A framework for the neuroscientific study of collective efficacy: Measurement and manipulation.

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A Framework for the Neuroscientific Study of Collective Efficacy: Measurement and Manipulation

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Abstract

Collective efficacy research to date has yet to consider the neural mechanisms associated with its formation. Specifically, no measurement tools have been developed for use with brain imaging study designs. In addition, there has been limited consideration of how collective efficacy can be manipulated in such circumstances. The aim of this thesis was to provide a framework (measurement and manipulation) for the neuroscientific study of individual collective efficacy perceptions. In chapter two, three separate study designs (cross-sectional, laboratory, field) were used to examine the psychometric properties of an operational stem designed for use with single-item collective measurement in sports teams. Study one assessed the ability of two theoretically linked inventories and previous performance results to predict single-item stem scores. Incorporated in a single-item measure suitable for use in neuroscientific study the stem had robust concurrent, convergent, and predictive validity with competitive sports teams in a cross-sectional design. In the second study, a single-item measure specific to the laboratory-based task correlated strongly with an existing collective efficacy instrument. In addition, scores at pre- and post-intervention showed no change in collective efficacy. Combined, these findings indicate concurrent validity and test-retest reliability for the stem in a laboratory-based context. In the third study, an identical single-item measure to study one correlated strongly with an existing collective efficacy instrument. Furthermore, strong correlations were reported between scores at pre- and post-intervention for individuals predicted to show no change in collective efficacy. Together, these results indicate concurrent validity and test-retest reliability for the stem in a field-based context. Chapter three of the thesis considered intervention strategies appropriate for the manipulation of collective efficacy. Observation was proposed to have a strong theoretical/conceptual link with collective efficacy. Chapter four subsequently comprised two studies examining the use of observation interventions to manipulate individual collective efficacy perceptions. Study one examined the effect of observation content (positive/neutral/negative) upon collective efficacy using a laboratory-based design. Collective efficacy increased for positive and neutral intervention conditions and decreased for the negative condition. Study two examined the effect of familiarity of observation content (familiar vs. unfamiliar) upon collective efficacy using a field-based design. Collective efficacy increased for both familiar and unfamiliar conditions when viewing a positive observation intervention, with the largest increase for the familiar condition. The overall findings of this thesis have increased understanding of single-item measurement of collective efficacy and its manipulation using observation interventions. Practical recommendations are suggested for how the single-item stem can measure the effects of observation interventions upon collective efficacy across different settings in sport. Finally, it is recommended that the single-item stem and observation interventions developed in this thesis be used to measure and increase collective efficacy within a neuroscientific study design to investigate the neural correlates of collective efficacy perceptions.

Declaration

This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

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STATEMENT 1

This thesis is the result of my own investigations, except where otherwise stated. Other sources are acknowledged by footnotes giving explicit references.

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Publications

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"Success is not the key to happiness. Happiness is the key to success. If you love what you are doing, you'll be a success."

Albert Schweitzer

1.0 Chapter One: Introduction

Group dynamics research in sport has almost exclusively investigated team sports because of the level of interdependence associated with competitive group performance (Evans, Eys, & Bruner, 2012). Within this setting a number of variables important to group functioning have been considered, including intra-team communication (e.g., Smith, Arthur, Hardy, Callow, & Williams, 2013), team cohesion (e.g., Carron, Colman, Wheeler, & Stevens, 2002), and collective efficacy (Myers, Feltz, & Short, 2004). While several of these constructs, such as team cohesion and collective efficacy, have received extensive research attention in sport psychology (see e.g., Loughead & Hardy, 2006; Chow & Feltz, 2008, for respective reviews), there has been very little consideration towards the types of interventions that can be adopted to influence these processes, and ultimately the manner in which a group functions (cf. Widmeyer, Brawley, & Carron, 2002).

In sport, numerous activities occur in environments that require individuals to work interdependently with important others, producing complex interactions at multiple levels (individual, sub-group, team). Subsequently, factors influencing both individual and team performance have been frequently studied in the group dynamics literature, a common example being the relationship between self- and collective efficacy. In 1977, Bandura introduced self-efficacy theory to explain individual behavior. Bandura proposed self-efficacy as a situation-specific form of confidence that affects an individual's feelings, thoughts, and behaviors. Recognizing that participation in teams requires members to collectively strive to reach common objectives and aspirations, Bandura (1986) extended the notion of self-efficacy to incorporate collective efficacy beliefs. Bandura (1997) suggested that collective efficacy influences a team's individual efforts, resourcefulness, level of persistence, and resistance to discouragement, all characteristics often observed in highly successful sports teams. A wealth of subsequent studies has examined the correlates and behavioral outcomes associated with increased collective efficacy in sports, with the majority investigating its relationship with team performance (Chow & Feltz, 2008). Both laboratory (e.g., Greenlees, Graydon, & Maynard, 1999) and field-based studies (e.g., Myers, Payment, & Feltz, 2004) have consistently demonstrated a significant positive association between the two variables, suggesting that sports teams with high collective efficacy beliefs perform greater than teams who lack such beliefs.

Despite the wealth of literature investigating the social psychological process between collective efficacy and performance, these accounts do not offer a mechanism by which individuals initially develop their feelings of collective efficacy. In this respect, social cognitive neuroscience can be used to discern the underlying cognitive mechanisms associated with observable psychological phenomena such as group constructs. Understanding the nature of neural connectivity associated with a psychological process can complement existing behavioral methods to advance theories of mind/behavior, such as collective efficacy theory (cf. Amodio, 2010). Although Shearer, Holmes, and Mellalieu (2009) discussed the potential involvement of the mirror neuron system (MNS) and cortical midline structures (CMS) in the development of collective efficacy beliefs, research has yet to directly examine the neural circuitry associated with collective efficacy. Existing studies examining brain activity associated with psychological processes have adopted a variety of methods to evoke (e.g., visual stimuli such as images of trustworthy vs. untrustworthy faces, Winston, Strange, O'Doherty, & Dolan, 2002) and subsequently measure a desired psychological response (e.g., items from a psychometric scale, Dimoka, 2011). This suggests that a psychological intervention and psychometric scale can be integrated within a neuroimaging study design to examine the neural activity involved with a specific psychological process. However, given the expense of neuroimaging techniques, such as functional magnetic resonance imaging (fMRI), any experimental manipulation and assessment of collective efficacy must be thoroughly tested (i.e., to see if it is a successful manipulation and valid/reliable assessment method) before committing scanner time and funding.

To date collective efficacy in sport has been measured via assessment of an athlete's beliefs in their team's ability to perform significant game competencies (Myers, Feltz, et al., 2004). A multitude of collective efficacy measures have been developed for use in sports contexts, the majority of which are multi-item questionnaires designed with specific research questions in mind (i.e., to measure collective efficacy for a specific situation such as competitive performance in professional basketball, see e.g., Heuze, Raimbault, & Fontayne, 2006). However, in certain circumstances (i.e., situations with strict time constraints such as experimental laboratory-based tasks, see e.g., Greenlees et al., 1999) measuring collective efficacy using multi-item instruments is both impractical and detrimental when compared to using a shorter instrument such as a single-item scale. To date, only two single-item collective efficacy measures have been adopted in sport psychology (Greenlees et al.; Spink, 1990), both assessing outcome efficacy (i.e., belief in their team's ability to achieve a specific outcome) and specific to the research question being answered. In order to compare collective efficacy levels within/across sports there is a need to develop a single-item stem that can be used accordingly with different single-item measures within and across different settings and populations.

Despite collective efficacy being acknowledged as an important determinant of successful group functioning, there have been few investigations of potential interventions to increase individual perceptions of this construct. A number of different techniques have been adopted in an attempt to influence collective efficacy beliefs (e.g., goal-setting; Gibson, 2001), with mixed results. Conceptually grounded interventions are needed in order to establish an effective method for increasing collective efficacy in sports teams. In an attempt to address this issue recent studies have used self-efficacy interventions as a means to increase collective efficacy perceptions with equivocal findings (e.g., imagery: see Shearer, Mellalieu, Shearer, & Roderique-Davies, 2009). Although imagery is conceptually linked with collective efficacy (e.g., imaginal experiences are listed as an antecedent of efficacy beliefs), from a socio-cognitive and neuroscience perspective observation provides a closer match to actual action execution in comparison to imagery (Holmes and Calmels, 2008), suggesting observation-based interventions may be more effective for the manipulation of collective efficacy.

Observation in the form of self-modeling involves an individual viewing him/herself performing a given action or behavior (Dowrick, 1999, 2012). To date, self-modeling interventions have been used to influence performance in diverse settings, including sporting, academic, and business domains (see Dowrick, 1999 for a full review of self modeling literature). Self-modeling has the capacity to provide an individual with the essential components of self-efficacy, informing them on how best to perform skills, and strengthening their beliefs in their abilities (Bandura, 1986, 1997). Research has reported self-modeling strategies as an effective method to increase self-efficacy beliefs (e.g., Singleton & Feltz, 1999).

As collective efficacy is a group-level adaptation of self-efficacy (Bandura, 1997) that is developed from similar sources (Carron & Hausenblas, 1998) and holds a positive relationship with this construct (Magyar, Feltz, & Simpson, 2004), interventions used to improve self-efficacy (e.g., observation), should, from a conceptual perspective, also increase individual perceptions of collective efficacy. However, studies to date are yet to consider a group version of self-modeling (i.e., viewing one's group performing a given action or behavior) as a means to increase collective efficacy beliefs. Evidence within cognitive neuroscience research indicates similar neural activity for both execution and observation of action (for a review see Gatti et al., 2013), suggesting that viewing performance footage of one's own team may have a similar influence on collective efficacy as actual team performance. Further support for observation increasing collective efficacy is provided in observational learning theory, which proposes that the process of observational learning (i.e., learning through observing desired behaviors) can be considered a form of both mastery and vicarious experience (cf. Law & Hall, 2009), two of the strongest sources of efficacy information.

Before researchers can accurately measure the neural activity associated with collective efficacy, it must first be possible to effectively measure and manipulate this construct within a functional neuroimaging study design. Existing collective efficacy assessment tools either take too long to complete (see e.g., Short, Sullivan, & Feltz, 2005), or have been developed for use with a specific situation (see e.g., Greenlees et al., 1999), making them unsuitable for use with such neuroscientific experimentation. Research to date has also used numerous intervention techniques that lack conceptual basis for increasing collective efficacy, demonstrating equivocal findings (e.g., Shearer, Mellalieu, et al., 2009). In order to investigate the neural correlates for individual collective efficacy perceptions using fMRI, there is a need to establish a conceptually grounded intervention technique and short psychometric scale that can be used to stimulate and record collective efficacy levels, respectively. The aim of this thesis therefore, was to develop methodological techniques (assessment tool and psychological intervention) to provide the basis for a social cognitive investigation of individual collective efficacy perceptions. Specifically, the first objective was to develop a valid operational stem for use with single-item collective efficacy measurement across a variety of settings in sport with the intention to use this as a psychometric assessment method in future neuroscientific experimental settings. The second objective was to examine observation as an intervention to influence collective efficacy beliefs in order to develop a potential method by which collective efficacy can be manipulated for the purpose of neuroscientific study.

Following this introduction, Chapter two examines the development and validation of an operational stem for use with single-item collective efficacy measurement across three different study designs in sport (cross-sectional, laboratory-based, field-based). Chapter three provides a review of literature examining the use of observation as a collective efficacy intervention, highlighting conceptual and empirical evidence for the relationship between observation and this construct. Chapter four comprises a two-study investigation examining the effects of observation interventions towards individual collective efficacy perceptions in team sport athletes. Chapter five concludes with a discussion of the findings of the experimental chapters in relation to the study aim and objectives, and resulting practical implications and future directions for research in collective efficacy measurement and manipulation.

This thesis aimed to develop a psychometric assessment tool and intervention technique for use with neuroscientific study of collective efficacy. Therefore, it is appropriate that both be investigated simultaneously within the experimental chapters listed (chapters two and four). Consequently, data for chapters two and four was collected concurrently to validate the single-item stem and examine observation as a collective efficacy intervention technique using the same experimental methods.

2.0 Chapter Two: Validation of a Single-Item Stem for Collective Efficacy Measurement in Sports Teams: A Tool for use with Neuroimaging Protocol

2.1 Introduction

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

Collective efficacy has been conceptualized (and subsequently analyzed) both at an individual (e.g., Heuze, Sarrazin, Masiero, Raimbault, & Thomas, 2006) and group level (e.g., Gibson, 1999). Although collective efficacy is a group's shared belief, Bandura (1997) advocated that each team member's belief in the team's overall capabilities should be considered, and these individual measures aggregated to the team level. Therefore, both individual and group level approaches are suitable for use with collective efficacy measurement, with the choice of level contingent on the situation involved (i.e., suited to the specific context). Aggregated collective efficacy details a group's overall beliefs, but does not consider individual differences within the group (Shearer, Holmes, et al., 2009). Given that collective efficacy is ultimately measured through individual cognitions, this study adopted an individual-level approach to the manipulation, measurement, and analysis of collective efficacy perceptions.

As the study of collective efficacy has become popular in sport multiple methods to access this construct have been developed. To date, four operational methods have been used to measure collective efficacy (cf. Bandura, 1997; Lindsley, Brass, & Thomas, 1995): the first (CE-SE) aggregates individual responses to self-efficacy items, the second (CE-CEI) aggregates individual assessments of their confidence in their team, the third (CE-CET) aggregates individual perceptions of their team's confidence in themselves, and the fourth (CE-GCE) uses a group discussion to obtain a single estimate of collective efficacy (see Myers & Feltz, 2007 for a detailed discussion of these operational methods). Of the operational methods mentioned, the CE-CEI and CE-CET approaches have received most use in sports literature. For example, Paskevich, Brawley, Dorsch, and Widmeyer (1999) used the CE-CET approach to measure collective efficacy with volleyball players (item e.g., "our team's confidence that we can spike from the left side of the court is..."), whereas Magyar et al. (2004) used the CE-CEI approach to assess collective efficacy beliefs in rowing teams (item e.g., "how confident are you that your crew can settle into the race?").

A key aspect of using psychometric tools to measure social psychological constructs such as collective efficacy is the wording of the operational stem, which represents the beginning part of an item that presents the issue about which the question is asking (Roe, 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, Apostal, 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 et al., 2005). Short, Sullivan, et al. suggested that this stem accounts for an individual's team-based cognitions, which are different to the cognitions they experience as individuals inside/outside the team context. According to Louis and Sutton (1991) a group can possess a belief even if the cognitions reside within the individual group members. Considering therefore that collective efficacy is a group belief, it makes intuitive sense that the group's viewpoint is being considered by the respondent when assessing collective efficacy perceptions. However, there is insufficient evidence that one assessment method (i.e., CE-CET vs CE-CEI) produces measures that relate to theoretically linked variables (e.g., team cohesion, team performance) significantly better than the other (cf. Myers & Feltz, 2007).

Another measurement issue that has received considerable debate in collective efficacy literature regards the categorization of rating scales. Similar to the standard methodology used for self-efficacy measurement, Bandura (2006) advocates the use of 100-point response scales ranging in 10-unit intervals to assess collective efficacy beliefs. He also suggests that efficacy scales using fewer steps should be avoided because they are less sensitive and reliable than 11-category scales. This assertion is supported by the majority of collective efficacy research in sport, with most studies adopting 11-point rating scales (e.g., Feltz & Lirgg, 1998; Heuze, Raimbault, et al., 2006; Kozub & McDonnell, 2000). While this method has been employed extensively in the sports domain, research has also questioned its effectiveness and suggested that rating scales of this size employ too many categories and should be collapsed (Myers, Wolfe, & Feltz, 2005; Zhu & Kang, 1998; Zhu, Updyke, & Lewandowski, 1997). Specifically, Zhu et al. and Zhu and Kang identified improved functioning for a self-efficacy instrument when the rating scale was reduced from a 5-point to a 3-point version. In a similar manner, Myers et al. found that a coaching efficacy scale functioned better when collapsed from a 10-category to a 4-category structure. The original rating scales employed across these studies used too many categories, meaning respondents were unable to successfully distinguish between ratings for each category.

It is possible that previously conceptualized collective efficacy instruments would benefit from a similar reduction in rating scale categories, yet no research exists for this purpose. Although Bandura (2006) suggests that such a reduction may reduce sensitivity of the scale because raw scores will become more closely grouped, Myers and Feltz (2007) promote the use of item response theory (IRT) to overcome this issue. IRT can be used to determine whether a rating scale structure produces psychometrically acceptable estimates and if not, determine an optimal structure that is conceptually sound and produces acceptable psychometric approximations. IRT has the capacity to allay Bandura's sensitivity concerns as raw scores are typically stretched further apart using a nonlinear transformation onto a logit scale (Smith, 2000). While the optimal categorization of rating scales is not the objective of this investigation, this is an important consideration for the future study of collective efficacy and the further validation of instruments for use in sport.

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, Feltz, et al., 2004). Although multi-item instruments are acknowledged as the 'gold-standard' measurement tool for the majority of settings, 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. The time constraints in such settings make single item measures the only practical option and this outweighs a number of their disadvantages (see

Dollinger & Malmquist, 2009; Hoeppner, Kelly, Urbanoski, & Slaymaker, 2011; Kwon & Trail, 2005; Loo, 2002).

Single-item instruments also offer opportunities for the exploration of novel research domains beyond those currently available using traditional multiple-item scales. For example, recent 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 recent review in sport), the neuropsychological mechanisms that underpin individual perceptions of collective efficacy within groups have recently been considered (see Shearer, Holmes, 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 explored (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 using an intervention (e.g., team-based video footage; Shearer, Holmes, et al., 2009) as this will heighten neural activity for the brain areas involved with collective efficacy development. In order to improve the link between 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.

The foundation of rigorous research in psychology is the use of measurement tools that are psychometrically sound both in terms of validity (the ability of an instrument to measure what it is purported to) and reliability (the ability of an instrument to measure a target variable consistently; cf. DeVon et al., 2007). Single-item measures contain one item and therefore do not allow for the computation of internal consistency values, which represent the correlations between items that make up an instrument (Bergkvist & Rossiter, 2007). The psychometric properties of single-item instruments are traditionally examined externally using conceptually related/unrelated variables (validity) or across different time points (reliability). Various methods can be used to assess the external validity of single-item measures, including: predictive validity, which refers to the degree to which test scores predict/are predicted by a future/past variable (Shultz & Whitney, 2005), concurrent validity, which represents the level of agreement with an already existing measure of the same construct/variable (cf. Elo, Leppännen, & Jahkola, 2003), and convergent and discriminant validity, which refer to the relationship of the test scores with scores for a theoretically similar or different construct, respectively (DeVon et al., 2007). For reliability, the stability of single-item instruments is often computed using test-retest reliabilities, which assess the correlation between test scores at different time points for the same population (see e.g., Nichols & Webster, 2013; Robins, Hendin, & Trzesniewski, 2001).

