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Validation of a Single-Item Stem for Collective Efficacy Measurement in Sports Teams

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Abstract

The validity and reliability of an operational stem for single-item collective efficacy measurement was examined across three studies in sport. Study one used a cross-sectional design with team sports participants to assess the stem's validity by examining the ability of the Collective Efficacy Questionnaire for Sports (CEQS), Group Environment Questionnaire (GEQ), and previous performance (win %) to predict single-item collective efficacy scores. Total CEQS scores predicted single-item scores ($\beta = .69$), with the CEQS Ability ($\beta = .51$) and Persistence ($\beta = .15$) subscales the only significant predictors of single-item score. Previous performance ($\beta = .41$) and three GEQ dimensions; Individual Attractions to the Group-Task ($\beta = .18$), Group Integration-Task ($\beta = .22$), and Group Integration-Social ($\beta = .16$) were also significant predictors of single-item collective efficacy. Study two examined the validity and reliability of the stem using an intervention with team sports participants in a laboratory-based design. The single-item measure demonstrated high concordance (pre-intervention; $r = .53$, post-intervention; $r = .73$) and reliability ($r = .77, .62$) with CEQS scores. Study three assessed the validity and reliability of the stem using an intervention with team sports participants in a field-based design. The single-item measure reported high concordance (pre-intervention; $r = .74$, post-intervention; $r = .69$) and reliability ($r = .88, .87$) with CEQS scores. The studies support the stem as valid and reliable for single-item collective efficacy measurement with team sports players.

Key words: collective efficacy, operational stem, single-item measurement, validity, reliability

1 **Validation of a Single-Item Stem for Collective Efficacy Measurement in Sports Teams**

2 Bandura (1982, 1997) suggested that humans often work together towards collective
3 objectives in groups or teams and have collective efficacy beliefs regarding their functional
4 abilities for specific tasks. Collective efficacy is defined as “a group’s shared belief in its
5 conjoint capability to organize and execute the courses of action required to produce given
6 levels of attainment” (Bandura, 1997, p. 477). Meta-analyses consistently indicate collective
7 efficacy has a positive effect upon performance of groups (see e.g., Gully, Incalcaterra, Joshi,
8 & Beaubien, 2002; Stajkovic, Lee, & Nyberg, 2009), a finding that has been replicated in
9 both laboratory (e.g., Greenlees, Graydon, & Maynard, 2000) and field-based settings with
10 sports teams (e.g., Myers, Feltz, & Short, 2004).

11 Collective efficacy has been conceptualized (and subsequently analyzed) both at an
12 individual (e.g., Heuze, Sarrazin, Masiero, Raimbault, & Thomas, 2006) and group level
13 (e.g., Gibson, 1999). Bandura (1997) advocates that each team member’s belief in the team’s
14 overall capabilities be considered, and these individual measures aggregated to the team
15 level. Therefore, both individual and group level approaches are suitable for use with
16 collective efficacy measurement, with the choice of level contingent on the situation involved
17 (i.e., suited to the specific context). Aggregated collective efficacy details a group’s overall
18 beliefs, but does not consider individual differences within the group (Shearer, Holmes, &
19 Mellalieu, 2009). Given that collective efficacy is ultimately measured through individual
20 cognitions, in the current paper we adopted an individual-level approach to the manipulation,
21 measurement, and analysis of collective efficacy perceptions.

22 A key aspect of using psychometric tools to measure social psychological constructs
23 such as collective efficacy is the wording of the operational stem, which represents the
24 beginning part of an item that presents the issue about which the question is asking (Roe,
25 2008). In collective efficacy research, different stems have been used to direct the

participant's focus towards either their own beliefs about the team, or what they perceive the team thinks (cf. Bandura, 1997; Lindsley, Brass, & Thomas, 1995). In Short et al.'s (2002) examination of the difference between these two operational methods, the first stem assessed individual perceptions of a team's collective efficacy (*'rate your confidence that your team...'*), whereas the second asked the respondent to consider their team's perceptions (*'rate your team's confidence...'*). No significant differences were reported between the two operational stems, and consequently, the stem *'rate your team's confidence...'* was used for the Collective Efficacy Questionnaire for Sports (CEQS; Short, Sullivan, & Feltz, 2005). Short, Sullivan, et al. suggested that this stem accounts for an individual's perceptions about their team, which is different to the cognitions they experience as individuals inside/outside the team context (e.g., perceptions of their individual performance).

In terms of questionnaire structure, the majority of literature has measured collective efficacy using multi-item instruments that assess an athlete's confidence in their team's ability to perform significant game competencies (e.g., Myers et al., 2004). Studies have suggested that psychometric concerns regarding single-item instruments make them inappropriate for use with multidimensional constructs such as collective efficacy (see e.g., Loo, 2002). However, empirical support does exist for the use of single-item measures, suggesting they are appropriate for use in certain circumstances (e.g., Jordan & Turner, 2008; Kwon & Trail, 2005; Nagy, 2002). First, single-items have increased face validity in comparison to multi-item measures, particularly when the respondent deems the item representative of the construct as a whole (Nagy, 2002). Single-item measures are easier to interpret than their multi-item counterparts and if an individual understands the requirements of a measurement tool (i.e., what is being asked of them) they are more likely to provide a response. Second, single-items eliminate item redundancy and therefore reduce the fatigue, frustration, and boredom associated with answering similar questions repeatedly (Robins,

Hendin, & Trzesniewski, 2001). Finally, measures of this type lower the chance of common method variance (Gardner, Cummings, Dunham, & Pierce, 1998), where imitative correlations are observed due to the use of the same response format rather than the content of items (Williams, Cote, & Buckley, 1989).

Single-item measures hold advantages over multi-item measures in a number of practical circumstances. For example, when considering team performance in sport where time is constrained, single-item measures allow for in-game measurement. This is intuitively attractive, as group constructs such as collective efficacy comprise state beliefs that may vary during an event. Due to the short response time accompanying single-item measurement, they are ideally suited to the collection of quantitative data in research projects with large target populations (e.g., longitudinal studies; cf. Jordan & Turner, 2008). In addition, as the readiness of participants to complete questionnaires decreases as item numbers increase (Bean & Roszkowski, 1995; Edwards, Roberts, Sandercock, & Frost, 2004), single-item measures ensure maximal adherence of participants and prevent the likelihood of response set bias.

Single-item instruments also offer opportunities for the exploration of novel research domains beyond those currently available using traditional multiple-item scales. For example, studies have used individual items from existing multi-item psychometric scales as stimuli to trigger the brain activation associated with a specific psychological process (see e.g., Dimoka, 2011). Indeed, to comprehensively understand human processes and social constructs, such as collective efficacy, further integration of both brain and behavior assessment has been advocated (cf. Dimoka). In addition to the considerable literature examining behavioral and cognitive variables associated with collective efficacy (see Chow & Feltz, 2008 for a review in sport), the neuropsychological mechanisms that underpin individual perceptions of collective efficacy within groups have been considered (see Shearer

et al., 2009 for a full review). While studies have yet to directly examine the neural activity associated with the development of collective efficacy beliefs, neural correlates of other social psychological processes such as empathy (e.g., Carr, Iacoboni, Dubeau, Mazziotta, & Lenzi, 2003), and emotional recognition have been considered (e.g., Thom et al., 2012). The neuroscience literature shows that human processes activate many brain areas, and in turn, brain areas are activated by many different processes (Poldrack, 2006). A complex construct such as collective efficacy would therefore typically map onto more than one brain area, complicating the neural matching process.

