase motivation, as well as to better concentrate and stay focused. Accordingly, Landin & Hebert (1999) also reported that tennis players felt more focused and more self-confident after the implementation of self-talk inbuilt into their training program. Another study that found a positive relationship between self-talk and the success in the performance of certain tasks in tennis was conducted by Landin et al. (1999). During this study, tennis players were assigned the task to use the key words "turn" and "share" (an instructional form of self-talk) in order to improve the technique of the volley shot. Finally, the results showed that this technique yielded results and was effective in four out of the five female tennis players who participated in this study. It should be noted that the study of Lambert and Hebert in fact only confirmed and strengthened the claims of the positive impact of instructional self-talk on the performance of tennis players. We point this out because Ziegler (1987) twelve years earlier conducted a study that showed that this type of self-talk leads to a large and prolonged increase in successful performance in two major strokes in tennis, namely, the backhand and forehand. During this study, tennis players were given instructions to use four different key words depending on what position they were in, in order to improve their focus on the task itself. The first key word was "ball" and the participants" task was to recite it aloud, at the time when the ball was launched from the machine on the opposite side of the net. Another key word ("bounce") was recited in order to improve the timing of hitting the ball and was verbalized at the time of striking the ball on the ground. The third instructional word was "shot" and the task was to pronounce

it just before the contact of the racket and the ball. Last, the final key word was “ready” and was recited it in order to re-orient the focus of attention on the machine that was to throw a new ball.

The positive impact of self-talk on the performance of the athletes was tested in athletics as well. A study conducted by Mallett & Hanrahan (1997) included elite Australian sprinters. They were supposed to use the key words “push”, “heel”, “claw” during 0-30, 30- 60, and 60-100 m sections of the race at 100 m. The final average improvement amounted to 2 %, which was an exceptional result considering the fact that top athletes were involved in the study, as well as the discipline itself, where every millisecond is of great importance.

Hardy, Gammage and Hall (2001) in their study on the effectiveness of self-talk yielded important results as to the description of the use of self-talk by athletes. Thus, the study revealed that athletes use their self-talk strategies much more frequently during sports-related events with the location of their home being the second most frequent place. As to the time when athletes employ self-talk techniques, the most frequent was during actual practice and competition rather than off-sport. As far as the content of self-talk is concerned, the research has shown that positive self-talk prevails and only in particular circumstances do athletes employ negative statements. The form of their statements involved mostly phrases rather than cues or longer sentences which is expected given that athletes are already familiar with their sport and can abbreviate their statements. These statements were addressed in the first-person singular or the second in the form of commands and included specific skill commands rather than more general utterances. Finally, as per the reasons why athletes employ self-talk strategies, the participants have mentioned skill development and skill execution for the particular skill they are targeting almost as frequently as for general purposes. Some of the reasons

also mentioned were to remain focused, to regulate arousal level and most importantly, to maintain and increase their personal motivation and drive.

One of the more recent studies showed that a conversation with oneself has a positive impact on the performance of dribbling and passing among young basketball players (Perkos, Effects of the Self-Talk Strategy in the Mental Training of Athlete 55 Theodorakis, & Chroni, 2002). During this experimental program, the researchers conducted a twelve-week self-talk training program with 62 young basketball players, who were divided into two groups (an experimental and control group). During this period, the experimental group was, in addition to the normal training process, subjected to specific self-talk instructions. In the end, the research results demonstrated that the experimental group performed better than the control group of players. In accord with these findings, a delayed questionnaire showed that the players of the experimental group also improved their self-confidence and concentration levels.

Yet another study (Rogers & Hrycaiko, 2002), which aimed to investigate the influence of mental training on improving the performance of athletes in team sports, was conducted among the junior hockey goal keepers in America. We emphasize "mental training" because this study in its experimental section, except self-talk, also contained a mental relaxation technique (specific breathing exercises) which was combined with self-talk. Briefly, 5 goal keepers who participated in this study were given instructions to use this technique after every whistle of the judges in the matches and during every training session. The technique involved a simultaneous combination of the components of breathing (a deep breath - exhalation) and one of the three types of self -talk: instructional ("Stay big at the goal", "my man with the puck"), self-affirming ("I deserve to win") and those that affect mood ("relaxed and alert"). In this case, the dependent variable was the percentage of defended shots (S%), which is

defined as the number of defended shots divided by the number of shots directed at the goal and then multiplied by the number 100. The average value that the goalkeepers made in 3 games before the intervention was taken as the initial value, so that their performance could be measured again during three games that followed the interventions. The results showed a positive correlation between the content of the mental training and the percentage of defended shots in the final measurement.