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 used as part of a single-item measure of collective efficacy. Although this method has not been used with single-item collective efficacy measurement, the utility of different operational stems has been examined empirically with the CEQS (see Short, Apostal, et al., 2002). In Short and colleagues' study, two different operational stems were used with the same pool of items to compare test scores for these two operational methods. It is not the aim of this chapter to assess the use of different stems for single-item collective measurement but it is possible to validate a question stem using a similar method if the additional components that make up the instrument are designed in a controlled manner. In the case of a single-item collective efficacy measure this can be undertaken by combining the same item stem with different item tails that are designed using the same guidelines, but tailored to a specific situation. Therefore, 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. The stem used with the CEQS (Short et al., 2005) *'Rate your team's confidence in their ability to...'* was chosen 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 stem 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 interactive team sports players.

2.2 Study one introduction

To test concurrent validity of the stem, the predictive capabilities of the CEQS towards the single-item measure were examined. As the two instruments were hypothesized to measure the same construct, it was suggested that both CEQS composite and subscale scores would predict single-item scores. To test the convergent validity of the stem, the predictive capabilities of the GEQ towards the single-item measure were examined. As collective efficacy and task cohesion exhibit a strong relationship (e.g., Kozub & McDonnell, 2000), it was hypothesized that the two task components of the GEQ would predict single-item collective efficacy scores. To test the predictive validity of the stem, the predictive capabilities of previous performance (win percentage over the previous three results) towards the single-item measure were examined. As team performance is reported to predict collective efficacy (see Stajkovic et al., 2009, for a meta-analysis), it was hypothesized that previous performance would predict single-item scores.

2.3 Study one methods

2.3.1 Participants

311 interactive sports team players (M_{age} = 21.69, age range: 16-54) were purposively sampled from a variety of interactive 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 (*n* = 250 male, *n* = 61 female)

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).

2.3.2 Measures

Single-Item Measure of Collective Efficacy. For the present study the stem was combined with an item tail 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 item tail 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). As per Bandura's recommendations, 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. 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 this study: Ability (α = .93), Effort (α = .83), Unity (α = .80), Persistence (α = .81), Preparation (α = .85).

The Group Environment Questionnaire (GEQ). 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 (α = .60), ATG-S (α = .57), GI-T (α = .48), GI-S (α = .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.

2.3.3 Procedure

Ethical approval was granted by the 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 interactive 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, that 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 questionnaire pack took approximately ten minutes to complete in its entirety.

2.3.4 Data analysis

All statistical procedures for the three studies were conducted using SPSS for Windows, version 20; utilising 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 measure score, and two forced entry multiple regression analysis were used 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).

2.4 **Study one results**

2.4.1 Data screening

To examine the assumptions of multivariate normality Tabachnick, Fidell, and Osterlind (2001) proposed the use of Mahalanobis distances to indicate multivariate outliers with a criterion level of $p < 0.001$. Five predictor variables were used for the first multiple regression analysis, using the criterion of $\chi 2 = 20.52$ to indicate multiple outliers (see Barnett & Lewis, 1978 for a table of critical values). For this sample five cases had values greater than 20.52, indicating that they responded differently compared to other participants across multiple dimensions. Subsequently, these outliers were deleted, leaving 306 cases for the analysis. The VIF values were all well below 10 with an average close to 1, and the tolerance statistics were above 0.2, indicating no collinearity within the data. Four predictor variables were used for the second multiple regression analysis, using the criterion of $\chi 2 = 18.47$ to indicate multiple outliers (see Barnett & Lewis, 1978 for a table of critical values). For this sample five cases had values greater than 18.47, indicating that they responded differently compared to other participants across multiple dimensions. Subsequently, these outliers were deleted, leaving 306 cases for the analysis. The VIF values were all well below 10 with an average close to 1, and the tolerance statistics were above 0.2, indicating no collinearity within the data.

2.4.2 Concurrent validity

The relationship between collective efficacy responses to the CEQS and the single-item were assessed using two regression analyses because the composite CEQS score and CEQS subscale scores were likely to be too highly correlated. The first simple regression analysis identified composite CEQS score as a significant predictor of single-item score ($\beta = .69$, adjusted $R^2 = .47$, $F_{1\text{-}309} = 280.28$, $p < 0.001$, Table 2.1). The second multiple regression analysis identified the Ability subscale of the CEQS as the only significant predictor of collective efficacy measured using the single-item measure ($\beta = .52$, adjusted $R^2 = .55$, $F_{5\text{-}300} = 74.78$, $p < 0.001$, Table 2.2). No other CEQS subscale was predictive of single-item score ($p > 0.05$, Table 2.2).

2.4.3 Convergent validity

The relationship between group cohesion and collective efficacy was assessed using two separate multiple regression analyses, one for the stem and one for the CEQS. For the stem: ATG-T ($\beta = .19$, adjusted $R^2 = .16$, $F_{4\text{-}302} = 15.88$, $p < 0.05$, Table 2.3), GI-T ($\beta = .21$, adjusted $R^2 = .16$, $F_{4\text{-}302} = 15.88$, $p < 0.05$, Table 2.3), and GI-S ($\beta = .18$, adjusted $R^2 = .16$, $F_{4\text{-}302} = 15.88$, $p < 0.05$, Table 2.3) 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 ($p > 0.05$, Table 2.3). For the CEQS: ATG-T ($\beta = .18$, adjusted $R^2 = .36$, $F_{4\text{-}302} = 43.12$, $p < 0.05$, Table 2.3), GI-T ($\beta = .39$, adjusted $R^2 = .36$, $F_{4\text{-}302} = 43.12$, $p < 0.05$, Table 2.3), and GI-S ($\beta = .18$, adjusted $R^2 = .16$, $F_{4\text{-}302} = 43.12$, $p < 0.05$, Table 2.3) subscales were identified as significant predictors towards composite collective efficacy scores. The ATG-S subscale was not a significant predictor of the composite score ($p > 0.05$, Table 2.3).

2.4.4 Predictive validity

The relationship between previous performance and collective efficacy was assessed using two separate simple regression analyses, one for the stem and one for the CEQS. For the stem: Previous performance was identified as a significant predictor of single-item collective efficacy ($\beta = .42$, adjusted $R^2 = .17$, $F_{1\text{-}305} = 63.70$, $p < 0.001$, Table 2.4). For the CEQS: Previous performance was identified as a significant predictor of composite collective efficacy ($\beta = .31$, adjusted $R^2 = .09$, $F_{1\text{-}305} = 31.74$, $p < 0.001$, Table 2.4).

Table 2.1

Summary of simple regression analysis for composite CEQS score predicting single-item collective efficacy score in team sport participants

	B	B_{SE}	*B*
Constant	9.58	3.91	
CEQS	8.90	.53	.69 ***

Note: B = Unstandardized Beta Coefficient, B_{SE} *= Standard Error of B,* β *= Standardized Beta Coefficient. N = 311,* R^2*=0.48, Adjusted* R^2*= 0.47,* $F_{1\text{-}309}$ *=280.28, (**** $p < 0.001$*).*

Table 2.2

Summary of multiple regression analysis for CEQS subscales predicting single-item collective efficacy in team sport participants

		B	B_{SE}	B
Constant		5.84	3.93	
	Effort	0.93	.99	.08
	Ability	5.42	.52	.52***
CEQS	Persistence	1.38	.78	.12
	Preparation	0.55	.70	.05
	Unity	1.04	.81	.09

Note: B = Unstandardized Beta Coefficient, B_{SE} *= Standard Error of B,* β *= Standardized Beta Coefficient.* $N = 306$, $R^2=0.56$, *Adjusted* $R^2= 0.55$, $F_{5\text{-}300} =74.78$, *(**** $p < 0.001$*).*

Table 2.3

Summary of multiple regression analyses for GEQ subscales predicting single-item collective efficacy(1) and composite CEQS(2) scores in team sport participants

		B	B_{SE}	*B*
(1) Constant		35.18	5.92	
	ATG-T	2.07	.67	.19**
GEQ	GI-T	2.87	.86	.21**
	ATG-S	-1.17	.77	-.10
	GI-S	1.89	.69	.18**
(2) Constant		2.45	0.40	
	ATG-T	0.15	.05	.18**
GEQ	GI-T	0.40	.06	.39***
	ATG-S	0.03	.05	.03
	GI-S	0.12	.05	.16**

Note: (1) *B = Unstandardized Beta Coefficient,* B_{SE} *= Standard Error of B,* β *= Standardized Beta Coefficient. N = 307,* R^2*=0.17, Adjusted* R^2*= 0.16,* $F_{4\text{-}302}$ *=15.87, (**** $p < 0.001$*).*

(2) *B = Unstandardized Beta Coefficient,* B_{SE} *= Standard Error of B,* β *= Standardized Beta Coefficient. N = 307,* R^2*=0.17, Adjusted* R^2*= 0.16,* $F_{4\text{-}302}$ *=15.87, (**** $p < 0.001$*).*

Table 2.4

Summary of simple regression analyses for previous performance results predicting single-item collective efficacy(1) and composite CEQS(2) scores in team sport participants

	B	B_{SE}	*B*
(1) Constant	60.00	1.96	
Previous Performance	0.24	0.03	.42***
(2) Constant	6.46	0.16	
Previous Performance	0.14	0.00	.31***

Note: (1) *B = Unstandardized Beta Coefficient,* B_{SE} *= Standard Error of B,* β *= Standardized Beta Coefficient. N = 307,* R^2*=0.17, Adjusted* R^2*= 0.17,* $F_{1\text{-}305}$ *=63.70, (**** $p < 0.001$*).*

(2) *B = Unstandardized Beta Coefficient,* B_{SE} *= Standard Error of B,* β *= Standardized Beta Coefficient. N = 307,* R^2*=0.09, Adjusted* R^2*= 0.09,* $F_{1\text{-}305}$ *=31.74, (**** $p < 0.001$*).*

2.5 Study two introduction

To further test the concurrent and predictive validity of the stem the relationship between the CEQS and the single-item measure was measured before and after an intervention designed to manipulate collective efficacy. Research has shown observation interventions can be used to manipulate self-efficacy beliefs (e.g., Clarke & Ste-Marie, 2007) highlighting their potential to increase collective efficacy beliefs in teams (Shearer, Holmes, et al., 2009). 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 recently 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.

2.6 Study two methods

2.6.1 Participants

One hundred and thirty three undergraduate students (M_{age} = 20.63 years, SD_{age} =1.84 years) from a higher education institution in South Wales, UK were recruited via opportunity sampling. All participants (*n* = 94 male, *n* = 39 female) played in an interactive 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).

2.6.2 Measures

Single-Item Measure of Collective Efficacy. In this design the stem was combined with an item tail 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 item tail 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 (AVAS: see Marsh-Richard, Hatzis, Mathias, Venditti, & Dougherty, 2009 for a full description of this measurement type). This scoring method was chosen with the overall aim of this thesis in mind. Specifically, the computer-based interface and simple 'scroll and click' recording procedure make AVAS ideal for use with fMRI, and therefore the neuroscientific study of collective efficacy.

Collective Efficacy Questionnaire for Sports. 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 (α = .89), Effort (α = .84), Unity (α = .81), Persistence (α = .83), and Preparation (α = .80).

2.6.3 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 demonstrated 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 so that 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 completed each team participated in three practice trials for an obstacle-based task (Figure 4.1), 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 and groups allocated to the negative condition viewed negative video clips 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.

2.6.4 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. Pearson's correlation coefficient (*r*) was used to measure effect size for the mixed ANOVA because it is a standardized measure of the magnitude of an observed effect that is constrained to lie between 0 (no effect) and 1 (perfect effect), making it simple to interpret (Field, 2009). 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 reliability of a single-item anxiety measure.

2.7 Study two results

2.7.1 *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).

2.7.2 *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% CI [.34, .60]) and post-intervention (r = .73, p < .001, 95% 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% CI [.36, .62], with additional positive correlations for Preparation (r =.39, p < .001, 95% CI [.24, .53], Persistence (r =.35, p < .001, 95% CI [.19, .49], Unity (r =.34, p < .001, 95% CI [.18, .48], and Effort (r =.28, p < .001, 95% CI [.12, .43]. Post-intervention, Ability showed the strongest correlation (r =.71, p < .001, 95% CI [.62, .79], with additional positive correlations for Preparation (r =.66, p < .001, 95% CI [.55, .75], Persistence (r =.63, p < .001, 95% CI [.52, .73], Unity (r =.62, p < .001, 95% CI [.51, .72], and Effort (r =.63, p < .001, 95% CI [.52, .73].

2.7.3 *Predictive validity*

An alpha level of .05 was used for the initial analyses. 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 2.1). Pre-intervention collective efficacy scores (Table 2.3) 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, M_{diff} = -0.7%) neutral (M = 64.89, SD = 13.61, M_{diff} = -6.4%) and negative conditions (M = 42.60, SD = 17.59, M_{diff} = -36.1%).

2.7.4 Test-retest reliability

The two-way random effects ANOVA results for the single-item collective efficacy scores suggested adequate test-retest reliability over time. For the individuals that showed the smallest change ($\leq .2$) in CEQS scores (n = 25), a large single measure ICC ($r = .77$, $p < .05$, CI = .47-.90) was reported between pre- and post-intervention measures (M_{diff} = 4.94). For the individual's allocated to the neutral intervention condition (n = 41), a moderate single measure ICC ($r = .62$, $p < .05$, CI = .38-.79) was reported between pre- and post-intervention measures (M_{diff} = 4.40).

Table 2.5

Pre- and post-intervention collective efficacy mean and standard deviation for positive, negative, and control conditions

	Pre-intervention		**Post-intervention**		**Change**
Condition	*M*	*SD*	*M*	*SD*	(%)
CEQS (composite)					
Positive	6.51	.81	7.06	.71	8.5
Neutral	6.49	.80	6.79	.92	4.6
Negative	6.40	.78	5.44	1.12	-15.0
Single-item measure					
Positive	73.15	7.85	72.65	9.80	-0.7
Neutral	69.29	11.75	64.89	13.61	-6.4
Negative	66.64	14.05	42.60	17.59	-36.1

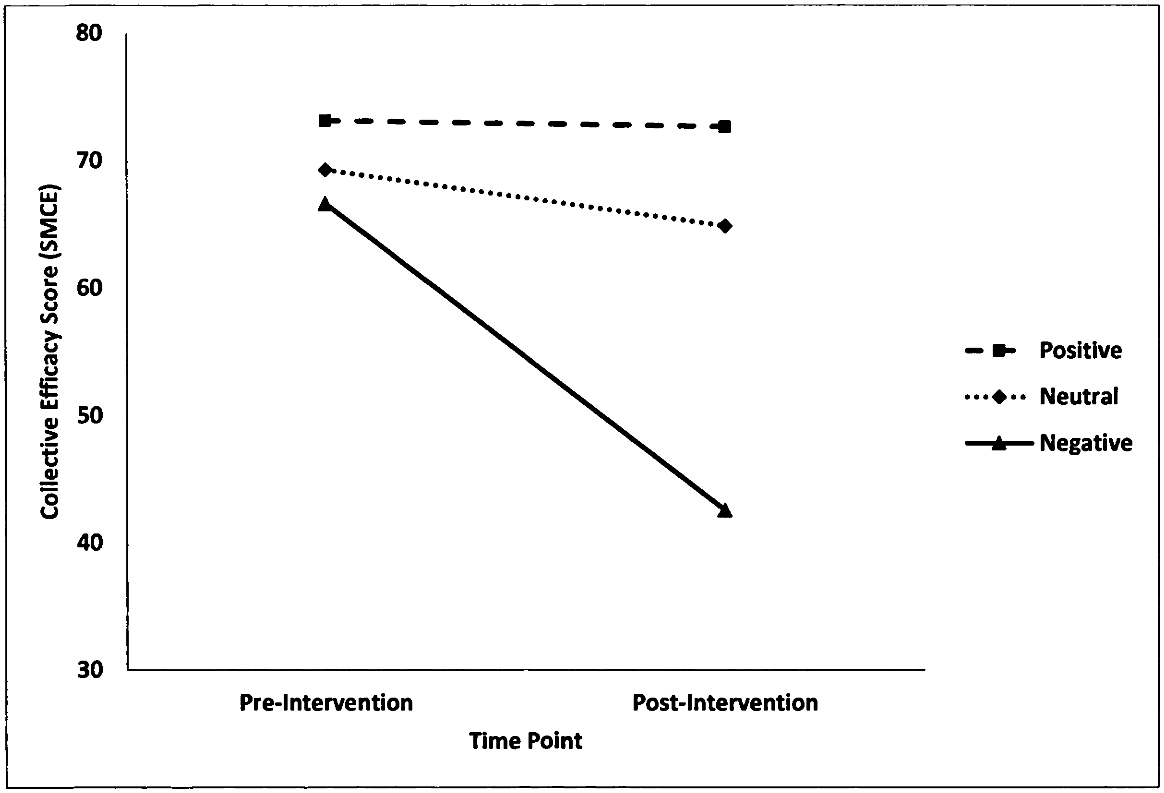

Figure 2.1 Intervention effect upon collective efficacy beliefs for positive, negative and neutral conditions.

2.8 Study three introduction

To examine the concurrent validity of the stem it was 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 collective efficacy levels were measured 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 the same positive basketball footage, members of a basketball team (sample A) would experience increased efficacy, and members of other interactive 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 et al., 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.

2.9 Study three methods

2.9.1 *Participants*

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

2.9.2 *Measures*

Single-Item Measure of Collective Efficacy. In this design the stem was included in a single-item measure identical to that used in study one, namely '*Rate your team's confidence in their ability to perform to a high level, in order to achieve success in their next competitive performance*'. All responses 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 et al., 2009 for a full description of this measurement type).

Collective Efficacy Questionnaire for Sports. 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 ($\alpha = .88$), Effort ($\alpha = .82$), Unity ($\alpha = .81$), Persistence ($\alpha = .81$), Preparation ($\alpha = .74$).

2.9.3 Procedure

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

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

2.9.4 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 single-item collective efficacy scores and CEQS scores (composite & subscales). In addition, confidence intervals were computed for all of the correlations. A mixed 2 x 2 (*familiarity* x *time*) model ANOVA was used to examine the 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 $p = 0.05$.