Mapping of human processes to brain areas is accomplished by engaging participants in specific actions and observing their corresponding brain activations (Dimoka, 2011). To measure the neural correlates of collective efficacy it is necessary to stimulate individual perceptions over a short time period as this will heighten neural activity for the brain areas involved with collective efficacy development. A recent study has used observation-based interventions to enhance individual collective efficacy in team sports players in this manner (see Bruton, Mellalieu, & Shearer, 2014). In order to improve the measurement of psychological processes and their corresponding neural activity, it is suggested that psychometric scales need to be integrated with functional neuroimaging methods (cf. Dimoka). The instantaneous, simple response format associated with single-item instruments makes a single-item collective efficacy measure ideal for use with observation interventions and fMRI protocols. Combined, these two methods are likely to evoke a strong collective efficacy response and will allow for the collection of psychometric and brain mapping data simultaneously, permitting the accurate measurement of the neural activity associated with collective efficacy development.

According to Bandura (2006), all efficacy measures should be designed specifically for the intended context under examination. It is therefore unfeasible to create a single item

collective efficacy instrument that can be used in all contexts. To improve consistency between future studies, the alternative option is to employ a standardized operational stem that can be combined with any situational-specific context to form a single-item measure of collective efficacy. The current investigation reports the validation of an existing stem for use with single-item collective efficacy measurement across three studies using team sports participants. We chose the stem used with the CEQS (Short et al., 2005) '*Rate your team's confidence in their ability to...*' for this investigation. Study one examines the concurrent, convergent, and predictive validity of the stem incorporated in a single-item collective efficacy measure for use with competitive sports teams. Specifically, comparisons are made with validated full form measures of collective efficacy and team cohesion in a cross-sectional design with team sports participants. In study two the stem was included in a single-item measure for a laboratory-based task to manipulate the direction (positive, neutral, or negative) of collective efficacy beliefs with team sport participants. Concurrent and predictive validity of the measure was examined, along with test-retest reliability. Finally, study three assessed the validity and reliability of the stem (concurrent and predictive validity and test-retest reliability) using a field-based intervention design with interdependent team sports players.

Study 1

To test concurrent validity of the stem we examined the predictive capabilities of the CEQS towards the single-item measure. As the two instruments were hypothesized to measure the same construct, we suggested that both CEQS composite and subscale scores would predict single-item scores. To test the convergent validity of the stem we examined the predictive capabilities of the Group Environment Questionnaire (GEQ) towards the single-item measure. As collective efficacy and task cohesion exhibit a strong relationship (e.g., Kozub & McDonnell, 2000), we hypothesized that the two task components of the GEQ would

predict single-item collective efficacy scores. To test the predictive validity of the stem we examined the predictive capabilities of previous performance (win percentage over the previous three results) towards the single-item measure. As team performance is reported to predict collective efficacy (see Stajkovic et al., 2009, for a meta-analysis), we hypothesized that previous performance would predict single-item scores.

Method

Participants

311 interdependent sports team players ($M_{\text{age}} = 21.69$, age range: 16-54) were sampled from a variety of interdependent team sports in the United Kingdom and Ireland, including; football ($n = 96$), rugby ($n = 81$), hockey ($n = 42$), netball ($n = 28$), basketball ($n = 20$), cricket ($n = 19$), lacrosse ($n = 9$), badminton ($n = 7$), Australian rules ($n = 4$), American football ($n = 4$), and handball ($n = 1$). On average participants had played for their current team for 3.63 years ($SD = 2.77$ years). The competitive level of the teams represented comprised collegiate ($n = 244$), amateur ($n = 61$), and semi-professional ($n = 6$).

Measures

Single-Item Measure of Collective Efficacy. For the present study the stem was combined with a secondary component to form a single-item measure of collective efficacy for use with competitive sports teams: *'Rate your team's confidence in their ability to perform to a high level, in order to achieve success in their next competitive performance'*. The additional component of the item accounts for Bandura's (2006) recommendations that measures be phrased in terms of "can do" rather than "will do", treat efficacy beliefs as a state, and include information regarding the specific domain of functioning (i.e., competitive team sports performance). All responses to the single-item measure were rated on a confidence scale between 0 (not at all confident) and 100 (completely confident).

Collective Efficacy Questionnaire for Sports (CEQS). The CEQS (Short et al., 2005) was used as a validated measure of collective efficacy for comparison with the single-item measure. The CEQS is a 20-item questionnaire consisting of five factors (effort, persistence, ability, preparation, and unity) that can be combined to create a composite collective efficacy score. Ratings were made on a 10-point rating scale ranging from 0 (not at all confident) to 9 (completely confident). Construct validation of the measure with college-age student-athletes (Short et al.) using confirmatory factor analysis has indicated that the model is robust (CFI = .92, NNFI = .90, SRMR = .06), the exception being the error of approximation statistic (RMSEA = .10), which represents a mediocre fit (see Browne & Cudeck, 1993). Short et al. also reported strong internal reliability (α range = .81 - .96), with similar findings evident for our study: Ability (α = .93), Effort (α = .83), Unity (α = .80), Persistence (α = .81), Preparation (α = .85).

The Group Environment Questionnaire. The GEQ (GEQ; Carron, Widmeyer, & Brawley, 1985) was used to assess group cohesion for comparison with collective efficacy results for the single-item measure. The GEQ is an 18-item questionnaire consisting of four factors: Individual Attractions to the Group-Task (ATG-T), which reflects a member's feelings about their personal involvement with the group's task; Individual Attractions to the Group-Social (ATG-S), which reflects a member's feelings about their personal social interaction with the group; Group Integration-Task (GI-T), which reflects a member's perceptions of the similarity and unification of the group as a whole around their tasks and objectives; Group Integration-Social (GI-S), which reflects a member's perceptions of the similarity and unification of the group as a social unit. Responses are made on a 9-point likert scale between 1 (strongly disagree) and 9 (strongly agree). The original study reported acceptable internal reliability for each of the GEQ factors (α range = .64 - .76) with mixed

findings evident for this study: ATG-T ($\alpha = .60$), ATG-S ($\alpha = .57$), GI-T ($\alpha = .48$), GI-S ($\alpha = .73$).

Previous Performance. As performance outcome (win/loss) predicts collective efficacy levels (Feltz & Lirgg, 1988), participants recorded their team's performance record for their three most recent competitive performances to form a win percentage (cf. Bruton, Mellalieu, Shearer, Roderique-Davies, & Hall, 2013).

