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Application of Strategic Self-Talk: An Experimental Study on the Effects on Shooting Stability and Performance

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ABSTRACT

Background: Pistol shooting is a sport with high attentional demands. Strategic self-talk has been shown to assist learning and increase performance, in particular due to its effects on attention. **Objective:** The current study aimed to examine the impact of a strategic self-talk intervention on the learning of pistol shooting. **Methods:** An experimental study was designed and implemented. Forty sport sciences students with no experience in pistol shooting were randomly assigned to experimental and control groups. The study took part in nine sessions, one for familiarization, two for baseline measurements, four for training, and two for final measurements. The shooting was performed from a distance of five meters and recorded through the SCATT shooting system. Performance as Average Score (AS) and two stability variables, Average Length of Tracing (ALOT) and Stability of Aim (SOA), were recorded. **Results:** Repeated measures MANOVA showed a significant multivariate group by measurement interaction. Pairwise comparisons revealed that (a) AS increased for both the experimental (p<.001) and the control group (p=.006), with the experimental group showing greater improvement, and (b) SOA and ALOT improved for the experimental group (p<.001 and p=.003, respectively) but not for the control group (p=.37 and p=.21, respectively). **Conclusions:** The increases in performance for both groups can be attributed to the learning effect; however, the impact of self-talk was evidenced in the greater performance improvement, but also in the improvement of the stability variables that were targeted through the instructional self-talk cues that were used. The greater performance change for the self-talk group may be attributed to attentional mechanisms that brought about the improvement of the stability parameters.

Key words: Self-Talk Mechanisms, Attention, Steadiness, Pistol

INTRODUCTION

Strategic self-talk involves the planned use of self-talk cues that aims at achieving self-regulation goals and ultimately enhancing performance (Latinjak et al., 2020). The main idea behind the use of self-talk strategies is that individuals give self-instructions that direct their action and self-reinforcement to achieve a goal (Hatzigeorgiadis, Zourbanos, et al., 2014). Strategic self-talk plans and interventions can be developed or discussed with a sport psychologist but can also be self-managed; however, they must be predetermined and organised in advance (Hatzigeorgiadis et al., 2011). The effectiveness of such interventions has been consistently supported in sport psychology research and more emphatically documented by two review studies. Tod et al. (2011) in a systematic review confirmed the positive effects of strategic self-talk for performance. Additionally, a meta-analysis by Hatzigeorgiadis et al., (2011) revealed a moderate effect size (d=.42) for the strategic self-talk interventions on sport performance and identified moderators of the self-talk effects.

Further research in sport settings has examined the mechanisms that explain the facilitating effects of self-talk on learning and performance, exploring the question "what does self-talk do to us (or make us do) that influences our performance?" (Galanis & Hatzigeorgiadis, 2020, p. 137). Several postulations have been made about such mechanisms through the perceptions of athletes participating in experimental and intervention studies. Based on such reports, it was suggested that self-talk can help direct attention (Johnson et al., 2004), build confidence, regulate effort, and control anxiety (Cutton & Hearon, 2014). Galanis et al. (2016) introduced a prospective model of self-talk mechanisms, describing two clusters of mechanisms that can potentially explain the positive effect of self-talk. The first involves attentional processes and comprises the different attention functions (intensity, selectivity, and spatial attention), and involves several attention-related parameters, such as attentional focus, mental effort, and resistance to distraction. The second cluster involves a motivational interpretation of the self-talk effects, involving affective, cog-

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nitive, and behavioural facets of motivation, such as self-efficacy, effort, and anxiety.

Fine tasks require high levels of accuracy and precision, and thus better attention skills. Accordingly, self-talk researchers have employed such tasks in the expectation that performance would be enhanced due to attentional improvements. Such studies have involved closed tasks like golf-putting (Bell & Hardy, 2009), tennis serves (Latinjak et al., 2011), and dart throwing (Zourbanos et al., 2013), but also football shooting (Johnson et al., 2004) and basketball free throws (Abdoli et al., 2018). These studies have shown increases in performance, thus providing indirect evidence for the attentional mechanism. Further, direct evidence has been provided from more recent studies. Sarig et al. (2017) reported that instructional self-talk cues prior to a golf putt prolonged the duration of the quiet eye period, which has been linked to higher quality of visual attention. Galanis et al. (2018), examined experimentally how self-talk can affect attention and performance under conditions of external distraction, induced through sudden, non-continuous, loud noise, in laboratory (cognitive task) and field (basketball free-throw) settings. In both studies the results showed that under distracting conditions the experimental group displayed superior performance compared to the control group. This research has provided valuable evidence for attention as a potential mechanism for the beneficial impact of self-talk in fine tasks.

