Use of Relaxation Skills in Differentially Skilled Athletes

Abstract

Objectives. To examine the use of relaxation skills by differentially skilled athletes in relation to the deliberate practice framework. Design. Differentially skilled athletes completed a survey about their use of relaxation skills. Method. 150 athletes representing three skill levels (recreational, college, and professional) completed the deliberate relaxation for sport survey, which assessed relaxation on three deliberate practice dimensions (relevancy, concentration, and enjoyment); time spent in different relaxation skills in a recent typical week; and functions of relaxation. Results. Athletes perceived relaxation as relevant to performance, requiring concentration, and enjoyable, and the relationships between these dimensions were positive. Professional and college athletes perceived relaxation as more relevant to effective competition than recreational athletes. Professional athletes engaged in more relaxation in a typical week than college and recreational athletes. In a typical week, autogenic, eastern, and muscle relaxation types were used least, deep breathing, meditation, and imagery relaxation types moderately, and stretching most. Athletes reported the primary functions of relaxation were to cope with competitive anxiety and promote recovery but relaxation was also reported to be used to cope with "everyday" anxieties associated with being an athlete. More physical (e.g., muscle relaxation) than mental relaxation types were used in relation to coping with competitive anxiety, whereas more mental (e.g., meditation) than physical relaxation types were used in relation to coping with everyday anxiety. Conclusions. The study provides support for the sport-specific framework of deliberate practice in relation to use of relaxation skills and informs the current understanding of self-regulation by athletes.

Keywords: competitive anxiety; deliberate practice; psychological preparation; psychological skills; recovery; self-regulation

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An athlete's psychological state, in terms of self-confidence, motivation, anxiety, and attention, is considered to affect his or her performance. Certain psychological states are more facilitative to performance than others dependent upon the individual athlete and the task at hand. A challenge for athletes is to attain and maintain a state comprising the right "recipe of…emotions and cognitions" (Gould & Udry, 1994, p. 479). The ability to obtain such a state is thought to depend, in part, on the use of self-regulatory skills (Eccles et al., 2011; Hardy, Jones, & Gould, 1996). Hardy et al. proposed that such skills take two forms, termed *basic* and *advanced psychological skills*. Advanced psychological skills are the skills of being able to regulate self-confidence, motivation, anxiety, and attention. Basic psychological skills are considered to underpin advanced psychological skills and include goal-setting, mental imagery, relaxation and activation, and self-talk skills.

Of the four basic psychological skills, goal-setting and imagery have been relatively well researched (Wadey & Hanton, 2008). In contrast, while sport psychologists often advocate the use of relaxation and self-talk skills to athletes and coaches, these skills have not been widely examined. The lack of data concerning these psychological skills limits our current understanding of self-regulation by athletes and our ability to advise sports performers and practitioners about the use of these skills (Tod, Hardy, & Oliver, 2011). While others have taken up the challenge of better understanding self-talk skills (e.g., Tod et al., 2011), our concern here is to investigate relaxation skills. Little is known about these skills in terms of the relevance of their role to performance, extent of their use, types of skills used, and their functions. Furthermore, little is known about whether relevance to performance, extent of use, types, and functions of such skills depend on athlete skill level.

Studies that have considered the extent to which relaxation skills are used by athletes typically have involved the Test of Performance Strategies (TOPS) questionnaire (Thomas, Murphy, & Hardy, 1999) as a measure of relaxation skill use during competition and practice. Our review of studies involving the TOPS revealed 11 studies reporting data on use of relaxation during competition; fewer studies reported data on use of relaxation during practice. Reviewing these 11 studies revealed that, in general, athletes report using relaxation skills at least "sometimes" during competition. (Limitations on space prevent us from providing references to these studies but the references can be obtained from the corresponding author). Less clear is how relaxation use depends on athlete skill level as only 3 of the 11 studies involved skill level contrasts in relaxation use and the results of these studies were mixed. Thomas et al. found that female (but not male) international level athletes reported more relaxation use in competition compared to their less skilled counterparts and Hayslip, Petrie, MacIntire, and Jones (2010) reported that golfers with a handicap less than 12 used more relaxation during competition than golfers with a handicap greater than 11. In contrast, Neil, Mellalieu, and Hanton (2006) found that professional rugby players reported less relaxation use than rugby players at or below the semi-professional level. Thus, studies of the extent of relaxation use by athletes are limited in number. Furthermore, the data yielded by these studies are almost exclusively in the "never-to-always" likert-scale form associated with the TOPS questionnaire. Currently, there are no alternative sources of quantitative data about athletes' use of relaxation skills and how such use might differ by skill level.