Procedure

Ethical approval was granted by a university ethics committee for all three studies, and all participants provided informed consent before taking part. Prior to the beginning of the competitive season the research team created a questionnaire pack that included a demographic sheet, the single-item measure, the CEQS, and the GEQ. During the competitive season interdependent sports team players were provided with a link to an online version of the questionnaire pack, developed using an online-survey provider (www.surveymonkey.com). Prior to participation individuals were informed that their involvement in the study was voluntary, there was no correct/incorrect answer to any of the questions provided, and that answers would remain strictly confidential and securely stored on computers within the university department of the research team. The online questionnaire pack took approximately ten minutes to complete.

Data Analysis

All statistical procedures for the studies were conducted using a minimum significance level of $p = 0.05$. First, data were screened for univariate normality, multivariate normality, and multicollinearity. Second, using Miller, Meier, Muehlenkamp, and Weatherly's (2009) recommendations, regression analyses were used to examine validity. Specifically, two simple regression analyses were used to examine whether composite CEQS score and previous performance (win %) predicted single-item collective efficacy

respectively. Similarly, two forced entry multiple regression analysis were used respectively to examine whether CEQS subscales and GEQ dimensions were predictive of collective efficacy measured using the single-item (i.e., the direction and relative contribution of each variable towards the variance in collective efficacy scores).

Results

Data Screening

Cook's distances were used to examine the assumptions of multivariate normality, with a value greater than 1 indicative of multivariate outliers (cf. Cook & Weisberg, 1982). For all regression analyses Cook's distance values were below 1 with a maximum value of 0.24, indicating that no single case had a large influence on the respective model, leaving 311 cases for each analysis. The VIF values were all below 10 with an average close to 1, and the tolerance statistics were above 0.2, indicating no collinearity within the data.

Concurrent Validity

The relationship between collective efficacy responses to the CEQS and the single-item measure were assessed using two regression analyses. The first simple regression analysis identified that the composite CEQS score accounted for 48% of variability in collective efficacy using the single-item measure ($\beta = .69$, R^2 change = .48, $F_{1-309} = 280.28$, $p < 0.001$). The second multiple regression analysis reported that CEQS subscales accounted for 56% of variability in collective efficacy measured using the single-item. The analysis identified that Ability ($\beta = .51$, R^2 change = .56, $F_{5-305} = 76.14$, $p < 0.001$) and Persistence ($\beta = .15$, R^2 change = .56, $F_{5-305} = 76.14$, $p < 0.05$) subscales of the CEQS were the only significant predictors of collective efficacy using the single-item.

Convergent Validity

The relationship between group cohesion and collective efficacy was assessed using a multiple regression analysis. The regression analysis reported that the GEQ dimensions

accounted for 17% of variability in collective efficacy. ATG-T ($\beta = .18$, R^2 change = .17, $F_{4-306} = 15.15$, $p < 0.01$), GI-T ($\beta = .22$, R^2 change = .17, $F_{4-306} = 15.88$, $p < 0.01$), and GI-S ($\beta = .16$, R^2 change = .17, $F_{4-306} = 15.88$, $p < 0.05$) dimensions were identified as significant predictors towards single-item collective efficacy scores. The ATG-S dimension was not a significant predictor of the single-item score ($p > 0.05$).

Predictive Validity

The relationship between previous performance and collective efficacy was assessed using a simple regression analysis. The regression analysis reported that 17% of variability in collective efficacy was accounted for by Previous Performance scores ($\beta = .41$, R^2 change = .17, $F_{1-309} = 63.84$, $p < 0.001$).

Discussion

In study one, concurrent validity for the operational stem was supported with composite CEQS scores identified as a significant predictor of collective efficacy measured using the single-item. The findings also supported the convergent validity for the stem, with the ATG-T, GI-T, and GI-S components of the GEQ identified as significant predictors of single-item collective efficacy. Finally, the predictive validity of the stem was demonstrated with previous performance predicting single-item collective efficacy scores.

Study 2

To further test the concurrent and predictive validity of the stem we examined the relationship between the CEQS and the single-item measure before and after an intervention designed to manipulate collective efficacy. Recent research has shown observation interventions can be used to manipulate collective efficacy beliefs in teams (Bruton et al., 2014), therefore, group-specific observation interventions (positive/neutral/negative) were tailored to manipulate collective efficacy beliefs. The single-item measure was predicted to distinguish collective efficacy scores according to the expected direction of the intervention

effects. Specifically, individuals allocated to a negative observation condition would experience decreased efficacy, allocation to the neutral condition would result in no change, and allocation to a positive condition would increase efficacy. Finally, test-retest reliability of the stem was investigated using pre- and post-intervention single-item scores for two subsamples. Based on the procedures adopted when examining test-retest reliability for a previously developed anxiety measure (cf. Williams, Morlock, & Feltner, 2010), the first sample included participants that experienced little/no change in CEQS scores (≤ 0.2) between pre- and post-intervention measures. As the simple regression from study one showed CEQS scores predicted single-item scores, participants that exhibit little/no change in CEQS scores were predicted to show little/no change in single-item scores. Based on the assumption that the neutral intervention would have no effect on collective efficacy perceptions, the second sample included participants allocated to the neutral intervention condition. A positive correlation was predicted to exist between pre- and post-intervention collective efficacy scores for the single-item measure for both samples.

Method

Participants

One hundred and thirty three undergraduate students ($M_{\text{age}} = 20.63$ years, $SD_{\text{age}} = 1.84$ years) from a higher education institution in South Wales, UK were recruited via opportunity sampling. Each participant played in an interdependent team sport, including; rugby union ($n = 42$), soccer ($n = 36$), field hockey ($n = 24$), basketball ($n = 18$), and netball ($n = 13$), ensuring a degree of familiarity with teamwork, physical activity, and group dynamics (i.e., collective beliefs).

Measures

Single-Item Measure of Collective Efficacy. In this study the stem was combined with a secondary component to form a single-item measure of collective efficacy for use with

the experimental task: *'Rate your team's confidence in their ability to complete the obstacle course in the shortest possible time'*. In line with the procedure of study one the second component of the single-item measure was constructed to account for Bandura's (2006) guidelines for the development of efficacy scales. All responses to the single-item measure were rated on a confidence scale between 0 (not at all confident) and 100 (completely confident) using an adaptive visual analogue scale (see Marsh-Richard, Hatzis, Mathias, Venditti, & Dougherty, 2009 for a full description of this measurement type).

Collective Efficacy Questionnaire for Sports. As in study one, the CEQS (Short et al., 2005) was employed as a criterion measure for individual-level perceptions of collective efficacy. Cronbach alpha coefficients indicated adequate internal reliability for the sample: Ability ($\alpha = .89$), Effort ($\alpha = .84$), Unity ($\alpha = .81$), Persistence ($\alpha = .83$), and Preparation ($\alpha = .80$).

Procedure

The experiment was fifteen-days in duration with participants required to attend the laboratory on day one and day fifteen respectively. To maximize motivation participants were told that they were to participate in a UK-wide experiment on teamwork, competing in a complex task requiring balance, co-ordination, and communication, characteristics desirable in the performance of sports teams. To ensure the task was competitive teams were led to believe that they were participating as representatives of their university against other university teams. This was established by showing the participants a false datasheet, with a large sample size and names of UK-wide universities.

