

One Year Follow-Up of Mindful Sport Performance Enhancement (MSPE) With Archers, Golfers, and Runners

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The purpose of the present investigation was to evaluate the long-term effects of mindful sport performance enhancement (MSPE), a program designed to improve athletic performance and psychological aspects of sport. One-year follow-up assessments were conducted on archers, golfers, and long-distance runners ($N = 25$) who attended Kaufman, Glass, and Arnkoff's (2009) and De Petrillo, Kaufman, Glass, and Arnkoff's (2009) MSPE workshops. Across the athlete groups, participants reported significant increases in the ability to act with awareness (an aspect of trait mindfulness) and overall trait mindfulness from pretest to follow-up, along with significant decreases in task-related worries and task-irrelevant thoughts (both aspects of cognitive interference during sport). The long-distance runners exhibited significant improvement in their mile times from pretest to follow-up, with significant correlations between change in runners' performance and trait variables. Results suggest that MSPE is a promising intervention associated with long-term changes in trait variables that may contribute to optimal athletic performance.

Keywords: Mindfulness, sport, performance enhancement, awareness

Mindfulness can be described as “the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment” (Kabat-Zinn, 2003, p. 145). Although mindfulness originated as a Buddhist meditation practice (Kabat-Zinn, 1990), its secular adaptations have recently received a great deal of interest in the Western empirical psychology literature (Baer, 2003). Numerous mindfulness-based interventions have been developed for a variety of clinical disorders and adjustment problems, the most well-known of which is mindfulness-based stress reduction (MBSR; Kabat-Zinn, 1990), and numerous studies support its effectiveness (see Baer, 2003). Mindfulness has also been successfully integrated into treatments for borderline personality disorder (Linehan, 1993), generalized anxiety disorder (Roemer & Orsillo, 2002), and recurrent depression (Segal, Williams, & Teasdale, 2002). For

a comprehensive meta-analytic review of mindfulness-based clinical interventions, readers are referred to Hoffman, Sawyer, Witt, and Oh (2010).

Recent lines of evidence suggest that mindfulness interventions, emphasizing both awareness and acceptance of internal and external states (Kabat-Zinn, 1990) may also be useful for athletes (Gardner & Moore, 2004, 2007; Kaufman et al., 2009). These approaches offer an exciting alternative to the traditional cognitive-behavioral techniques frequently used by sport psychologists, which may sometimes be contraindicated for athletes because mental control techniques that encourage the suppression or replacement of negative thoughts and images may paradoxically increase the frequency and saliency of those very thoughts (Beilock, Afremow, Rabe, & Carr, 2001; Gardner & Moore, 2006; Janelle, 1999; Wegner, 1994).

The contention that mindfulness interventions may improve athletic performance is further supported by the theoretical overlap between mindfulness and “flow” (Gardner & Moore, 2004; Kaufman et al., 2009; Kee & Wang, 2008). Thought to be a facilitator of peak performance (Jackson & Csikszentmihalyi, 1999; Jackson & Eklund, 2002), flow is a state of consciousness in which a person is completely absorbed in his or her actions and experiences a unity of the mind and body (Csikszentmihalyi, 1990). Both mindfulness and flow share a focus on present experience and are often associated with feelings of calmness, serenity, and mind-body unity, suggesting that the practice of mindfulness techniques may render an athlete more likely to experience flow, and by extension, peak performance (Gardner & Moore, 2004; Kaufman et al., 2009). Recent empirical studies suggest that athletes who are more mindful are also more likely to experience characteristics of flow (Bernier, Thienot, Codron, & Fournier, 2009; Kee & Wang, 2008). In addition, sport psychology interventions that emphasize mindfulness and acceptance have been shown to be associated with corresponding increases in dispositional and state flow (Kaufman et al., 2009; Schwanhausser, 2009)

Despite theoretical support for the potential usefulness of mindfulness techniques in sport psychology, the study of mindfulness interventions for athletes is still in its youth. In perhaps the first reported application of this approach, Kabat-Zinn, Beall, and Rippe (1985) provided training in mindfulness meditation to both collegiate and Olympic rowers with specific applications of mindfulness to rowing (e.g., focus on the breath, letting go of thoughts of pain and discomfort). They reported that collegiate rowers exceeded the coach’s expectations based on their level of experience and physical abilities. Furthermore, several rowers who medaled at the Olympics reported that the mindfulness training helped them to perform at their full potential. More recently, Bernier and colleagues (2009) implemented a mindfulness and acceptance-based intervention with elite young golfers, who increased their national ranking and achieved their competition goals, while a control group receiving traditional psychological skills training did not exhibit the same degree of improvement in objective performance. In addition, Gooding and Gardner (2009) reported that greater levels of mindfulness predicted increased game free-throw percentage among NCAA Division I male basketball players. Although a mindfulness-based sport intervention was not implemented in this study, the findings offer converging evidence that mindfulness and acceptance are associated with enhancements in athletic performance.