Relaxation types can be grouped into mental relaxation skills, where relaxation is achieved via regulation of thinking, or physical relaxation, where relaxation is achieved via regulation of a physical parameter such as breathing (Hardy et al., 1996). Athletes report using

various types of mental relaxation, such as imagery, and physical relaxation, such as deep breathing (Hanton & Jones, 1999; Jones & Hardy, 1990; Wadey & Hanton, 2008). However, there are no data at present concerning the extent to which athletes use these different types. Most previous studies of the functions of relaxation have involved a focus on one function, which is to cope with anxiety and arousal experienced in relation to competition (e.g., Wadey & Hanton, 2008). Little is known about possible alternative functions of relaxation. We propose that alternative functions include promoting recovery and coping with "everyday" anxiety. The basis for this proposal is as follows. First, Kellmann (2002) proposed that psychological and physical recovery from practice or competition is critical to effective performance and means of recovery include "psychoregulative techniques" such as relaxation activities (p. 18). Second, researchers have recently broadened investigations of stressors in sport beyond a focus on competition-based stressors to consider the athlete's overall environment (Pain & Harwood, 2007). Research has revealed many stressors are present within the "everyday" environments of athletes such as uncertainty about being selected to compete. Thus, it is likely athletes develop strategies, including relaxation skills, to cope with anxiety resulting from these everyday stressors.

The purpose of the present study is to better understand the relevance of relaxation skills to athletic performance as well as the extent of use, types, and functions of relaxation skills. Another aim is to identify how athlete skill level affects relaxation use. The rationale for examining the effects of skill level on relaxation use, which is akin to Griffith's (1922, p. 194) "first task" for sport psychologists, is as follows. By identifying psychological skills that discriminate highly skilled athletes from their less successful counterparts, it is possible to develop "expert models" of self-regulation in athletes (cf. Eccles, Ward, & Woodman, 2009).

These models constitute a principled basis for the design of practice regimens aimed at helping less skilled athletes cope with the demands of practice and competition. To this end, relaxation skills are examined within the context of the deliberate practice framework (Ericsson, Krampe, & Tesch-Römer, 1993). According to Ericsson et al., deliberate practice is structured, purposeful practice relevant to improving performance in a domain. It comprises activities requiring effort and/or concentration and as such is not inherently enjoyable. Researchers have investigated which activities constitute deliberate practice within a sport by asking athletes to rate practice activities on three dimensions: relevance to performance; enjoyment; and effort and/or concentration required to perform the activity (Helsen, Starkes, & Hodges, 1998; Young & Salmela, 2002). Activities studied have mainly included physical activities such as technical skills practice in soccer (Helsen et al.) but one basic psychological skill has been studied, which is imagery (Cumming & Hall, 2002). Generally, activities rated more relevant to performance require more effort and/or concentration, in line with Ericsson et al.'s proposals. In contrast with their proposals, activities rated more relevant to performance are often rated more enjoyable, a finding that has led to the development of a sport-specific framework of deliberate practice in which activities that enhance performance are perceived as enjoyable, despite requiring effort and/or concentration (Helsen et al.).

In the present study, the extent to which use of relaxation might be considered a deliberate practice activity was investigated by examining athletes' ratings of dimensions of deliberate practice for relaxation skills (relevance, concentration, and enjoyment). On the basis that relaxation may be used by athletes to cope with anxiety and arousal experienced in relation to competition (hereon, simply "to cope with competitive anxiety"), cope with everyday anxiety, and promote recovery, we predicted that relaxation activities would be perceived as at least

moderately relevant to performance. We also predicted that such skills would require at least moderate levels of concentration, as effective engagement in relaxation likely requires considerable concentration (cf. Cumming & Hall, 2002). Given the empirical support for the sport-specific framework of deliberate practice, we predicted that the relevance, concentration, and enjoyment dimensions would be positively related.

Generally, perceptions of relevance, concentration and/or effort, and enjoyment of deliberate practice activities, including imagery, do not depend significantly on athlete skill level (Helsen et al., 1998). Cumming and Hall's (2002) study of imagery is an exception: Athletes at different skill levels did not differ on ratings of concentration and enjoyment but more skilled athletes rated imagery as significantly more relevant to improving current performance and competing effectively. As the demands of sport are likely greater at higher skill levels, we hypothesized that athletes at higher skill levels would perceive relaxation as more relevant to improving current performance and competing effectively. Following Cumming and Hall's finding, it was also hypothesized that ratings of concentration and enjoyment would not depend significantly on athlete skill level.

We also examined time spent in relaxation and the types of relaxation used during a recent typical training week. As athletes at higher skill levels spend more hours in a typical training week engaged in demanding practice activities, they likely spend more hours using relaxation to cope with, and recover from these demands. Cumming and Hall (2002) found that higher skilled athletes spent more time in a typical training week using imagery than lower skilled athletes. We hypothesized that this would be true in the present study for use of relaxation. No hypotheses were proposed about differences in time spent between relaxation types as this was an exploratory component of the study.

Following the discussion above about the potential functions of relaxation, we examined the extent to which athletes use relaxation to cope with everyday anxiety, promote recovery, and cope with competitive anxiety, hypothesizing that relaxation would be used most to cope with competitive anxiety, as anxiety is often intense during competitions. A final aim here was to identify relationships between: (a) relaxation types and ratings of deliberate practice dimensions, to gain insight into which relaxation types are, for example, perceived as relevant to performance; and (b) relaxation types and relaxation functions, to gain insight into which relaxation types are associated with, for example, coping with anxiety. No hypotheses were proposed about these relationships as this was an exploratory component of the study.

