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Psychology of Sport and Exercise 7 (2006) 29–39

Psychology
OF SPORT AND EXERCISE

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Examining the efficacy of the concentration grid exercise as a concentration enhancement exercise

Iain Greenlees^{a,*}, Richard Thelwell^b, Tim Holder^a

^a*School of Sport, Exercise; Health Sciences, University College Chichester, Bishop Otter College, College Lane, Chichester, West Sussex PO19 4PE, UK*

^b*University of Portsmouth, St Michael's Building, White Swan Road, Portsmouth, UK*

Received 18 February 2004; accepted 15 February 2005

Available online 21 April 2005

Abstract

Objectives: The purpose of this study was to examine the efficacy of Harris and Harris' (1984) concentration grid exercise, an exercise proposed to enhance concentration and visual scanning speed [Harris, D.V., & Harris, B. L. (1984). *The athlete's guide to sport psychology: Mental skills for physical people*. New York: Leisure Press].

Method: Twenty-eight male collegiate soccer players were assigned to either a 9-week concentration grid training condition or a control condition. Concentration grid training consisted of 9 weekly meetings with an experienced sport psychologist with practice assignments in between sessions. During the first, fifth and final weeks of the experiment all participants completed a battery of concentration tasks (a visual search task, a video observation task and a concentration grid).

Results: A series of MANOVA's and ANOVA's indicated no significant interaction effects indicating that the concentration training group did not improve to a greater extent than the control group in any measure of concentration.

Conclusions: The findings highlight the need for further research examining the efficacy of the concentration grid exercise using different training protocols and different dependent measures. In addition, the results also indicate support for sport psychologists who have urged caution with the use of the concentration grid exercise in applied sport psychology.

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Keywords: Concentration Training

* Corresponding author. Tel.: +44 1243 816437; fax: +44 1243 816080.

E-mail addresses: i.greenlees@ucc.ac.uk (I. Greenlees), richard.thelwell@port.ac.uk (R. Thelwell), t.holder@ucc.ac.uk (T. Holder).

The ability to concentrate on appropriate stimuli during athletic endeavours has been proposed as one of the most important psychological skills underlying athletic success (Abernethy, 2001; Landers et al., 1994). In general, research within sport has been supportive of the importance of concentration, defined as “the ability to focus one’s attention on the task at hand and thereby not be disturbed or affected by irrelevant external and internal stimuli” (Schmid & Peper, 1998, p. 316). Such research has indicated that high levels of concentration are associated with the occurrence of peak performances (Gould, Eklund, & Jackson, 1992; McCaffrey & Orlick, 1988) and may differentiate between elite and sub-elite athletes (Mahoney & Avenier, 1977; Mahoney, Gabriel, & Perkins, 1987). Research, although limited in amount and beset with methodological weaknesses (for a review, see Moran, 1996), has indicated that high-level performers perform significantly better in a number of experimental tasks that may be said to require high levels of concentration on a specific stimuli. Such tasks include the recall of sport specific visual information (e.g. Allard, Graham, & Paarsalu, 1980), the speed of visual search (Allard & Starkes, 1980) and the ability to block out potentially distracting stimuli (Rose & Christina, 1990).

Armed with the assumption that such skills can be trained, the development of concentration skills has been proposed as being one of the most important functions of the sport psychologist (Moran, 2000). As a consequence of the acceptance of this, the applied sport psychology literature has seen a proliferation of ideas and techniques designed to promote and train concentration within sport. Moran (1996) proposed that such training could be divided into two categories. The first of these Moran termed ‘concentration techniques’. These refer to those strategies which are used during competition itself (e.g. performance routines, keywords) to establish, maintain and regain appropriate concentration. The second category is termed ‘training exercises’ and refers to specific tasks completed during an athlete’s competition preparation and includes exercises such as practising the ability to focus on a sport specific object (Burke, 1992), the concentration grid exercise (Schmid & Peper, 1998) and simulation training (Moran, 1996).