Adapted from the work of Hayes, Strosahl, and Wilson (1999) and Segal, Williams, and Teasdale (2002), Gardner and Moore’s mindfulness-acceptance-

commitment (MAC) approach for athletic performance enhancement (2004, 2006, 2007) emphasizes mindful attention, nonjudgmental acceptance of internal states, and commitment to achieving valued goals. A preliminary investigation with collegiate athletes showed a trend toward improved athletic performance among members of the MAC group who did not exhibit subclinical psychological difficulties (Gardner & Moore, 2006; Wolanin & Schwanhausser, 2010). In a large sample of Division I collegiate athletes, a significantly greater number of athletes in the MAC program received at least a 20% improvement in their coach's ratings of performance when compared to athletes who received a traditional psychological skills training intervention. Athletes in the MAC program also exhibited significant decreases in experiential avoidance and increases in aggressiveness and flow scores (Lutkenhouse, Gardner, & Moore, 2010). Recently, a study describing the utility of MAC with an adolescent competitive springboard diver reported increases in mindful attention, experiential acceptance, nonjudgmental awareness, and dispositional flow, and improvements in diving performance from pre- to post-intervention (Schwanhausser, 2009). Taken together, these findings indicate that MAC is a useful intervention for enhancing sport performance and increasing experiential acceptance, mindful awareness, and distress tolerance in athletes (Moore, 2009).

Kaufman et al. (2009) developed and evaluated mindful sport performance enhancement (MSPE), a 4-week mindfulness program for athletes integrating elements of both MBSR (Kabat-Zinn, 1990) and Segal et al.'s (2002) mindfulness-based intervention. MSPE teaches athletes how to apply mindfulness skills to sport through repeated practice and discussion of mindfulness exercises, including a walking meditation adapted to participants' sport of focus. MSPE was initially applied to archers and golfers, both individual sports requiring a high degree of mental focus (Kaufman et al.). Archers' overall trait mindfulness and dispositional optimism (a component of sport confidence) increased significantly, and golfers exhibited significant increases in their ability to describe observed phenomena (an aspect of mindfulness). Finally, over 75% of the athletes who participated in the study indicated that they felt the mindfulness training would increase their performance and/or enjoyment of their respective sports.

De Petrillo et al. (2009) evaluated the utility of MSPE for long-distance runners, a population of athletes that often experiences negative thoughts and physical discomfort during sport. Compared to wait-list controls, runners who received MSPE reported significantly fewer organizational demands (an aspect of perfectionism). Moreover, runners who participated in the workshop experienced significant decreases in sport-related worry and significant increases in awareness (an aspect of trait mindfulness).

Although both Kaufman et al. (2009) and De Petrillo et al. (2009) demonstrated some positive results for MSPE, given the brief 4-week duration of the intervention, it is unlikely that considerable change in sport performance and trait characteristics would have been observed at posttest. Consequently, a follow-up evaluation of MSPE is warranted to determine its value for athletic performance enhancement. Despite the need to understand the long-term effects of sport interventions, few sport psychology studies have conducted follow-up assessments and rarely employ follow-up intervals greater than 6 months in length. Furthermore, no follow-up evaluations of mindfulness-based sport psychology interventions have been published to date.

The goal of the present study was thus to conduct a one-year follow-up of athletes who had participated in either Kaufman et al.'s (2009) or De Petrillo et al.'s (2009) investigations of MSPE, adding to the sport psychology literature by examining the long-term effects of this intervention. Of primary interest was whether the athletes' archery and golf scores and running times would show improvement from pre-workshop to follow-up. We anticipated that the athletes would report reductions in sport anxiety and disruptive thoughts during sport as well as increases in trait mindfulness. We also examined whether the athletes continued to practice mindfulness skills in the year after the workshops ended. Finally, the present study sought to determine whether MSPE had any long-term effects on non-athletic domains of participants' lives. Specifically, there is evidence that mindfulness meditation leads to reductions in both clinical anxiety (Baer, 2003; Kabat-Zinn et al., 1992) and the general anxiety and life stress experienced by non-clinical populations (Shapiro, Astin, Bishop, & Cordova, 2005; Williams, Kolar, Reger, & Pearson, 2001). Both mindfulness and flow are also believed to be associated with increases in quality of life and satisfaction with life (Csikszentmihalyi, 1990; Kabat-Zinn, 1990). Since non-sport-related stress may be as detrimental to athletic performance as sport-related stress (Haney, 2004), whether MSPE led to long-term reductions in general anxiety and stress, as well as to increases in overall life satisfaction, was also of interest.

Method

Participants

Originally, 11 archers, 21 golfers, and 25 long-distance runners from the Washington, DC metropolitan area attended at least one session of Kaufman et al.'s (2009) or De Petrillo et al.'s (2009) MSPE workshop. At the time of the workshop, 10 of the archers, 17 of the golfers, and all of the long-distance runners gave written consent to be contacted for a later follow-up. Of these, 4 archers (40%), 8 golfers (47.06%), and 13 runners (52%) chose to participate in the current follow-up study. Of the 25 follow-up participants, 14 were men and 11 were women, ranging in age from 18 to 72 years ($M = 48.28$ years). Twenty-three athletes were Caucasian, one was African-American, and one was Asian/Pacific Islander.

Procedure

One year after the end of each workshop, the original 52 archers, golfers, and long-distance runners who gave consent to be contacted for follow-up were invited to participate in the current study and were sent a packet of questionnaires. They were asked to return the completed questionnaires and one signed informed consent form in the enclosed stamped envelope within two weeks time, resulting in 25 returned packets. Three versions of most measures were used, with wording specific to each sport.