Method

Participants

Three groups of 50 athletes participated: recreational (*M* age = 25.0 years; 23 males and 27 females), college (*M* age = 21.3 years; 23 males and 27 females), and national, international, and professional (hereon, simply *professional*; *M* age = 25.1 years; 22 males and 28 females). Recreational athletes were defined as undertaking their sport for leisure. College athletes were defined as student-athletes representing colleges. The professional group contained national, international, and professional athletes. Participants represented 12 individual sports (e.g., tennis) and 7 team sports (e.g., basketball) and had competed in the last four months. The recreational group contained 34 individual and 16 team sport athletes, the college group 37 individual and 13 team sport athletes, and the professional group 36 individual and 14 team sport athletes. Groups did not differ significantly for sex or sport type ($p > .05$). A Kruskal-Wallis test, used as data were non-normal, showed groups differed significantly for age, $H(2) = 31.15$, $p < .001$. Pairwise

Mann-Whitney tests revealed the college group was younger than the recreational ($p < .001$, $r = .43$) and professional groups ($p < .001$, $r = .53$).

Instrument

A "deliberate relaxation for sport survey" was developed for this study based on prior deliberate practice research (Cumming & Hall, 2002; Ericsson et al., 1993). The survey comprised four sections. First, a description was provided of relaxation activities as "routines, techniques, or skills that involve specific thoughts (e.g., saying "relax" to yourself) and/or actions (e.g., breathing deeply) that help you relax and that you do for reasons related to your sport". It was stated that these activities differ from leisure activities used to relax (e.g., watching TV) and the survey did not concern relaxation activities undertaken for the purpose of recreation.

Second, participants were asked to "match" each type of relaxation activity they use in relation to their sport (if any) with one of seven relaxation types. Five of these types were identified in the literature as used by athletes: deep breathing, imagery, meditation, muscle relaxation strategies, and stretching (e.g., Wadey & Hanton, 2008). Two other types were included as they are commonly taught to athletes and likely to be used by athletes as they are easily self-administered (Hardy et al., 1999): autogenic relaxation and eastern relaxation (e.g., yoga). Participants were encouraged to identify the "best match", even if the match was not perfect. A short description of each activity was provided. Participants were then asked to provide the time in minutes they spend in a (recent) typical training week in each relaxation type. Responses were provided on a 10-point scale ranging in 15 minute bandwidths from "0 mins" to "more than 120 mins." The middle point of each bandwidth was scored (e.g., "16-30 mins" was scored 23 mins) with the exception of the highest bandwidth, which was scored as 127 mins. To assess reliability (described below), participants were asked to estimate the total time in minutes

spent in relaxation activities in a typical week in the prior calendar year (2010) and provide a response by entering a value into the survey. If a participant responded that he or she spent any time in a typical training week in any type of relaxation, he or she was asked to complete the remainder of the survey; otherwise, the participant was informed that the study was complete.

Third, participants were asked the extent to which their engagement in relaxation activities in general is relevant to (a) improving their performance and (b) competing effectively. They were also asked the extent to which engagement in relaxation activities is enjoyable and directed to consider only enjoyment experienced during the activities and to disregard enjoyment experienced as a result of the activities (Ericsson et al., 1993). Next, participants were asked how much they are "mentally concentrated" during relaxation activities. Responses were provided on an 11-point scale ranging from 0 (not at all) to 10 (highly). The final section concerned relaxation functions. Participants were asked the extent to which they use relaxation activities to (a) cope with competitive anxiety, (b) promote recovery following practice and competition and (c) cope with the everyday anxiety associated with being an athlete. Responses were provided on a 5-point scale ranging from 0 (never) to 4 (always).

Reliability of estimates of time spent in a recent typical week in a given deliberate practice activity has been assessed by correlating these estimates with values calculated from diaries of time spent in this activity over a week; such diaries are known to be quite reliable (Ericsson et al., 1993). Results indicate reliability is good for skilled performers but poorer for less skilled performers (Hodges & Starkes, 1996). Reliability also has been assessed by correlating performers' estimates of time spent in a recent typical week in a given deliberate practice activity and with retrospective estimates of time spent in that activity in a typical week in the prior calendar year. Results from this method generally indicate that reliability is good

(Cumming & Hall, 2002). Evidence for the validity of ratings of deliberate practice dimensions has been provided by diary studies indicating that the scheduling of a deliberate practice activity within a training week depends, in theoretically meaningful ways, on how the activity is rated on the deliberate practice dimensions. For example, Ericsson et al. (1993) showed that, within performers' weekly schedules, activities rated relatively high for concentration were limited in duration, scheduled for mornings, and followed or broken up by daytime naps. Furthermore, individuals spending more time engaged in practice activities rated high for concentration napped more during practice days than rest days and obtained more hours sleep per week.