2.10 Study three results

2.10.1 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 ($D\ (18) = .87\text{-}.92, p > .05$) and unfamiliar groups ($D\ (18) = .94\text{-}.95, p > .05$) was normal at both time points. The Levene's test reported equal variance in collective efficacy scores for both groups pre- ($F\ (1, 34) = .49\text{-}.51, p > .05$) and post-intervention ($F\ (1, 34) = .01\text{-}2.2, p > .05$).

2.10.2 Concurrent validity

The single-item measure scores were strongly correlated with the composite CEQS scores both pre- ($r = .74, p < .001$, 95% CI [.54, .86]) and post-intervention ($r = .69, p < .001$, 95% 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% CI [.44, .82]), Preparation ($r =.64, p <.001$, 95% CI [.39, .80]), Persistence ($r =.66, p <.001$, 95% CI [.42, .81]), Unity ($r =.54, p <.001$, 95% CI [.26, .74]), and Effort ($r =.62, p <.001$, 95% CI [.37, .79]). Post-intervention the single-item correlated positively with Ability ($r =.57, p <.001$, 95% CI [.30, .76]), Preparation ($r =.66, p <.001$, 95%

CI [.42, .81]), Persistence ($r = .68$, $p < .001$, 95% CI [.45, .82]), Unity ($r = .38$, $p < .05$, 95% CI [.06, .63]), and Effort ($r = .68$, $p < .001$, 95% CI [.45, .82]).

For participants allocated to the familiar condition the single-item measure scores were strongly correlated with the composite CEQS scores both pre- ($r = .81$, $p < .001$, 95% CI [.55, .93]) and post-intervention ($r = .78$, $p < .001$, 95% CI [.49, .91]). The single-item also showed positive correlations with each of the five subscales for the CEQS. Pre-intervention the single-item correlated strongly with Ability ($r = .76$, $p < .001$, 95% CI [.45, .91]), Preparation ($r = .66$, $p < .01$, 95% CI [.28, .86]), Persistence ($r = .74$, $p < .001$, 95% CI [.42, .90]), Unity ($r = .79$, $p < .001$, 95% CI [.52, .92]), and Effort ($r = .64$, $p < .001$, 95% CI [.25, .85]). Post-intervention the single-item correlated positively with Ability ($r = .46$, $p < .05$, 95% CI [-.01, .76]), Preparation ($r = .70$, $p < .001$, 95% CI [.35, .88]), Persistence ($r = .77$, $p < .001$, 95% CI [.47, .91]), Unity ($r = .82$, $p < .001$, 95% CI [.57, .93]), and Effort ($r = .73$, $p < .001$, 95% CI [.40, .89]).

For participants allocated to the unfamiliar condition the single-item measure scores were strongly correlated with the composite CEQS scores both pre- ($r = .63$, $p < .01$, 95% CI [.23, .85]) and post-intervention ($r = .67$, $p < .01$, 95% CI [.30, .87]). The single-item measure also showed positive correlations with four of the five subscales for the CEQS. Pre-intervention the single-item correlated strongly with Ability ($r = .57$, $p < .01$, 95% CI [.14, .82]), Preparation ($r = .60$, $p < .01$, 95% CI [.18, .83]), Persistence ($r = .59$, $p < .01$, 95% CI [.17, .83]), and Effort ($r = .58$, $p < .01$, 95% CI [.16, .82]), but demonstrated a weak correlation with Unity ($r = .16$, $p > .05$, 95% CI [-.33, .58]). Post-intervention the single-item correlated positively with Ability ($r = .61$, $p < .01$, 95% CI [.20, .84]), Preparation ($r = .75$, $p < .001$, 95% CI [.44, .90]), Persistence ($r = .66$, $p < .01$, 95% CI [.28, .86]), and Effort ($r = .64$, $p < .01$, 95% CI [.25, .85]), but once again showed a weak correlation with Unity ($r = .04$, $p > .05$, 95% CI [-.44, .50]).

Significance tests were run using Preacher's (2002) computer software to see if correlations between the stem and the CEQS (composite & subscales) were different for the familiar and unfamiliar conditions both pre- and post-intervention. The tests reported no differences ($p < .05$) between conditions for the stems correlations with the composite CEQS score, and the ability, preparation, persistence, and effort subscales of the CEQS at either time point. Differences between familiar and unfamiliar conditions were reported for the stems correlation with the unity subscale of the CEQS familiar both pre- ($p < .01$) and post-intervention ($p < .01$).

2.10.3 Predictive validity

An alpha level of .05 was used for the initial analyses. The mixed 2 x 2 ANOVA results for the single-item collective efficacy scores suggested a significant main effect within groups for time, between the pre- and post-intervention measures (F (1,34) = 33.66, $p < .05$, $r = .66$), a significant main effect between groups for condition (F (2,34) = .37, $p < .05$, $r = .10$) and a significant interaction between time and condition (F (2,130) = 21.84, $p < .05$, $r = .62$). Closer inspection of the score profiles indicated the nature of the difference between the groups (Figure 2.2). Pre-intervention collective efficacy scores (Table 2.6) identified that the familiar group ($M = 74.61$, $SD = 9.91$) had a lower mean score than the unfamiliar group ($M = 76.94$, $SD = 8.34$). However, an increase was observed in post-intervention mean scores for both the familiar ($M = 83.56$, $SD = 6.26$, M_{diff}= 12.0%) and unfamiliar group ($M = 77.94$, $SD = 8.83$, M_{diff}= 1.3%), with the increase greatest for the familiar group.

2.10.4 Test-retest reliability

The two-way random effects ANOVA results for the single-item measure suggested strong test-retest reliability over time for both samples. For individuals who demonstrated little/no change in CEQS scores ($n = 7$), a large single measure ICC ($r = .88$, $p < .05$, $CI = .44$-.98) was reported between pre- and post-intervention single-item scores ($M_{diff} = 0\ .43$). For individuals allocated to the unfamiliar observation intervention (n = 18), there was a large single measure ICC (r = .87, p < .05, CI = .70-.95) between pre- and post-intervention single-item scores (M_{diff} = 0.89).

Table 2.6

Pre- and post-intervention collective efficacy mean and standard deviation for basketball and non-basketball groups

	Pre-intervention		**Post-intervention**		**Change**
Condition	*M*	*SD*	*M*	*SD*	(%)
CEQS (composite)					
Basketball	6.16	1.08	7.03	1.01	14.1
Non-Basketball	6.52	.82	6.81	.87	4.4
Single-item measure					
Basketball	74.61	9.91	83.56	6.26	12.0
Non-Basketball	76.94	8.34	77.94	8.83	1.3

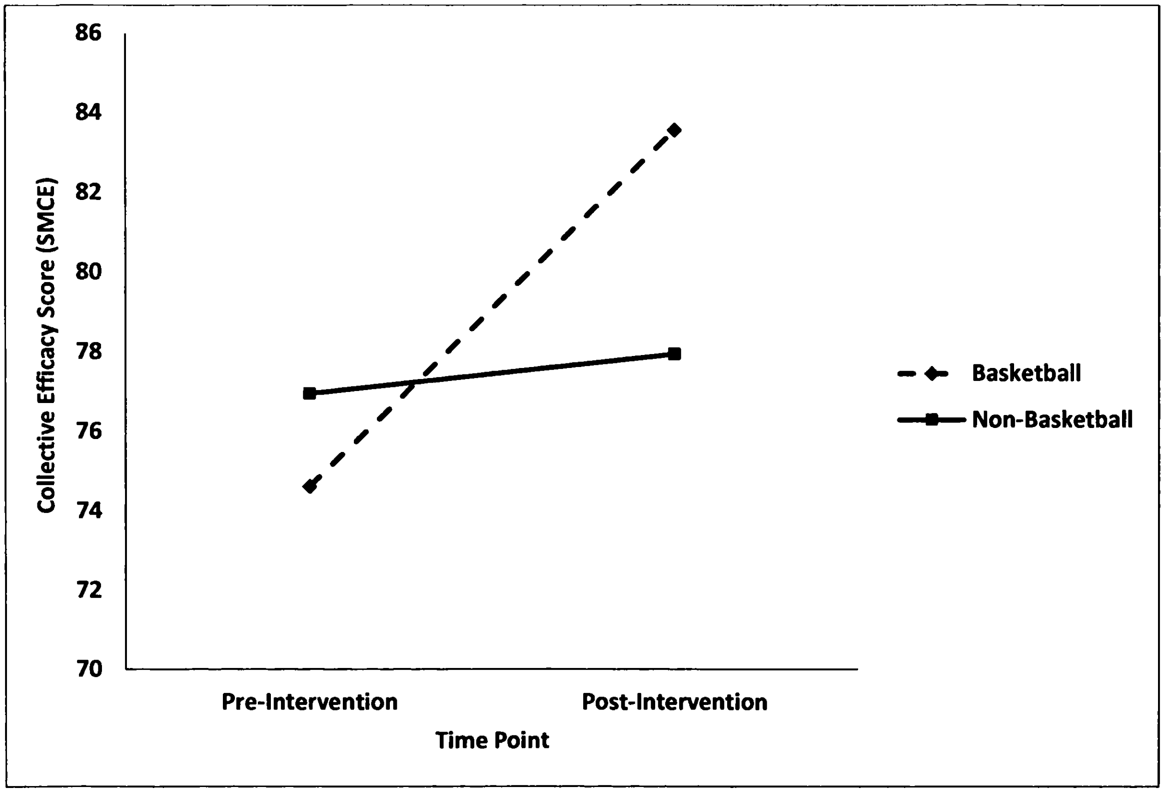

Figure 2.2. Intervention effect upon collective efficacy beliefs for basketball and non-basketball conditions.

2.11 Discussion

Taken together the findings of this investigation support the validity and reliability of the operational stem for use with single-item collective efficacy measurement with team sports players. 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. However, further analysis identified the ability subscale of the CEQS as the only significant predictor of single-item collective efficacy. The findings also support the convergent validity for the stem, with the ATG-T, GI-T, and GI-S components of the GEQ identified as significant predictors of collective efficacy scores for both the single-item and CEQS. Finally, the predictive validity of the stem was demonstrated with previous performance predicting collective efficacy scores for the single-item and CEQS.

Study two reported strong correlations between the single-item measure and CEQS for interactive 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 indicate 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.

The findings from study three replicated the correlations between the single-item and CEQS for interactive sports team players in a field-based setting, further demonstrating the concurrent validity of the stem. For participants allocated to the familiar intervention condition single-item scores were positively correlated with CEQS scores (composite & all subscales) both prior to and post-intervention. For participants allocated to the unfamiliar intervention condition single-item scores were positively correlated with composite CEQS scores and ability, preparation, persistence, and effort subscale scores both prior to and post-intervention. A greater increase in collective efficacy was reported for the group 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 reliability for the stem was supported with strong correlations between pre-and post-intervention single-item scores using participants allocated to the unfamiliar observation condition and individuals that demonstrated little/no difference in corresponding CEQS scores.

Correlations between the single-item measures and the CEQS were consistently strong, especially when compared to existing single-item measures of self-efficacy and their multi-item counterparts (e.g., Hoeppner et al., 2011, $r = .30$-$.56$). The high concurrence with the CEQS held for different designs (cross-sectional/laboratory/field) using team sports participants, demonstrating the rigor of the operational stem for collective efficacy measurement in a sports domain. The strong correlations between the stem and the composite CEQS scores indicate that the single-items represented collective efficacy accurately. However, the relationship between the stem and the subscales of the CEQS varied across the three studies. The results of the investigation indicated that the ability dimension of the CEQS was the only significant predictor of single-item collective efficacy for study one, and the most correlated dimension with single-item collective efficacy for study two (pre- and post-intervention). These findings suggest that the single-items may have represented outcome efficacy or outcome-oriented team confidence (cf. Fransen, Kleinert, Dithurbide, Vanbesalaere, & Boen, 2014) rather than the broader construct of collective efficacy. It is also possible that these results occurred because the word 'ability' is used in the single-item stem and the items used for this subscale were worded specifically to reference the ability of the team, otherwise known as a 'wording effect' (cf. Horan, DiStefano, & Motl, 2003).

In the third study, correlations were computed separately for the two experimental groups (familiar vs unfamiliar). For the familiar condition (basketball players) the stem held positive correlations with all CEQS subscales pre- and post-intervention, this being strongest with the unity subscale at both time points. It is possible that this correlation was strong because the basketball teams allocated to the familiar condition had played together both at a university and district level for a long-time period. Therefore, when considering aspects such as the closeness of the team the basketball players will have considerable experiences, both socially and performance-based, to form strong perceptions about their team's unity irrespective of other dimensions of collective efficacy. In contrast, for the unfamiliar condition (other sports team players) the stem did not correlate with the unity subscale for the CEQS but once again showed positive correlations with the ability, effort, persistence, and preparation subscales. This finding could also be explained by an individual's level of experience with their team. It is conceivable that a team sports player can develop perceptions about the level of effort or capabilities of their team without forming strong social bonds or communication pathways with their fellow team members, thus demonstrating low efficacy beliefs regarding the team's unity whilst having high efficacy beliefs regarding their performance capabilities.

This investigation considered the issue of reliability when examining the psychometric properties of the stem, something that has proved a limitation when using single-item measures to date (cf. Robins, Hendin, & Trzesniewski, 2001). Across study two and three high test-retest reliabilities were evident for four different subgroups using two different study designs, supporting the reliability of the stem for use with single-item collective efficacy measurement with team sports participants. This investigation also examined whether the stem could be incorporated within a single-item to assess collective efficacy, a multidimensional construct. A positive relationship, either predictive or correlative, was not always apparent between the stem and all subscales for the CEQS. However, a positive correlation was identified with each subscale at least four times across the three studies. Although ability was identified as the only CEQS subscale to predict single-item collective efficacy scores in the first study, all subscales were correlated with single-item scores in the second study, as was the case for the familiar condition in the third study, with all subscales apart from unity correlated with single-item scores for the unfamiliar condition in this final study. Whilst it is important that the stem correlates with the components that makeup collective efficacy a more accurate reflection of this broad construct is provided by the composite CEQS score. In this regard, the CEQS was a significant predictor of single-item scores for the first study, and demonstrated positive correlations with the stem-based single-items at all times for studies two and three. Therefore, given that the CEQS is considered an accurate measurement tool for collective efficacy based on Bandura's (1997) definition (Fransen et al., 2014), it is appropriate to consider the stem as valid for the assessment of this broad construct.

The results of this investigation show that the stem can be used as part of two different single-item measures and employed across three different study designs in a sports context. Due to its adaptability, the stem allows for greater consistency when measuring collective efficacy using single-item scales, a characteristic which Bandura (1997) deems necessary for the measurement of collective efficacy in future research. Whilst allowing for greater consistency, this approach also takes into account Bandura's (2006) guidelines for the construction of efficacy scales. Bandura recommends that efficacy measures are context-specific, treat efficacy beliefs as a state, and are phrased in terms of 'can do' rather than 'will do'. This information can be included as an item tail combined with the stem to form a single-item measure. While two single-item collective efficacy scales have been used in previous collective efficacy research (Greenlees et al., 1999; Spink, 1990), both instruments assessed outcome efficacy and the psychometric properties of these measures were not examined. Study results suggest the stem is a valid and reliable method for use with single-item collective efficacy measurement in sport. This scale type allows for the instantaneous measurement of collective efficacy, something that is beneficial considering the construct is a state belief (i.e., can vary based on situational factors). This approach allows researchers and practitioners to examine collective efficacy at any given moment, providing a flexible measurement tool that can be used for both repeated measures and case study designs, promoting multi-level research within groups as well as between different contexts. For example, the stem could be used to measure collective efficacy at various time points during a sports team's training session to examine the relative impact of different coaching strategies or leadership tactics upon collective efficacy beliefs.

In the past decade experimental psychologists have identified the need for integration of brain and behavior assessment to gain a greater understanding of human psychological processes (cf. Henson, 2005). In this respect, a major reason for this investigation was to develop a single-item measure that can be used as part of a neuroimaging study to examine the neuropsychological processes involved with collective efficacy. The majority of fMRI studies investigating the neural correlates of psychological processes have involved procedures designed to evoke a desired psychological response. For example, when exploring the brain activity linked to empathy, Rameson, Morelli, and Lieberman (2011) showed participants sentences and images depicting sad situations. However, recent research has advocated that psychometric scales be integrated within fMRI designs to assess brain/behavior more accurately. Specifically, Dimoka (2011) used items from multi-item psychometric scales for four psychological processes (trust, distrust, perceived usefulness, perceived ease of use) as a means to stimulate brain activity associated with each focal psychological process. The stem developed in the current study is suitable for use with single-item collective efficacy measurement in fMRI protocols. Moreover, the single-item scale can be combined with observation interventions designed to increase efficacy beliefs as a comprehensive method for assessing the brain activity associated with collective efficacy (see Shearer, Holmes, et al., 2009 for details of group-based observation interventions). Functional neuroimaging data provides an additional dependent variable that can be combined with behavioral data to inform psychological theory and further understand a psychological process (Henson). Successful mapping of the brain activity associated with collective efficacy will advance understanding of this construct, providing information that can be used in the refinement of existing theories, development of conceptually grounded intervention techniques, and production of assessment methods combining brain, behavior, and psychometric modes.

Although the stem is both valid and reliable in the context of this investigation, there are some limitations that need to be acknowledged. Specifically, there is a need to consider the utility of single-item measures, the use of the CEQS across this investigation, 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).

The CEQS was used to assess the concurrent validity of the stem across the three studies discussed in this chapter. This measure was chosen because it is the only validated multi-item collective efficacy instrument for use across different team sports (see e.g., Hampson, & Jowett, 2012; Jowett, Shanmugam, & Caccoulis, 2012) and was operationalized to assess collective efficacy in keeping with the approach preferred in this thesis (i.e., asked the respondent to judge their team's perceptions of their collective efficacy beliefs). The beginning part of the operational stem employed by the CEQS 'Rate your team's confidence in their ability to...' was also chosen as the single-item stem used in this chapter. It is possible that the involvement of the CEQS in both the wording of the stem and the assessment of its concurrent validity could have influenced the results of this chapter. Specifically, a wording effect (cf. Horan et al., 2003) may exist whereby the strong correlations evident between the stem and the CEQS reflect the similarity of the questions being asked rather than the effectiveness of the measures in assessing collective efficacy beliefs. Although the CEQS is a psychometrically sound measure for use in sport, the identically worded stem calls into question its ability to validate the single-item stem. Future studies should examine the concurrent validity of the stem using sport-specific instruments with differently worded operational stems in order to control for this wording effect.