Furthermore, the effect of self-talk on four young female soccer players was also examined, with a focus on the existence of a positive correlation between the specific motor performance of the athletes (efficiency of the ground, shooting at the goal) and instructional self-talk (Johnson, Hrycaiko, Johnson, & Hallas, 2004). This intervention was aimed at the improvement of a specific task in soccer - ground shooting at a small net of the goal, one of the most effective kicks in soccer. During the study, the female soccer players were instructed to use words, the keywords “down” and “tight foot”. In the end, the results showed that the female soccer players improved their performance when compared to the results achieved at the beginning of the experimental program.

Theodorakis et al. (2000) came to the conclusion that instructional self-talk is more efficient in cases where the sport task requires fine motor responses (movements). In such cases, the athlete is presented with a task which is successfully solved primarily by calmness and precision. In contrast, in situations that require strength and endurance, motivational self-talk is significantly more efficient. The results which corroborated the findings in this study were obtained by Hatzigeorgiadis, Theodorakis & Zourbanos (2004). Doing so, they compared the effectiveness of motivational and instructional self-talk on specific water polo and basketball tasks. The results showed that the instructional self-talk was more effective than the motivational kind in tasks that

required accuracy and precision. In contrast, in tasks that required strength, it is the motivational self-talk that improved the performance of the athletes.

A similar study (Theodorakis, Chroni, Laparidis, Bebetsos, & Douma, 2001) further clarified the situation, and showed that within one type of self-talk (be it instructional or motivational) one can expect a positive effect on the final result only if its content (words that are pronounced) are adapted to a task that is to be executed. In their work, they implemented a specific test that was aimed to evaluate the impact of different words used in instructional self-talk on the success of the free-throw line shots in basketball. The participants were students of the Faculty of Sport and Physical Education, who after the initial tests were divided into two experimental groups and one control group. All of the members of both experimental groups were instructed to use instructional self-talk before each shot, but their words differed. The first group used the word "relax" (in order to regulate the speed and the accuracy of the embodiment), while the second group at the same time used the word "fast" (in order to increase the speed of execution). The obtained results showed that the first group ("relaxation") substantially improved their performance as compared to the other two groups. No disparities were found in the performance between the second experimental group ("fast") and the control group.

Hardy, Hall and Hardy (2005) have carried out research regarding the compiling of quantitative data as an addition to Hardy, Gammage and Hall's (2001) qualitative study which described the 4 Ws (where, when, what, why) of self-talk. They also aspired to further explore possible differences in using self-talk strategies in a variety of settings, namely practice and competition settings. Their participant sample was 295 athletes and the results added to the qualitative analysis of the previous study and also

showed how differences among athletes including gender, skill level and being in a team or not influenced the employment of self-talk techniques.

The survey conducted by Malouff & Murphy (2006) confirmed the earlier findings that self-talk improves sport performance. In this study, 100 adult athletes competed in a golf tournament. The aim of this study was to investigate whether the use of instructional conversations with oneself improves the performance of golf players. Participants were divided into two groups - the experimental and control one. While the participants in the control group received instructions to strike the balls as usual, the members of the experimental group were instructed to self-administer the instructions of their choice before each shot (e.g. “shoulders rotate toward the planned path of the balls”, “Eyes follow the path of the target route”). The results showed that the golfers who used self-instructions needed much less effort to complete all the holes than the golfers in the control group. Speaking about the nature of self-talk, we need to note that previous studies showed that the efficiency of this technique depends significantly on the choice of words, that is, on the distinction between motivational and instructional self-talk, and all depending on the nature of the task (type of the sport) which the athlete is to fulfill.

Hamilton, Scott and MacDougall (2007) have focused on the effect of positive as well as negative self-talk -assisted and self-regulated- on a cycling ergometer task. The participants were 9 university students who reported than indeed the effect of self-verbalization whilst performing an athletic activity is beneficial either assisted or self-regulated. An interesting result deriving from this study was that the subjects who were subjected to negative self-talk actually improved their performance which comes in contrast with findings from previous research that showed how negatively the individual is influenced. It could thus be interpreted that negative self-talk is actually

seen as challenging by certain athletes. Following this study, the need for more research on the particular psychological characteristics of the athletes who benefit from particular types of self-talk has come forward.