Procedures

Completion of the survey took approximately 30 mins. Participants able to meet the researchers completed a hard copy survey; those unable to meet undertook an identical survey online. Participants provided informed consent prior to participation.

Analysis

General considerations. Throughout the analyses, alpha was set at .05 and adjusted using the Bonferroni correction when multiple comparisons were undertaken. For analyses of variance, non-normal data sets that were not normalized following transformation were analyzed using non-parametric statistics. For analyses of variance involving skill level, repeated contrasts were used to compare the college group to the recreational group and the professional group to the college group. To compare the professional group to the recreational group, Tukey's test was used if group variances were homogeneous and a Games-Howell test was used if group variances were heterogeneous. Prior to the main analyses, we examined the effects of age, sex, and type of sport on each variable. Effects of age were examined using Pearson correlations and effects of sex and type of sport (individual vs. team) using *t* tests. One significant effect was revealed.

Total time spent in relaxation in a recent typical week was greater for males (n = 68, M = 2.07 hrs/week, SD = 1.81) than females (n = 82, M = 1.26 hrs/week, SD = 1.22), t (1, 148) = 3.13, p = .002, r = .25.

Analysis of time spent in relaxation. Following the preliminary analysis, sex was considered as a factor in the analysis of differences in time spent in relaxation in a recent typical week (hereon, *relaxation time*) between skill levels and relaxation types. Further analyses revealed that sex did not interact with skill level or relaxation type. Thus, sex was not included as a factor in the subsequent analysis.

We planned to analyze differences between skill levels and relaxation types in relaxation time using a mixed design ANOVA. However, some data sets were non-normal and not normalized with transformations, so the effects of skill level and relaxation type were analyzed separately. With skill level collapsed, data sets for all relaxation types were normal following log transformation. Consequently, differences between relaxation types in relaxation time were analyzed with a RM ANOVA. To simplify follow up procedures, the grand mean of the seven relaxation types was computed and, following log transformation, compared to each relaxation type with a paired samples t test. Alpha was adjusted to .007.

Skill levels differences in relaxation time were examined for each relaxation type using a (3 skill level) one-way ANOVA or Kruskal-Wallis test, depending on whether the data sets pertaining to the relaxation type were (a) normal or normalized with transformations or (b) non-normal and not normalized with transformations. Alpha was adjusted to .007. Differences between skill levels were also examined in *total* relaxation time; this variable was computed by summing relaxation time across the seven relaxation types. Data sets were normalized with

square root transformation. A (3 skill level) one-way ANOVA of total relaxation time was then computed.

Reliability of the estimates of time spent in relaxation was assessed by correlating total relaxation time for a *recent* typical week with estimates of time spent in relaxation in a typical week in the *prior calendar year* (2010). Spearman's rho was computed as variables were non-normally distributed.

Analysis of deliberate practice dimensions. Pearson correlations were computed to examine relationships between the relevance, concentration, and enjoyment dimensions of relaxation. Preliminary analyses showed correlations between dimension pairs were similar across skill levels for each pair except for relevance to competing effectively and enjoyment; for this pair of dimensions only, the correlation for each skill level was computed in addition to the correlation for the entire sample.

We planned to analyze differences between skill levels in the two relevance dimensions using a mixed design ANOVA. However, heterogeneous variances and unbalanced group sizes led us to compare cell means at each level of each factor using alternative tests. Differences between skill levels in each relevance variable were examined using Welch's *F* test. Alpha was adjusted to .025. Differences between ratings of the two relevance variables were analyzed using a paired-samples *t* test for the college group, as the difference scores were normally distributed. A Wilcoxon test was used for this purpose for the recreational and professional groups because difference scores were non-normally distributed and not normalized with transformations. Alpha was adjusted to .017. Skill level differences in ratings of concentration were examined using a one-way ANOVA. A similar analysis was undertaken for ratings of enjoyment.

Relationships between ratings of deliberate practice dimensions and relaxation time for each relaxation type were examined using Pearson's, Spearman's or Kendal's correlations, depending on the distribution of the data. Following the preliminary analysis, these relationships were examined first for each sex, with skill levels collapsed. Correlations were similar across sexes for all relaxation types, so sex was collapsed for each relaxation type and relationships were examined at each skill level. Correlations differed across skill levels only for deep breathing. Therefore, for each relaxation type except deep breathing, skill level was collapsed so that values were computed based on the entire sample. For deep breathing, values were computed by skill level. Alpha was adjusted to .007.

Analysis of relaxation functions. Differences between skill levels for the function variables were analyzed using an (3 skill level × 3 function) ANOVA. Relationships between ratings of relaxation functions and relaxation time for each relaxation type were examined using Pearson's, Spearman's or Kendal's correlations, depending on the distribution of the data. Following the preliminary analysis, these relationships were examined first for each sex, with skill level collapsed. Correlations were similar across sexes for all relaxation types except autogenic relaxation. Consequently, excepting autogenic relaxation, sex was collapsed for each relaxation type and relationships were examined at each skill level. Correlations differed across skill levels for many relaxation types, so values were computed for each skill level and the entire sample. Alpha was adjusted to .008. For autogenic relaxation, correlations were computed by sex for each skill level and the entire sample. Alpha was set at .05 given small sample sizes.