A single-blinded randomized design was adopted identical to that used in a recent collective efficacy investigation (see Bruton et al., 2014 for detailed information). Members of the same sports team were placed into teams of three and randomly and blindly allocated to one of three treatment groups (i.e., positive, $n = 16$; neutral, $n = 14$; or negative, $n = 15$).

Once assembled each team participated in three practice trials for an obstacle-based task (Figure 1), after which they were provided with a false average performance time lying in the middle tenth of a fictitious database across other UK universities. Participants were asked to return to the laboratory in fourteen days time and informed that they would participate in a competitive trial to be used for the UK wide experiment. All practice sessions were video recorded for the purpose of developing team-specific video interventions during this fourteen-day break period. The interventions were condition-based, meaning groups allocated to the positive condition viewed positive video clips of their team (i.e., footage displaying five examples of successful team performance for obstacles used in the task) and groups allocated to the negative condition viewed negative video clips of their team (i.e., footage displaying five examples of unsuccessful team performance for obstacles used in the task) collected from their respective practice performances. For the neutral condition a standardized video intervention was adopted displaying footage depicting the layout of the obstacle course used in the experimental task.

When participants returned to the laboratory on day 15, they were reminded of both the task requirements and their mediocre results in the practice trials. Each of the teams completed the CEQS and the single-item measure for the first time (pre-intervention), after which they were informed they would take part in the competitive trial in thirty minutes. Upon completion of this first measure, their respective intervention strategies were administered. Once the intervention was complete, collective efficacy responses were recorded for the second time (post-intervention) using the CEQS and single-item measure and the participants debriefed about the real purpose of the experiment.

Data Analysis

Data was screened for normality and homogeneity of variance using the Shapiro-Wilk test and Levene's test respectively. A bivariate, one-tailed Pearson's correlation was used to

examine the relationship between the collective efficacy scores for the single-item measure and the composite and subscale scores for the CEQS. In addition, confidence intervals were computed for all of the correlations. A mixed 3 x 2 (*condition* x *time*) model analysis of variance (ANOVA) was used to examine the predictive validity of the single-item collective efficacy scores for main effects and interactions of the independent variables. Specifically, *condition* (*positive/neutral/negative*) was used as the between-subjects factor, while *time* (*pre-intervention/post-intervention*) was used as the within-subjects factor. Simple planned contrasts were used to make comparisons between time (reference category: pre-intervention) and condition (reference category: negative). Test-retest reliabilities for the single-item scores were computed for the two aforementioned subsamples. Intraclass correlation coefficients (ICCs) were computed using a two-way (*participants* x *time*) random effects ANOVA as recommended by Williams et al. (2010) in their design examining the validity of a single-item anxiety measure.

Results

Data Screening

Collective efficacy data for each group was screened for assumptions of normality both pre- and post-intervention. The Shapiro-Wilk test identified CEQS and single-item measure scores for the positive ($D(48) = .95-.99, p > .05$), neutral ($D(41) = .94-.97, p > .05$), and negative groups ($D(44) = .90-.98, p > .05$), as normal at both time points. The Levene's test reported equal variance in CEQS and single-item measure scores for all conditions both pre- ($F(2, 130) = 0.38, 2.45, p > .05$) and post-intervention ($F(2, 130) = 5.20, 7.43, p > .05$).

Concurrent Validity

The single-item measure reported significant correlations with the criterion measure for collective efficacy. Specifically, the single-item scores were highly correlated with the composite CEQS scores both pre- ($r = .48, p < .001, 95\% \text{ CI } [.34, .60]$) and post-intervention

($r = .73, p < .001, 95\% \text{ CI } [.64, .80]$). The single-item also correlated strongly with each of the five subscales for the CEQS at both time points. At pre-intervention the strongest correlation was reported for Ability ($r = .50, p < .001, 95\% \text{ CI } [.36, .62]$, with additional positive correlations for Preparation ($r = .39, p < .001, 95\% \text{ CI } [.24, .53]$, Persistence ($r = .35, p < .001, 95\% \text{ CI } [.19, .49]$, Unity ($r = .34, p < .001, 95\% \text{ CI } [.18, .48]$, and Effort ($r = .28, p < .001, 95\% \text{ CI } [.12, .43]$). Post-intervention Ability showed the strongest correlation ($r = .71, p < .001, 95\% \text{ CI } [.62, .79]$, with additional positive correlations for Preparation ($r = .66, p < .001, 95\% \text{ CI } [.55, .75]$, Persistence ($r = .63, p < .001, 95\% \text{ CI } [.52, .73]$, Unity ($r = .62, p < .001, 95\% \text{ CI } [.51, .72]$, and Effort ($r = .63, p < .001, 95\% \text{ CI } [.52, .73]$).

10 Predictive Validity

The mixed 3 x 2 ANOVA results for the single-item collective efficacy scores suggested a significant main effect within groups for time, between pre- and post-intervention measures ($F(1,130) = 75.96, p < .05, r = .61$), a significant main effect between groups for condition ($F(2,130) = 32.57, p < .05, r = .45$) and a significant interaction between time and condition ($F(2,130) = 43.97, p < .05, r = .50$). Inspection of the score profiles indicated the nature of the difference between the three conditions (Figure 2). Pre-intervention collective efficacy scores (Table 1) indicated little difference between the positive ($M = 73.15, SD = 7.85$), neutral ($M = 69.29, SD = 11.75$) and negative conditions ($M = 66.64, SD = 14.05$). Simple planned contrasts showed post-intervention differences between the positive and neutral conditions ($M_{diff} = 5.81, SE = 2.34, p < .05$), positive and negative conditions ($M_{diff} = 18.28, SE = 2.30, p < .05$), and the neutral and negative conditions ($M_{diff} = 12.47, SE = 2.39, p < .05$). A decrease was observed in mean scores for the positive ($M = 72.65, SD = 9.80$), neutral ($M = 64.89, SD = 13.61$), and negative conditions ($M = 42.60, SD = 17.59$).

Pre- and Post-intervention Collective Efficacy Mean and Standard Deviation for Positive, Negative, and Control Conditions

Condition	Pre-intervention		Post-intervention	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
CEQS				
Positive	6.51	.81	7.06	.71
Neutral	6.49	.80	6.79	.92
Negative	6.40	.78	5.44	1.12
Single-item measure				
Positive	73.15	7.85	72.65	9.80
Neutral	69.29	11.75	64.89	13.61
Negative	66.64	14.05	42.60	17.59

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Study two reported strong correlations between the single-item measure and CEQS for interdependent team sports players in a lab-based experiment, further substantiating the concurrent validity of the stem. The results also provide support for the stem's predictive validity. Although single-item collective efficacy scores decreased post-intervention for all three conditions, the largest decrease coincided with the negative condition, and the smallest decrease existed for the positive condition. Whilst it is reasonable to expect an increase for the positive condition, no change for the neutral condition, and a decrease for the negative condition, this was not apparent for the CEQS. CEQS scores increased for the positive and neutral conditions, and decreased for the negative group. However, post-intervention collective efficacy beliefs were highest for the positive condition and lowest for the negative condition using both measures. Lastly, the findings indicated test-retest reliability for the stem as strong correlations were reported between pre-and post-intervention single-item scores using participants allocated to the neutral observation condition and individuals that demonstrated little/no difference in corresponding CEQS scores.