In 2007, Hatzigeorgiadis, Zourbanos, & Theodorakis have assessed the performance of 21 female swimming class students following self-talk strategies implementation on an experimental task. The findings of the study have revealed that attention was enhanced and there was an additional smaller effect on anxiety control. Finally, the participants have reported that self-talk has helped decrease automatic execution.

The effect of motivational self-talk on specific motor skills of the players, their level of self-confidence and anxiety is further explored in the work of Hatzigeorgiadis, Zourbanos, Mpoumpaki, & Theodorakis (2009). The researchers found that positive, motivational self-talk helped tennis players improve their performance on the tennis court, their self-confidence, but it also helped them to reduce cognitive anxiety.

The most recent systematic review of all the studies that investigated the effect of self-talk on the performance of athletes was conducted by three researchers (Tod, Hardy, & Oliver 2011). They included as many as 47 papers in their comprehensive analysis, all studies form previous years in the same area. In a nutshell, one can reach the conclusion that this very thorough and complex analysis only confirmed the previous findings that self-talk, with its two positive forms (motivational and instructional) enhances and has positive effects on the performance of athletes in different sports.

Similar to this systematic review of the previous work on this topic, Hatzigeorgiadis, Zourbanos, Galanis, & Theodorakis (2011) have also conducted a

meta-analysis that included 32 studies in this field. The conclusions of this study did not differ from the Effects of the Self-Talk Strategy in the Mental Training of Athlete 57 previous research, and strengthened the already existing findings, indicating that the self-talk strategy represents an effective means of improving athletic performance.

Hatzigeorgiadis, Galanis, Zourbanos, & Theodorakis (2014) have continued their ersearch by examining 55 young swimmers from different swimming teams with regard to their performance vis-à-vis the use of self-talk strategies. The results concluded that self-talk interventions have been an effective tool to enhance sports performance particularly in a competitive sports environment through the experimentally induced timings. An interesting finding in their study showed the predilection of the participants towards motivational self-talk. The swimmers had designed a self-talk plan for themselves during training sessions including a number of instructional and motivational cues to which they adhered throughout the competition. Additionally, the degree of improvement is considerable and could ultimately have a significant impact on competition. As stated by the researchers themselves “future research should investigate the influence of self-talk interventions on complete sport performance when the nature of the sport allows for such designs but also on performance features in sports where overall performance depends on multiple and complex factors, such as performance of the opponent. (Hatzigeorgiadis, Zourbanos, Galanis, & Theodorakis 2014)

Another relatively recent study by Kolovelonis, Goudas and Dermitzaki (2012) was conducted in order to examine the combined effects of self-talk and process or performance goals on self-regulated learning of a new motor skill in physical education. The participants were 85 elementary students with no experience in dart-throwing which was the task at-hand. Generally, the results indicated self-talk to be a positive

influence on the students' performance on the given task deeming the students who practiced self-talk more successful than those who did not. Additionally, as stated by the researchers "students who combined self-talk with a process or a performance goal and students who set a process goal largely surpassed control group students in dart-throwing performance". The findings of the study also indicate that the use of instructional cue words comes to the aid of students in their attempt to focus their attention on the task, thus improving their performance as well as positively influencing and facilitating the acquisition of the skill from the first time they try it.

Another interesting study has been carried out by Hardy, Begley and Blanchfield (2014) examining the effectiveness of motivational and instructional self-talk on skilled football players using their dominant and non-dominant feet which given the particularity of the study should yield intriguing results as to how self-talk can actually help the performance of the non-dominant foot. However, while self-talk has yet again proven beneficial for the performance of the athletes using their dominant foot, no results emerged indicating differences in using the non-dominant foot. This gives motivation for further study so that more findings can be assessed and thus aim coaches and sport professionals in substantially facilitating the attempts of players to develop and improve.