Measures

Archery Questionnaire (AQ) and Golf Questionnaire (GQ). The 8-item AQ and the 10-item GQ were both designed for the present study, with a number of items adapted from Kaufman et al.'s (2009) background questionnaire. Athletes

report their best scores in competition and practice within the past year, as well as approximately how many times per month they currently shoot or play a round of golf. The AQ and GQ also contain 5-point rating scales and open-ended questions that assess perceived changes in performance, involvement, and feelings toward their respective sports since participation in the workshop. They also contain items that pertain to participation in other sport activities and whether or not athletes received any additional sport psychology or mindfulness training since the conclusion of the workshop.

Runner Questionnaire (RQ). The RQ is an 11-item questionnaire that was adapted from De Petrillo et al.'s (2009) background and follow-up questionnaires. Initial items ask participants to record their best running times over the past year, including their best mile time. Further items inquire about running routines, including any changes in running routine over the past year. Similar to the AQ and GQ, the RQ also contains items that assess changes in performance, involvement, and feelings toward running since participation in the workshop and an item concerning additional participation in sport psychology or mindfulness training.

Workshop Credibility and Expectations Measure (CEM). The Workshop Credibility and Expectations Measure (CEM; Kaufman et al., 2009) was revised for the present study in order to assess the current perceived credibility and usefulness of the mindfulness workshop with seven items using 10-point Likert rating scales. Kaufman et al. adapted the original CEM from Holt and Heimberg's (1990) Response to Treatment Questionnaire, a treatment credibility measure that was originally developed from the work of Borkovec and Nau (1972).

Follow-up Questionnaire (FQ). Included in the questionnaire packets for archers and golfers, the 12-item FQ assesses the extent to which participants continued to practice mindfulness skills after the workshop ended. Additional items ask participants to rate their life satisfaction and the frequency and intensity of feelings of anxiety and stress both before and after the workshop on 5-point Likert scales. They were also asked to rate the degree to which changes in these areas could be attributed to their participation in the workshop on a scale from 1 (*not at all*) to 5 (*a great deal*). In addition, four open-ended questions inquire about how participants perceived the workshop contributed to any changes in these non-athletic domains.

Follow-up Questionnaire for Runners (FQ-R). Included in the questionnaire packet for runners, the 19-item FQ-R contains all of the items on the FQ, along with additional items adapted from De Petrillo et al.'s (2009) background and follow-up questionnaires. The FQ-R also contains open-ended items concerning current life stressors, the extent to which the MSPE workshop may have helped participants to deal with these stressors, and what specifically about the workshop participants perceived to be helpful to deal with these concerns.

Trait Measures. All three athlete groups received the same trait measures given at pre- and post-workshop: Kentucky Inventory of Mindfulness Skills (KIMS; Baer, Smith, & Allen, 2004), Thought Occurrence Questionnaire for Sport (TOQS; Hatzigeorgiadis & Biddle, 2000), and Sport Anxiety Scale (SAS; Smith, Smoll, & Schutz, 1990). Additionally, the Carolina Sport Confidence Inventory (CSCI; Manzo, Silva, & Mink, 2001) and the Dispositional Flow Scale-2 (DFS-2; Jackson & Eklund, 2002) were completed by the archers and the golfers,

while the Multidimensional Perfectionism Scale (MPS; Frost, Marten, Lahart, & Rosenblate, 1990) was completed by the long-distance runners. See Kaufman et al. (2009) and De Petrillo et al. (2009) for a comprehensive description of these measures.

Qualitative Item Scoring

Coding manuals were developed by the authors in order to classify participants' responses to the qualitative items included in the Archery, Golf, and Runner Questionnaires, as well as the FQ and FQ-R. Responses were first separated into discrete content units, and then coded by the first author and an additional research assistant. A satisfactory κ was reached on training items before the actual responses were coded. A κ of 0.73 was found for participants' responses to questions on the AQ and GQ, and a κ of 0.85 was found for the RQ. Kappas of 0.81 and 0.85 were obtained for participants' responses to the FQ and FQ-R, respectively.

Results

Comparison of Follow-Up Participants With Nonparticipants

A series of independent sample *t*-tests and chi-square tests were conducted in order to determine if any pre-workshop differences existed between athletes who chose to participate in the follow-up and those who did not. The two groups did not differ in terms of age, gender, ethnicity, expectations for the workshop, sport of concentration, the number of years they played their sport, or prior exposure to sport psychology or meditation practice. Follow-up participants did not differ from nonparticipants on appraisals of the workshop's credibility or ratings of satisfaction with their sport performance at post-workshop. Also, no differences were found between follow-up participants and nonparticipants on pre- or post-workshop measures of overall sport anxiety, trait mindfulness, or thought disruption during sport.

Sport-Specific Comparisons. Those golfers who chose to participate in the follow-up did not differ from those who did not participate in terms of their initial handicap, initial best-ever score for a practice round, or initial best-ever score for a tournament or competition. Although archers and golfers who chose to participate in the follow-up did not differ from those who chose not to participate with regard to overall sport confidence at pre-workshop or post-workshop, the follow-up participants reported experiencing significantly more overall flow ($M = 133.08$) than did nonparticipants ($M = 118.00$) prior to the workshop, $t(30) = 2.22$, $p = 0.034$. Archers and golfers who chose to participate in the follow-up also reported experiencing significantly greater overall flow ($M = 137.80$) at post-workshop than did nonparticipants ($M = 121.27$), $t(19) = 2.64$, $p = 0.016$. Due to the very small number of nonparticipant golfers who provided data on their sport performance at post-workshop ($n = 1$), comparisons between best 18-hole round scores at post-workshop could not be calculated. Long-distance runners who participated in the follow-up did not differ from those who chose not to participate in terms of the distances they tended to run, initial best-ever mile time, best mile time at post-workshop, or overall trait perfectionism at pre- or post-workshop.