Results

The first purpose of the study was to examine the time athletes spend engaged in various types of relaxation and how athlete skill level affects time spent in relaxation. The second

purpose was to examine the extent to which athletes' ratings of the relevance and enjoyment of relaxation and the concentration required for relaxation provide evidence that relaxation use is a deliberate practice activity. The third purpose was to examine athletes' perceptions of the functions of relaxation and how these perceptions are affected by athlete skill level. The results are presented below in three sections that are related respectively to these purposes. Unless otherwise stated, the total sample size was 150, with 50 in each skill group. Partial eta squared and Pearson's *r* are provided as measures of effect size.

Time Spent in Relaxation

Table 1 provides descriptive statistics for time spent in relaxation types in a recent typical week. There were significant differences in time spent in relaxation between relaxation types, F (5.54, 825.12) = 46.66, $p < .001$, $\eta_p^2 = .24$. Time spent in autogenic ($p < .001$, $r = .79$), eastern ($p < .001$, $r = .75$), meditation ($p < .001$, $r = .60$), and muscle ($p < .001$, $r = .62$) relaxation types was significantly lower than the grand mean (M = 13.96 mins, SD = 13.40) and time spent in imagery ($p = .001$, $r = .39$) and stretching ($p = .001$, $r = .27$) relaxation types was significantly higher than the grand mean. Time spent in deep breathing was not significantly different from the grand mean.

Insert Table 1 near here

There were significant differences between skill levels in time spent in two relaxation types: imagery, F (2, 147) = 5.85, $p = .004$, and stretching, F (2, 147) = 5.91, $p = .003$. The college group ($p = .014$, $r = .25$) and professional group ($p = .006$, $r = .33$) spent more time per week using imagery to relax than the recreational group. The professional group also spent more time per week using stretching to relax than the recreational group ($p = .007$, $r = .30$). There were also significant differences between skill levels in total time spent in relaxation in a recent

typical week, F (2, 147) = 6.39, p = .002, η_p^2 = .08. The professional group spent more time per week in relaxation than the college group (p = .034, r = .23) and recreational group (p = .005, r = .31).

The correlation between estimates of time spent in relaxation is a recent typical week and estimates of time spent in relaxation in the previous calendar year (2010) of the participant's career was strong for the recreational group (r_s = .65, n = 49, p < .001), moderate for the college group (r_s = .38, n = 50, p = .007), strong for the professional group (r_s = .61, n = 49, p < .001), and strong overall (r_s = .58, n = 148, p < .001); note that two participants did not report a value for 2010. Thus, reliability was good for the recreational and professional groups and reasonable for the college group.

Ratings of Dimensions of Deliberate Practice

Data in this section were provided by 141 participants as 9 participants (7 recreational, 1 college, and 1 professional) reported spending no time per week in relaxation and thus did not provide responses relating to the present section.

Correlations between all pairs of dimensions were positive. There were moderate and significant relationships between concentration and relevance to improving performance (r = .36, p < .001) and relevance to competing effectively (r = .38, p < .001). The relationship between enjoyment and relevance to improving performance was also moderate and significant (r = .35, p < .001). The relationship between enjoyment and relevance to competing effectively was negligible and not significant for the recreational group (n = 43, r = .05, p = .761), weak and non-significant for the college group (n = 49, r = .26, p = .072), moderate and significant for the professional group (n = 49, r = .40, p = .005), and weak and significant overall (r = .18, p =

.030). The relationship between concentration and enjoyment was moderate and significant (r = .31, $p < .001$).

Table 2 provides descriptive statistics for ratings of deliberate practice dimensions. There was no significant difference between skill levels for relevance to improving performance (p = .152) but there was for relevance for competing effectively, F (2, 89.44) = 6.95, p = .002, adjusted η_p^2 = .13. The professional group (p = .022, r = .27) and the college group (p = .001, adjusted r = .32) rated relaxation more relevant to competing than the recreational group. However, the professional group and college group did not differ significantly on this variable (p = .853). There was no significant difference between ratings of relevance to improving performance and ratings of relevance competing effectively for any group ($p > .017$).

Ratings of concentration did not differ significantly between groups ($p > .05$). This was also true for ratings of enjoyment ($p > .05$).

Insert Table 2 near here

There were few significant correlations between ratings of deliberate practice dimensions and time spent in the different types of relaxation in a recent typical week; all were positive. Deep breathing was strongly related to relevance for improving performance for the recreational group (n = 43, r = .51, p = .001) and moderately related to this dimension for the entire sample (n = 141, r_s = .31, $p < .001$). Deep breathing was also weakly related to relevance to competing effectively (n = 141, r_s = .24, p = .004) and moderately related to concentration (n = 141, r_s = .24, p = .004) for the entire sample. Imagery was weakly related to relevance to competing effectively for the entire sample (n = 141, r_s = .28, p = .001).