Research has also examined the effectiveness of self-talk strategies in endurance tasks, such as cycling (Hamilton et al. 2007; Blanchfield et al. 2014), long-distance running (Miller 2003) and cross-country running (Weinberg et al. 2012). Recently, Wallace, McKinlay, Coletta, Vlaar, Taber, Wilson and Cheung (2016) have incorporated an intriguing factor into their study. Their hypothesis tested the effect on motivational self-talk in particular circumstances which involved tolerance to heat and cognitive function which initially, they deem to increase their endurance to elevated

heat and fatigue levels as well as improve performance in higher-order cognitive tasks as the individuals are subjected to heat stress. The subjects of the study included 18 cyclists who received two weeks of control regimen and two weeks of motivational self-talk. Their results have shown a beneficial effect of motivational self-talk on the cyclists, however it is also possibly the first to quantify the use of an intervention in order to train athletes on a psychological skill given the particular thermal conditions. On the whole, they argued that internal psychophysiological control of exercise and fatigue plays an important role for endurance capacity in thermoneutral environments, and that the use of psychological skills training interventions, and in particular self-talk, can benefit exercise performance in the heat.

In recent studies the relevance of the psychobiological model of endurance performance has been identified (Pageaux, 2014). In general, the model is used to explain self-paced endurance performance by taking into account both internal (e.g. perception of effort and physiological responses) and external (e.g. tactical decisions and presence of competitors) factors. The psychobiological model, though, provides valid explanation of the effects of both psychological and physiological manipulations on endurance performance during constant-load exercise (Pageaux, 2014). The psychobiological model is an effort-based decision-making model that is based on motivational intensity theory and postulates that the conscious regulation of pace is determined primarily by some cognitive and motivational factors. These factors are: perception of effort, potential motivation, knowledge of distance and time to cover, knowledge of distance and time remaining and previous experience or memory of perception of effort during exercise of varying intensity and duration.

In the current study, we are focusing on the first of these factors, that is, the perception of effort. Perception of effort is the conscious sensation of how hard,

difficult, heavy and intense an exercise is under specific conditions, something that is heavily related to the elevation of RPE (Ratings of the Perceived Exertion) and the deterioration of the endurance performance (Blankfield et al., 2013). The psychobiological model of endurance of performance suggests that sensory signals are processed by the brain and subsequently generate perceptions of effort. So, this model offers a clear-cut explanation of what perception of effort is like and how it is applied in each human being from both the physiological and the psychological aspect. The explanation for the alteration of perception of effort and performance appears when central motor commands are increased to compensate for muscle or mental fatigue. As stated by Wallace et al. (2016) the conscious perception of exertion and fatigue comes from the afferent input of various types of systems, like, cardiovascular and musculoskeletal along with the affective appraisal of the exercise. Adding to this, the current study was, also, closely related to a previous study conducted by Hatzigeorgiadis et al. (2017). In this study, only athletes were included and cycled in high intensity performance in elevated heat. The two groups (control and experimental) were asked to keep a stable RPE corresponding at 14 in Borg's Scale for 30 minutes. The results revealed that the self-group produced greater output (Watt) compared to the control group. This means that RPE was stable and only the output produced was examined.

Based on the psychobiological model of endurance performance and the related findings described above, this study aimed to complement the results by Hatzigeorgiadis et al. (2017). In particular, while in Hatzigeorgiadis et al (2017) participants were asked to maintain a stable RPE, and researchers assessed the output they produced, the present study explored the effects of self-talk strategies on

perceptions of exertion during moderate intensity exercise, while keeping the exercise intensity stable, and assessing RPE.

METHOD

Participants

Participants were 85 (47 males, 38 females; mean age 21.03 years) healthy, physically active, non-smokers, undergraduate students who received course credit for their participation. Participants were randomly assigned to experimental (n = 44) and control (n = 41) groups. A Chi-square test revealed no differences in sex distribution, $\chi 2(1) = 8.56$, $p = .38$, whereas t-test revealed no differences in age, $t(83) = 1.09$, $p = .28$.

Procedures

The study received ethical approval from the University of Thessaly Ethics Committee**.** Participation involved only one visit to the lab which lasted approximately one hour. Before the onset of the experimental procedures participants received information regarding their participation, signed informed consent and were fitted a strap for heart rate monitoring through a polar watch (Polar V800).