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. The findings showed ATG-T, GI-T, and GI-S were significant predictors of the stem, however, the ATG-S dimension did not significantly predict collective efficacy. This suggests that liking the social activities of your team does not influence your view of your team's confidence. Although the GEQ is a valid and reliable measure for use in sport (e.g., Li & Harmer, 1996), the ATG-S and GI-T components did show poor reliability in this instance. It is recommended that future studies further examine the stem's validity using the GEQ with team sports players.

In study three the intervention was developed using video footage collected for both basketball teams across several fixtures. This meant it was only possible to use two basketball teams and subsequently the study population could not exceed thirty-six as to avoid any biases. Despite this small population size, the within-subject and interaction effect sizes for this study (>.50) are classified as a large effect within previous guidelines (Cohen, 1992), supporting the strength of the observation effect and the predictive validity of the stem. In both study two and three the reliability of the measure was considered across two different study designs. In the absence of the internal reliability statistic due to the single-item nature of the measure, its reliability over time was considered. Because observation-based interventions were used in both studies, the number of participants predicted to show little/no change in collective efficacy was comparatively small to that used to measure reliability in previous studies (e.g., Williams et al., 2010).

Test-retest reliabilities were assessed using novel methods employed by a recent study on anxiety (Williams et al.). However, Williams and colleagues did not provide guidance for determining a small change in scores for criterion measures. In their study criterion of ± 1(20%) between time points on the Hamilton Rating Scale for Anxiety (HAM-A; Hamilton, 1959) was used to determine whether test-retest reliabilities would be computed for a participant. In this investigation a post-intervention change in composite CEQS score of ±.02 was used, accounting for 2.22% of the total CEQS scale size. This value was proportionally lower than that used by Williams et al. and may have impacted the size of the populations used to assess reliability. In teams with considerable past experiences, as is often the case with sports teams, collective efficacy beliefs are likely to be robust (i.e., if a team has experienced multiple years of success they are likely to have deep-seated high collective efficacy levels), meaning changes to efficacy perceptions will be relatively small (cf. Bandura, 1997, p. 480). Therefore, it can be assumed that a small change in collective efficacy is disproportional to a small change in anxiety, promoting the use of a conservative criterion value as to ascertain that the sub-groups reflect their intended purpose (i.e., a population with little/no change in CEQS score). Despite this small population the findings are similar to the reliability statistics reported for other domains and outcomes, such as pain (Chang, Hwang, & Feuerman, 2000) and anxiety (Williams et al.). There is a need to further examine the stem using groups/teams with large populations or multiple groups/teams in order to ensure that desired observation effects are attainable. The reliability of the single-item measure across several time points, while attempting to control for change in collective efficacy, also requires consideration. Specifically, a similar design to study three can be used to record collective efficacy responses for team sports players viewing an unfamiliar observation intervention over an extended period of time (i.e., repetitive viewing over several weeks).

Finally, the findings of this investigation provide preliminary evidence for the use of the stem in future single-item collective efficacy measures, however, there is a need to further examine the psychometric properties of the stem for collective efficacy measurement in sports contexts. To provide a more thorough assessment of the stem, research should focus on the relations between collective efficacy and other group related constructs, such as communication and group member satisfaction. In this chapter mixed populations were used in the first and second studies, with a male population used in the final study. This investigation did not compare gender differences in collective efficacy responses using the stem. However, this is a pertinent issue that requires further consideration to validate this approach to collective efficacy measurement. Researchers have yet to consider gender specific response patterns when validating existing collective efficacy measures in sport, but this topic has been investigated for processes conceptually linked to collective efficacy, such as imagery. There is some evidence that males and females differ in their imagery generating capabilities (e.g., Taktek, 2004). However, Monsma, Short, Hall, Gregg and Sullivan (2009) have found no gender variability for athlete responses to the revised movement imagery questionnaire (MIQ-R: Hall & Martin, 1997). Although research has yet to assess gender invariance when validating existing collective efficacy measures, a recent study in sport identified that factors predicting collective efficacy were the same for males and females (Fransen et al., 2012) suggesting that collective efficacy responses to the single-item stem will not vary because of gender. There still remains a possibility that males and females will interpret the stem differently, and therefore it is recommended that future studies compare single-item scores for the stem as a function of gender (i.e., males vs females). With specific reference to sport, invariance tests for age, level of competition, type of sport, and level of sport are also required to fully validate this measure for use in this context (cf. Short et al., 2005), with multiple sports teams, research designs, and settings (i.e., in both training and competition).

3.0 Chapter Three: An integrative review supporting the use of observation as a method for influencing collective efficacy

3.1 Introduction

Collective efficacy is important for group performance because it influences a team's individual efforts, use of available resources, persistence in the face of failure, and resistance to discouragement (Bandura, 1997). A large body of evidence exists to suggest collective efficacy has a positive effect upon group performance across many domains of group function (see Stajkovic, Lee, & Nyberg, 2009, for a meta-analysis). Despite the wealth of literature that has described collective efficacy (i.e., its antecedents and effects), less attention has been paid to methods used to change or manipulate this construct. Indeed, to date, existing techniques, such as imagery, have displayed equivocal findings when used to manipulate collective efficacy beliefs (see e.g., Shearer, Mellalieu, et al., 2009). In order to develop a conceptually grounded intervention technique there is a need to consider the specific antecedents for collective efficacy. In this respect, observation of a group task/action can provide an individual with mastery and vicarious experiences, suggesting it may be effective towards increasing collective efficacy beliefs.

The overall aim of this review is to provide an argument for the use of observation interventions to manipulate collective efficacy from observation-based literature, original theories of human behavior, and more modern understandings of brain and behavior. Following an overview of collective efficacy as a construct in the context of Bandura's (1986) social cognitive theory (SCT) and as an extension of self-efficacy, I discuss extant research focusing on collective efficacy interventions in the group-based literature. Observational learning, an important component of Bandura's SCT, is then introduced, with emphasis on modeling types and styles, and their link to collective efficacy. Next, I consider the contemporary social neuroscience literature examining action observation and human social cognition, providing evidence for the shared neural mechanisms underlying both as support for the use of observation as a collective efficacy intervention. Finally, I consider why observation of team action is an ideal intervention for collective efficacy enhancement, and provide recommendations to further understand the relationship between observation and collective efficacy across group contexts.

3.2 The background to collective efficacy and its manipulation

Bandura (1977b) introduced social learning theory to advance understanding of human learning and behavior, placing special emphasis on the important roles played by vicarious, symbolic, and self-regulatory processes which had little mention in contemporary theories at that time. Subsequently, social learning theory was adapted to provide greater focus on human cognition in the context of social learning, this became known as SCT (cf. Bandura, 1986). SCT provides an overall framework for understanding human functioning, suggesting that human achievement depends on a reciprocal triad between personal, behavioral, and environmental influences. According to SCT, self-referent thoughts mediate between knowledge and action, and of these thoughts, none is more central than a person's judgments of their capabilities, namely self-efficacy beliefs (cf. Bandura, 1989; Pajares, 1996). Self-efficacy is defined as "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments" (Bandura, 1997, p. 3) reflecting the confidence an individual has in their ability to perform a specific task.

Bandura (1977a, 1986, 1997) suggested four specific antecedents of self-efficacy beliefs: enactive mastery experiences; vicarious experience; verbal persuasion; and physiological/affective states, with mastery and vicarious experiences the two strongest sources (cf. Law & Hall, 2009). Enactive mastery experiences are viewed as the most influential source of efficacy information because they provide direct evidence of whether one can perform at the level required to achieve success (Bandura, 1997). The effects of these experiences on efficacy perceptions depend on factors such as pre-existing knowledge structures (see e.g., Cervone & Palmer, 1990), the difficulty of the task being mastered (see e.g., Bandura, 1988), and the effort expended during the mastery experience (see e.g., Bandura & Cervone, 1986). Efficacy appraisals are also partly determined by vicarious experiences, and refer to experiences that are generated through modeling the behaviors of others. The influence of these experiences are determined by factors such as the similarity of the observed performance to that of the intended performance (see e.g., Bandura & Jourden, 1991), the extent to which the attributes of a model are similar to that of the observer (e.g., George, Feltz, & Chase, 1992), and the competence/skill level of the model being observed (Lirgg & Feltz, 1991).

Efficacy beliefs are one set of proximal determinants of a person's behavior, thought patterns, and emotional reactions for a given situation. Self-efficacy judgments have a positive relationship with individual performance across several domains of human functioning (e.g., business: Stajkovic & Luthans, 1998). However, humans often work together towards collective objectives within groups or teams and hold collective efficacy beliefs regarding their functional abilities for specific tasks (Bandura, 1982, 1997). Within existing research collective efficacy has been conceptualized and subsequently measured in different ways, with two definitions having received popular use in sport (Myers & Feltz, 2007). The first definition by Bandura describes collective efficacy as "a group's shared belief in its conjoint capability to organize and execute the courses of action required to produce given levels of attainment" (1997, p. 477). The second definition by Zacarro, Blair, Peterson, and Zazanis (1995) describes collective efficacy as "a sense of collective competence shared among individuals when allocating, coordinating, and integrating their resources in a successful concerted response to specific situational demands". Although similar, subtle differences exist between the two. For example, Bandura's definition considers the specific goals defined by the team (i.e., "given level of attainment") and Zacarro and colleagues' definition refers to success in general (i.e., "successful concerted response"). Since collective efficacy is an abstract construct (meaning neither definition can be truly correct or incorrect) we must consider which definition leads to the development of instruments that most accurately predict group behaviors within a given domain (cf. Maddux, 1999). As team sports performance is underpinned by the achievement of specific goals (e.g., shots on target in football) rather than success in general, Bandura's definition will be adopted for this thesis. This is because the definition clearly states the presence of a "shared belief" and is more specific about what a team is trying to attain (i.e., goals). In addition, this definition has been used by the majority of literature to date, allowing for comparison across studies.

The development of collective efficacy is linked closely with that of self-efficacy, the difference being the unit of agency to which they concern. Self-efficacy exists at an individual level (cf. Bandura, 1997), whereas collective efficacy has been conceptualized (and subsequently analyzed) both at an individual (e.g., Heuze, Sarrazin, Masiero, Raimbault, & Thomas, 2006) and group level (e.g., Gibson, 1999). Although collective efficacy is a group's shared belief, Bandura (1997) advocated that each team member's belief in the team's overall capabilities should be considered, and these individual measures aggregated to the team level. Therefore, both individual and group level approaches are suitable for use with the study of collective efficacy, with the choice of level contingent on the situation involved (i.e., suited to the specific context). Aggregated collective efficacy details a group's overall beliefs, but does not consider individual differences within the group (Shearer, Holmes, et al., 2009). Given that collective efficacy is ultimately measured through individual cognitions, it seems appropriate to adopt an individual-level approach to the manipulation, measurement, and analysis of collective efficacy perceptions. This approach recognizes the unique characteristics of each team member and does not assume that one global method will work for all team members (i.e., interventions should be individualized).

The close link between self- and collective efficacy has been established empirically, with studies demonstrating a moderate positive relationship between the two (e.g., Feltz & Lirgg, 1998; Watson, Chemers, & Preiser, 2001). People's shared beliefs in their collective efficacy influence the types of futures they seek to achieve through collective action, their effective use of resources, the amount of effort they put towards group performance, their resilience when encountering a taxing situation/formidable opposition, and their resistance to discouragement (Bandura, 2000). As collective efficacy is in part determined by self-efficacy, they are proposed to share the same antecedents (enactive mastery experiences, vicarious experience, verbal persuasion, and physiological/affective states) with the addition of leadership, cohesion and group size specific to collective efficacy beliefs (cf. Bandura, 1997; Carron & Hausenblas, 1998).

Bandura (1997) proposed that performance accomplishments are the most influential source of efficacy information, something which has received support in sports settings (e.g., Chase, Feltz, & Lirgg, 2003). Indeed, it is thought that when repeated, perceived success will lead to increased efficacy expectations and perceived failure will lead to decreased efficacy expectations (Bond, Biddle, & Ntoumanis, 2001; Feltz, 1988). However, there is currently a lack of understanding of the sources contributing to collective efficacy development and it is possible that differences may exist between an individual and team (Fransen et al., 2012). Fransen and colleagues investigated the information sources used by volleyball players and coaches to develop their collective efficacy perceptions during actual game performance. A number of new collective efficacy antecedents in addition to those originally proposed by Bandura (1997) were identified, including both general and context-specific sources that exist in pre-game, warm-up, and in-game settings. For example, the expression of collective efficacy by the team leaders and the communication between the team players were found to be predictive of collective efficacy during actual performance (Fransen et al.). In contrast to previous research (e.g., Chase et al., 2003) Fransen et al. identified positive supportive communication as a more important predictor of collective efficacy than previous performance in volleyball teams.

Collective efficacy beliefs are primarily developed through a person's actual experiences of team performance (i.e., their mastery experiences; Bandura, 1997). When basing efficacy perceptions on the collective performance of a team an individual will take into account both their performance within the team, and the performance of their teammate's. In consideration of their own performance an individual will gather efficacy information directly from their execution of action. However, when they develop efficacy beliefs from the performance of their teammate's they will do so through observing their actions and interpreting the level of success (i.e., action understanding) and emotions (via empathy) associated with said performance. The process of empathy has received extensive research interest across multiple disciplines including social psychology (e.g., Davis, 1994), and more recently cognitive neuroscience (Masten, Morelli, & Eisenberger, 2011). Due to its complex nature, researchers have used the construct in different ways, with the term "empathy" adopted to label eight conceptually distinct phenomena (Batson, 2009). Of the concepts outlined by Batson, the first, "knowing another person's internal state" provides a broad definition of empathy appropriate for use with collective efficacy development given that efficacy perceptions are developed by considering the aggregated beliefs of one's self and teammates. However, this definition does not provide an explanation for how an individual may know another's internal state and it is plausible that multiple existing concepts may be used to do so. In line with simulation theory (Gordon, 1986; Heal, 1986) an individual may project oneself into another's situation, or imagine how one would think and feel in the other's place, in order to feel as the other feels (Batson). For example, in soccer when an individual team member watches their teammate's performing a corner kick routine they may imagine themselves being part of said routine in order to gauge the collective efficacy perceptions of their team for that given situation.

A number of intervention techniques have been developed to strengthen self-efficacy beliefs based on the two strongest sources of efficacy information (performance accomplishments and vicarious experiences) outlined within Bandura's (1977) self-efficacy theory (see Short & Ross-Stewart, 2008 for a full review of self-efficacy interventions). To improve self-efficacy using past performance accomplishment information, performance should be structured so that success is achieved and interpreted as a result of one's own efforts (cf. Short & Ross-Stewart). For intervention purposes, instructional strategies such as progressions, performance aids, and physical guidance can be used to achieve success, making them ideal for use in training sessions to increase self-efficacy for the athletes involved (see e.g., Feltz, Short, & Sullivan, 2008). Vicarious experiences, which involve observing and comparing oneself with others/norms, are considered less powerful than mastery experiences when forming self-efficacy perceptions (see e.g., Wise & Trunnell, 2001), but are particularly useful when individuals have little previous performance experience. The social comparison aspect of vicarious experience has resulted in the repeated investigation of peer modeling-based interventions to strengthen self-efficacy beliefs (e.g., Clark, & Ste-Marie, 2002; Feltz, Landers, & Raeder, 1979; Weiss, McCullagh, Smith, & Berlant, 1998). For example, Clark and Ste-Marie demonstrated that viewing peer coping models (i.e., individual's displaying progression from unskilled to skilled performance) and peer mastery models (i.e., individual's displaying skilled execution of a skill) improved self-efficacy and performance for a diving skill.

Despite collective efficacy having a positive effect upon group performance in organizational, sport, education, nursing, and military settings (see e.g., Bandura, 1993; Gibson, 1999; Goddard, Hoy, & Hoy, 2004; Myers, Payment, & Feltz, 2004; Zaccaro, Blair, Peterson, & Zazanis, 1995), and the wealth of literature investigating interventions designed to increase self-efficacy there is scant research considering specific interventions that can be used to increase a group/team's efficacy perceptions. Previous studies have used goal-setting (Gibson, 2001) and verbal self-guidance (Brown, 2003) to increase collective efficacy beliefs in organizational and educational contexts; however, neither method has been examined as a collective efficacy intervention technique since.

Given efficacy perceptions have several antecedents, intervention strategies should seek to provide individual's with multiple sources of efficacy information to maximize collective efficacy. One example of such an intervention technique is motivational general-mastery imagery (MG-M), which requires the individual to image being mentally tough and confident in all circumstances (cf. Shearer, Thomson, Mellalieu, & Shearer, 2007). MG-M has the capacity to provide an individual with both mastery (i.e., imagining themselves performing successfully) and vicarious experience (i.e., imagining peers performing successfully), both salient factors that affect a team's collective efficacy. Predominantly, MG-M has been acknowledged as an effective method for the manipulation of both self-efficacy (e.g., Short et al., 2002; Munroe-Chandler, Hall, & Fishburne, 2008) and collective efficacy beliefs in sport (e.g., Munroe-Chandler & Hall, 2004; Shearer, Mellalieu, Thomson, & Shearer, 2008; Shearer, Mellalieu, et al., 2009). For example, Shearer et al. (2008) provided partial support for the use of MG-M type imagery interventions to enhance collective efficacy in elite sports teams. Using a multiple baseline across groups design with elite wheelchair basketball players, Shearer and colleagues (2008) reported equivocal collective efficacy responses to a 4-week imagery intervention. Specifically, using three experimental groups, average collective efficacy scores increased for the first group, became more consistent for the second, and remained unchanged for the third.

3.3 Observational learning: Modeling as an intervention to manipulate social processes

As emphasized in SCT, the advanced capability for vicarious learning is a distinctive human quality that enables an individual to expand their knowledge, skills, and beliefs based on information conveyed by modeled actions (i.e., observed actions of others: Bandura, 1989). This framework suggests that virtually all phenomena achieved through direct experience (e.g., efficacy beliefs) can occur vicariously by observing people's behaviors and the resulting consequences. Bandura (1989) suggests that individuals can experience diverse modeling influences (i.e., influences resulting from observing others actions) with modeled actions serving as instructors, motivators, inhibitors, disinhibitors, social facilitators, and emotional arousers. According to Bandura's (1986) SCT, the acquisition of social behaviors primarily exists in social-contexts, and the majority of what is learned is gained through observational learning. This suggests that individuals develop their individual and social actions (i.e., team-related behavior) through the modeling of others behaviors, which in-turn influences their collective efficacy. For example, if an individual/team improves their ability to perform an action through observing other teammates'/teams' performances, their efficacy beliefs would also be expected to increase.