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To examine the concurrent validity of the stem we predicted that CEQS composite and subscales scores would hold a positive correlation with single-item scores based on the relationship demonstrated between the two measures in studies one and two. To test the predictive validity of the stem we measured collective efficacy levels before and after an intervention. Previous studies using modeling techniques that involve the observation of oneself or others, have shown its influence on both psychological processes and task performance to be greatest when similarity between the model and the observer is high (e.g., Calvo-Merino, Glaser, Grezes, Passingham, & Haggard, 2005, 2006; Short & Ross-Stewart, 2009). Consequently, observing positive footage of one's own team performing familiar activities should increase collective efficacy, whilst observing positive footage of an unknown team performing unfamiliar activities should have little impact upon efficacy beliefs. The single-item measure was predicted to distinguish collective efficacy scores according to the expected direction of the intervention effects. When viewing positive basketball footage, members of a basketball team (sample A) would experience increased efficacy, and members of other interdependent sports teams (sample B) would experience no change in efficacy perceptions. Finally, test-retest reliability of the stem was examined in the same manner as study two, using pre- and post-intervention single-item scores for two subsamples. The first sample included participants that experienced little/no change in CEQS scores between pre- and post-intervention measures (cf. Williams, Cote, & Buckley, 2010), and the second sample included participants who were allocated to the unfamiliar observation intervention condition. It was predicted that a positive correlation would exist between pre- and post-intervention collective efficacy scores for the single-item measure using both samples.

1 Method

2 Participants

3 Male participants ($N = 36$) were recruited via opportunity sampling from a university
 4 basketball squad ($n = 18$, $M_{\text{age}} = 21.73$ years, $SD_{\text{age}} = 1.51$ years) and other interdependent
 5 sports teams ($n = 18$, $M_{\text{age}} = 21.94$ years, $SD_{\text{age}} = 1.76$ years) from a South Wales university.
 6 The basketball players competed for either the men's 1st team or 2nd team in British
 7 Universities and Colleges competition. They were recruited because the controlled
 8 environment for competitive fixtures allowed for the collection of detailed video footage for
 9 use with the observation interventions. Interdependent team sports players were recruited
 10 from other team sports at the same institution (rugby union, soccer, and field hockey) because
 11 of their understanding of competitive sport, and their relative lack of understanding of
 12 basketball performance (i.e., no competitive experience). Together, these two sub-samples
 13 provided an opportunity to examine the effect of content familiarity upon collective efficacy
 14 responses to positively oriented video footage of competitive basketball.

15 Measures

16 **Single-Item Measure of Collective Efficacy.** In this design the stem was included in
 17 a single-item measure identical to that used in study one, namely '*Rate your team's*
 18 *confidence in their ability to perform to a high level, in order to achieve success in their next*
 19 *competitive performance*'. All responses were rated on a confidence scale between 0 (not at
 20 all confident) and 100 (completely confident).

21 **Collective Efficacy Questionnaire for Sports.** The CEQS (Short, Sullivan, & Feltz,
 22 2005) was employed as a criterion measure for individual-level perceptions of collective
 23 efficacy. Cronbach alpha coefficients indicated adequate internal reliability for the sample:
 24 Ability ($\alpha = .88$), Effort ($\alpha = .82$), Unity ($\alpha = .81$), Persistence ($\alpha = .81$), Preparation ($\alpha =$
 25 $.74$).

1 Procedure

2 Video footage of seventeen competitive fixtures was collected for two university
3 basketball teams over an 8-week period. Footage consisted of actual performance (on court),
4 team interactions during performance (i.e., communication, team drills), and reactions to
5 performance results (both on and off court, i.e., successful baskets/plays). Recordings
6 focused on positive video footage (i.e., a celebratory reaction to success, a performer being
7 pleased with performance, a successful completion of an action, a significant performance
8 result). The team-specific observation interventions were tailored to include each team
9 member in at least two of the video clips, and involve all aspects of overall basketball
10 performance. Subsequently, a ninety second video compiling seven separate video clips was
11 developed for each of the basketball teams' *familiar* observation intervention, and the non-
12 basketball participants were randomly allocated either the 1st ($n = 9$) or 2nd ($n = 9$) basketball
13 team intervention for their *unfamiliar* observation intervention.

14 Data collection comprised a three-step process. First, participants completed the
15 CEQS and single-item measure (pre-intervention), after which the intervention was
16 administered. Once the observation intervention was watched in full, collective efficacy
17 beliefs were once again collected using both measures (post-intervention) and participants
18 were debriefed on the purpose of the study.

19 Data Analysis

20 Data was screened for normality and homogeneity of variance using the Shapiro-Wilk
21 test and Levene's test respectively. A bivariate, one-tailed Pearson's correlation was used to
22 examine the relationship between the single-item collective efficacy scores and CEQS scores
23 (composite & subscales). In addition, confidence intervals were computed for all of the
24 correlations. A mixed 2 x 2 (*familiarity* x *time*) model ANOVA was used to examine the
25 data for main effects and interactions of the independent variables for the single-item scores.

Specifically, *familiarity (familiar/unfamiliar)* was used as the between-subjects factor, while *time (pre-intervention/post-intervention)* was used as the within-subjects factor. Test-retest reliabilities for the single-item measure were computed using the two aforementioned subsamples. Specifically, ICCs were computed using a two-way (*participants x time*) random effects ANOVA. All statistical procedures were conducted using SPSS for Windows, version 20, utilizing a minimum significance level of $p = 0.05$.

Results

Data Screening

Collective efficacy data for each group was screened for the assumptions of normality at both pre- and post-intervention. The Shapiro-Wilk test indicated that CEQS and single-item data for the familiar ($D(18) = .87-.92, p > .05$) and unfamiliar groups ($D(18) = .94-.95, p > .05$) was normal at both time points. The Levene's test reported equal variance in collective efficacy scores for both groups pre- ($F(1, 34) = .49-.51, p > .05$) and post-intervention ($F(1, 34) = .01-2.2, p > .05$).