Experimental protocol. Participants were taken into a separate quiet room with a comfy mat on the floor where they rested, lying down for 5 minutes. During the 5 minutes of rest, the researcher recorded the lowest heart rate value as resting hear rate and calculated the 50% of heart rate reserve. Subsequently participants were brought back into the main room and introduced to the cycloergometer. The experimenter adjusted the seat so as to suit them as comfortably as possible. Before the onset of the experimental trial, participants were asked to warm up for 5 minutes at 50 rotations per minute. During this time participants of the experimental group received instructions and practiced self-talk cues, which were posted on a paper placed in front of them. In particular participant were told to use the cue words cue

words “steady and calm” to maintain their rhythm and remain composed. One minute before the end of the warm up, participants of the experimental group were left alone to think of what the researcher has presented to them and ask for anything they would like concerning self-talk.

Upon completion of the warm-up all participants were asked to cycle for 20min following the instructions of the experimenter regarding rotations per minute that were displayed on the ergocyclometer’s monitor. The experimenter was also monitoring participants’ heart rate, aiming at maintaining heart rate at 50±5% of heart rate reserve. Accordingly the experimenter instructed participants to increase or decrease rotations per minute, so that they remain in the designated heart rate reserve range. During the 20 minutes, heart rate, power output (Watt) and distance covered were recorded. In addition, participants’ perceived exertion (6-20 Borg scale; Borg, 1982) was assessed every 2 minutes. Participants of the experimental group were instructed to use the cue words that were advised as frequent as they liked, and at least every time the experimenter was asking for the RPE states, every two minutes. After the completion of the 20min participants were instructed to cycle for another 3min at 50 rotations per minute to cooldown.

After the experiment. Upon completion of the experimental task participants filled in a standard manipulation check questionnaire related to self-talk (Hatzigeorgiadis, Galanis, Zourbanos, and Theodorakis, 2014). In particular, participants of the experimental group were asked: (a) how often they uses the self-talk cue word of choice (b) whether they used any other self-talk cue words (c) if so, what self-talk cues they used, and (d) if so, how often (on a scale of 1-10). Participants of the control group participants were asked: (a) whether they systematically used any self-talk cues (b) if so, what were these cues, and (c) if so,

how often they used them (on a scale of 1-10). Subsequently they were thanked for their participation and dismissed.

Statistical Analysis

Repeated measures ANOVA with one repeated factor (time, five 4-min intervals) and one independent factor (group, experimental and control) were conducted to examine differences in control variables (HR, output and distance covered) and RPE during cycling.

Results

Manipulation check

Participants of the experimental group reported consistent use of self-talk during the experimental task (M = 7.70, SD = .97). Five participants of the control group reported using self-talk cues during the task. In particular, they reported cues like ‘let’s go’, ‘you can do it’, ‘keep going’; however they all reported using the cues at low to moderate frequency (ranging from 2 to 5).

Control measures

Three 2-way (5 x 2) mixed measures ANOVAs with one repeated factor (time: five 4-min intervals) and one independent factor (group: experimental, control) were calculated to test for differences in HR, distance covered, and output (Watt) throughout the 30 min of exercising as a function of group. The analysis revealed no significant group by time interaction in any of the control measures; for HR, F (4, 80) = 0.25, p = .91; for distance covered, F (4, 80) = 0.30, p = .88; and for output, F (4, 80) = 1.49, p = .21. The mean scores for all control measures are presented in Figure 1 (Heart Rate), Figure 2 (Distance covered) and Figure 3 (Power Output); full descriptive statistics in Appendix 1.

Hypothesis testing

Two-way (5 x 2) mixed measures ANOVAs with one repeated factor (time: five 4-min intervals) and one independent factor (group: experimental, control) were calculated to test for differences in RPE as a function of group. The analysis revealed a significant group by time interaction, F (4, 80) = 2.44, p = .05. Examination of the pairwise comparisons showed that (a) when comparing as a function of time there were significant increases ($p < .01$) in RPE from each time point to the next for both groups; and (b) when comparing as a function of group, there were no significant differences between the two groups for min1-4 (p = 57) and min5-8 (p = .44),

however, the control group reported higher RPE for min9-12 ($p < .05$), min13-16 ($p < .05$), and min17-20 ($p < .05$). The mean scores for RPE across cycling for the two groups are presented in Figure 4.