Shooting is a sport requiring enhanced psychological skills. Early investigations in sports involving aiming at a target, such as archery (Salazar et al., 1990) and rifle shooting (Konttinen et al., 1998), have identified decreases in heart rate just before execution; these were evident in novice and expert shooters, with experts showing a larger deceleration. Researchers postulated that heart rate deceleration is linked to more efficient attentional focus. Thus Bahrami et al. (2020), in a study confirming the relationship between attentional focus and shooting performance, concluded that the performance of athletes would be greatly improved if they manage to minimize the effect of distraction, thus maximizing concentration. Considering these postulations in combination with the attention-enhancing impact of self-talk, it appears that strategic self-talk may prove a valuable mental strategy for shooting.

The present study aimed to test the effectiveness of a strategic self-talk intervention, targeting attention and calmness, on pistol shooting performance parameters in novice participants. Accordingly, shooting performance, and, in addition, average length of tracing and stability of aim, which are important stability indices in pistol shooting, were examined. To our understanding this would be the first empirical study exploring the effects of a strategic self-talk intervention on shooting performance parameters. The study extends the literature pertaining to the attentional effects of self-talk, but also provides useful insights for pistol-shooting athletes and coaches. Taking into account the attention demands of pistol shooting, the performance enhancing properties of strategic self-talk, and attention as a viable self-talk mechanism, it was hypothesized that shooting performance and stability parameters would improve for both groups due to the learning effect, but that improvements would be greater for participants using self-talk.

METHOD

Participants and Study Design

The conduct of the study was approved by the institution's ethics committee (Ref: 1811/9-6-21). An experimental study was conducted. A power analysis (G*Power, Faul et al., 2007) considering the meta-analytic evidence supporting a moderate effect size (d =.48) for the impact of strategic self-talk on task performance showed that to achieve a power of .80 at an alpha of .05, a total of 38 participants were required. The inclusion criterion was that participants were sport science students; however, students with prior experience in pistol shooting were excluded. A total of 40 sport science students (22 males 18 females; M_{age}= 20.35, SD=.89) participated in this study voluntarily. All students provided written informed consent. Participants were randomly assigned to a control group (n=20; 10 males, 10 females) and an experimental group (n=20; 12 males, 8 females). Group (experimental, control) and time (pre-, post-intervention) were the independent variables; shooting performance and stability (length of tracing and stability of aim) were assessed as dependent measures.

Apparatus and Test Protocol

A Walther air-pistol was used for the shooting task and the SCATT shooting analysis system was used to record performance and stability indices. Three variables were assessed: Average Shooting Score (AS), Average Length of Tracing (ALOT), and Stability of Aim (SOA). The shooting score was the average of the shooting sets the participant took across the sessions; scores ranged from 0 to 10. Stability of aim refers to the diametrical dispersion of the tracing before the shot. It assesses stability and is measured in millimetres (mm) with smaller distances showing greater stability. The average length of tracing refers to the total distance of the tracing the last second before the trigger is pulled. This is also measured in millimetres (mm), with smaller distances showing greater stability, and is the most fundamental index of stability. The difference between SOA and ALOT is that SOA measures how the centre of the aim moves across small intervals over one second while ALOT measures the total distance travelled within this second. These two measures together accurately depict overall stability. The shooting distance was set at five metres and participants performed sets of ten shots.