Concurrent Validity

The single-item measure scores were strongly correlated with the composite CEQS scores both pre- ($r = .74, p < .001, 95\% \text{ CI } [.54, .86]$) and post-intervention ($r = .69, p < .001, 95\% \text{ CI } [.47, .83]$). The single-item measure also showed positive correlations with each of the five subscales for the CEQS. Pre-intervention the single-item correlated strongly with Ability ($r = .67, p < .001, 95\% \text{ CI } [.44, .82]$), Preparation ($r = .64, p < .001, 95\% \text{ CI } [.39, .80]$), Persistence ($r = .66, p < .001, 95\% \text{ CI } [.42, .81]$), Unity ($r = .54, p < .001, 95\% \text{ CI } [.26, .74]$), and Effort ($r = .62, p < .001, 95\% \text{ CI } [.37, .79]$). Post-intervention the single-item correlated positively with Ability ($r = .57, p < .001, 95\% \text{ CI } [.30, .76]$), Preparation ($r = .66, p < .001, 95\% \text{ CI } [.42, .81]$), Persistence ($r = .68, p < .001, 95\% \text{ CI } [.45, .82]$), Unity ($r = .38, p < .05, 95\% \text{ CI } [.06, .63]$), and Effort ($r = .68, p < .001, 95\% \text{ CI } [.45, .82]$).

1 Predictive Validity

2 The mixed 2 x 2 ANOVA results for the single-item collective efficacy scores
 3 suggested a significant main effect within groups for time, between the pre- and post-
 4 intervention measures ($F(1,34) = 33.66, p < .05, r = .66$), no effect between groups for
 5 familiarity ($F(1,34) = .37, p > .05, r = .10$) and a significant interaction between time and
 6 familiarity ($F(1, 34) = 21.84, p < .05, r = .62$). Closer inspection of the score profiles
 7 indicated the nature of the difference between the groups (Figure 3). Pre-intervention
 8 collective efficacy scores (Table 2) identified that the familiar group ($M = 74.61, SD = 9.91$)
 9 had a lower mean score than the unfamiliar group ($M = 76.94, SD = 8.34$). However, an
 10 increase was observed in post-intervention mean scores for both the familiar ($M = 83.56, SD$
 11 $= 6.26$) and unfamiliar group ($M = 77.94, SD = 8.83$), with the increase greatest for the
 12 familiar group.

Table 2

*Pre- and Post-intervention Collective Efficacy Mean and Standard Deviation for Basketball
and Non-Basketball Groups*

Condition	Pre-intervention		Post-intervention	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
CEQS				
Basketball	6.16	1.08	7.03	1.01
Non-Basketball	6.52	.82	6.81	.87
Single-item measure				
Basketball	74.61	9.91	83.56	6.26
Non-Basketball	76.94	8.34	77.94	8.83

13

14 Test-Retest Reliability

15 The two-way random effects ANOVA results for the single-item measure suggested
16 strong test-retest reliability over time for both samples. For individuals who demonstrated
17 little/no change in CEQS scores, a large single measure ICC ($r = .88, p < .05, CI = .44-.98$)
18 was reported between pre- and post-intervention single-item scores ($M_{diff} = 0.43$). For
19 individuals allocated to the unfamiliar observation intervention, there was a large single
20 measure ICC ($r = .87, p < .05, CI = .70-.95$) between pre- and post-intervention single-item
21 scores ($M_{diff} = 0.89$).

22 Discussion

23 The findings from study three replicated the correlations between the single-item and
24 CEQS from the first two studies in a field-based setting, further demonstrating the concurrent
25 validity of the stem. A greater increase in collective efficacy was reported for the group
26 familiar with the content of the observation-intervention in comparison to the unfamiliar
group, indicating predictive validity for the single-item measure. Finally, the test-retest
27 reliability for the stem was supported with strong correlations between pre-and post-
1 intervention single-item scores using participants allocated to the unfamiliar observation
condition and individuals that demonstrated little/no difference in corresponding CEQS.

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1 In this investigation, we have shown that the stem can be used as part of two different
2 single-item measures and employed across three different study designs in a sports context.
3 Due to its adaptability, the stem allows for greater consistency when measuring collective
4 efficacy using single-item scales, a characteristic which Bandura (1997) deems necessary for
5 the measurement of collective efficacy in future research. Whilst allowing for greater
6 consistency, this approach also takes into account Bandura's (2006) guidelines for the
7 construction of efficacy scales. Bandura recommends that efficacy measures are context-
8 specific, treat efficacy beliefs as a state, and are phrased in terms of 'can do' rather than 'will
9 do'. We suggest this information be included as a second component combined with the
10 stem to form a single-item measure. While two single-item collective efficacy scales have
11 been used in previous collective efficacy research (Greenlees, Graydon, & Maynard, 1999;
12 Spink, 1990), the psychometric properties of these measures were not examined. Our results
13 suggest the stem is a valid and reliable method for use with single-item collective efficacy
14 measurement in sport. This scale type allows for the instantaneous measurement of
15 collective efficacy, something that is beneficial considering the construct is a state belief (i.e.,
16 can vary based on situational factors). This approach allows researchers and practitioners to
17 examine collective efficacy at any given moment, providing a flexible measurement tool that
18 can be used for both repeated measures and case study designs, promoting multi-level
19 research within groups as well as between different contexts. For example, the stem could be
20 used to measure collective efficacy at various time points during a sports team's training
21 session to examine the relative impact of different coaching strategies or leadership tactics
22 upon collective efficacy beliefs.

23 In the past decade experimental psychologists have identified the need for integration
24 of brain and behavior assessment to gain a greater understanding of human psychological
25 processes (cf. Henson, 2005). In this respect, a major reason for this investigation was to

1 develop a single-item measure that can be used as part of a neuroimaging study to examine
2 the neuropsychological processes involved with collective efficacy. The majority of fMRI
3 studies investigating the neural correlates of psychological processes have involved
4 procedures designed to evoke a desired psychological response. For example, when
5 exploring the brain activity linked to empathy, Rameson, Morelli, and Lieberman (2011)
6 showed participants sentences and images depicting sad situations. However, research has
7 advocated that psychometric scales be integrated within fMRI designs to assess
8 brain/behavior more accurately. Specifically, Dimoka (2011) used items from multi-item
9 psychometric scales for four psychological processes (trust, distrust, perceived usefulness,
10 perceived ease of use) as a means to stimulate brain activity associated with each focal
11 psychological process. We suggest the stem developed in the current study is suitable for use
12 with single-item collective efficacy measurement in fMRI protocols. Moreover, the single-
13 item scale can be combined with observation interventions designed to increase efficacy
14 beliefs as a comprehensive method for assessing the brain activity associated with collective
15 efficacy (see e.g., Bruton et al., 2014 for group-based observation interventions). Functional
16 neuroimaging data provides an additional dependent variable that can be combined with
17 behavioral data to inform psychological theory and further understand a psychological
18 process (Henson, 2005). Successful mapping of the brain activity associated with collective
19 efficacy will advance understanding of this construct, providing information that can be used
20 in the refinement of existing theories, development of conceptually grounded intervention
21 techniques, and production of assessment methods combining brain, behavior, and
22 psychometric modes.