Bandura (1986) proposed four procedural components of modeling. The first component - the attentional process - determines the modeling influences people observe and what information they extract from them. In the context of collective efficacy, individual beliefs are formed by perception of others actions. Therefore, during team performance an individual will attend to their teammate's behaviors and apparent emotions to inform their collective efficacy beliefs. For example, in basketball performance an individual will pay attention to teammate behaviors he/she deems influential towards successful performance (e.g., effective passing/goal shooting) when developing collective efficacy perceptions about their team as a whole. The second component governing observational learning is the retention process, which involves the transformation and restructuring of information obtained from modeled events. When observing teammates' behaviors an individual's collective efficacy perceptions are only influenced by the events they remember. When considering team performance, the recent actions of fellow team members will contribute towards an individual's collective efficacy perceptions, but it is unlikely an individual can remember all of their teammates' previous behaviors. During the third component of modeling - the behavioral production process - the resultant conceptions from the modeled behavior are turned into action. When an individual views their teammates behaviors collective efficacy is effected by the modeled events, and subsequently performance is influenced as a result of both the observed behaviors and the change in collective efficacy perceptions. The fourth component governing the modeling process involves the role of motivational processes in the performance of observationally-learned behaviors. Individuals are more likely to exhibit modeled behavior if it results in desired outcomes. Consequently, if collective efficacy increases as a result of observed events, and performance improves as a result of both enhanced collective efficacy and reproduction of the observed behaviors, an individual is likely to be highly motivated to repeat these actions.

Observational learning is often described as a process of watching others to assist in the learning of varied skills (e.g., Schmidt & Wrisberg, 2008) and vicarious influence is significant because observers can acquire lasting attitudes, emotional reactions, perceptions, and behavioral tendencies towards persons, places, and actions associated with the model's emotional experience. SCT distinguishes between acquisition and performance because people do not perform everything they learn. In the case of efficacy beliefs, observation of others can provide an individual with vicarious experiences, which are important towards the development of efficacy perceptions, but does not provide evidence of mastery experiences, the strongest source of efficacy information. While research has demonstrated that observing the actions of others is useful when attempting to learn a new skill (e.g., Clark & Ste-Marie, 2002) the potency of the model is related to the similarities between the model and the observer, this being greatest when the observer is viewing them self (Bandura, 1986, 1997; Schunk, 2001). To date, two modes of self-as-a-model interventions have been used: self-observation and self-modeling (Clark & Ste-Marie, 2007). Self-observation methods involve an individual viewing themself performing an action/skill at their current level (Clark, Ste-Marie, & Martini, 2006). Two subclasses of self-modeling have been proposed: positive self-review modeling involves observing footage of best performances and editing out errors, and feed-forward modeling involves observing footage that depicts a skill that is not yet acquired or an existing skill in a context that is yet to be addressed (Dowrick, 1999). Self-as-a-model techniques have received considerable attention as interventions for various human motor performance activities. For example, self-modeling has been shown to increase performance in an academic setting (see Hitchcock, Dowrick, & Prater, 2003, for a full review) and across various sports including, swimming (Martini, Rymal, & Ste-Marie, 2011), gymnastics (Baudry, Leroy, Seifert, & Chollet, 2006), and volleyball (Zetou, Kourtesis, Getsiou, Michalopoulou, & Kioumourtzoglou, 2008).

In addition to influencing performance and learning, video-based observation interventions, which involve viewing one's self (self-modeling) or others (peer-modeling) performing an action, have received considerable attention as a means to enhance a number of psychological factors. For example, conceptually, both SCT and self-efficacy theory (Bandura, 1986, 1997) suggest individual efficacy beliefs can be influenced through self-modeling techniques. Feltz, Short, and Sullivan (2008) outlined the potential for modeling to influence efficacy beliefs by providing the observer with instructional information, and by showing that a task can be learned and completed successfully. Modeling has the capacity to provide individuals with performance accomplishment information (Feltz et al., 1979), a known source of self-efficacy perceptions. Indeed, numerous studies have shown increased self-efficacy as a result of self-modeling interventions in sport (e.g., Clark & Ste-Marie, 2007; McCullagh & Weiss, 2001; Short & Ross-Stewart, 2009; Singleton & Feltz, 1999). Specifically, Singleton and Feltz reported greater self-efficacy levels for collegiate hockey players who viewed a positive self-modeling intervention in comparison to those allocated to a control group. In an extension of this research Clark and Ste-Marie compared self-efficacy responses to self-modeling, self-observation, and control (physical training alone) conditions over the course of a one-week experiment using adolescent swimmers. Self-efficacy increased for all three conditions post-intervention, however, higher group means were reported for the two self-as-a-model intervention groups in comparison to the control group.

The ability of self-as-a-model interventions to influence performance and self-efficacy lends support to the use of group-based modeling interventions to manipulate collective efficacy perceptions. As collective efficacy is closely linked with self-efficacy (cf. Bandura, 1997), and highly correlated with task performance (see Stajkovic et al., 2009), techniques designed to influence self-efficacy and task performance offer the potential to be tailored to manipulate collective efficacy perceptions. Specifically, observing one's own team perform a group task/action includes both self- and other-modeling and can be used to influence collective efficacy through two of its strongest sources, namely mastery and vicarious experiences.

3.4 Neuroscientific basis for observation as a means to manipulate collective efficacy

Like many concepts and constructs studied in sport psychology, collective efficacy has lacked an explanation for the potential mechanisms underpinning both its function and action (cf. Shearer, Holmes, et al., 2009). Over a decade ago, Keil, Holmes, Bennett, and Davids (2000) put forward the need to integrate several lines of research when investigating psychological processes in sport psychology. Specifically, Keil and colleagues advocated that future studies combine brain activity measurement using neuroimaging techniques with traditional behavioral methods, such as psychometric assessment, in a bid to fully understand psychological constructs important to sports performance (i.e., collective efficacy). More recently, Cross, Acquah, and Ramsey (2013) critically reviewed the importance of cognitive neuroscientific research in sport psychology. While Cross and colleagues suggested that an overreliance on neuroscience would be misplaced in the field of psychology, they identified several advantages associated with this type of research, suggesting that knowledge gained from neurobiological approaches can be used to compliment more traditional approaches and further understand psychological states. In this section I outline evidence from existing cognitive neuroscience literature to provide further support for the role of observation as an intervention in the development of collective efficacy beliefs.

Mirror neurons are a special class of neuron that were first discovered by single cell recordings in the parieto-frontal areas of macaque monkeys (di Pellegrino, Fadiga, Fogassi, Gallese, & Rizzolatti, 1992; Gallese, Fadiga, Fogassi, & Rizzolatti, 1996; Rizzolatti, Fadiga, Gallese, & Fogassi, 1996). These neurons are activated both when a monkey executes a specific motor action and when it watches the same action being performed (Rizzolatti et al., 1996). Ever since their discovery, mirror neurons have received considerable interest within neuroscience with recent neuroimaging studies proposing the existence of an MNS in humans similar to that which exists for monkeys (see e.g., Ferrari & Rizzolatti, 2014; Rizzolatti & Fogassi, 2014, for an overview). There is considerable evidence that motor areas recruited in humans during action observation overlap with areas where mirror neurons have been reported in monkeys (e.g., Carr et al., 2003; Iacoboni et al., 2005; Lago-Rodriguez, Lopes-Alonso, & Fernándes-del-Olmo, 2013). Of the studies that have investigated mirror neurons in humans, the majority have used neuroimaging techniques such as fMRI (see e.g., Molenberghs, Cunnington, & Mattingley, 2012 for a meta-analysis), providing indirect evidence for their existence (Keysers & Gazzola, 2010). However, in 2010, Mukamel, Ekstrom, Kaplan, Iacoboni, and Fried published a seminal paper in Current Biology that directly investigated the single-neuron responses to execution and observation of actions in humans. Their findings showed that humans have neurons that behave in an identical manner to mirror neurons in monkeys, discharging when they view and perform a specific action. They also demonstrated that these neurons exist in additional cortical areas to those proposed by the majority of mirror neuron investigations (i.e., premotor and inferior parietal cortex).

In line with Kilner and Lemon's (2013) suggestions that the discovery of mirror neurons was "exciting because it has led to a new way of thinking about how we generate our own actions and how we monitor and interpret the actions of others" (p. 57), the potential role of mirror neurons in human social cognition and observational learning provides a neural-level explanation for how humans develop collective efficacy perceptions. Specifically, the MNS has been proposed as the neurophysiological mechanism that underpins observational learning (Cattaneo & Rizzolatti, 2009), the process by which an individual learns how to perform an action that is presented to them by an observed model. As outlined by Bandura's (1986) SCT, individuals develop the majority of their social behaviors and beliefs through observing others. Given that collective efficacy refers to individual beliefs about the confidence of a social group, it is apparent that efficacy development will involve both the observation of one's teammates and comparative teams within the same domain. Therefore, the apparent role of mirror neurons within observational learning suggests that they will be heavily involved with the development of collective efficacy perceptions.

Neuroimaging studies indicate comparable motor areas are recruited not only when biological movements are executed, but also when they are observed (for a recent review see Gatti et al., 2013). These neurons appear to be activated both when an individual performs an action, and when they view a similar action (e.g., Dinstein, Hasson, Rubin, & Heeger, 2007; Iacoboni et al., 2005; Rizzolatti & Craighero, 2004), suggesting they form the basis of an observation-execution matching system otherwise known as the MNS. Over the past three decades since the discovery of mirror neurons (Rizzolatti, Carmada, Fogassi, Gentilucci, Luppino, & Matelli, 1988) several neuroimaging studies have shown increased mirror neuron activity during observation of simple motor tasks such as hand grasping (see Grezes & Decety, 2001 for a meta-analysis). More recently, studies have reported heightened activity within areas where the MNS is presumed to exist for individuals during observation of more complex actions when they exist within their motor repertoire (e.g., dance movements: Calvo-Merino, Glaser, Grèzes, Passingham, & Haggard, 2005, 2006; Cross, Hamilton, & Grafton, 2006; Orgs, Dombrowski, Heil, & Jansen-Osmann, 2008). Although consensus has yet to be reached on a specific function for the MNS there is agreement that this system is involved with many aspects of human social cognition (Pacherie & Dokic, 2006). The MNS is suggested to play an important role in action and intention understanding, imitation, empathy, 'mind'-reading, and language development (cf. Rizzolatti, 2005), and is the only mechanism that allows individuals to understand others' actions from the inside, giving them a first-person account of their motor goals and intentions (Rizzolatti & Sinigaglia, 2010).

While the MNS accounts for action understanding and motor intention (e.g., watching team mates perform a strategy correctly), collective efficacy perceptions also require individuals to empathize with the thoughts and emotions of group members. Empirical findings suggest cortical midline structures (CMS) account for additional aspects of social cognition to those supposedly accounted for by the MNS (e.g., the processing of social relationships: Iacoboni et al., 2004; Schilbach et al., 2006). This links the CMS to 'theory of mind', which refers to the ability of an individual to attribute independent mental states of self/others in order to explain behavior (Fletcher et al., 1995) an important building block of social behaviors such as collective efficacy (Iacoboni et al., 2005). Moreover, Uddin, Iacoboni, Lange, and Keenan (2007) suggest that an interaction between frontoparietal mirror neuron areas and CMS accounts for both social understanding and functioning and may therefore be involved with the processing of socially communicated phenomena, such as collective efficacy. A number of studies propose that empathizing with conspecifics' emotions activates similar brain areas that include, but extend beyond the MNS to limbic areas (which hold a close association with emotion) via the insula (e.g., Carr et al., 2003; Pfeifer, Iacoboni, Mazziotta, & Dapretto, 2008). Consequently, when individuals consider perceptions of their groups' collective efficacy, it is likely that they empathize with the content of the observed behaviors (e.g., a positive reaction to a score), engaging this neural system. This neuroscience evidence links closely with Bandura's (1986) SCT, and in particular the process of observational learning which suggests that when observing other teammates, individual's take into account both their teammate's emotions and behaviors.

Collectively, the neuroscience evidence highlighted suggests that it is appropriate to consider the neural circuitry of the MNS, CMS, and limbic system in the context of collective efficacy where judgments are made about shared beliefs through behavioral empathy with teammates (Shearer, Holmes, et al., 2009). The comparable neural activity that exists for social cognitions (e.g., collective efficacy) and both the observation and execution of action indicates the potential involvement of observation in the development of social phenomena such as collective efficacy. When developing collective efficacy beliefs, an individual's perceptions are based on the actions, behaviors, and emotions of both themselves and their teammates during team performance. Consequently, the observation of team performance can hypothetically influence an individual's collective efficacy perceptions via the neural mechanisms that link this process to both actual execution and social cognition. For example, when a soccer player views their teammate's performing a set-play successfully and scoring a goal, they observe their actions, behaviors, and apparent emotions, this innervates the MNS, CMS, and limbic system, which may then allow the individual to make a judgment about his/her collective efficacy. This provides a neural level mechanism of how mastery and vicarious experiences lead to changes in collective efficacy beliefs.

3.5 Practical implications and future research directions for observation as a collective efficacy intervention

Based on the evidence presented in this review I tentatively offer two potential practical recommendations regarding the use of observation-based techniques to manipulate collective efficacy. First, throughout this review I have discussed extant literature supporting the use of observation-based interventions to increase several variables associated with successful group/team performance (e.g., self-efficacy, collective efficacy). These findings suggest that providing athletes (individual/team) with positive footage from their previous performances (training and competition) prior to competition can increase efficacy beliefs, potentially benefitting performance. Second, in this review I have highlighted that neural activity for action observation is closest to that of actual action execution when an individual views a familiar action (Calvo-Merino et al., 2005, 2006). Indeed, Bandura (1986, 1997) contends that modeling interventions will have the greatest influence on efficacy beliefs when the model-observer similarity is maximized. In order to maximize collective efficacy, and therefore team performance, teams should be provided with interventions comprising positive performance footage specific to both the team and setting (e.g., footage of their own team performing in competitive settings).

In light of the conceptual basis and initial evidence provided in this review, I conclude with a number of recommendations regarding the investigation of observation interventions as a means to increase collective efficacy in groups/teams. First, there is a need to examine the effectiveness of group-based observation interventions in modifying individual collective efficacy perceptions. To develop understanding of using observation interventions for this purpose, their effectiveness with different sports teams needs consideration (e.g., soccer, field hockey, rugby union). Due to the lack of literature regarding observation and collective efficacy, there is a need to determine whether existing findings for self-efficacy (e.g., Zetou et al., 2008) are replicated for collective efficacy across different team sports. This will advance understanding of observation intervention application in sport whilst comprehensively examining the usefulness of this intervention type to increase collective efficacy with all groups/teams.

Second, although it is beneficial to investigate whether observation interventions can provide an immediate increase in collective efficacy perceptions, there is also a need to study the application of such techniques across longer time periods. In 'real world' settings it is likely that observation interventions will be used repeatedly to increase collective efficacy. For example, in a sporting context a coach will want their team to have high levels of collective efficacy throughout the season. It is possible that repeated exposure to observation interventions might 'blunt' an individual's collective efficacy response due to boredom or provision of similar efficacy information (i.e., displaying performance accomplishments of equal worth). Therefore, to advance understanding of this technique as an applied collective efficacy intervention with sports teams there is a need to understand the dose-response relationship better.

Third, to determine the most effective strategy for increasing collective efficacy there is also a need to compare observation with existing group dynamics interventions (e.g., traditional team building techniques; Voight & Callaghan, 2001) and other prevalent collective efficacy interventions (e.g., imagery). From a socio-cognitive and neuroscience perspective, motor imagery, as a reflection of past experiences, is conceptually linked with collective efficacy due to its shared neural mechanisms with action execution (e.g., Jeannerod, 2001; Gallese et al., 2004). However, observation interventions provide a more accurate neural representation of action execution in comparison to imagery (cf. Holmes & Calmels, 2008), suggesting they may offer a viable alternative to imagery interventions for increasing collective efficacy perceptions in teams.

Fourth, if observation proves to be the most effective strategy for increasing collective efficacy, there is a need to investigate whether separate observation intervention types influence collective efficacy perceptions differently. In the third section of this review I identify three types of self-as-a-model intervention that have been used in modeling literature to date (self-observation, positive self-review, feedforward modeling). Research comparing the effectiveness of these different observation techniques as collective efficacy interventions with sports teams is warranted. Different modeling types may provide an individual/team with different sources of efficacy information, for example, positive self-review interventions are designed to provide the observer with mastery experiences through displaying positive examples of previous performance, whereas self-observation interventions may provide less performance accomplishment information but evoke a sense of coping and resilience by including a team/individual's responses to negative situations. Alternatively, the effects of the different interventions could be individualized (i.e., an individual may prefer a certain observation style) or suitable for a team at a given point (i.e., when their collective efficacy beliefs are high/low). For example, if a sports team's defense has been weak during the majority of their performances, a positive self-review intervention displaying only attacking content may be unsuitable and potentially ineffective towards their collective efficacy perceptions.

Finally, a significant part of the conceptual basis for observation influencing collective efficacy is that similar neural activity exists for social cognitions (e.g., collective efficacy) and the observation and execution of action. Despite evidence for the link between the MNS, CMS, observation, and social cognition, to date, no research has investigated the neural processes involved with collective efficacy perceptions directly and therefore no direct explanation exists for the mechanisms that underpin both its function and action (Shearer, Holmes, et al., 2009). To fully understand psychological constructs such as collective efficacy there is a need to integrate understanding of both brain and behavior (cf. Keil et al., 2000). It is proposed that team-based video footage can be used to investigate the neurological basis of individual collective efficacy perceptions in combination with functional magnetic resonance imaging (fMRI), a common method employed to measure neural activity in past neuroscience research. Future studies need to compare an individual's brain activity whilst watching positive footage of their own group's performance with subsequent activity associated with unfamiliar group footage and neutral footage (cf. Calvo-Merino et al., 2006). This knowledge will further our understanding of the specific mechanisms involved with collective efficacy development, providing neuroscience evidence that can be used to tailor interventions to increase individual collective efficacy perceptions.

3.6 Summary

Considerable evidence currently exists supporting the importance of collective efficacy towards group/team performance across several domains including sport, business, and education (see Stajkovic et al., 2009 for a review). However, a lack of conceptually-grounded interventions exist that can be used to manipulate an individual's collective efficacy beliefs. This review discusses the use of observation-based techniques as a means to manipulate individual perceptions of collective efficacy. Conceptually, Bandura's (1986) theories of social cognition and observational learning place emphasis on the importance of observation in the development of collective efficacy beliefs. Empirically, observation in the form of self-modeling enhances task performance and self-efficacy (e.g., Feltz, Short, & Singleton, 2008), two correlates of collective efficacy. Lastly, from a neuroscience perspective, when we observe others actions and emotions, our brain activates as though we were experiencing those actions and emotions ourselves (Gatti et al., 2013). Similar activation of the MNS, CMS, and limbic system indicates that we empathize with others and provides an answer for 'theory of mind'. Practically, this suggests that individuals develop collective efficacy perceptions when observing teammates' behaviors and emotions, further supporting the use of observation as a suitable intervention to increase collective efficacy.