Intervention Protocol

The intervention protocol was based on the recommendations for the development of strategic self-talk intervention provided by Hatzigeorgiadis et al. (2020) and Hatzigeorgiadis

et al. (2009) including baseline assessment, training using self-talk, and final assessment. The study was implemented over nine sessions. In the first session, participants received detailed information for the study and signed consent forms. Subsequently, they were introduced to the equipment and received instructions on the basic aspects of the shooting technique. Finally, participants practiced ten familiarisation shots, which were not recorded. Sessions two and three were the same for participants of both groups. Following a standard calibration procedure, the participants performed two shooting sets (ten shots per set) from a five-meter distance, with a one-minute interval between sets. They were advised to shoot at their own pace while keeping in-stance between shots. During these two sets participants were provided feedback and technical instructions. The average score of the two sets was used as the baseline measurement. The following four sessions (session four to seven) were used for shooting training. In these sessions, participants of the experimental group received instructions regarding the use of strategic self-talk (Galanis et al., 2018) and practiced using different cues (e.g., loose trigger, shooting pin). The final two sessions (session eight and nine) comprised the final assessment. In these sessions, participants of the experimental group were asked to choose a self-talk cue among the ones practiced in the previous sessions based on their preference and use it consistently before each shot.

Statistical Analysis

A one-way MANOVA was performed to test for differences between the two groups at baseline on the three dependent variables (AS, SOA, ALOT). A mixed-method MANOVA, with one independent factor (group) and one repeated factor (measurement), was calculated to examine differences between the two groups across time on the dependent variables. The assumptions of normality, linearity, and homogeneity for the analyses of variance were satisfied. The level of significance was set at a<.05. IBM SPSS Statistics 23 was used for the data analysis.

RESULTS

Baseline comparison: A one-way MANOVA analysis showed a non-significant multivariate effect at baseline, $F(3, 36)= 1.27$, $p=.30$, indicating no statistical differences between the experimental and the control group for all dependent measures; for AS, $F(1, 38)= 0.31$, $p=.58$, for SOA, $F(1, 38)= 3.53$, $p=.07$; for ALOT, $F(1, 38)= 0.28$, $p=.60$. The mean scores are presented in Table 1.

Hypothesis testing: Mixed method MANOVA analysis revealed a significant multivariate group by time interaction effect for the final measures, $F(3, 36)= 3.72$, $p=.02$. Examination of the pairwise comparisons revealed that (a) for AS both groups improved significantly, with the effect for the experimental group ($p<.001$, partial $\eta^2 =.57$) being greater than that of the control group ($p=.006$. partial $\eta^2=.29$); (b) for SOA there was a significant improvement for the experimental group ($p<.001$, partial $\eta^2=.66$) but not for the control group ($p=.37$, partial $\eta^2=.04$); for ALOT there was likewise a significant improvement for the experimental group ($p=.003$, partial $\eta^2=.49$) but not for the control group ($p=.21$, partial $\eta^2=.08$).

DISCUSSION

The present study aimed to examine the effectiveness of a strategic self-talk intervention on a pistol shooting task among individuals with no prior experience. The impact of self-talk on learning was assessed through performance measures, but also through the assessment of parameters that are crucial for shooting performance and that are linked to attentional processes. For this purpose, an intervention employing instructional self-talk was developed and implemented. Overall, the results were supportive of the hypotheses, in particular with regard to performance, where both study groups improved with the self-talk group showing greater improvements, and less so with regard to the performance parameters, as these improvements were only observed for the self-talk group.

Both study groups displayed a significant performance increase (average shooting scores); however, examination of the effect sizes shows that the improvement of the experimental group was considerably higher than that of the control group. That both groups improved significantly can be attributed to the learning effect, as for novel tasks, as was the case in this study, there is more room for learning and improvement can be achieved faster compared to well-learned tasks. In our study, participants practiced the skill enough to improve. Nevertheless, in accordance with our hypothesis, the impact of the strategic self-talk intervention was identifiable in the greater progress participants using self-talk exhibited. The effectiveness of strategic self-talk to facilitate learning in novel tasks has been well documented in previous studies involving basketball skills (Perkos et al., 2002), taekwondo kicking (Zetou et al., 2014), softball throwing (Chang et al., 2014), and overarm handball throwing accuracy (Zourbanos et al., 2013). Compared to these studies that assessed performance in different skills, the present study in addition explored differences in performance parameters that can help to understand why performance was improved.