23 Although we believe the stem is both valid and reliable in the context of our
24 investigation, there are some limitations that need to be acknowledged. Specifically, there is
25 a need to consider the utility of single-item measures, the group cohesion measure used for

study one, the small population used for study three, and the small subsamples used for the reliability analyses in study two and three respectively. First, it is important to note that the collective efficacy literature has predominantly used multi-item instruments that consider several factors contributing towards a team's overall efficacy beliefs (see e.g., CEQS: Ability, Effort, Persistence, Preparation, Unity) and can therefore provide insights into the dynamics of team behavior (Bandura, 2006). Knowing that a group is confident or not is of upmost importance, but in order to aid the development of a group further their confidence in specific group processes needs to be considered. Using a single-item tool to measure collective efficacy does not inform the researcher/practitioner about an individual's efficacy perceptions for specific aspects of group performance. Single-item instruments should only be used to measure collective efficacy when multi-item tools are unfeasible (i.e., situations that accommodate little response time) or not warranted (i.e., only interested in overall collective efficacy response).

In study one, the GEQ was used as a multidimensional measure of group cohesion to examine the convergent validity of the stem. Previous research shows task components of group cohesion are related to collective efficacy (e.g., Kozub & McDonnell, 2000). Indeed, of all the GEQ subscales Short et al. (2005) suggest that GI-T should hold the strongest relationship with collective efficacy because this subscale considers the group and the task. Our findings showed GI-T was not a significant predictor, however, the ATG-T dimension significantly predicted collective efficacy. This suggests that liking your team's style of play relates to your view of your team's confidence. Although the GEQ is a valid and reliable measure for use in sport (e.g., Whitton & Fletcher, 2014), the ATG-S and GI-T components did show poor reliability in this instance. We suggest that future studies further examine the stem's validity using the GEQ with team sports players.

1 In study three the development of the intervention required collection of video
2 footage for both basketball teams across several fixtures. This meant it was only possible to
3 use two basketball teams and subsequently our study population couldn't exceed thirty-six as
4 to avoid any biases. Despite this small population size, the within-subject and interaction
5 effect sizes for this study ($>.50$) are classified as a large effect within previous guidelines
6 (Cohen, 1992), supporting the strength of the observation effect and the predictive validity of
7 the stem. In both study two and three the reliability of the measure was considered across
8 two different study designs. In the absence of the internal reliability statistic due to the
9 single-item nature of the measure, we must consider its reliability over time. Because we
10 used observation-based interventions in both studies, the number of participants predicted to
11 show no change in collective efficacy was comparatively small to that used to measure
12 reliability in previous studies (e.g., Williams et al., 2010). However, the findings are similar
13 to the reliability statistics reported for other domains and outcomes, such as pain (Chang,
14 Hwang, & Feuerman, 2000) and anxiety (Williams et al.). There is a need to further examine
15 the stem using groups/teams with large populations or multiple groups/teams in order to
16 ensure that desired observation effects are attainable. In this investigation we assessed
17 collective efficacy at specific time points (e.g., before and after an intervention for studies
18 two and three). Although we attempted to control for change in collective efficacy, the
19 reliability of our single-item measure across several time points also requires consideration.
20 A similar design to that adopted in study three can therefore be used to record collective
21 efficacy responses for team sports players viewing an unfamiliar observation intervention
22 over an extended period of time (i.e., repetitive viewing over several weeks).

23 In summary, our findings provide preliminary evidence for the use of this stem in
24 future single-item collective efficacy measures. However, there is a need to further examine
25 the psychometric properties of the stem for collective efficacy measurement in sports

1 contexts. To provide a more thorough assessment of the stem, research should focus on the
2 relations between collective efficacy and other group related constructs, such as
3 communication and group member satisfaction. With specific reference to sport, invariance
4 tests for age, gender, level of competition, type of sport, and level of sport are required to
5 fully validate this measure for use in this context (cf. Short et al., 2005), with multiple sports
6 teams, research designs, and settings (i.e., in both training and competition).

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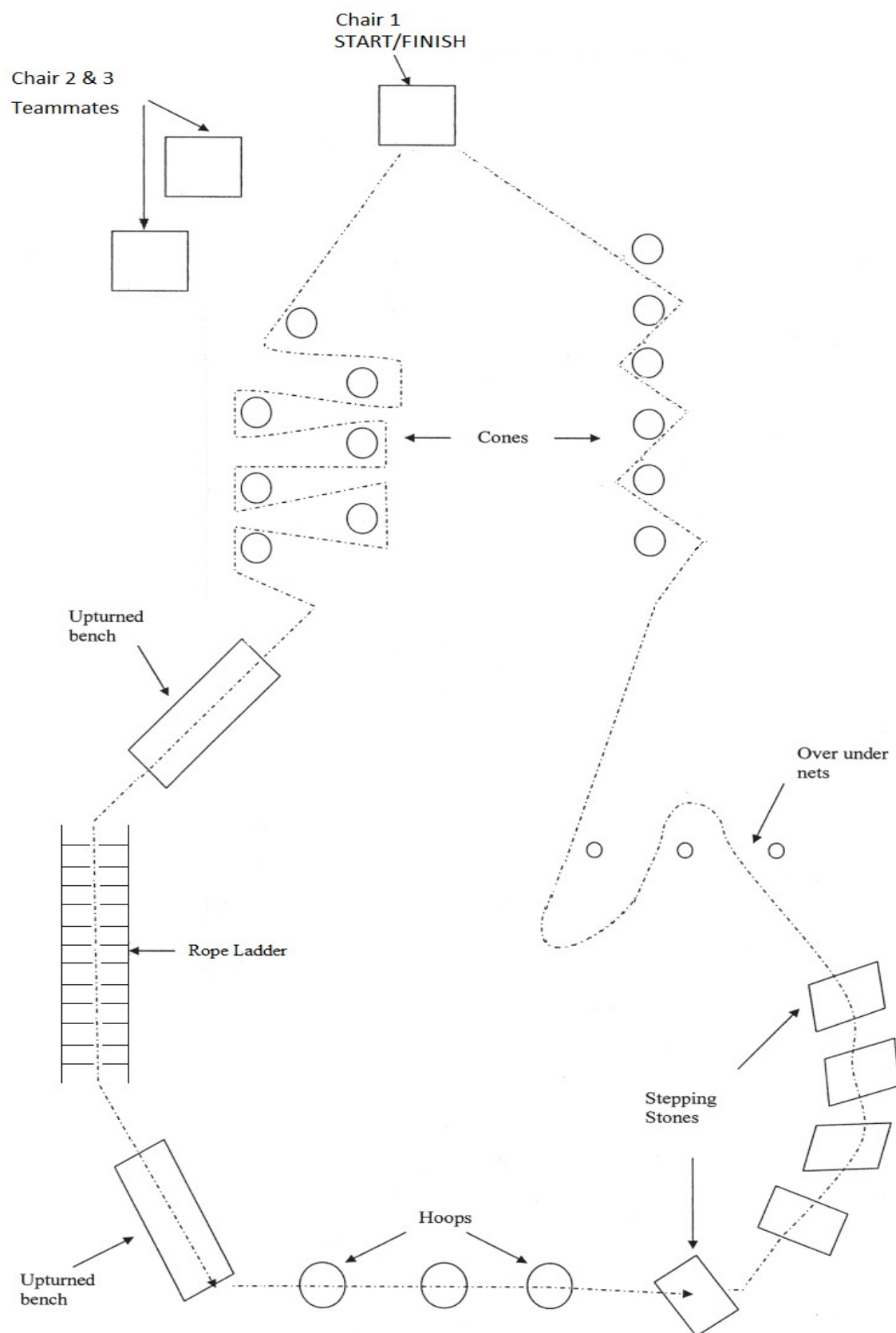
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Figure Captions

Figure 1. Overhead layout view of obstacle course used for team-based task.