4.0 Chapter Four: Observation as a means to manipulate collective efficacy in groups

4.1 Introduction

Bandura's (1977) self-efficacy theory was developed within the framework of social cognitive theory and was first introduced to explain and adapt human behavior. Bandura (1997) defined self-efficacy as "beliefs in one's capabilities to organise and execute the courses of action required to produce given attainments" (p. 3). Bandura (1982, 1997) also acknowledged that humans often work together towards collective objectives within groups or teams and proposed that groups have collective efficacy beliefs regarding their functional abilities for specific tasks. Bandura (1997) defined collective efficacy as "a group's shared belief in its conjoint capability to organize and execute the courses of action required to produce given levels of attainment" (p. 477).

Collective efficacy is important for group performance because it influences a group's task choice, effort expenditure, persistence in the face of failure, and resistance to discouragement (Bandura, 1997). A positive relationship between collective efficacy and sporting performance has been reported in both laboratory (Greenlees et al., 1999, 2000; Hodges & Carron, 1992) and field settings (Feltz & Lirgg, 1998; Myers, Feltz, et al., 2004; Myers, Payment, et al., 2004). For example, Feltz and Lirgg's season-long investigation of intercollegiate hockey identified collective efficacy as the strongest predictor of team performance. Specifically, previous performance predicted collective efficacy beliefs, which in turn predicted team performance. The reciprocal relationship between collective efficacy and group performance has subsequently been supported across a variety of sports including: American football (Myers, Feltz, et al.), basketball (Watson, Chemers, & Preiser, 2001), and ice hockey (Myers, Payment, et al.). Collective efficacy is also positively related to other psychological constructs important towards performance at an individual and group level, including self-efficacy (e.g., Magyar et al., 2004) and group cohesion (e.g., Kozub & McDonnell, 2000). Indeed, there is increasing evidence to suggest that collective efficacy has a positive effect upon group performance in organisational, sport, education, nursing, and military settings (see e.g., Bandura, 1993; George & Feltz, 1995; Gibson, 1999; Goddard et al., 2004; Zaccaro et al., 1995).

The close association between self-efficacy and collective efficacy has led researchers to suggest that the two constructs share the same antecedents (enactive mastery experiences, vicarious experience, verbal persuasion, and physiological/affective states) with the addition of leadership, cohesion and group size specific to collective efficacy (cf. Bandura, 1997; Carron & Hausenblas, 1998). Research has since indicated that mastery experiences are the strongest source of self-efficacy information (for a full review see Short & Ross-Stewart, 2009) and are important towards the development of collective efficacy perceptions (e.g., Goddard, 2001). Bandura also outlined the importance of vicarious experiences when developing efficacy beliefs, a position that has subsequently received empirical support (e.g., Gorrell & Capron, 1990; Hagen, Gutkin, Wilson, & Oats, 1998).

Although the current study does not measure constructs at the neural activation systems level, a complete understanding of psychological constructs cannot be achieved through abstract constructions of behavior alone. To fully understand psychological constructs, integrated understanding of both brain and behavior is required (cf. Keil et al., 2000). In this sense, understanding of the development of group-related constructs such as collective efficacy can be enhanced by recent neuroscience literature. Specifically, evidence within cognitive neuroscience shows that when observing others actions and emotions, an individual's brain activates as though they were experiencing those actions and emotions (for a review see Gatti et al., 2013). This physical mechanism allows us to empathise with others and provides an answer for 'theory of mind'. Practically, this suggests that observing teammates behaviors and emotions is the physical process by which collective efficacy perceptions are formed.

To date, limited attention has been given to the potential of individual interventions for manipulating psychological variables that contribute to group functioning in sport, and in particular, collective efficacy beliefs. Studies have reported that both goal-setting (Gibson, 2001) and verbal self-guidance (Brown, 2003) hold a positive relationship with collective efficacy, yet neither method has been employed extensively. Motivational general-mastery imagery (MG-M), which requires the individual to image being mentally tough and confident in all circumstances, has been acknowledged as an effective method for the manipulation of collective efficacy beliefs (e.g., Munroe-Chandler & Hall, 2004; Shearer, Mellalieu, et al., 2009). Research has identified imagery and observation as similar yet distinct cognitive processes, acknowledging the absence/presence of an external stimulus for the individual as a clear difference between the two (e.g., Cumming, Clark, Ste-Marie, McCullagh, & Hall, 2005; McCullagh & Weiss, 2001). However, given the proposed observational basis of collective efficacy perceptions, observation interventions present a viable alternative to imagery. Indeed, live observation provides a more accurate neural representation of action execution in comparison to imagery (Holmes & Calmels, 2008) suggesting it may be more effective at influencing collective efficacy. Social comparison and self-modeling techniques are suggested to provide individuals with efficacy information (Maddux, 1995; Singleton & Feltz, 1999). Observation of a group task/action includes both the modeling of oneself and others' actions and behaviors, and is thereby recognized as an antecedent for efficacy beliefs in the form of vicarious experiences (Shearer, Holmes, et al., 2009). Specifically, Feltz, Short, and Singleton (2008) outlined the potential for modeling to influence efficacy beliefs by providing the observer with instructional information, and by showing that a task can be learned and completed successfully. Moreover, modeling has the capacity to provide an individual with performance accomplishment information (Feltz et al., 1979), a source from which collective efficacy perceptions can be formed.

Further support for the potential role of observation interventions in the development of collective efficacy beliefs can also be found within the cognitive neuroscience literature. Considerable evidence shows that similar neural pathways are accessed for both live observation and movement execution (e.g., Cross et al., 2006; Grezes & Decety, 2001; Uddin et al., 2007), with the shared structures extending beyond motoric regions to the emotional limbic system (Carr et al., 2003). These findings suggest that an observation intervention can provide an individual with similar information for actions, behaviors and emotions to that of actual execution. Indeed, the techniques of self-observation and modeling have received considerable attention as interventions for various human performance activities (e.g., Baudry et al., 2005; Cross, Kraemer, Hamilton, Kelley, & Grafton, 2009; Feltz, Short, & Singleton, 2008). The majority of these studies have reported performance benefits in skill acquisition as a result of observation, and while observation has yet to be considered as an intervention for collective efficacy, studies have reported increased self-efficacy as a result of self-modeling (e.g., Clark & Ste-Marie, 2007; Weiss, McCullagh, Smith, & Berlant, 1998; Starek & McCullagh, 1999).

A salient factor to consider when studying collective efficacy is the level of analysis adopted. Although collective efficacy is a group's shared belief, it still reflects an individual's perceptions of the team's capabilities and may therefore be considered at both the individual and group level of analysis (Bandura, 1997). Collective efficacy has been examined both as an individual (e.g., Heuze, Sarrazin, et al., 2006) and group belief (e.g., Gibson, 1999), together with the use of both levels of analysis simultaneously (Lindsley et al., 1995; Moritz & Watson, 1998). Bandura advocated that each team member's belief in the team's overall capabilities should be considered, and these individual measures aggregated to the team level. While aggregated collective efficacy details a group's overall beliefs, it does not consider the differences that may occur between individual perceptions within a group (Shearer, Holmes, et al., 2009). Therefore, it would seem sensible that the individual-level analysis would have the greatest sensitivity to measure small changes within a group (e.g., identifying team members who have low collective efficacy). This suggests that an individual-level approach is appropriate when considering the effects of an individual intervention upon collective efficacy perceptions.

In consideration of both observation as an antecedent of collective efficacy (i.e., vicarious experience), and the neural mechanisms of social cognition, observation interventions have the potential to influence collective efficacy perceptions because they represent the actual mechanisms by which collective efficacy is formed. Collective efficacy perceptions are formed by perceiving what others feel, suggesting that video footage of group-based performance and interactions can be used to influence such beliefs. Consequently, this investigation aimed to examine observation interventions as a method for manipulating individual collective efficacy perceptions. Study one explored the effect of observation content upon collective efficacy beliefs. While observation content has yet to be examined, imagery content (positive/negative) has been shown to influence several correlates of collective efficacy, including: motor skill performance, sport performance, and self-efficacy (e.g., Short, Bruggeman, et al., 2002; Taylor & Shaw, 2002; Woolfolk, Parrish, & Murphy, 1985). Based upon potential provision of both vicarious and mastery information through observation, it was hypothesized that changes in individual collective efficacy beliefs would be contingent with the content of the observation intervention. Specifically, when considering a lab-based obstacle course task, 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 cause an increase in efficacy.

In study two the effects of observation content familiarity upon individual collective efficacy beliefs were explored in a field-based setting (that of a sports team). As neural activation is similar for action execution and observation of familiar action compared to observation of non-familiar action (see Calvo-Merino et al., 2005, 2006) it was predicted that a change in collective efficacy beliefs would be dependent upon familiarity with the content of the observation intervention. Given that athletes often train and compete in groups, sport provides an ideal environment to examine this influence. Specifically, observing positive footage of one's own team performing familiar activities was predicted to increase collective efficacy, whilst observing positive footage of an unknown team performing unfamiliar activities was suggested to have no impact upon efficacy beliefs.

4.2 Study one methods

4.2.1 Participants

An opportunity sample of one hundred and thirty three undergraduate students (M_{age} = 20.63 years, SD_{age} =1.84 years) from a higher education institution in South Wales, UK participated in this study. Each participant held membership with an interactive sports team, ensuring a degree of familiarity with teamwork, physical activity, and group dynamics (i.e., collective beliefs). The five most popular and successful team sports at the institution of the researchers were used for this study (rugby union, soccer, field hockey, basketball, and netball). Consistent with University ethical guidelines, participants provided informed written consent prior to participation.

4.2.2 Measures

Collective efficacy. The Collective Efficacy Questionnaire for Sport (CEQS; Short et al., 2005) was employed to measure individual-level perceptions of collective efficacy. The CEQS is a 20-item questionnaire consisting of five factors: effort, persistence, ability, preparation, and unity. 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* = .85 - .96), with similar findings evident for this study (α = .91).

4.2.3 Procedure

The experiment was fifteen-days in duration with participants required to attend two sessions on day one and day fifteen respectively. In order to maximise motivation, participants were told that they were to participate in a UK-wide experiment on teamwork, competing in a task requiring balance, co-ordination and team work ("egg and spoon" race combined with a team obstacle course) similar to that used by Shearer et al. (2008). The obstacle course consisted of thirteen cones, two upturned benches, one speed ladder, three hula-hoops, five step boxes, three badminton posts, two badminton nets, and three chairs, spanning the dimensions of a basketball court and completed in an anti-clockwise direction (Figure 4.1). Teams were informed of the competitive nature of the experiment and thus instructed to perform to the best of their abilities. Teams were led to believe that they were participating as representatives of their University and that several teams had already taken part in the experiment from other UK-based universities. This was demonstrated by showing the participants a false datasheet, with a large sample size and names of universities for all over the UK. To begin the experiment, participants were placed into teams of three with people whom they were already familiar (i.e., not strangers) and homogeneous in terms of both gender and height. Each team was randomly allocated to one of three treatment groups (i.e., positive, n = 16; neutral, n = 14; or negative, n = 15) remaining blind to this allocation. Each of the teams were instructed that they should not discuss performance results with

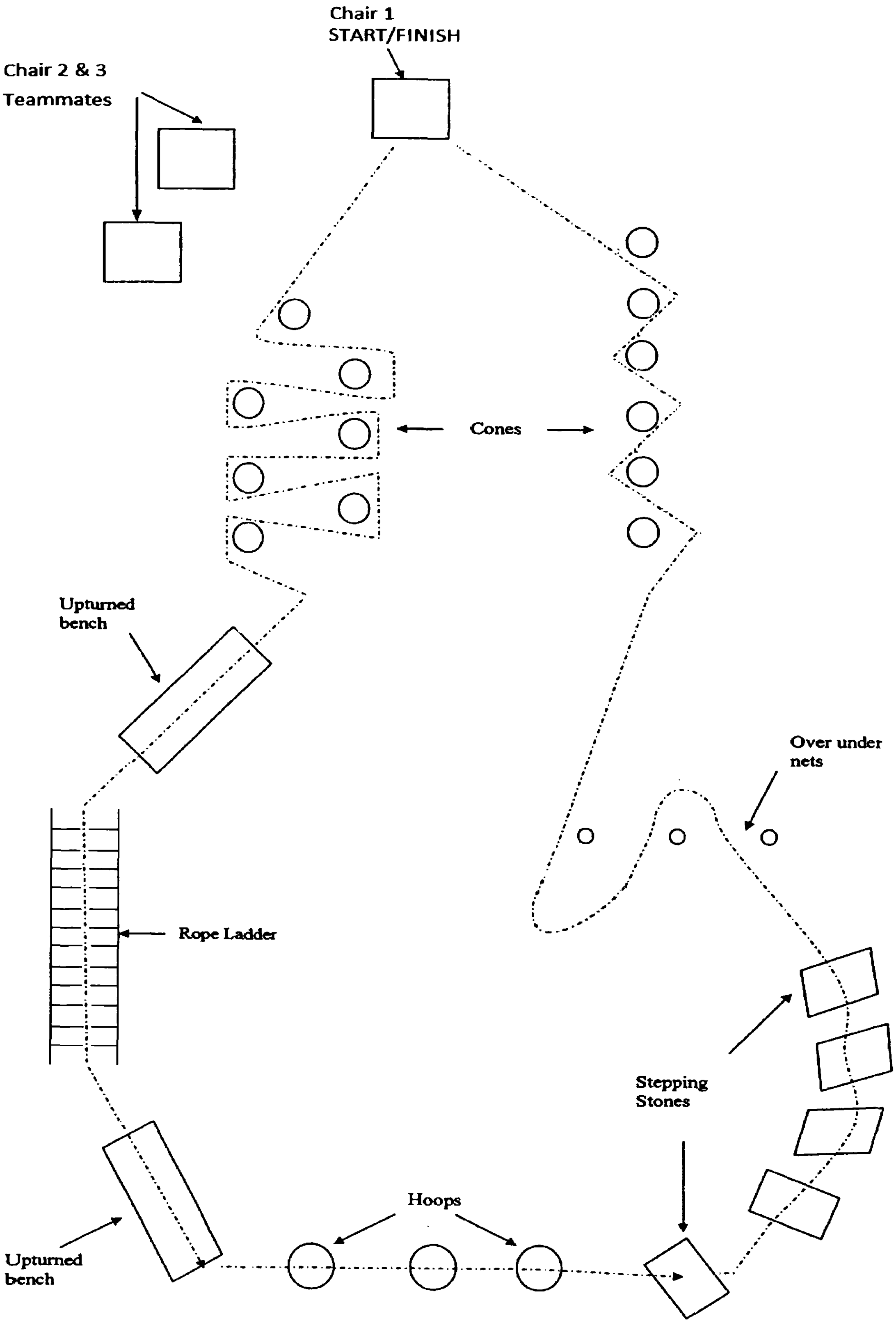

Figure 4.1. Overhead view of the layout of the obstacle course used for the team-based task.

participants from opposing teams and if they were found to have done so the team would be withdrawn from the competition.

Once formed, each team had three timed practice trials for the obstacle course task. The task was setup in a relay format, requiring each of the three team members to complete the obstacle course in the fastest time possible. Once each participant had completed the obstacle course they would transfer the ball to the next participant (interactive component), subsequently the ball was transferred from the first participant to the second, and from the second to the third until all three had completed the course. Five second time penalties were added to each team's overall time for any mistakes they made while completing the course. For example, time penalties were given for touching the golf ball with anything other than the spoon (even during exchange from teammate to teammate), dropping the golf ball, putting a foot down while crossing the benches, or touching/moving the nets. Each section of the course was adjudicated by a member of the research team. The team was given five minutes rest, the procedure was then completed two more times. Upon completion of the third trial, the team was provided with a false average time for the three trials, and this was identified as a mediocre time lying in the middle tenth of the fictitious database provided for all participants across other UK universities. Participants were informed that all forms of practice were prohibited and asked to return in fourteen days time to the laboratory, prior to participation 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. This fourteen-day break period was required for the production of the video interventions, during this period all video footage was edited, formulating multiple video clips for each of the teams ($M_{\text{clips}} = 25$ per team). This footage consisted of actual performance, team interactions during performance, and reactions to performance results. The recordings focused on positive video footage (i.e., a celebratory reaction to success, a performer being pleased with performance, a successful completion of one of the obstacles), and negative video footage (i.e., disappointed reactions to failure, dropping the ball, a mistake being made). The video interventions lasted twenty-five seconds, combining five separate five-second video clips. Each intervention included five different obstacles and showed footage for each of the three performers. The interventions were condition-based, meaning groups allocated to the positive condition viewed positive video clips and groups allocated to the negative condition viewed negative video clips collected from their respective practice performances. For the neutral condition, to take account of the social cognitive nature of collective efficacy, a standardized video intervention was adopted based on the layout of the obstacle course with no participants appearing in the footage.

When the participants returned to the laboratory fourteen days later, the competitive trials were fully explained and each team was reminded of the task requirements and their mediocre results in the practice trials. Each of the teams completed the CEQS for the first time (pre-intervention), after which they were informed that 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 the participants debriefed about the real purpose of the experiment.

4.2.4 Data analysis

Data was screened for normality and homogeneity of variance using the Shapiro-Wilk test and Levene's test respectively. A mixed 3 x 2 (*condition* x *time)* model ANOVA was used to examine the data 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 (first) and condition (last). In addition, Gabriel's procedure was used for post-hoc analysis as this test is accurate when sample sizes are unequal (Field, 2009). All statistical procedures were conducted using SPSS for Windows, version 19; utilising a minimum significance level of $p = 0.05$.

4.3 Study one results

4.3.1 Data screening

CEQS data for each group was screened for the assumptions of normality at both pre- and post-intervention. The Shapiro-Wilk test identified collective efficacy scores for the positive (D (48) = .98-.99, $p > .05$), neutral (D (41) = .96-.97, $p > .05$), and negative groups (D (44) = .96-.98, $p > .05$), as normal at both time points. The Levene's test reported equal variance in collective efficacy scores for all conditions both pre-intervention (F (2, 130) = 0.38, $p > .05$), and post-intervention (F (2, 130) = 5.20, $p > .05$).