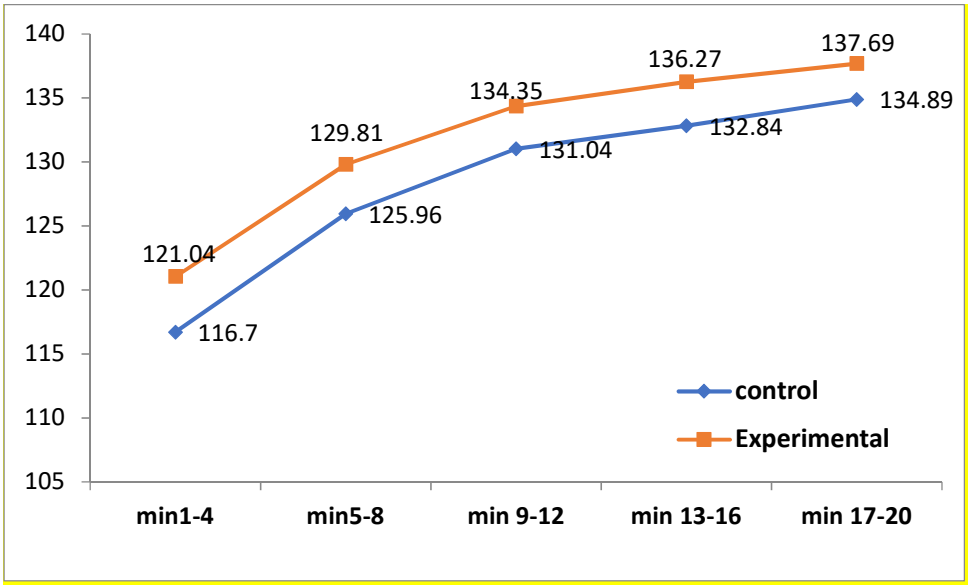

Figure 1. Mean scores for the control measure of Heart Rate during exercise.

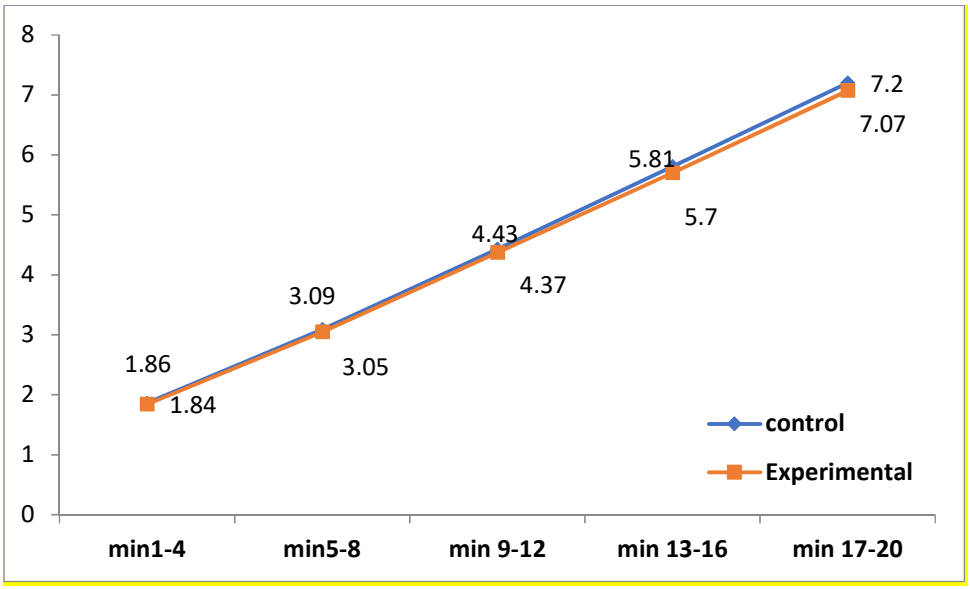

Figure 2. Mean scores for the control measure of Distance covered during exercise