Table 1. Mean scores and standard deviation for the experimental and the control groups

	Baseline		Final	
	M	***SD***	***M***	***SD***
AS				
Experimental	3.95	1.35	5.40	1.22
Control	4.22	1.68	5.11	1.46
SOA				
Experimental	102.69	20.56	80.44	14.94
Control	90.73	19.70	86.94	21.89
ALOT				
Experimental	459.27	131.72	378.42	74.65
Control	435.07	158.82	403.02	95.27

M: Mean; SD: Standard Deviation, AS: Average Shooting Score, SOA: Stability of Aim, ALOT: Average Length of Tracing

In particular, the self-talk intervention improved the parameters reflecting stability, SOA and ALOT, which contrary to our hypotheses did not show significant changes for the control group. Our expectations were based on the learning assumption, i.e., that practice would improve stability as participants were made aware of its importance through the instructions. Nevertheless, the improvement of the control group was not significant. That the self-talk group improved can be attributed to the use of the cues that reflected the instructions all participants received at the beginning of the shooting sessions regarding stability (e.g. loose trigger, shooting pin). The self-talk cues apparently increased participants' attention to the stability instructions and as a result improved SOA and ALOT. Accordingly, the improvements in shooting performance can possibly be attributed to the improvements of the stability parameters, thus supporting an attentional interpretation of the performance effects of self-talk.

In the sport literature, indirect and direct evidence for the attentional effects of self-talk has been provided. Indirect evidence can be claimed by studies examining the effects of self-talk in sport tasks with particular attentional demands (Bell & Hardy, 2009; Latinjak et al., 2011), or under conditions that are challenging for attention (Galanis et al., 2018; Gregersen et al., 2017). Direct evidence has been reported in a study examining the effects of self-talk in shooting through eye-tracking (Sarig et al., 2017), where it was found that self-talk extended quiet eye duration before the shot. Moreover, direct evidence has been reported by Galanis et al. (2021) who tested the effects of strategic self-talk on attentional performance through cognitive tests. Their findings throughout six experiments revealed that in the tests assessing the different dimensions of attention, participants using self-talk had faster reaction times than controls.

Limitations and Recommendations for Future Research

A limitation that has to be noted regarding the present study is that the sample consisted of sport science students. In the sport self-talk literature, the relatively large number of student samples that have been employed, for convenience reasons, to test the effectiveness of strategic self-talk has been identified as a limitation, because it restricts the generalizability of the findings for athletes (Hardy et al., 2018). As self-talk has been developed as a strategy not only for performance enhancement but also for skill acquisition, the use of such samples is justifiable; nevertheless, future studies with athletes in the early sporting stages will further enhance our confidence in the effectiveness of strategic self-talk in assisting the learning process for the fine and complex task of pistol shooting.

Strengths and Practical Implications

Despite this limitation, our study adds valuable evidence to the contemporary self-talk literature. Until recently, the majority of the studies conducted have explored the impact of self-talk interventions in different settings, both laboratory (Theodorakis et al., 2000) and field (Hatzigeorgiadis, Galanis, et al., 2014), in a variety of tasks such as tasks involving fine (e.g., Latinjak et al., 2011) and gross (e.g., McCormick et al., 2018) skills. These studies have provided important support for the effectiveness of strategic self-talk on facilitating learning; however, as Hardy et al. (2009) indicated, research should move beyond mere performance and explore the mechanisms that can help explain the effectiveness of strategic self-talk. Considering this recommendation, the present study explored, in addition to performance, the effects of strategic self-talk on shooting performance parameters related to attentional aspects of shooting. The findings provide evidence that can eventually inform practice. Coaches and sport educators should be encouraged to teach shooters how to use strategic self-talk tailored to individual needs. Drawing on the results of this study, strategic self-talk could aim at improving stability through development of attentional skills pertaining to arm steadiness and trigger pooling.

CONCLUSION

The present study adds to the extant literature by combining in one study performance and attention-related performance parameters, thus further enhancing our confidence that attention is a viable mechanism explaining the effectiveness of self-talk in sport tasks. This line of research, in particular with regard to pistol shooting, a sport where attention, composure, and fine movement are predominant and hand-eye coordination is of utter importance, can be further extended through the use of eye-tracking technology. Such research would further enhance our understanding of the attentional mechanisms regulating the effectiveness of self-talk.

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