Changes in Sport and Trait Variables at Follow-up

Sport Performance. Paired-samples *t*-tests were used to compare archers' best indoor and outdoor tournament scores, golfers' best 18-hole round scores, and long-distance runners' best mile times in the 12 months prior to the workshop (reported prior to the MSPE program) to their best scores and mile times in the 12 months following the workshop. Because archers shot in different types of tournaments, with a varying number of arrows and thus different possible scores, a standard metric was computed based on each archer's score as a percentage of the total possible score for each competition. No significant differences were found for archers' tournament scores from pretest to follow-up. Although no significant differences were found for golfers' 18 round-hole scores in a practice round from pretest to follow-up, golfers' 18-hole round scores at follow-up ($M = 79.00$) were significantly lower than their scores at posttest ($M = 82.42$), $t(6) = -2.59$, $p = 0.041$. Runners' best mile times (in minutes) in the 12 months following the workshop ($M = 6.54$) were found to be significantly lower than both their best mile times in the 12 months preceding the workshop ($M = 7.36$), $t(9) = 3.06$, $p = 0.014$ and at posttest ($M = 7.28$), $t(10) = 2.39$, $p = 0.038$.

For all of the athletes combined, the mean rating for the AQ, GQ, and RQ item asking participants to compare their performance over the past year to their pre-workshop performance was a 3.62 on a 5-point Likert scale ranging from 1 (*much worse than before*) to 5 (*much better than before*), and the mean rating for the item asking to what extent performance changes could be attributed to the MSPE workshop was a 3.00 on a 5-point Likert scale ranging from 1 (*not at all*) to 5 (*a great deal*). Similarly, on a scale from 1 (*not at all confident*) to 10 (*very confident*), the athletes' mean rating for the CEM item asking participants to rate their confidence that the MSPE workshop improved their sport performance was a 5.48, suggesting moderate confidence.

Trait Variables. Repeated-measures ANOVAs were conducted on those trait variables that were measured at pre-workshop, post-workshop, and follow-up assessments for all three athlete groups. There was a significant effect of assessment time on the ability to act with awareness (an aspect of trait mindfulness), overall trait mindfulness, task-related worries (an aspect of thought disruption during sport), task-irrelevant thoughts (an aspect of thought disruption during sport), and overall sport anxiety (see Table 1).

Planned contrasts demonstrated significant increases in the ability to act with awareness from both pre-workshop and post-workshop to follow-up, $F(1, 21) = 8.24$, $p = 0.009$, and $F(1, 21) = 6.20$, $p = 0.021$, respectively. Significant increases in overall trait mindfulness were also found from pre-workshop and post-workshop to follow-up, $F(1, 21) = 9.40$, $p = 0.006$, and $F(1, 21) = 6.51$, $p = .019$, respectively. Furthermore, there were significant decreases in task-related worries from pre-workshop to follow-up, $F(1, 20) = 4.26$, $p = 0.052$, and significant decreases in task-irrelevant thoughts from both pre-workshop and post-workshop to follow-up, $F(1, 21) = 7.62$, $p = 0.012$, and $F(1, 21) = 5.47$, $p = 0.029$, respectively. Moreover, planned contrasts revealed significant decreases in overall sport anxiety from post-workshop ($M = 40.35$) to follow-up ($M = 34.09$), $F(1, 19) = 10.23$, $p = 0.005$.

Additional repeated-measures ANOVAs were conducted on those trait measures that were completed only by athletes in certain sports. No significant effect

Table 1 Archers', Golfers', and Long-Distance Runners' Pre-Workshop, Post-Workshop, and Follow-Up Means and Repeated Measures F-Values for Trait Variables

Trait Variable	Time			F
	Pre Workshop	Post Workshop	Follow-Up	
Trait mindfulness (<i>n</i> = 22)	130.32	132.86	138.58	6.00**
Observe	38.55	39.41	40.32	2.15
Describe	30.14	31.09	32.67	3.07+
Act with awareness	30.41	30.73	32.82	4.92*
Accept without judgment	31.23	31.64	32.77	1.41
Thought disruption (<i>n</i> = 21)	51.00	47.86	45.63	2.40
Task-related worries (<i>n</i> = 21)	22.95	20.19	20.37	3.41*
Task-irrelevant thoughts (<i>n</i> = 22)	15.73	15.27	13.59	3.63*
Thoughts of escape (<i>n</i> = 22)	12.64	12.55	11.79	0.29
Sport anxiety (<i>n</i> = 20)	35.70	40.35	34.09	7.31*
Somatic anxiety (<i>n</i> = 21)	13.19	14.48	13.66	0.88
Worry (<i>n</i> = 22)	16.18	15.32	15.55	0.6
Concentration disruption (<i>n</i> = 20)	6.45	6.45	5.80	1.70

+*p* < .10. **p* < .05. ***p* < .01.

of assessment time was found for archers and golfers for any aspect of sport confidence or dimension of flow or for any aspect of trait perfectionism with runners.