Within the sport psychology literature that has examined concentration enhancement strategies the focus has tended to be on concentration techniques (Moran, 1996). This research has provided support for the efficacy of goal-setting techniques (e.g. Filby, Maynard, & Graydon, 1999; Kingston & Hardy, 1997), pre-performance routines (e.g. Cohn, Rotella, & Lloyd, 1990; Thomas & Over, 1994) and self-talk techniques (e.g. Rushall, Hall, & Rushall, 1988). Ultimately however, this research has tended to focus upon the impact of these techniques on global performance rather than attempting to examine the impact of these techniques on concentration skills per se. In addition those studies that have attempted to assess changes in concentration skills have typically only employed self-report measures of concentration and attention (e.g. Kingston & Hardy, 1997).

Although this aspect of research in concentration skills training is encouraging, little research has examined the efficacy of concentration exercises. Moran (1996) argues that despite their proliferation, and testaments to their efficacy in applied sport psychology texts (e.g. Harris & Harris, 1984), many of the concentration exercises that have been proposed are based neither on a firm theoretical underpinning nor on sufficient (and at times non-existent) empirical research. Given that a number of authors (e.g. Hardy, Jones, & Gould, 1996; Smith, 1989; Weinberg, 1989) have argued that one of the professional responsibilities of sport psychologists is the systematic evaluation of the techniques they use it is perhaps surprising that (a) research is not being undertaken to examine the claims of sport psychologists and (b) without such support techniques are still being advocated.

One such exercise that may fit into this category is the concentration grid exercise (Harris & Harris, 1984). This exercise, reported to have been developed in Eastern bloc athletic programmes

(Weinberg & Gould, 1999), involves the athlete scanning a grid divided into 100 randomly numbered (from 00 to 99) equal size squares. The athlete's task is to mark-off as many consecutive numbers as they can in a specified time slot (usually 1 min) under different levels of distraction (from silence to verbal abuse) chosen by the administrator of the test. A number of applied sport psychologists (e.g. Boutcher & Rotella, 1987; Gill, 2000; Harris & Harris, 1984; Schmid & Peper, 1998; Weinberg, 1988) have proposed that the exercise is effective in enhancing concentration. Furthermore, it has been proposed that the exercise works by developing the athlete's ability to (a) ignore irrelevant, distracting stimuli (Gill, 2000; Harris & Harris, 1984) and (b) scan a visual array for relevant information (Gill, 2000). It can be proposed that it does this through the practising of these skills and by allowing the athlete to try different visual search strategies for blocking out distractions (e.g. through using instructional self-talk).

Unfortunately, however, empirical research examining the qualities of the concentration grid has not been forthcoming. Boutcher and Rotella (1987) and Harris and Harris (1984) both supported their claims for the value of the grid with reference to its use within Eastern Bloc athletic training programmes. Although neither researcher provided empirical support for the technique, Harris and Harris (1984) proposed that athletes with highly developed concentration skills were able to achieve concentration grid scores of between 20s and 30s. However, no information was given concerning the development and training of concentration grid performance and how such training impacted on in-event concentration and performance. Beyond these initial proposals of the role of the concentration grid exercise, no empirical evidence has been published that either supports or refutes the concentration grid. Due to the lack of empirical research, and the non-sport specific nature of the exercise, Gill (2000) has urged caution with the use of the concentration grid whilst Moran (1996) has questioned using the grid, and other concentration exercises, until it has been fully evaluated.

Given this, and the widely accepted need for sport psychologists to examine the efficacy of the techniques they use (Hardy et al., 1996), the aim of the present study was to examine the worth of the concentration grid exercise as a concentration enhancement tool. As the focus of the enquiry lay in examining the impact of the grid on concentration skills rather than global performance, it was decided to employ sport-specific laboratory tasks that required the participants to (a) block out distractions and (b) be able to scan a visual array quickly and accurately. This, it is argued, represents a more sensitive assessment of the concentration grid technique. Due to the preliminary nature of the research and the doubts that have been raised concerning the concentration grid no a priori directional hypotheses were advanced. Rather, the research question was to examine whether or not the concentration grid would have an effect on performance in a series of laboratory tasks requiring high levels of concentration.

Method

Participants

The participants ($n=28$) were male soccer players, all of whom were at the time of the study representing their college in intercollegiate soccer competitions. All self-reported themselves as being of white-European ethnicity. Their mean age was 20.79 years ($SD=1.76$). All had played soccer at school until the age of 16 years and were playing regularly at the time of the study. The mean number of years of soccer playing experience was 10.45 years ($SD=2.31$). All participants were volunteers and signed

informed consent forms prior to participation. Soccer players were chosen for this study because although closed skills sports may require greater levels of concentration, an essential skill for soccer players, as with many open sports, is the ability to scan an environment quickly and attend to only the most relevant cues.