4.3.2 Collective efficacy scores

An alpha level of .05 was used for the initial analyses. The mixed 3 x 2 ANOVA results for the overall CEQS scores suggested a non-significant main effect within groups for time, between the pre- and post-intervention measures (F (1,130) = .31, $p > .05$, $r = .05$), a significant main effect between groups for condition (F (2,130) = 16.04, $p < .05$, $r = .33$) and a significant interaction between time and condition (F (2,130) = 47.99, $p < .05$, $r = .52$)[1]. Closer inspection of the score profiles indicated the nature of the difference between the three conditions (see Figure 4.2). Specifically, pre-intervention collective efficacy scores (Table 4.1) indicated little difference between the positive ($M = 6.51$, $SD = 0.81$), neutral ($M = 6.49$, $SD = 0.80$) and negative conditions ($M = 6.40$, $SD = 0.78$). Post-hoc analysis using Gabriel's procedure showed post-intervention differences in collective efficacy between the positive and negative conditions ($M_{diff} = .86$, $SE = .16$, $p < .05$) and the neutral and negative

[1] An identical pattern of findings were derived when the separate dimensions of CE were operationalized. The results of the ANOVAs are available from the author upon request.

conditions (M_{diff} = .72, *SE* = .17, $p < .05$), however, no differences were observed between the positive and neutral conditions (M_{diff} = .15, *SE* = .16, $p > .05$). Specifically, an increase was observed in mean scores for both the positive (*M* = 7.06, *SD* = 0.71) and neutral conditions (*M* = 6.78, *SD* = 0.92) with a decrease evident for the negative condition (*M* = 5.44, *SD* = 1.12).

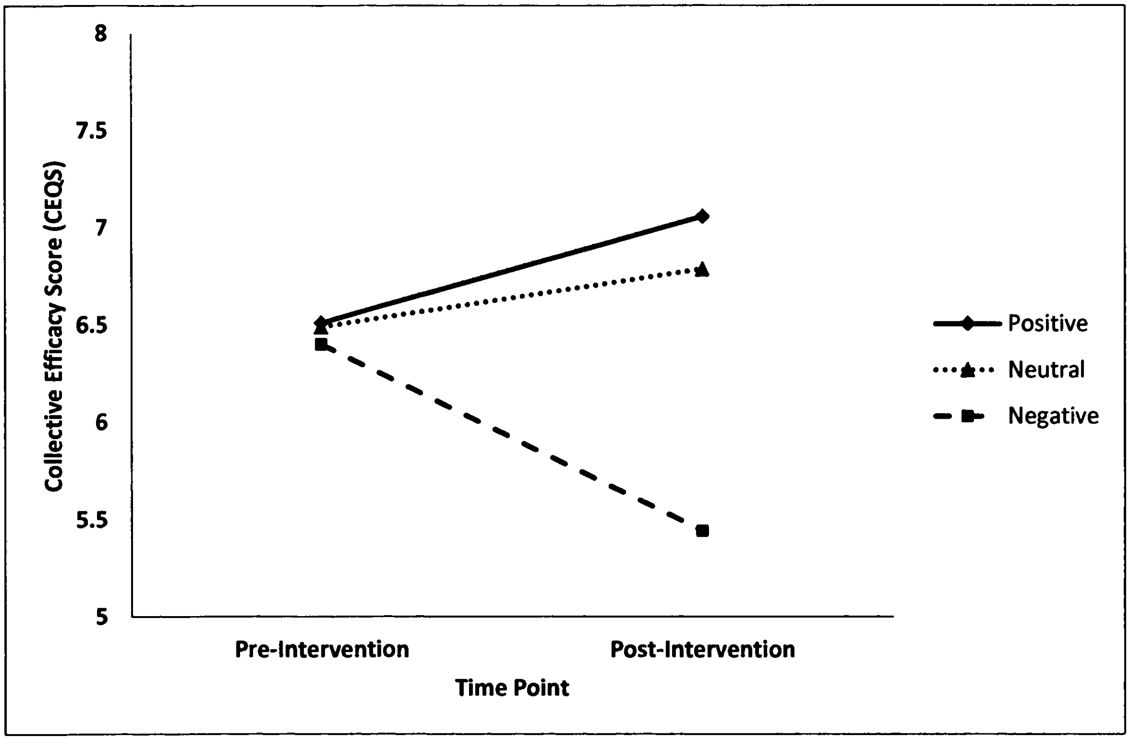

Figure 4.2 Intervention effect upon collective efficacy beliefs for positive, neutral and negative conditions.

Table 4.1

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

	Pre-intervention		Post-intervention	
Condition	Mean	SD	Mean	SD
Positive	6.51	0.81	7.06	0.71
Neutral	6.49	0.80	6.78	0.92
Negative	6.40	0.78	5.44	1.12

4.4 Study two methods

4.4.1 Participants

Participants (n = 36) were recruited via opportunity sampling from a university men's basketball squad (n = 18, M_{age} = 21.73 years, SD_{age} = 1.51 years) and other interactive sports teams (n = 18, M_{age} = 21.94 years, SD_{age} = 1.76 years). Basketball players competed for either the men's 1st team or 2nd team in British Universities Western Divisions 1A and 2B, respectively. Interactive team sports players were recruited from other popular sports at the same institution (rugby union, soccer, and field hockey). Basketball players were recruited for participation in this study because the controlled environment for competitive fixtures allowed for the collection of detailed video footage. Participants from other interactive teams were recruited because of their understanding of competitive sport, and their relative lack of understanding of basketball performance. Together, these two sub-samples provided an opportunity to examine the effect of content familiarity upon collective efficacy responses to positively oriented video footage of competitive basketball. Consistent with University ethical guidelines, each of the participants provided informed written consent prior to participation.

4.4.2 Measures

Collective efficacy. Remaining consistent with the methods from study one, collective efficacy was measured using the CEQS (Short et al., 2005). Cronbach alpha coefficients indicated adequate internal reliability for the sample (α = .91).

4.4.3 Procedure

Following recruitment of participants, informed consent was obtained for each individual. Video footage of the basketball teams participating in the study was collected over an 8-week period. During these dates the men's 1st team took part in eleven competitive matches and the 2nd team took part in six competitive matches, ranging from university league and cup to regional men's fixtures. Footage consisted of actual performance (on court), team interactions during performance (i.e., communication, team drills), and reactions to performance results (both on and off court, i.e., successful baskets/plays). Recordings focused on positive video footage (i.e., a celebratory reaction to success, a performer being pleased with performance, a successful completion of an action, a significant performance result). All video footage was edited using CyberLink PowerDirector 10 Ultra, producing sixty five and seventy two video clips for the men's first and second teams respectively. In coordination with the University basketball coach, criterion was set for the development of both team-specific observation interventions. Specifically, all team members had to play an active role in at least two of the video clips, and all aspects of overall basketball performance had to be accounted for within the intervention as a whole. Subsequently, seven separate video clips lasting between ten and fifteen seconds were selected for both basketball teams' *familiar* observation intervention, lasting approximately ninety seconds in total. Accordingly, the non-basketball participants were randomly allocated either the 1st ($n = 9$) or 2nd ($n = 9$) basketball team intervention for their *unfamiliar* observation intervention.

Data collection comprised a three-step process that each participant completed individually. To begin, participants completed the CEQS (pre-intervention), after which the intervention was administered. Once the observation intervention was watched in full, collective efficacy beliefs were once again collected using the CEQS (post-intervention) and detailed information regarding the true nature of the study was revealed.

4.4.4 Data analysis

Data was screened for normality and homogeneity of variance using the Shapiro-Wilk test and Levene's test respectively. A mixed 2 x 2 (*familiarity* x *time*) model ANOVA was used to examine the data for main effects and interactions of the independent variables for the collective efficacy 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. All statistical procedures were conducted using SPSS for Windows, version 19, utilising a minimum significance level of $p = 0.05$.

4.5 Study two results

4.5.1 Data screening

CEQS data for each group was screened for the assumptions of normality at both pre- and post-intervention. The Shapiro-Wilk test indicated that collective efficacy data for the familiar (D (18) = .90-.91, p >.05) and unfamiliar groups (D (18) = .94-.94, p >.05) was normal at both time points. The Levene's test reported equal variance in collective efficacy scores for both groups pre-intervention (F (1, 34) = .49, p >.05) and post-intervention (F (1, 34) = .02, p >.05).

4.5.2 Collective efficacy scores

An alpha level of .05 was used for the initial analyses. The mixed 2 x 2 ANOVA results for the CEQS scores suggested a significant main effect within groups for time, between the pre-intervention and post-intervention measures (F (1, 34) = 46.90, p < .001, r = .76), no main effect between groups for familiarity (F (1, 34) = 0.60, p > .05, r = .04) and a significant interaction between time and familiarity (F (1, 34) = 11.72, p < .01, r = .51)[2]. Closer inspection of the score profiles indicated the nature of the difference between the groups (See Figure 4.3). Specifically, pre-intervention collective efficacy scores recorded using the CEQS (Table 4.2) identified that the familiar group had a lower mean score (M = 6.16, SD = 1.08) than the unfamiliar group (M = 6.52, SD = 0.82). However, an increase was observed in post-intervention mean scores for both the familiar group (M = 7.03, SD = 1.02) and unfamiliar group (M = 6.81, SD = 0.87), this increase was greatest for the familiar group.

[2] An identical pattern of findings were derived when the separate dimensions of CE were operationalized. The results of the ANOVAs are available from the author upon request.

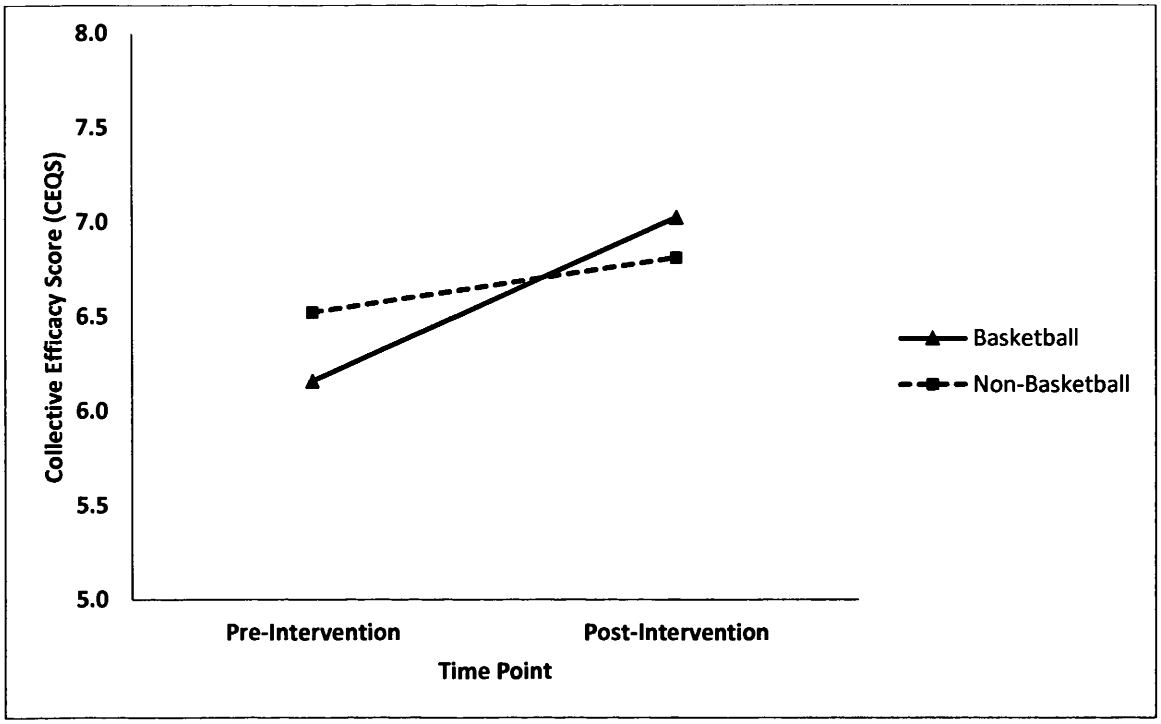

Figure 4.3 Intervention effect upon collective efficacy beliefs for basketball and non-basketball conditions.

Table 4.2

Mean and standard deviations for pre- and post-intervention collective efficacy for basketball and non-basketball groups

	Pre-intervention		**Post-intervention**	
Condition	M	SD	M	SD
CEQS				
Basketball	6.16	1.08	7.03	1.02
Non-basketball	6.52	0.82	6.81	0.87

4.6 Discussion

Taken together the study findings promote observation interventions as a means to manipulate individual collective beliefs in groups. The results from study one support the assumption that the content (positive, neutral, negative) of an observation intervention can be used to manipulate individual collective efficacy perceptions. The positive intervention caused an increase in collective efficacy beliefs comparable to previous findings examining positive imagery and collective efficacy (e.g., Munroe-Chandler & Hall, 2004; Shearer, Mellalieu, et al., 2009). Observation of video footage with negative content resulted in decreased collective efficacy beliefs, a similar finding to that reported in the existing imagery literature. Specifically, negative imagery use is associated with decreased motor skill performance (Woolfolk et al., 1985), sport performance (e.g., Taylor & Shaw, 2002), and self-efficacy (Short, Bruggeman, et al., 2002), all correlates of collective efficacy. As similarities exist between imagery and observation, it is expected that imagery content and observation content will hold a comparable influence towards collective efficacy perceptions.

Observation interventions have the capacity to provide an individual with both mastery experiences and vicarious experiences. When referring to the provision of mastery experiences through observation, the direction of change in collective efficacy beliefs will ultimately depend upon the content of the observation intervention. Bandura (1997) suggests that negative mastery experiences (i.e., failures) undermine efficacy development, this effect being greatest when beliefs are yet to be firmly established, this was observed in study 1. Moreover, when considering observation as a form of vicarious experience it is logical to assume an association can exist in both a negative and positive direction. Goddard et al. (2004) suggest that when an observer is viewing an identifiable model a change in their efficacy beliefs will coincide with the nature of the model's performance. Previous research has opted to use positive imagery and observation tactics when manipulating efficacy beliefs (e.g., Dowrick, 1999; Shearer et al., 2008). However, the findings of this study suggest that collective efficacy can be influenced in both a positive and negative direction, emphasising the importance of video content when considering an observation intervention for efficacy manipulation.

The results from study two partially support the assumption that content familiarity is important when considering the manipulation of collective efficacy beliefs through observation-based techniques. Individuals observing video footage of their own team performing successful actions experienced larger increases in collective efficacy beliefs to those observing video footage of an unknown team of a different sport. Support for the results of this investigation exist within previous modeling literature. Specifically, self-modeling and positive self-review have received support as interventions to enhance self-efficacy (see Dowrick, 1999 for a full review). Both of these observation types provide an individual with video footage of oneself performing an activity in a positive manner. As collective efficacy is considered the group equivalent to self-efficacy, and a relationship has been established between the two constructs, it seems reasonable that in the second study the largest efficacy response was found for individuals who viewed footage of their own team performing successfully. Bandura (1997, p. 94) suggests that the advantage of seeing oneself perform successfully is that it "provides clear information on how best to perform skills, and it strengthens beliefs in one's capability". Seeing oneself performing successfully potentially evokes a greater efficacy response than viewing an unknown in an identical context.

As collective efficacy is both rooted in and shares the antecedents of self-efficacy (Carron & Hausenblas, 1998), it is plausible that 'seeing oneself' is equally applicable to 'seeing one's group'. When considering observation of one's team as an alternative to self-modeling, familiarity may have an important role in the effectiveness of this technique. Varying levels of success have been achieved in past research examining self-modeling and self-efficacy and it is suggested that model similarity is a distinguishing factor between effective and ineffective studies (see Short & Ross-Stewart, 2009 for a review). Indeed, the findings from this study indicate that model, action, and environmental similarity are all important in the manipulation of efficacy beliefs. The observation intervention is most influential when the content is familiar to the individual involved, emphasising the importance of content familiarity. However, individual collective efficacy perceptions are increased for the unfamiliar group also, suggesting that an observation intervention displaying positive group based footage may also positively influence the development of collective efficacy beliefs in those to whom the footage is unrelated. The potential for emotional reward has been cited as the main reason for media consumers watching sports performance (Raney, 2006). Indeed, competitive sports fixtures are highly emotive events for those that are indirectly involved (i.e., fans/audience), often leading to changes in various emotions whilst a performance is being viewed (i.e., arousal, self-esteem, mood; see e.g., Kerr, 1994; Wann, Brewer, & Royalty, 1999; Raney & Depalma, 2006). Use of video footage from competitive team sports performance is therefore likely to evoke an emotional response from all individuals, no matter their familiarity with the sport/team displayed. Observation of any group displaying positive 'group' characteristics and producing positive performance is likely to inspire an increase in individual collective efficacy beliefs. This effect is likely to be greatest when the individual is familiar to the content of the observation intervention (e.g., viewing one's team performing in a familiar situation). Sports fanship research suggests identification as an important motive for viewing sports performance, while various studies have reported increased self-esteem and confidence when viewing a favoured team performing successfully (e.g., Hirt, Zillmann, Erickson, & Kennedy, 1992; Madrigal, 1995). Study findings also indicate that the level of identification an individual holds with a team dictates the size of emotional response. Therefore, when watching positive team sports footage, the size of an emotional response (i.e., collective efficacy) is expected to be dependent upon the individual's level of identification (i.e., familiarity) with the team involved.

From a practical perspective the results of this investigation provide evidence for the use of observation interventions to increase individual-level collective efficacy beliefs for sports teams, with the potential for application to groups across other settings (e.g., military, educational, organisational). The study findings place emphasis on the need to control the content of video footage in order to ensure that an observation intervention has the desired influence upon an individual's collective efficacy beliefs. In a sporting context, teams may employ a team-specific observation intervention similar to that used in study two. For example, if a team often struggles with a certain play, video footage of them performing this successfully could be integrated within a training session, thereby increasing the team's collective efficacy beliefs and potentially leading to improved performance in this situation. Additionally, a team viewing an intervention with positive content immediately prior to competitive performance may experience an immediate increase in collective efficacy beliefs to be carried through to competition.