Changes Endorsed at Post-Workshop

Feelings Toward Sport. When the athletes were asked on the AQ, GQ, and RQ to rate the extent to which their feelings toward their sport changed since the beginning of the workshop on a 5-point Likert scale ranging from 1 (*not at all*) to 5 (*very much*), the athletes endorsed a mean score of 2.52, reflecting a small to moderate change. Furthermore, on the qualitative item that asked archers and golfers to explain *how* their feelings toward their sport had changed, five participants (1 archer, 4 golfers) gave responses that were classified as reflecting a greater emphasis on understanding and refining the mental aspects of sport. Three participants' (2 archers, 1 golfer) responses were coded into a category describing greater confidence, positive emotion, or self-evaluation related to sport, and three responses (1 archer, 2 golfers) were coded as reflecting increased feelings of relaxation during sport. Two responses (1 archer, 1 golfer) were coded into a category attributing changes in feelings toward sport to improvements in physical condition, sport-related abilities, or form, while one archer's response was classified as describing negative feelings toward sport as a result of physical injury. Finally, when asked to explain *why* they experienced changes in their feelings toward their

sport, seven responses (3 archers, 4 golfers) were classified as attributing changes to the use of mindfulness principles and techniques.

On a similar qualitative item asking participants *how* their feelings toward running had changed, three long-distance runners gave responses that were coded as reflecting increased enjoyment of or participation in running. Two runners described improvements in the ability to relax while running, and one runner expressed an increased emphasis on understanding and refining the mental aspects of running. Furthermore, when asked to explain *why* they experienced changes in their feelings toward running, three runners' responses were classified as attributing changes in their feelings to the use of mindfulness principles and techniques, and two runners gave responses attributing changes in emotions to increased feelings of relaxation.

For all of the athletes combined, the mean rating for the CEM item asking how satisfied they were with their sport performance over the past year was a 6.92 on a 10-point Likert scale ranging from 1 (*not at all satis ed*) to 10 (*very satis ed*), and the mean rating for the item asking how satisfied they were with their current sport performance was 6.79 on an identical scale.

General Anxiety and Life Satisfaction. Using paired-samples *t*-tests, ratings of the frequency of the athletes' general anxiety at follow-up ($M = 2.44$) were found to be significantly lower than their retrospective ratings of their anxiety before the workshop ($M = 3.00$), $t(24) = 2.42$, $p = 0.024$. Ratings of the intensity of the athletes' general anxiety at follow-up ($M = 2.64$) were also found to be significantly lower than retrospective ratings of anxiety before the workshop ($M = 2.12$), $t(24) = 2.40$, $p = 0.025$. The mean ratings for the FQ and FQ-R items asking participants to rate the extent to which MSPE helped them to reduce and cope with anxiety on a 5-point Likert scale ranging from 1 (*not at all*) to 5 (*a great deal*) were 2.21 and 2.52, respectively. Participants also reported significantly greater satisfaction with their lives at follow-up ($M = 4.10$) when compared to retrospective reports of pre-workshop life satisfaction ($M = 3.74$), $t(24) = -2.42$, $p = 0.023$. The mean rating for the item asking participants to rate the extent to which MSPE helped to change their satisfaction with life was a 2.00 on a 1 to 5 scale.

Qualitative analyses were also conducted on archers and golfers' coded responses to open-ended questions that inquired about how the workshop helped to improve *non-athletic* domains of life. Five participants' (2 archers, 3 golfers) responses were coded to reflect the helpfulness of mindfulness and its principles in anxiety/stress reduction, and three participants' (1 archer, 2 golfers) responses were classified as attributing reductions in anxiety to an increased ability to focus. Analysis of open-ended questions about coping with anxiety revealed responses that were coded as describing the helpfulness of mindfulness and relaxation techniques (4 archers, 2 golfers), an improved ability to focus (1 golfer), and heightened feelings of confidence and competency (1 golfer). When asked to explain how the workshop helped to change participants' overall life satisfaction, two participants (1 archer, 1 golfer) gave attributions coded as the application of mindfulness principles to stress reduction, three (2 archers, 1 golfer) described changes in approach toward life, and two (1 archer, 1 golfer) expressed an increased ability to focus.

Similarly, those long-distance runners who indicated workshop-related reductions in stress were asked to provide qualitative responses explaining how the workshop helped them to reduce and cope with anxiety and stress. Seven participants gave responses that were coded as indicating that knowledge of mindfulness

principles and techniques led to reductions in anxiety. When describing the effects of the workshop on coping with anxiety, six participants gave responses indicating that mindfulness principles led to an improved ability to cope.

Finally, long-distance runners were asked to respond to a qualitative item inquiring how the workshop helped them to cope with their life stressors. Five participants' responses described how mindfulness principles led to an improved ability to deal with stressors, while three indicated that an increased ability to relax or cope with stress led to an improved ability to deal with life concerns.

Relationships Between Changes in Sport Performance and Trait Variables

Pearson correlations were conducted with the goal of determining if changes in golfers' best 18-hole round scores and changes in long-distance runners' best mile times were associated with changes in their scores on trait measures from pre-workshop to follow-up. Correlations were not calculated for archers' performance scores due to the small number of archers who participated in the follow-up; similarly, correlations were not calculated for change in golfers' performance in a competition due to the small number of golfers who provided this information during the follow-up. A significant relationship was found between golfers' performance in a practice/friendly round and unambiguous feedback (an aspect of flow) at follow-up, such that the greater the increase in flow, the greater the improvement in scores, $r = -.78$, $p = 0.021$. For long-distance runners, a number of significant correlations were found between performance improvement and increases in describing, the ability to accept without judgment, and overall trait mindfulness, as well as decreases in concentration disruption (an aspect of sport anxiety), concern over mistakes, doubting of actions, and overall perfectionism (see Table 2).