Experimental tasks

Visual search

In order to test visual search (scanning) ability a similar task to that used by numerous authors (e.g. Allard et al., 1980; Allard & Starkes, 1980) to determine speed of visual search was utilised. Specifically, a series of tachistoscopically presented photographs of simulated footballing situations were shown to the participants. Of these slides 10 depicted structured (during play) situations and 10 depicted unstructured (ball not in play) situations. In these two sets of 10 slides half had a ball present and half had no ball. The task of the participant was to detect, as quickly and accurately as possible, whether a football was present or absent in each of 20 slides. All photographs were taken during a training session of a male soccer team and consisted of between 5 and 15 footballers. Consistent with the photographs used by Allard and colleagues the camera angle was not consistent for each photograph.

The photographs were presented to the participants using a Camden Instruments tachistoscope (Model 610). Each slide was shown for 0.5 s. The tachistoscope initiated a Phillips–Harris Timer when each slide was illuminated. The participants were instructed to state, as quickly and as accurately as possible, if a ball was present or not whilst pressing a corresponding button which stopped the timing mechanism. Accuracy and speed of response were used as dependent measures.

Video observation task

To examine the participants' ability to concentrate on a specific visual array a decision making test devised and validated by McMorris, Sproule, Draper, and Child (2000) was employed. This test consists of a video showing three attackers being marked by three defenders. These pairings are positioned on the right, left and center of the screen. The video shows the attackers trying to escape from their markers with only one being successful each time. Twelve clips, accepted as typical of footballing situations by two qualified coaches, were used. These clips were put into three sets of 12 with the order of presentation randomised for each. The task was used on the assumption that the capacity to anticipate and react to a sporting situation depends greatly on the ability to attend to appropriate cues in the environment Abernethy (1993). This task also required the participant to scan the screen for information.

In each clip, the participant's task was to scan the image and identify which of the attackers first escaped their marker. The participant sat facing a back projection screen 3 m away. The participants were asked to say, as quickly and as accurately as possible into a microphone, which player had escaped his marker ('left', 'right' or 'center'). When each film clip started this also started a voice reaction timer which was stopped when the participant responded. The dependent measures for this task were speed and accuracy of response. It was hypothesised that such a task required the participants to both focus attention on the display and scan the display (specifically the players) to receive the cues indicating which player was about to run towards them.

Concentration grid

Harris and Harris' (1984) concentration grid exercise was used as a training tool and as a measure of concentration. The concentration grid used in this study consisted of a grid of 100 squares (dimensions)

arranged in a 10×10 square. Two digit numbers (from 00 to 99) were placed randomly in the center of each of the squares. The task of the participant was to mark off as many consecutive numbers (always starting from 00) as possible within a 1-min period.

Procedure

The study was conducted over a period of 9 weeks. In the first, fifth, and final weeks of the study participants completed the three experimental tasks (one concentration grid, the video decision-making task and the visual search task). The order in which these tasks were completed was randomised. In addition, in order to control for any habituation effects, the order of presentation of the slides and video clips used in each of the tasks was changed and different versions of the concentration grid were used in each of the three testing sessions. Prior to the initial testing session in week 1 participants were randomly allocated to either a concentration training group or the control group.

Participants in the concentration training group were required to meet with the first author once per week to complete a concentration grid test in the weeks between the three testing sessions. In the first week, the participants in the concentration training group were introduced to the concentration grid and exercise and were provided with a rationale for its use. In addition to this, they were also given a number of concentration grids to practice on in their spare time and given instructions on how to use it. Specifically, they were told to find an environment where distractions would be present (e.g. a college canteen) and complete it in the same environment each time. They were asked to complete at least five practice trials per week. Each week these grids were collected from the participants to ensure that such practice had been completed. Visual inspection of these practice sheets confirmed that all but two of the participants in the concentration training group were completing the stipulated number of practice trials per week. The data from these participants were not used in the final data analysis. To avoid a habituation effect, the participants received a different version of the grid each week with the positioning of the numbers altered. Such a protocol was chosen in the absence of definitive guidelines on the use of the concentration grid as a device for enhancing concentration. However, it was felt that meeting once per week with a sport psychologist to go through the concentration grid exercise and completing a number of practice grids throughout the week was a realistic simulation of how the grid could be taught and used in a real world intervention programme.