Perceptions of Relaxation Functions

As in the last section, data in this section were provided by 141 participants. Table 3 provides descriptive statistics for the relaxation function variables. There was no significant main effect of skill level or interaction between skill level and function ($p = .097$ and $p = .238$, respectively). There was a significant main effect of function, F (1.89, 261.15) = 21.28, $p < .001$, $\eta_p^2 = .13$. Relaxation was used more to cope with competitive anxiety ($p < .001$, $r = .27$) and promote recovery ($p < .001$, $r = .45$) than cope with everyday anxiety; however, use of relaxation for coping with competitive anxiety was not significantly different from use of relaxation for promoting recovery ($p = .583$).

Insert Table 3 near here

Table 4 displays the correlations between ratings of relaxation functions and time spent in the different types of relaxation in a recent typical week. Only significant correlations are discussed here; all are positive. Use of relaxation to cope with competitive anxiety was moderately related to use of deep breathing, muscle relaxation, and imagery for the entire sample and more strongly related to these relaxation types for the professional group specifically. Use of relaxation for promoting recovery was weakly related to use of deep breathing, eastern relaxation, muscle relaxation, and stretching for the entire sample. This function of relaxation was also moderately related to use of deep breathing, eastern relaxation, and muscle relaxation for the recreational group and strongly related to the use of stretching for the professional group. The function was also strongly related to autogenic relaxation for males in the professional group ($n = 20$, $\tau = .52$, $p = .012$). Use of relaxation to cope with everyday anxiety was weakly related to use of deep breathing and meditation and moderately related to the use of imagery for the entire sample. This function was also strongly related to use of imagery for the recreational group and

moderately related to use of autogenic relaxation for the males in the professional group (n = 20, τ = .46, p = .026).

Insert Table 4 near here

Discussion

We investigated the extent to which relaxation activities used by athletes might be considered deliberate practice activities by examining the relevance, concentration, and enjoyment associated with these activities. As predicted, relaxation activities were perceived as at least moderately relevant to performance, requiring at least moderate levels of concentration, and moderately enjoyable. The findings obtained here are similar to Cumming and Hall's (2002) findings concerning imagery. Mean ratings out of 10 across all participants for relaxation, as measured here, and for imagery, as measured by Cumming and Hall, are, respectively: 6.3 and 7.1 for relevance to improving performance; 6.2 and 7.1 for relevance to competing effectively; 6.6 and 5.3 for concentration; and 6.6 and 5.6 for enjoyment. As such, relaxation appears to be rated in a way consistent with the notion of deliberate practice proposed within the sport-specific framework (Helsen et al., 1998). The relationships observed here between the practice dimensions provide further support for conceptualizing relaxation as a deliberate practice activity according to the sport-specific framework. Ericsson et al.'s (1993) original framework predicts a positive relationship between relevance and concentration and negative relationships between relevance and enjoyment and between concentration and enjoyment. By contrast, the sport-specific framework predicts positive relationships between all dimensions. Neither framework had clear support in the study of imagery by Cumming and Hall, whereas positive relationships were found here between all dimensions for the entire sample, in line with the sport-specific

framework. The more relaxation was perceived relevant to improving performance or competing effectively, the more it was perceived as requiring concentration and as enjoyable.

Within the sport-specific framework, it has been a challenge to understand why deliberate practice activities rated as highly relevant are enjoyable, given that they usually require substantial concentration and/or effort (Cumming & Hall, 2002; Helsen et al., 1998). Researchers have proposed that these activities are often competitive and/or challenging, and, in team sports, social and it is these aspects of the activity that athletes enjoy (Cumming & Hall; Helsen et al.). These descriptors do not seem to apply to relaxation activities, so an alternative explanation is required in relation to this psychological skill for the positive correlations between enjoyment and relevance, and enjoyment and concentration. One such explanation is that, even though relaxation requires concentration, which is not enjoyable, it may cause relatively rapid changes in way anxiety is interpreted and/or decreases in the intensity of any anxiety experienced, which likely is enjoyable.

One of the two primary functions of relaxation reported by the athletes here was to cope with competitive anxiety. Also, college and professional athletes rated relaxation skills more relevant to competing effectively than recreational athletes, consistent with Cumming and Hall's (2001) finding that national- and provincial-level athletes perceived imagery more relevant to competing effectively than recreational athletes. In the present study, professional athletes spent more time per week in relaxation than college and recreational athletes, consistent with the findings of Thomas et al. (1999) and Hayslip et al. (2010) that more (vs. less) skilled athletes made greater use of relaxation skills. An explanation for these combined findings is that more skilled athletes experience more intense anxiety because they compete at higher levels of competition, leading these athletes to perceive relaxation as more relevant to competing

effectively and spend more time using relaxation to cope with anxiety. However, these findings differ from Neil et al.'s (2006) finding that less skilled athletes made greater use of relaxation than more skilled athletes. Participants in the study by Neil et al. were from one sport (rugby union) and thus perhaps this finding is unique to this sport population.