Pearson correlations were also calculated to examine whether changes in golfers' best 18-hole round scores and changes in long-distance runners' best mile times were associated with changes in their scores on trait measures from post-workshop to follow-up. No significant correlations were found between changes in golfers' performance in a practice/friendly round and changes in trait variables from post-workshop to follow-up. One significant correlation was found for long-distance runners, such that greater improvement in mile times from post-workshop to follow-up was associated with decreases in parental expectations (an aspect of trait perfectionism), $r = 0.71$, $p = 0.015$.

Mindfulness Practice and Changes in Sport Performance and Trait Variables

Twenty-one out of 25 participants (84%) reported occasional practice of mindfulness meditation in the year following the workshop. The athletes' mean frequency of weekly mindfulness meditation practice at follow-up was 1.15 times per week (ranging from 0 to 7 times/week), while their mean duration of current practice was 0.42 hours per week (ranging from 0 to 2.50 hours/week). The athletes reported practicing a number of mindfulness exercises in the year following the workshop, most frequently mindful diaphragmatic breathing, but also including the body scan, mindful yoga, sitting meditation, and sport-specific walking meditation.

Table 2 Correlations Between Runners' Performance Change and Changes in Trait Variables From Pretest to Follow Up

Change in Trait Variable (Pretest to Follow-Up)	Change in Best Mile Time (Pretest to Follow-Up)
Trait Mindfulness (<i>n</i> = 10)	-.85**
Observe	-.56 ⁺
Describe	-.76*
Act with awareness	-.60 ⁺
Accept without judgment	-.89**
Thought disruption (<i>n</i> = 9)	0.62 ⁺
Task-related worries (<i>n</i> = 9)	0.44
Task-irrelevant thoughts (<i>n</i> = 10)	-.21
Thoughts of escape (<i>n</i> = 10)	0.56 ⁺
Sport Anxiety (<i>n</i> = 10)	0.57 ⁺
Somatic anxiety	0.24
Worry	0.23
Concentration disruption	0.70*
Trait Perfectionism (<i>n</i> = 10)	0.74*
Concern over mistakes	0.69*
Personal standards	0.30
Parental expectations	0.41
Parental criticism	-.27
Doubting of actions	0.75*
Organization	-.10

⁺*p* < .10. **p* < .05. ***p* < .01.

Analysis of archers' and golfers' coded qualitative responses was conducted with the goal of understanding why certain athletes practiced mindfulness skills infrequently. Three participants indicated a lack of perceived benefit from the practice of mindfulness, three described difficulty establishing a routine or becoming motivated for mindfulness practice, three described time constraints, and one response indicated difficulty achieving a mindful state. Among long-distance runners, four participants attributed their lack of practice to time constraints or a desire to participate in other activities, and three participants indicated difficulty becoming motivated to practice mindfulness, or a lack of interest in continuing with mindfulness practice.

Pearson correlations were used to investigate the hypothesis that greater practice of mindfulness exercises in the year following the workshop would be associated with greater changes in both sport performance and trait variables (subtracting post-workshop from follow-up scores). No significant correlations were found between total duration of mindfulness practice and change in any trait variables

from post-workshop to follow-up. Similarly, no significant correlations were found between duration of mindfulness practice and changes in golfers' and long-distance runners' sport performance from post-workshop to follow-up.

In order to better understand the relationship between mindfulness practice and change in trait variables, scores on overall trait mindfulness, sport anxiety, and thought disruption were plotted at all three assessment time points for three athletes who endorsed current practice of mindfulness exercises at follow-up and three athletes who reported that they were not practicing mindfulness at follow-up and who described a lack of interest or perceived value in regular mindfulness practice. No archers were included among the subset of athletes who endorsed mindfulness practice, as all of the archers who participated in the follow-up reported no mindfulness practice at follow-up. Visual inspection of the data failed to yield differences in patterns of change in trait mindfulness between those who practiced mindfulness at follow-up and those who did not practice mindfulness. Similarly, all six participants exhibited decreases in overall sport anxiety from pre-workshop to follow-up, with no evident differences in patterns of change in overall sport anxiety across assessment time points. However, visual inspection of the data suggests that athletes who reported mindfulness practice at follow-up exhibited sharper declines in overall thought disruption during sport from pre-workshop to follow-up than those who did not report practicing mindfulness.

Discussion

The purpose of the present study was to investigate the long-term effects of MSPE across different populations of athletes. This study is notable for its use of a one-year follow-up interval, and to our knowledge, the current study constitutes the first follow-up assessment conducted on a mindfulness-based intervention for athletic performance enhancement.

Although the athletes who participated in Kaufman et al.'s (2009) and De Petrillo et al.'s (2009) studies did not exhibit performance improvement at post-test, it was hypothesized that participants could show improvement with continued mindfulness practice. Significant performance improvement was demonstrated for long-distance runners' mile times from pretest to follow-up and from posttest to follow-up. Despite findings of lack of change in golfers' 18-hole round scores from pre-workshop to follow-up, it appears that golfers' scores decreased significantly during the year following the workshop. Although there was no control group, this finding of significant performance change is consistent with the growing body of evidence indicating that mindfulness and acceptance-based sport interventions have the potential to enhance athletic performance (Bernier et al., 2009; Gardner & Moore, 2004, 2007; Lutkenhouse et al., 2010; Moore, 2009; Schwanhausser, 2009; Wolanin & Schwanhausser, 2010).