Participants in the control group did not receive the weekly concentration grid test and practice sheets to complete. However, in an attempt to control for the potentially confounding variable of contact with a researcher the members of this group met with an experimenter every week for a period of 5 min (approximately the same length of time as the weekly sessions for the concentration training group) to discuss their performance in their weekly soccer matches. Following the completion of the study all participants were debriefed about the purposes of the research and control participants were offered the opportunity to take part in concentration grid training.

Statistical analysis

In order to assess the impact of the concentration grid training on performance in the visual search task (speed and accuracy of response) a 3 (test session) × 2 (condition) multivariate analysis of variance (MANOVA) was conducted with test session being a repeated measure. As there were no errors of accuracy for the video observation task a 3 (test session) × 2 (condition) univariate analysis of variance

(ANOVA) was conducted on the speed of response to the video observation task. A similar ANOVA was conducted to examine changes in concentration grid scores.

Results

Descriptive statistics are shown in Table 1. In order to ensure there were no differences in either age or years of playing experience across the condition independent sample *t*-tests were conducted on the data. These revealed no significant differences in either age ($t_{24}=0.95$, $P=0.35$) or playing experience ($t_{24}=0.21$, $P=0.83$). Further independent sample *t*-tests were conducted on the pre-test scores of the participants to check whether there were any differences between the two groups in their initial performances. The results of these tests indicated no significant differences in performance on the concentration grid ($t_{24}=1.40$, $P=0.17$), visual search speed ($t_{24}=-0.41$, $P=0.70$) or visual search accuracy ($t_{24}=-0.13$, $P=0.90$). The scores for the video observation task did reveal a significant difference between the two groups ($t_{24}=-12.76$, $P<0.05$) with the training group (mean=4.58 s) showing slower responses than the control group (mean=5.50 s).

Concentration grid scores

The ANOVA conducted on the concentration grid scores revealed neither a significant interaction effect ($F(2,48)=0.070$, $P=0.93$, effect size $\eta^2=0.003$, estimated power at 5% probability=0.06) nor

Table 1

Mean and standard deviations age, years playing experience and scores on experimental tasks for the concentration training and control participants

	Concentration training group ($n=12$)		Control group ($n=14$)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Age (years)	21.25	2.05	20.57	1.60
Experience (years)	10.41	2.68	10.21	2.15
<i>Concentration grid scores</i>				
Test session 1	10.33	3.14	8.50	3.48
Test session 2	11.50	4.45	9.86	3.71
Test session 3	12.50	3.39	10.07	3.25
<i>Video observation (s)</i>				
Test session 1	4.58	0.19	5.50	0.17
Test session 2	4.42	0.08	5.41	0.28
Test session 3	4.40	0.08	5.24	0.20
<i>Accuracy of visual search (% incorrect)</i>				
Test session 1	74.17	8.48	74.65	9.70
Test session 2	80.42	6.56	80.00	7.59
Test session 3	84.17	8.74	90.00	6.20
<i>Speed of visual search (ms)</i>				
Test session 1	437	140	464	96.7
Test session 2	453	117	418	85.0
Test session 3	455	135	426	23.8

a significant main effect for test session (trial: $F(2,48)=2.41$, $P=0.10$, effect size $\eta^2=0.09$, estimated power at 5% probability=0.46) The results did, however, indicate a main effect for training condition ($F(1,24)=4.41$, $P=0.046$, effect size $\eta^2=0.16$, estimated power at 5% probability=0.52). This, therefore, indicates that although the training condition group was superior to the control group neither group exhibited any improvement in the concentration grid during the 9 weeks.