Also revealed here was that use of relaxation to cope with competitive anxiety was associated most strongly with use of deep breathing, imagery, and muscle relaxation types, especially for professional athletes. These findings are quite consistent with those reported by Wadey and Hanton (2008), in which elite athletes were shown to use deep breathing and imagery to cope with competitive anxiety. In addition, time spent in deep breathing and imagery was positively related to ratings of relevance to competing effectively and professional athletes used imagery to relax approximately twice as much as college athletes and three times as much as recreational athletes. While prior quantitative studies have indicated that skilled (vs. less skilled) athletes make greater use of relaxation to cope with competitive anxiety (e.g., Thomas et al., 1999), they have not explored which types of relaxation are used by these athletes. Furthermore, while prior qualitative studies have explored the relaxation types used by skilled athletes (Wadey & Hanton, 2008), they have not quantified the use of these skills by skilled athletes or differences in their use across athlete skill levels. The present study overcomes these shortcomings by providing quantitative evidence that skilled athletes, when compared to their less skilled counterparts, make more use of the specific relaxation skills of imagery and deep breathing, and in relation to coping with competitive anxiety.

The second primary function of relaxation reported here was to promote recovery. A variety of relaxation types was associated with the recovery function but of note was the strong association between stretching and this function for professional athletes, especially given that

professionals spent twice as much time per week stretching as recreational athletes. Researchers have proposed that relaxation can be used as a means of psychological and physical recovery following practice or competition (Kellmann, 2002) but we believe this is the first study to present evidence supporting this proposal. What is unknown at this time is how relaxation strategies might function to enhance recovery but insights can be gained from other areas of psychology. Research in occupational settings suggests that relaxation might aid recovery via a psychological pathway, as relaxation interventions have been shown to reduce decrements to motivation that follow intensive periods of work (Awa, Plaumann, & Walter, 2010). Research in clinical psychology suggests that relaxation also might aid recovery via a physical pathway, as relaxation interventions have been shown to speed healing and reduce the negative effects of stress on the immune system (Broadbent et al., 2012).

Another result of theoretical relevance is that, while the use of deep breathing and imagery were associated with all three functions of relaxation, the remaining relaxation types were associated with only a subset of these functions. Specifically, muscle relaxation was associated with the use of relaxation to cope with competitive anxiety, especially for professional athletes, whereas meditation and (for male professional athletes) autogenic relaxation were associated with the use of relaxation to cope with everyday anxiety. This finding might be considered supportive of the matching hypothesis (Davidson & Schwartz, 1976; Hardy et al., 1996), which states that physical relaxation skills are most effective at reducing physical responses to stress (i.e., arousal) and mental relaxation skills are most effective at reducing mental responses to stress (i.e., anxiety). It is reasonable to assume that competing induces more intense arousal than everyday stressors (e.g., uncertainty about being selected to compete). As such, our findings support the matching hypothesis because more physical than mental relaxation

types were used in relation to coping with competitive anxiety and fewer physical than mental relaxation types were used in relation to coping with everyday anxiety. Most previous studies providing evidence for the matching hypothesis have involved experimental designs (e.g., Maynard & Cotton, 1993), so the present study, involving a survey of athletes' relaxation use, constitutes an alternative form of support for the hypothesis.

Self-regulation of psychological state is considered critical to high level performance in sport given the demands of practice and competition at this level. Our findings concerning the use of relaxation skills enhance understanding about self-regulation of psychological state (and, to a lesser extent, physical state) in athletes and inform the development of "expert models" of self-regulation in athletes (cf. Eccles et al., 2009). Consider the following example model based on a subset of the findings concerning professional athletes: Relaxation skills are relevant to performance generally and effective competition specifically and are used for over 2 hours per week; they require concentration but are enjoyable; and the use of imagery, followed by deep breathing, followed by muscle relaxation skills, is associated with efforts to cope with competitive anxiety. Such models provide a principled basis for the design of practice regimens aimed at helping less skilled athletes cope with the demands of practice and competition.

This study has several limitations. First, we asked athletes to "match" relaxation types they use to a finite, fixed set of relaxation types and, consequently, even though this set of skills had an empirical basis, we likely captured only a portion of the variance in relaxation types used by athletes. Second, it is likely athletes, and skilled athletes in particular, use relaxation skills unconsciously as well as consciously but the self-report measure used here would have captured only the conscious use of these skills (Eccles, 2012). Third, no insight was provided into the effectiveness of the relaxation skills used. Further studies are required to explore this issue.

Finally, while the reliability measure used here indicated good reliability, especially for recreational and professional athletes, researchers have raised concerns about the validity of reports about strategy use in general (e.g., during a typical week) versus in relation to a specific event or time period (Eccles, 2012). Future research should involve requests for relaxation skill use during specific events or time periods.