No changes were found in golfers' reported 18-hole round scores from pretest to follow-up. It is possible that different results would have been obtained if sport performance had been assessed in an alternate manner. Specifically, the comparison of athletes' best performance scores in the years before and after the MSPE workshop may not have been the optimal way of assessing changes in sport performance. Future evaluations of mindfulness-based interventions for athletes may find average scores to be a more valid index of athletic performance.

Post-workshop feedback from Kaufman et al.'s (2009) and De Petrillo et al.'s (2009) participants suggested that certain athletes experienced an increased enjoyment of and desire to participate in their sport following the conclusion of the MSPE workshop. The athletes' qualitative responses at follow-up reflected greater emphasis on understanding and refining the mental aspects of sport, greater confidence or positive emotion toward sport, and increased feelings of relaxation. Of note, more than half of the archers and golfers attributed changes in feelings toward their sport to the mindfulness principles and techniques taught in the workshop. At first glance, qualitative responses reflecting increased relaxation, confidence, and positive emotion may seem to contradict findings of increases in trait mindfulness. Unlike relaxation training, which is designed to reduce physiological arousal, mindfulness promotes the awareness and nonjudgmental acceptance of internal states. Nonetheless, although relaxation is not a goal of mindfulness-based interventions, the experience of relaxation is a relatively common outcome of mindfulness practice (Baer, 2003). Kabat-Zinn (1990) has noted that mindfulness-based interventions may result in improvements in the ability to relax, as well as increases in positive emotions toward oneself and the world. Consequently, outcomes suggested by qualitative data may not be incompatible with quantitative findings of increases in trait mindfulness. To further clarify this issue, future research on MSPE should investigate whether certain athletes may be using mindfulness exercises in the service of emotional, cognitive, and physiological control.

The vast majority of participants practiced mindfulness exercises sporadically in the year following the workshop, if at all. Kabat-Zinn (1990) emphasizes the importance of mindfulness practice in the development of positive mental and behavioral outcomes and recommends that mindfulness exercises be practiced at least 45 minutes each day, six days per week. Consequently, there remains a possibility that even greater performance improvement and involvement in sport would have been observed if participants had been more committed to continuing with mindfulness practice past the workshop. Future studies may wish to investigate the benefit of providing additional "booster sessions" in the months following mindfulness-based interventions for athletes, so as to reinforce previously learned skills and promote a commitment to continued mindfulness practice.

Statistical analyses in the present investigation combined archers, golfers, and long-distance runners whenever possible, in order to increase the power of the analyses and provide an index of long-term MSPE outcomes across divergent groups of athletes. The athletes reported significant increases in the ability to act with awareness and overall trait mindfulness and significant decreases in task-related worries and task-irrelevant thoughts (both aspects of cognitive interference during sport) from pretest to follow-up. It is noteworthy that the athletes also reported changes on several trait variables from post-workshop to follow-up, suggesting that change continued to occur in the year following the workshop.

A large body of evidence suggests that attempts to suppress unwanted thoughts may lead to cognitive interference, as thought suppression paradoxically increases the frequency of the thoughts the person wishes to avoid (Wegner, 1994). This theory has important implications for the field of sport psychology, as traditional performance enhancement techniques encourage the control of unwanted thoughts (e.g., Gardner & Moore, 2006; Whelan, Mahoney, & Meyers, 1991; Williams & Leffingwell, 1996). The current findings suggest that the willingness to experience

task-relevant worries, task-irrelevant concerns, and occasional disruptions in concentration may contribute to reductions in the frequency of negative thoughts detrimental to sport.

The results of the present study further add to the body of literature suggesting that mindfulness and acceptance-based sport psychology interventions lead to increases in mindful attention and awareness (e.g., De Petrillo et al., 2009; Kaufman et al., 2009; Schwanhausser, 2009). Findings of significant increases in overall trait mindfulness and the ability to act with awareness from post-workshop to follow-up are particularly interesting, considering participants' infrequent practice of mindfulness in the year following the workshop. The ability to act with awareness may be a very important target for athletes seeking to enhance their sport performance, since mindful absorption in athletic tasks is necessary for functional sport performance (Gardner & Moore, 2006).

Findings of lack of change in dispositional flow were unexpected, given past studies that relate interventions such as MSPE and MAC to increases in dispositional and state flow (Kaufman et al., 2009; Lutkenhouse et al., 2010; Schwanhausser, 2009). These findings may be partly explained by athletes' infrequent practice of mindfulness in the year following the workshop, since it has been suggested that mindfulness may promote the experience of flow during sport (Gardner & Moore, 2004; Kaufman et al., 2009; Kee & Wang, 2008). Nonetheless, a significant relationship was obtained for improvement in golfers' 18-hole round scores and increased unambiguous feedback. This finding offers further support for the relationship between the flow construct and heightened performance in sport (Csikszentmihalyi, Abuhamdeh, & Nakamura, 2005; Jackson & Eklund, 2002). It seems possible that MSPE, with its emphasis on mindfulness of present-moment attention, may promote greater awareness of external, internal, and kinesthetic cues during sport. In turn, this greater awareness of sensory feedback may facilitate performance improvement (Jackson & Csikszentmihalyi, 1999). Given the large number of correlations calculated for golfers and the few significant findings, however, it is possible that the significant relationship between heightened performance and flow was achieved by chance alone. Given findings of lack of change in dispositional flow from pretest to follow-up, further research is needed to determine if MSPE is associated with increases in dimensions of flow, and if increased flow, in turn, is related to improvements in sport performance.