Visual search scores

The MANOVA did not reveal a significant test session by training condition interaction effect (Wilk's $\lambda=0.90$, $F(4,94)=1.27$, $P=0.27$, effect size $\eta^2=0.05$, estimated power at 5% probability=0.39). However, the MANOVA did reveal a significant main effect for test session (Wilk's $\lambda=0.57$, $F(4,94)=5.73$, $P<0.001$, effect size $\eta^2=0.22$, estimated power at 5% probability=0.99). Observation of the separate univariate ANOVA's showed that this effect occurred for the accuracy of visual search ($F(2,48)=17.83$, $P<0.001$, effect size $\eta^2=0.43$, estimated power at 5% probability=1.00). Tukey post hoc tests revealed accuracy was significantly greater in trial 3 than trials 2 and 1 ($P<0.05$). Accuracy was also significantly greater in trial 2 than trial 1 ($P<0.05$). The main effect for group was not significant. No significant effects for the speed of visual search were observed.

Video observation task

The ANOVA conducted on the speed of response to the video observation task did not indicate a significant interaction effect ($F(2,48)=1.36$, $P=0.27$, effect size $\eta^2=0.05$, estimated power at 5% probability=0.28). The analysis did, however, indicate significant main effects for both training condition ($F(1,27)=323.95$, $P<0.001$, effect size $\eta^2=0.99$, estimated power at 5% probability=1.00) and for test session ($F(2,48)=11.18$, $P<0.001$, effect size $\eta^2=0.32$, estimated power at 5% probability=0.99). Tukey's post hoc tests indicated that the individuals in the training condition were significantly faster than the control group throughout the experiment ($P<0.05$). Tukey post hoc tests conducted on the test session means indicated that speed of response in test session 1 was significantly ($P<0.05$) slower than test sessions 2 or 3.

Discussion

The present study was stimulated by recent calls within sport psychology for the ongoing evaluation, for the sake of professional standards and accountability, of the techniques and exercises that are advocated and used by practising sport psychologists (Hardy et al., 1996). To this end, the concentration grid exercise advocated in past and current applied sport psychology texts (Harris & Harris, 1984; Schmid & Peper, 1998; Weinberg, 1989) was examined for its properties as a tool for enhancing concentration skills.

The results obtained are consistent with the cautious view of the efficacy of the concentration grid exercise urged by both Gill (2000) and Moran (2000). Specifically, the results (based on a 9-week training programme with the grid being completed a minimum of six times each week) indicated that although some improvements were seen on the experimental tasks any improvements were similar for both the control group and the training group. Based on these findings it can, therefore, be concluded that

the concentration training grid protocol used in this study lacks the efficacy that has been ascribed to it in previous literature and anecdotal accounts. However, caution should be used when interpreting the results for the video observation task. As the initial scores indicated that the training group performed significantly better than the control group in the first test, it could be that a ceiling effect prevented this group from improving their scores further. Thus further research, with matched groups, is warranted to examine the impact of concentration grid training on this measure.

In addition, the utility of the concentration grid exercise in distinguishing between high and low concentration skills is also called into question by the results of the present study. Specifically, although the participants in the experimental group were shown to have superior scores on the concentration grid exercise throughout the study, no parallel differences were observed in the other concentration tasks. This was supported by follow up Pearson's product-moment correlations that revealed no significant associations (all $P > 0.05$) between concentration grid scores and performance on the video observation or visual search tasks. This finding questions Harris and Harris' (1984) non-empirically based assertions concerning the predictive ability of the concentration grid exercise, although as the difference between the experimental and control group was only marginally significant, it could be argued that much greater differences are needed to see differences in sport-specific concentration skills. Thus, future researchers do need to examine further the extent to which grid scores are predictive of sport-specific concentration skills.

Taken together, the results of the current study indicate that the proposed (Harris & Harris, 1984) impacts of the grid exercise should be treated with some caution. By extension, this research also supports the need for ongoing evaluation of the techniques used by sport psychologists and a further questioning of concentration exercises/techniques that are not supported by firm theoretical underpinnings and/or empirical research evidence. Such interventions may include simulation training (Orlick, 1990), focusing on sport-specific objects (Burke (1992) or techniques such as self-talk (Moran, 1996). Despite the lack of support for the concentration grid exercise it must be remembered that the process of evaluation should be an ongoing, systematic process (Hardy et al., 1996). Therefore, to disregard any technique on the basis of one study is as problematic as accepting the validity of a technique based on one piece of supporting evidence (Greenspan & Feltz, 1989). This is especially true in this instance where the participants were restricted to one sex, one ethnic group, one age group and one performance level. The present study may represent a preliminary examination of the concentration grid, but there remains a need for further evaluations to be conducted on the concentration grid exercise broadening the populations it is tested upon. Such research should also seek to examine a number of additional issues that arise from the present study.