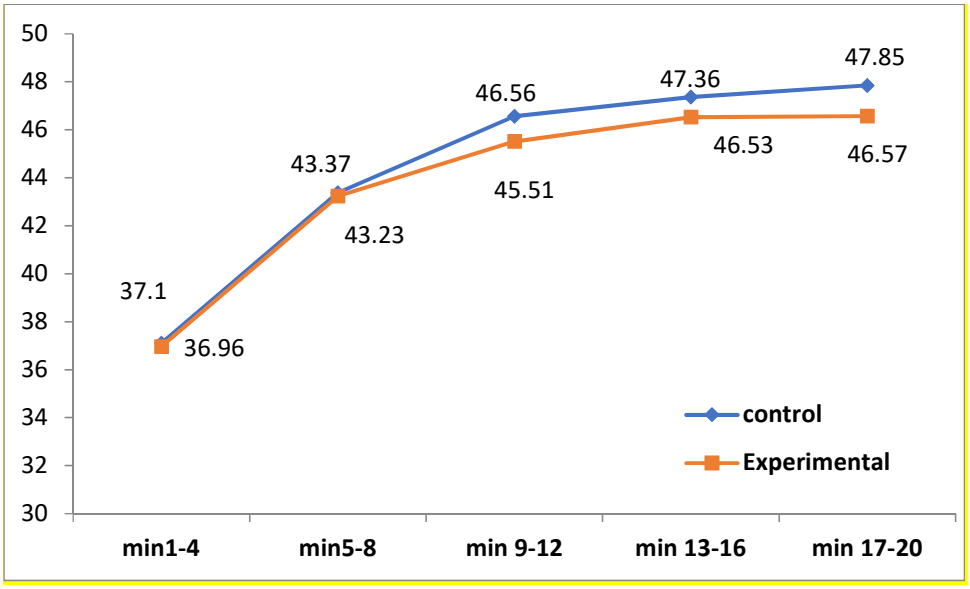

Figure 3. Mean scores for the control measure of Power Output during exercise

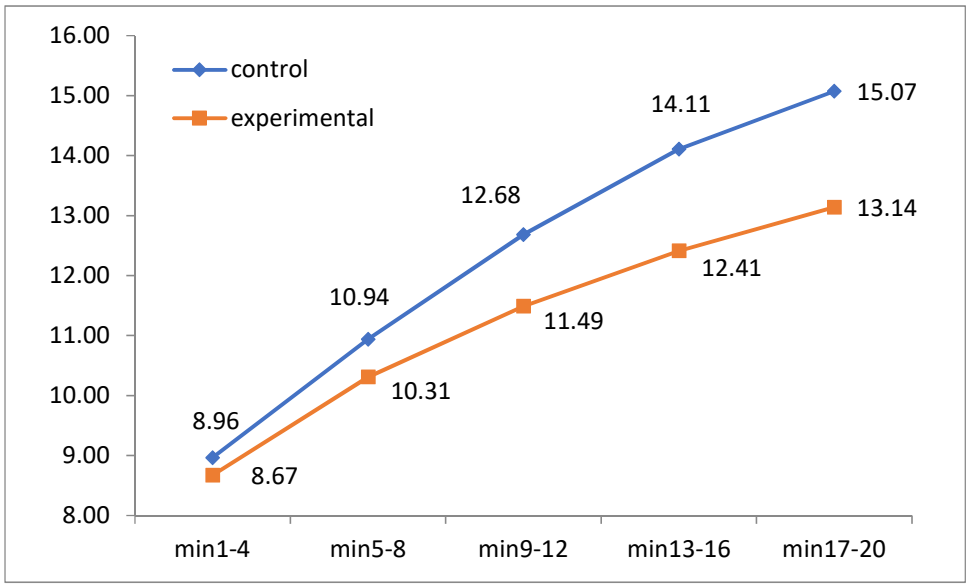

Figure 4. RPE per group across cycling.

Discussion

According to the psychobiological model of endurance performance perceptions of effort ere crucial in determining intensity and duration of physical effort in endurance tasks. Therefore, developing strategies aiming to regulate perceptions of effort is important. The present study examined the effects of self-talk strategies on perceptions of exertion during moderate intensity exercise. Overall, the results showed that self-talk helped maintaining lower perceptions of exertion during moderate intensity exercise.