Findings of significant relationships between improvement in long-distance runners' mile times and increased mindfulness further support the notion that optimal performance might not be reached through exerting control over internal states, but rather through awareness and acceptance of the present moment (e.g., Gardner & Moore, 2004, 2007; Moore, 2009). The significant relationship between improvement in mile times and an increased ability to accept without judgment is particularly interesting, as long-distance runners frequently struggle with fatigue, boredom, and pain. For this athlete population, the ability to accept uncomfortable internal states without judging and attempting to change these states may be necessary for optimal performance. Similarly, improvement in mile times was associated with decreased concern over mistakes, doubting of actions, and overall trait perfectionism, thereby adding to the body of literature associating perfectionism with suboptimal athletic performance (Flett & Hewitt, 2005). Interestingly, concern over mistakes and doubting of actions both seem to reflect negative evaluations of

oneself and one's experiences. Just as the ability to accept one's experience without judgment may improve runners' sport performance, nonjudgmental acceptance may also serve to reduce the negative self-rumination characteristic of trait perfectionism. In turn, these reductions in trait perfectionism may further promote the enhancement of long-distance runners' athletic performance. The analyses performed in this study were correlational in nature; therefore, causal conclusions cannot be made.

The present study also examined the relationships between the duration of participants' mindfulness practice and changes in both trait variables and sport performance from posttest to follow-up, but no significant relationships were found. These results are not entirely surprising, given participants' infrequent practice of mindfulness in the year following the workshop. Although visual inspection of the data suggested greater declines in overall thought disruption from pretest to follow-up among athletes who endorsed mindfulness practice at follow-up, athletes' practice of mindfulness at follow-up did not seem to be associated with different patterns of change in trait mindfulness or overall sport anxiety. Given the emphasis that is placed on frequent practice of mindfulness in order to achieve desired mental and behavioral outcomes (Kabat-Zinn, 1990), it is difficult to interpret how the athletes achieved greater trait mindfulness and improved sport performance without concomitant mindfulness practice. It seems unlikely that the four-week duration of the MSPE workshop was sufficiently powerful to render additional mindfulness practice unnecessary in the year following the workshop. Consequently, there remains a possibility that regular mindfulness practice is not necessary to maintain desired mental and performance outcomes among athletes, or that other factors such as demand characteristics may partly account for the present results. Future research would benefit from further investigating the utility of regular mindfulness practice for athletes, as well as the relationship between mindfulness practice, trait variables, and sport performance in athletes who are more motivated to engage in continued practice of mindfulness exercises.

De Petrillo et al. (2009) reported that a large percentage of participants described the application of mindfulness skills to stress reduction and overall well-being. Although general anxiety and life satisfaction were not specific targets of the MSPE workshop, it was hypothesized that repeated mindfulness practice both during and after the workshop might lead to unexpected changes in these non-athletic domains. In accordance with this hypothesis, the athletes reported significant decreases in the frequency and intensity of their general anxiety and significant increases in their life satisfaction at follow-up when compared to retrospective ratings of these traits before the workshop. Although we cannot conclude that the workshop was directly responsible for decreased general anxiety and increased life satisfaction, analysis of qualitative responses indicated that many of the athletes found mindfulness principles and techniques to be helpful in both reducing and coping with anxiety. Future research seeking to draw a causal relationship between mindfulness-based sport interventions and lower anxiety may benefit from investigating whether an association exists between frequency of mindfulness practice in athletes and reductions in ratings of general anxiety.

Taken together, the present findings continue to suggest that MSPE is a promising intervention for athletic performance enhancement. The current study has its limitations, however, including small sample sizes, which led to low power to detect significant findings. In addition, although the athletes who participated in this

follow-up study exhibited few differences on pre- and post-workshop assessments from those who chose not to participate in the study, the self-selection of athletes into the follow-up study raises the question of whether the present findings can be generalized to the wider sample of athletes who participated in the MSPE workshop. Similarly, given the athletes' infrequent practice of mindfulness exercises, there remains a possibility that findings of increases in trait mindfulness and decreases in thought disruption and sport anxiety may be better accounted for by demand characteristics of the study.

Future studies on MSPE are currently planned that would extend the length of the intervention to eight weeks, and thus be similar to empirically-supported mindfulness-based interventions for physical and psychological problems (e.g., Kabat-Zinn, 1990; Segal et al., 2002), as well as the MAC program for performance enhancement (Gardner & Moore, 2004, 2007). It is possible that eight sessions may constitute the minimal amount of time needed to achieve a commitment to, understanding of, and integration of mindfulness. Future research would also benefit from using a standardized metric to quantify athletic performance, such as coaches' ratings of athletes' performance (Gardner & Moore, 2007; Lutkenhouse et al., 2010; Wolanin & Schwanhausser, 2010). Finally, future studies of MSPE should recruit athletes who participate in team sports, where the strong competitive and/or social natures of their sports may increase their engagement in sport psychology interventions. In addition, research on MSPE should be extended to populations of elite athletes. Such athletes, who could be highly motivated to improve their athletic performance, may be especially likely to commit to continued mindfulness practice and thus benefit more from MSPE.

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