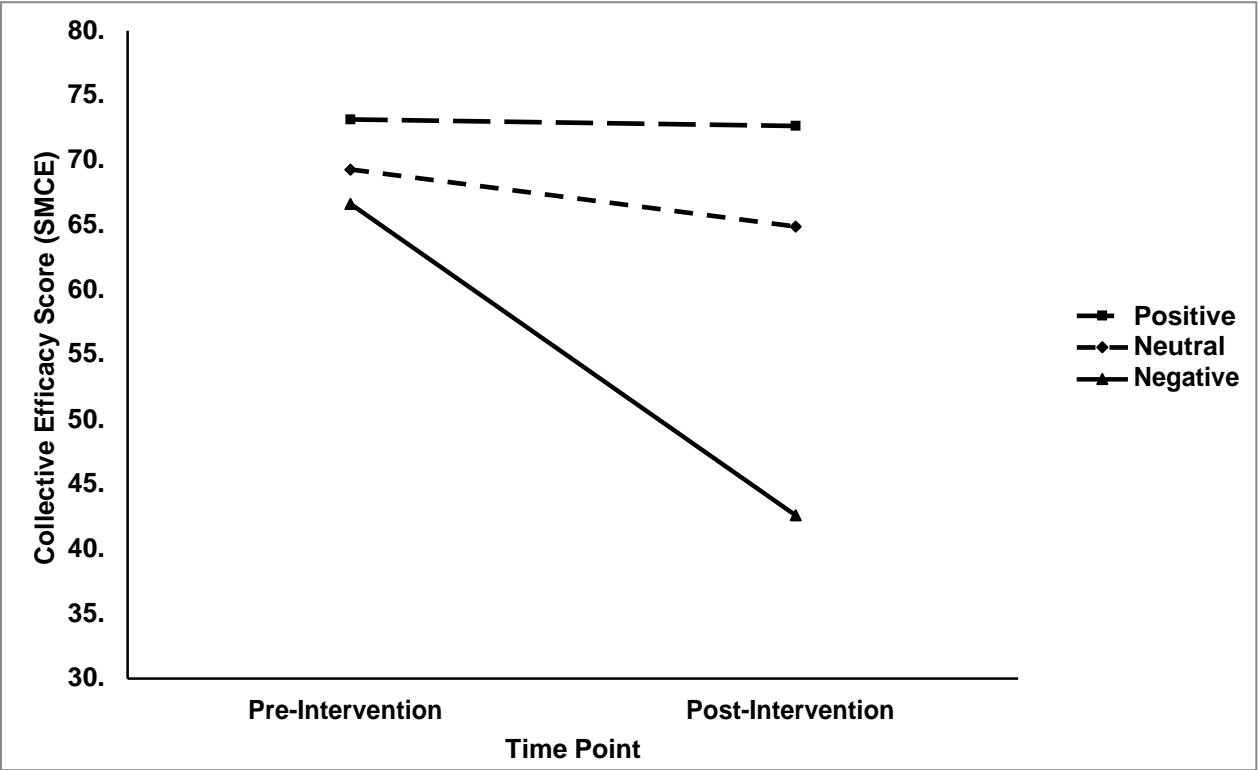
Figure 2. Intervention effect upon collective efficacy beliefs for positive, negative and neutral conditions.

Figure 3. Intervention effect upon collective efficacy beliefs for basketball and non-basketball conditions.

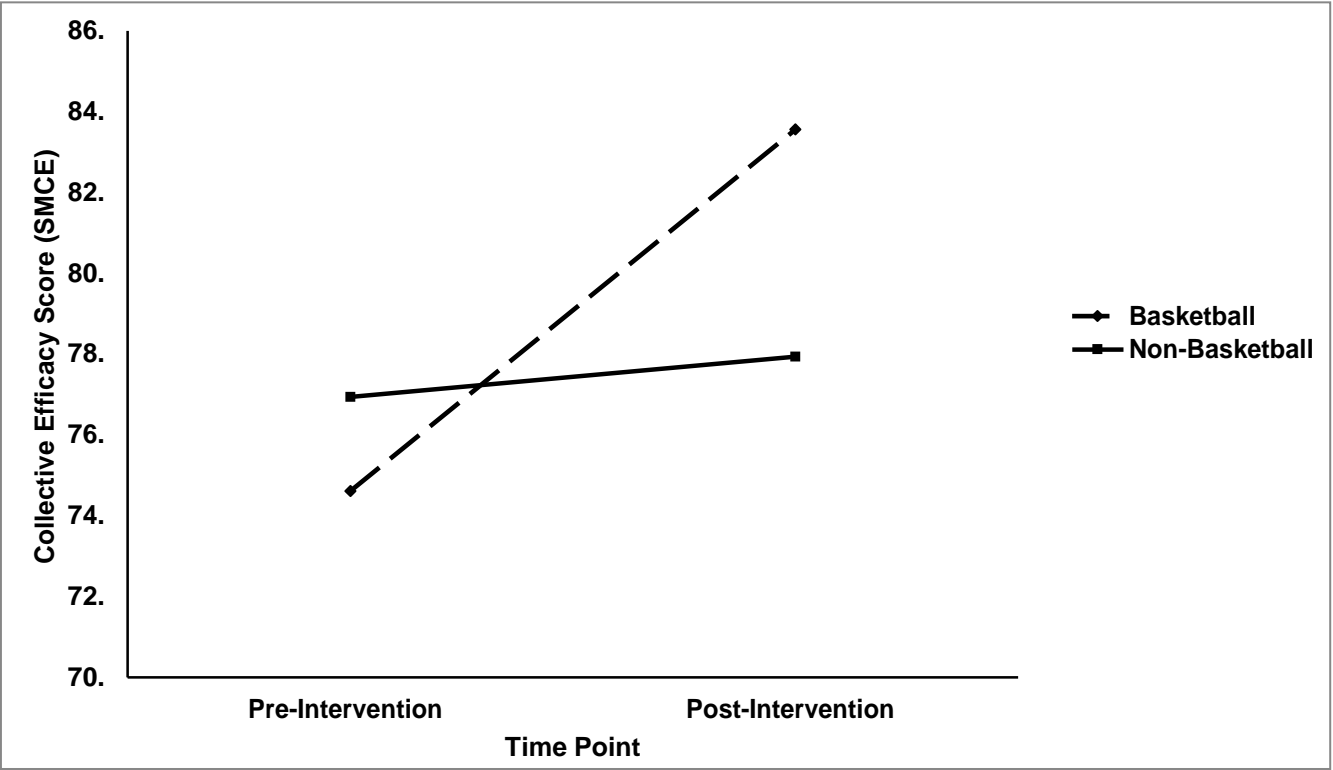


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