Several measures were taken to control for extraneous factors that may influence perceptions of effort for participants of the experimental and control groups. Apart from demographic variables, indices involving the intensity and the outcomes of exercise were recorded. The analysis showed that the two groups displayed similar heart rate during exercise, covered similar distance, and produced similar output (watt). Therefore, it was ensured that participants of the two groups underwent similar physical loads. Therefore, any differences in perceptions of effort would suggest different mental interpretations regarding exertion. The analysis regarding perceptions of effort during the task showed that perception of effort increased as the task progressed for both groups, and this is reasonable considering that physical stress for both group was increasing with time. However, the analysis also showed that while there were no differences between the two groups up to the eighth minute, from the that minute onwards participants of the experimental group reported lower perception of exertions compared to the control group. Thus, it can be concluded that self-talk helped maintaining perceptions of effort in lower levels.

Similar findings regarding the effects of self-talk on perceptions of exertions have been reported in two studies. Blanchfield, et al. (2014) found that in a cycling

task until exhaustion participants of the self-talk group had greater cycling time to exhaustion and reported lower RPE during the task. Barwood, et al. (2015) in a 10km time trial cycling task found that the experimental group using motivational self-talk produced a higher power output, while no differences were reported in RPE. Collectively the results of the present study in combination with the aforementioned studies provide consistent support the psychobiological model of endurance performance. Having said that, it should be noticed that in this study only moderate intensity exercise was used, rather than more strenuous endurance performance. This however, is not an aspect that limits the implications of the research in relation to the psychobiological model of endurance performance, as the effects on perceived exertion were confirmed even at that levels of exercise intensity. Furthermore, the present findings extend the applications to the exercise settings and generalize across the physical activity span.

In the studies mentioned above motivational self-talk was used to enhance confidence and maximize effort to keep participants going further and trying more. In this study instructional self-talk was used to keep rhythm and stay composed to maintain a pace. This type of self-talk was deemed more suitable for this task, as the physical load was lower, yet demanding, so that participants regulate their pace, rather than push to the limits. That perceptions of effort were lower like in the aforementioned studies suggest that different types of self-talk can be used depending on the demands of the task, yet if appropriate, these different types of self-talk may help regulating perceptions of exertion. Accordingly, sport performers or exercisers should adjust their self-talk to their goal and consider the outcomes they want to achieve in relation to preferred types of self-talk.

Future directions

The present study provides useful findings that can encourage further research into the mechanisms of self-talk. In relation to exertion it would be of particular interest that future research employs physiological and psychophysiological measures, including heart rate variability to assess reactions of the autonomous nervous system, and the functioning of the sympathetic and the parasympathetic systems. In addition, the use of electroencephalography would further allow to explore changes in brain activation as a function of self-talk. Overall, the mechanisms explaining the effectiveness of self-talk strategies provide exciting prospects for he self-talk in sport research.

Conclusion

It is well supported that rating of perceived exertions are closely associated with persistence, intensity, and finally performance in physical tasks. Self-talk is an influential tool that can play a key role in the regulation of ratings of exertion. In this study, it was supported that self-talk, as a psychological technique, helped maintaining lower levels of RPE during moderate intensity exercise in an ergometric bike. The results complement previous findings supporting the psychobiological model of endurance performance, extend the application of the model in the exercise domain, and encourage further research for the understanding of the mechanisms explaining the effectiveness of self-talk strategies in sport and exercise.

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Appendix 1.

Descriptive Statistics for the Control Measures and RPE during exercise.

	Control	Experimental
HR		
min 1-4	116.70±16.36	121.04±14.21
min 5-8	125.96±13.52	129.81±10.12
min 9-12	131.04±10.47	134.35±8.48
min 13-16	132.84±10.13	136.27±8.20
min 17-20	134.89±9.46	137.69±7.95
Distance		
min 1-4	1.86±.10	1.84±.08
min 5-8	3.09±.20	3.05±.22
min 9-12	4.43±.42	4.37±.44
min 13-16	5.81±.70	5.70±.68
min 17-20	7.20±1.00	7.07±.94
Watt		
min 1-4	37.10±2.36	36.96±2.88
min 5-8	43.37±6.81	43.23±6.68
min 9-12	46.56±9.41	45.51±8.27
min 13-16	47.36±10.49	46.53±8.83
min 17-20	47.85±10.99	46.57±9.24
RPE		
min 1-4	8.96±2.25	8.67±1.95
min 5-8	10.94±2.52	10.31±2.18
min 9-12	12.68±2.83	11.49±2.46
min 13-16	14.11±2.67	12.41±2.59
min 17-20	15.07±2.74	13.14±2.79