The principal issue that needs to be addressed by future researchers is the lack of observed improvements in concentration grid performance by the experimental group. Although it could be proposed that merely doing the concentration grid exercise may develop concentration skills it seems more plausible to suggest that for the concentration grid exercise to lead to improvements in concentration skills an improvement in grid performances is required. This would certainly seem to be implied by Harris and Harris' (1984) discussion of the technique whereby individuals who had progressed to scoring in the 20's and 30's exhibited strong concentration skills. Therefore, future researchers will need to examine the impact of the concentration grid exercise when its practice is accompanied by improvements in grid scores.

A related issue concerns the amount of practice that is required before concentration improvements may be observed. Due to the lack of guidelines given in descriptions of the concentration grid exercise

concerning this issue (Harris and Harris make no comments on the length of time it took Eastern Bloc athletes to show improvements), an arbitrary training period of 9-weeks was assigned with a minimum of six trials being completed every week. However, as this represents a minimum of only 54 completed grids it could be argued that this is not sufficient to see improvements in concentration skills. This could indicate that concentration grid scores may either not be amenable to practice improvements or such improvements may take a considerable time to occur. Alternatively, the lack of improvements may have been due to low levels of effort on behalf of the participants when completing the grids. Although no formal social validation checks were attempted, informal feedback from the participants indicated that they were motivated to undertake the training and invested high levels of effort in the task so it appears unlikely that this was the reason behind the lack of improvements in grid scores. Thus, future researchers may wish to examine whether concentration grid scores are amenable to improvement with practice and, if so, the amount and type of practice required to produce significant improvements. It will also be important for future researchers to examine participants' perceptions of the concentration grid training.

A further consideration with the current findings, and an issue to be addressed in further evaluations of the concentration grid exercise, is the manner with which concentration is operationalised. For the purposes of the current study, concentration was operationalised in terms of performance in tasks that require the participant to scan a visual array quickly and accurately and to ignore other distractions in the environment. These were chosen based on the claims that the concentration grid exercise leads to improved scanning ability and the ability to ignore distractions (Gill, 2000). However, much debate currently exists concerning the methods used to measure concentration skills (Abernethy, 2001) and as a result not one method is advocated. Thus the present study has relied on a relatively narrow approach to the measurement of concentration skill (laboratory based behavioral tasks) and further research utilising other approaches to the measurement of concentration (e.g. psychophysiological and self-report measures) and performance (e.g. in-vivo sporting performance measures) may be of benefit. It may also be beneficial to examine the impact of concentration grid training on global performance measures given that Harris and Harris (1984) reported scores to differentiate between elite and non-elite performers. In addition, the examination of concentration and performance in environments where many distractions are present may also provide a fuller evaluation of the grid exercise. The current study assessed concentration in laboratory environments relatively free from the distractions found in sporting arenas. It may be that concentration grid training is only effective in enhancing concentration in situations with many distractions and therefore further examinations of the method should be conducted in such settings.

A third potential issue to be considered in the evaluation of the concentration grid exercise as a psychological intervention is the manner of its use. Although the current study examined the use of the concentration grid as a solitary intervention strategy this may not reflect the current usage of the grid. Boutcher and Rotella (1987) report using the concentration grid as part of a package of techniques with claims that the concentration grid serves to introduce concentration training and augment other concentration enhancement strategies. Used in this way, it may be that the grid serves a useful role in enhancing awareness of attentional issues, promoting some control over attention and prompting adherence to the use of concentration enhancement strategies.

Thus, although the results of the current study provide evidence to suggest that the concentration grid exercise is not the effective technique it has been proposed to be (Schmid & Peper, 1998), it may be premature to judge its particular worth as a sport psychology intervention. In particular, an evaluation of the exercise using different practice requirements and criteria, using different methods of measuring concentration and performance, examining its role within different types of sport and examining its role

as part of a package of concentration enhancing tools will provide a fuller evaluation of the exercise. This may also provide support for the use of the exercise beyond the anecdotal evidence provided thus far in the literature. The current study also supports the importance of evaluating techniques that are used or advocated by sport psychologists for the development of the profession of sport psychology (Greenspan & Feltz, 1989; Smith, 1989; Weinberg, 1989).

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