In conclusion, the objective of this study was to examine use of relaxation skills by differentially skilled athletes within the context of the deliberate practice framework. The findings here provide support for considering relaxation as a deliberate practice activity as conceptualized by the sport-specific framework of deliberate practice. They also provide insights into how athletes at different skill levels cope with demands of practice and competition through the use of relaxation skills. The continued study of relaxation and other psychological skills by athletes, and skilled athletes in particular, will substantially enhance our current understanding of self-regulation in athletic populations and our ability to help athletes improve their current performance.

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Table 1. Means and standard deviations for time (minutes) spent engaged in seven relaxation types in a recent typical training week by skill level

Relaxation type	Recreational athletes (n = 50)		College athletes (n = 50)		Professional athletes (n = 50)		Total (n = 150)	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Autogenic relaxation	3.38	9.63	5.42	10.26	4.32	10.45	4.37[L]	10.09
Deep breathing	16.56	17.10	15.10	16.13	19.96	27.69	17.21	20.93
Eastern relaxation	7.42	23.33	4.16	10.01	15.30	27.20	8.96[L]	21.85
Imagery	8.40	13.29	15.04	18.87	27.44	35.82	16.96 [H]	25.68
Meditation	7.84	14.97	9.84	15.84	16.44	26.38	11.37 [L]	19.97
Muscle relaxation	6.80	10.97	7.70	7.80	14.78	27.14	9.76[L]	17.74
Stretching	21.34	23.08	26.20	23.79	39.82	35.11	29.12 [H]	28.78
Total	71.74	67.17	83.46	63.59	138.06	124.97	97.75	93.75

Note. L indicates variable is significantly lower, and H significantly higher, than the grand mean. Significance is at $p < .007$.

Table 2. Means and standard deviations for ratings of dimensions of deliberate relaxation practice by skill level

Dimension of deliberate practice	Recreational athletes (n = 43)	College athletes (n = 49)	Professional athletes (n = 49)	Total (n = 141)
Relevance of relaxation activities to improving current performance	5.58 (2.89)	6.63 (1.98)	6.53 (2.96)	6.28 (2.66)
Relevance of relaxation activities to competing effectively	5.05 (2.80)	7.08 (1.77)	6.43 (2.92)	6.23 (2.65)
Amount of concentration required to perform relaxation activities	6.44 (2.32)	6.78 (1.91)	6.57 (2.70)	6.60 (2.32)
Enjoyment of performing relaxation activities, regardless of the results	7.21 (2.42)	6.25 (1.87)	6.31 (2.87)	6.56 (2.44)

Note. Responses options ranged from 0 (not at all) to 10 (highly).

Table 3. Means and standard deviations for ratings of relaxation functions by skill level

Relaxation function	Recreational athletes (n = 43)		College athletes (n = 49)		Professional athletes (n = 49)		Total (n = 141)	
To cope with competitive anxiety	1.88	(1.03)	2.35	(1.07)	2.33	(1.26)	2.20	(1.14)
To promote recovery	2.21	(.97)	2.22	(1.09)	2.33	(1.21)	2.26	(1.09)
To cope with everyday anxiety	1.35	(1.02)	1.88	(.99)	1.55	(1.00)	1.60	(1.02)

Note. Response options ranged from 0 (never) to 4 (always).

Table 4. Correlations between time spent in relaxation types in a recent typical week and ratings of functions of relaxation

Variable	Recreational athletes (n = 43)	College athletes (n = 49)	Professional athletes (n = 49)	Total (n = 141)
Use of relaxation to cope with competitive anxiety				
Time spent in a recent typical week engaged in…				
…deep breathing	.08[†]	.31[†]	.41[††]*	.31[††]*
…eastern relaxation	.11[†††]	.12[†††]	-.04[†††]	.05[†††]
…imagery	.19[††]	.35[††]	.44[††]*	.36[††]*
…meditation	.23[††]	.03[††]	.02[††]	.01[††]
…muscle relaxation	.23[††]	.24[††]	.42[††]*	.33[††]*
…stretching	-.22[†]	.10[†]	.01[†]	-.01[†]
Use of relaxation to promote recovery				
…deep breathing	.41[†]*	.22[†]	.17[††]	.26[††]*
…eastern relaxation	.40[†††]*	-.10[†††]	.30[†††]	.22[†††]*
…imagery	.16[††]	.09[††]	.31[††]	.22[††]*
…meditation	.41[††]*	.02[††]	.17[††]	.19[††]
…muscle relaxation	.48[††]*	.03[††]	.20[††]	.24[††]*
…stretching	-.02[†]	.09[†]	.52[†]*	.27[†]*
Use of relaxation to cope with everyday anxiety				
…deep breathing	.12[†]	.37[†]	.08[††]	.23[††]*
…eastern relaxation	.09[†††]	.23[†††]	.05[†††]	.11[†††]
…imagery	.50[††]*	.33[††]	.33[††]	.37[††]*
…meditation	.24[††]	.16[††]	.31[††]	.24[††]*
…muscle relaxation	.32[††]	.23[††]	.05[††]	.22[††]
…stretching	-.15[†]	.10[†]	-.07[†]	-.04[†]

[†]Pearson's r [††]Spearman's rho [†††]Kendal's τ *$p < .008$