Although the study results indicate observation can be considered an effective method for collective efficacy manipulation, there are some limitations to be considered in relation to the neutral intervention adopted in study one and the population used for study two. Specifically, participants in the neutral condition in study one reported experiencing a significant increase in collective efficacy beliefs post-intervention, indicating that the content of the observation intervention used for this condition may have been unsuitable. The intervention included observation of obstacles used for the lab experiment which may have caused an individual to imagine their team's previous performances in this setting. The use of three practice trials for the obstacle course task afforded the likelihood that the participants experienced a positive performance for at least one of the obstacles displayed. Therefore, although the video intervention provided the individual with less performance accomplishment information (mastery experiences) than that of the other conditions, it's potential to evoke a positive emotional response may explain the subsequent increase in collective efficacy for the neutral condition. Future research should consider using a neutral intervention with no association to the task in hand. This may include observation of off-topic video footage, quotations from a book, or an appropriate alternative (see Betz & Schifano, 2000 for an example of an alternative neutral intervention). In study two the development of the intervention required collection of video footage for both basketball teams across several fixtures. This meant it was only feasible to use two teams and subsequently the study population couldn't exceed thirty-six as to avoid any biases. Despite this small population size, the within-subject and interaction effect sizes for this study (>.50) are classified as a large effect within previous guidelines (cf. Cohen, 1988, 1992), supporting the strength of the observation effect. If replicated, it is recommended that future research consider either using groups/teams with large populations or multiple groups/teams in order to ensure that the desired effects are attainable.

A further consideration in this study was the use of the CEQS measure to assess collective efficacy. Short and colleagues (2005) developed the CEQS as a domain-specific measure for use with sports teams. Whilst this allows for greater measurement consistency between collective efficacy studies in sport, this does not follow Bandura's (2006) recommendations for the development of context-specific scales that maximize concordance between the task and the measure of collective efficacy. Although the CEQS cannot achieve the same level of concordance as it measures team qualities that are common across sports, it does overcome a number of inconsistencies in how collective efficacy has been conceptualized, operationalized, and measured within previous literature (cf. Baker, 2001;

Maddux, 1999). Nevertheless, the utility of context- versus domain-specific measures is an important consideration for future collective efficacy investigation in sport. In addition, consistent with Bandura's (2006) guidelines and those of other measures utilized in efficacy-based research (e.g., Coaching Efficacy Scale (CES); Feltz, Chase, Moritz, & Sullivan, 1999) this investigation used a 10-point rating scale to gauge efficacy strength for the CEQS. While this method has been employed previously, research has also questioned its effectiveness and suggested that rating scales of this size should be collapsed, as they are too large and can confuse the respondent (Myers, Wolfe, & Feltz, 2005). Indeed, Myers et al. (2005) provided evidence against the use of a 10-point scale using the CES to demonstrate that a 4-category rating scale option, proved more effective. A revised form of the Coaching Efficacy Scale (CES II-HST: Myers, Feltz, Chase, Reckase, & Hancock, 2008), has also provided additional support for a 4-point rating scale over a 10-point scale. These findings suggest future investigation is warranted to specifically examine the ongoing psychometric properties of the CEQS and its utility in the measurement of collective efficacy.

Although the study findings show that observation can be used to influence collective efficacy for groups partaking in physical activity and sport, researchers are yet to consider its effectiveness across other domains. There is a need to compare the effects of observation with other group dynamics interventions (e.g., traditional team building techniques) in alternate contexts (e.g., organisational) to determine the most suitable intervention for each setting. Study two used a group equivalent of positive self-review modeling and there is a need to examine the effects of this observation type for groups across multiple domains (e.g., teaching faculties, army patrols). While the study findings showed that this observation type is an effective collective efficacy intervention, the potential for other types of observation to influence collective efficacy was not considered. Future research should seek to compare different modeling types when using observation interventions for individuals within groups.

It is possible that other forms of observation will provide an individual/group with different sources of efficacy information to that identified for the observation method used in this research. This may include another subset of modeling known as feed-forward observation which has the capacity to either display a skill that is not yet acquired, or relay performance in a context that is yet to be addressed (Dowrick, 1999). In addition, while this investigation identified that group-based observation interventions can be used to influence collective efficacy, it did not consider its effect upon group performance. Although a large body of literature exists identifying a positive relationship between collective efficacy and group performance (see Stajkovic et al., 2009, for a full review), and self-modeling has been shown to improve task performance (e.g., Feltz, Short, & Singleton, 2008), this relationship has not been examined at a group-level and represents an apparent area of future exploration.

Finally, part of the conceptual basis for the current investigation is that similar neural activation exists for social cognitions (e.g., collective efficacy) and both the observation and execution of action, suggesting their potential involvement with the development of social phenomena such as collective efficacy beliefs. Specifically, evidence within cognitive neuroscience research shows that mirror neurons are activated both when an individual performs an action, and when he/she views a similar action (for a review see Gatti et al., 2013). Although consensus has yet to be reached on a specific function for the MNS, there is agreement that this system accounts for several aspects of human social cognition, for example, action understanding and motor intention (e.g., watching team mates perform a strategy correctly). Furthermore, empirical findings suggest cortical midline structures (CMS) account for additional aspects of social cognition to those supposedly accounted for by the MNS (e.g., processing of social relationships; Iacoboni et al., 2004; Schilbach et al., 2006). Empathising with conspecifics' emotions is also proposed to activate similar brain areas that include, but extend beyond the MNS to the limbic areas (which hold a close association with emotion) via the insula (cf. Carr et al., 2003). Consequently, when individuals consider perceptions of their groups' collective efficacy, it is likely that they empathise with the content of the observed behaviors (e.g., a positive reaction to a score), engaging these neural systems. Despite these potential neuro social links, research is yet to directly measure the neural activity associated with collective efficacy development. No explanation exists for the actual mechanisms that underpin both its function and action (Shearer, Holmes, et al., 2009). Comprehension of the manner in which observation influences collective efficacy will allow for the measurement of neural activity in both the MNS and CMS via functional magnetic resonance imaging (fMRI). Findings from study two correspond with the findings from two neuroscience studies examining MNS activity associated with observation of motor skills in dance (Calvo-merino et al., 2005, 2006). Greater neural activity was identified in motor areas where the MNS is proposed to exist when individuals observed movement patterns within their existing motor repertoire in comparison to movement patterns that were yet to be learned. As previously suggested, this motor area's strong association with both action observation and social cognition acts as grounds for its involvement within the development of collective efficacy. However, the present investigation did not measure MNS activity during observation of team mates and it can therefore only be suggested that changes in collective efficacy beliefs may have occurred via the mechanism by which activity was increased for areas believed to be involved with the MNS in Calvo-Merino's studies. In line with the recommendations by Shearer and colleagues and the findings from this investigation, it is therefore feasible that observation can be adopted as a means to examine the neurological basis of collective efficacy, comparing brain activity associated with positive footage of their own group's performance with subsequent activity associated with unfamiliar group footage and neutral footage.

5.0 Chapter Five: General Discussion

Recently in the sport psychology literature researchers have called for the adoption of cognitive neuroscience in order to more fully explain social psychological process underpinning group constructs, such as collective efficacy (cf. Shearer, Holmes, et al., 2009). However, to date no studies have examined the neural activity associated with collective efficacy development. Before this research can be undertaken, it must first be possible to measure and manipulate collective efficacy instantaneously. In this respect, investigations are yet to develop a single-item collective efficacy measure that can be used across different settings, or a conceptually grounded collective efficacy intervention technique. The broad aim of this thesis was to provide a framework (measurement and manipulation) for the neuroscientific study of individual collective efficacy perceptions. The following sub-sections discuss the findings of the two experimental chapters in relation to the existing literature that has examined collective efficacy and observation, the practical implications of the thesis findings, the limitations of the research programme, and recommendations for future research considering observation as a collective efficacy intervention, and the neuroscientific study of this group construct.

5.1 Collective efficacy measurement in sport

The first objective of this thesis was to develop and validate an operational stem that could be used with different single-item collective efficacy instruments across a range of sports. In chapter two, based on the operational stem used by Short et al. (2005) for the CEQS, the phrase *'Rate your team's confidence in their ability to...'* was chosen as a universal stem for use with the single-item instruments. Across three different study designs (cross-sectional, laboratory-based and field-based) the stem was combined with two separate item tails to form single-item collective efficacy measures for use with sports teams. The results of the cross sectional study provide evidence for the concurrent, convergent, and predictive validity of the stem for use with competitive sports teams. Further support for the stem was provided in the findings of the laboratory and field-based studies, where the results again demonstrated validity whilst also showing a good degree of reliability for the single-item inventories.

Both the stem and the CEQS were used to assess collective efficacy across the manipulation studies reported in this thesis. In chapter two considerable evidence is provided to support the validity and reliability of the stem for use with single-item collective efficacy measurement. However, in the second study of this chapter post-intervention changes in collective efficacy scores were different for the stem and the CEQS. Specifically, collective efficacy increased for the positive and neutral conditions using the CEQS, and decreased for the same conditions using the stem. Although these findings call into question the validity of the stem, it is possible they were caused by the rating scale used with the single-item instruments, rather than the wording of the operational stem. The stem was developed with the neuroscientific study of collective efficacy in mind, meaning the rating scale had to function with the AVAS software employed in chapter two. A 100-point rating scale was used with the stem to account for Bandura's (2006) guidelines, but it was unfeasible to use intervals with this computer-based scoring method. Myers and Feltz (2007) have criticized existing measurement tools for employing too many categories when assessing collective efficacy beliefs as it can lead to ambiguity with respondents unable to distinguish between rating categories. Given that collective efficacy responses could be recorded at any point between 0 and 100 using the AVAS, it is conceivable that collective efficacy scores reported for this chapter were not accurate. Therefore, it is recommended that future studies look at the optimization of rating scale categories for use with this method in a bid to ensure the validity of the stem.

Despite demonstrating psychometric support for the operational stem using two different single-items, there is a need to further consider its utility in sports contexts. The majority of existing studies have used multi-dimensional collective efficacy instruments that employ multiple items to measure individual collective efficacy perceptions in groups/teams. According to Bandura (1997), efficacy beliefs involve several types of capabilities including management of thought, action, and motivation. Behavior is best predicted by an individual's belief in their capabilities to be successful in all aspects that make up overall performance (Bandura, 2006). Therefore, considering efficacy beliefs as a unitary trait sacrifices validity for internal consistency. In spite of this limitation, bespoke single-item collective efficacy measures also exist in the sports literature because the short time frame required for their completion is advantageous in several practical (e.g., during performance) and research settings (e.g., a neuroscientific research design that requires an immediate collective efficacy response). It is acknowledged that multi-dimensional collective efficacy scales are more robust than their single-item counterparts (cf. Myers & Feltz, 2007) and provide an ideal measurement tool for most situations (i.e., a situation that doesn't require an immediate response). However, it is recommended that researchers and practitioners should consider the stem from this thesis to advance single-item collective efficacy measurement for situations where an immediate response is beneficial (e.g., assessment during training sessions or competitive performances).

5.2 Collective efficacy manipulation

Although collective efficacy has a positive effect upon sports team performance (e.g., Heuze, Raimbault, et al., 2006; Myers, Feltz, et al., 2004; Myers, Payment, et al., 2004) relatively few studies have considered techniques designed to increase individual collective efficacy beliefs. The third chapter of this thesis reviewed existing literature concerning observation and its potential involvement with the development of collective efficacy beliefs. Specifically, this chapter outlined theoretical links between observation and collective efficacy (SCT and OLT), provided empirical support for the use of modeling interventions to increase collective efficacy, and identified recent neuroscience findings that show similar neural pathways are activated for action observation, action execution, and several aspects of human social cognition associated with collective efficacy (e.g., empathy). Based on these findings it was recommended that observation interventions should be used to increase collective efficacy beliefs in sports teams. Therefore, in line with the second thesis objective and recommendations that collective efficacy be studied at the individual level (see section 3.1), chapter four assessed observation as an intervention to increase individual collective efficacy perceptions in sport.

In chapter four, changes in collective efficacy through the use of an observation intervention were predicted to be dependent upon the content of the footage displayed (positive/neutral/negative) and the observer's level of familiarity with the video footage used (familiar/unfamiliar). The CEQS results from both studies proved this to be correct for team sports players across laboratory and field-based study designs. Specifically, for the laboratory-based study, collective efficacy increased for individuals that viewed positive footage of their experimental group's previous performances, and decreased for individuals viewing negative footage. For the field-based study, collective efficacy increased for individuals viewing both familiar and unfamiliar observation interventions, this effect being greatest for individuals viewing positive footage of their previous performances (familiar). Together, these findings indicate that observation interventions containing positive performance footage can be used to increase collective efficacy perceptions in sports teams.

In chapter three it was suggested that observation may prove an effective intervention for increasing collective efficacy beliefs because they have the capacity to provide individuals with mastery experiences, the strongest source of efficacy information (cf. Bandura, 1997; Short & Ross-Stewart, 2009). As viewing footage of one's own team performing a controlled laboratory task such as this (i.e., not competing directly against opponents) is centred on previous performance accomplishments, it was proposed that mastery experiences are the primary mechanism through which observation interventions, displaying only own team performance, impact upon collective efficacy perceptions. The results of the first study from chapter four show that viewing one's team performing successfully increased collective efficacy, and viewing one's team performing unsuccessfully decreased collective efficacy. These findings are conceivable given that positive mastery experiences (i.e., successes) are proposed to increase efficacy, and negative mastery experiences (i.e., failures) diminish efficacy beliefs (Bandura). Therefore, in order to increase collective efficacy the greatest, it is suggested that observation interventions based on team performance in situations without opposition (e.g., team training sessions) only include successful performance examples to increase collective efficacy the greatest. For example, in Rugby Union a coach should provide an intervention compiling footage of the team successfully completing specific set pieces in training sessions.

Observation interventions also have the capacity to increase collective efficacy through presenting individuals with vicarious experiences, a source from which efficacy beliefs can be developed (cf. Bandura, 1997; Hagen et al., 1998). Bandura has proposed that viewing peers/others performing skills (vicarious experiences) will influence the observer's beliefs in their competency to perform the same/similar skills (self-efficacy). Indeed, self-model theory suggests that individuals extract a self-model image when viewing the behavior of others, highlighting the potential for peer modeling to influence behavior and associated beliefs, such as efficacy (cf. Dowrick, 2012). The results of the second study from chapter four indicate that collective efficacy can be increased by viewing positive footage of an unfamiliar team/sport. This may have resulted because several components of performance are generic to all team sports (e.g., team work, communication, team drills) suggesting that collective efficacy was increased through individual's observing positive actions that relate to their own team's performances (i.e., vicarious experiences). It is also possible that this increase in efficacy was a direct result of MNS and CMS activation through empathy with the athlete's involved. However, the results of the study also showed that a greater increase in collective efficacy was observed for individual's that viewed positive footage of their own team performing (i.e., performance accomplishments). This may have occurred because interventions containing performance footage from team sports competition involve self (own team) and peer (opposition team) performance, providing the observer with mastery and vicarious sources of efficacy beliefs (cf. Short & Ross-Stewart, 2009). It is possible that this sizable increase in efficacy resulted because individuals are likely to empathize greater with persons, actions, emotions, and environments with whom they identify, stimulating neural activity in the MNS and CMS beyond those experienced for unfamiliar equivalents (cf. Beckes, Coan, & Hasselmo, 2013).

From a neural mechanism perspective, recent neuroscience research provides further insight into link between observation and collective efficacy. Specifically, findings indicate that action observation, action execution, and social-cognitions activate similar neural pathways where the MNS and CMS are proposed to exist (Calmels, Holmes, Jarry, Lévèque, Hars, & Stam, 2006; Gatti et al., 2013; Dinstein et al., 2007; Iacoboni, 2009; Lago-Rodriguez, Lopez-Alonso, & Fernández-del-Olmo, 2013). Evidence suggests that these two large-scale networks are involved with representation of self and others, the MNS through motor simulation mechanisms, and the CMS via more abstract means such as simulation of mental states. Both of these neural processes are crucial towards an individual understanding other social beings, something that is necessary when developing collective efficacy perceptions (Uddin et al., 2007). Greater activity has been reported in neural areas associated with the MNS for individual's viewing motor actions that exist within their motor repertoire when compared to viewing motor actions that do not (Calvo-Merino et al., 2006). Therefore, when viewing successful performance of one's own team, a person may motorically and mentally simulate successful group performance, activating both the MNS and CMS, and increasing their collective efficacy perceptions.

5.3 Practical implications

In addition to the robust validity and reliability of the operational stem for single-item collective efficacy measurement, the results from chapter two indicate that single items based on this stem are short and simple to complete, making them ideal for use in an applied context (cf. Cox, Russell, & Ribb, 1998). This stem-based approach could be used to measure collective efficacy across different settings in sport, for example, collective efficacy can be continuously monitored during training sessions and in the immediate build up to competitive fixtures. This allows coaching staff to identify any changes in collective efficacy for individual members of a team, information that can be used to develop specific intervention strategies (e.g., individually tailored training techniques), to gauge how confident a team are for a difficult routine/play they are rehearsing in training, or for team selection purposes (i.e., collective efficacy levels can contribute to the selection process). However, there are several occasions when an inventory is needed that assesses all components of a team's collective efficacy, providing insights into the dynamics of team behavior (cf. Bandura, 2006). To gain a greater understanding of specific team attributes that contribute towards overall collective efficacy perceptions a more in-depth collective efficacy instrument needs to be adopted. For example, a soccer player may have strong beliefs in their team's ability to produce a successful overall performance, but relatively weak perceptions in his/her team's ability to successfully perform a specific component of performance (e.g., defensive/offensive performance). In such instances, the multi-dimensional aspect of collective efficacy cannot be assessed by the single-item inventories used in this thesis. Coaches should use multi-item instruments, such as the CEQS used in chapters two and four, to measure the multiple dimensions for collective efficacy in team sport. This will subsequently allow practitioners to identify specific issues within a team's overall performance, such as communication (cf. Short et al., 2005), providing more detailed information that can be used to further increase levels of collective efficacy.

A second implication from the thesis findings relates to the advantages of using observation over existing intervention techniques to enhance collective efficacy. Specifically, to date, the group dynamics literature has frequently used group-based techniques, such as traditional team building, to improve aspects important to team functioning (e.g., intra-team communication: Voight & Callaghan, 2001). The findings of chapter four indicate that a positively oriented observation intervention can be used to increase social psychological processes beneficial to team performance, such as collective efficacy. Observation interventions used for this purpose hold several advantages over existing individual and group-based methods. First, they are easily tailored to the specific needs of an individual team member, allowing for the greatest possible increase in collective efficacy beliefs. Given the complexity of team sports performance and the multi-dimensional nature of collective efficacy (cf. Bandura, 1997) the ability to personalize an intervention may be particularly useful for team sports. For example, an observation intervention can include content focused on a specific aspect of team performance (e.g., defensive situations), or specific dimension of collective efficacy (e.g., unity), and can therefore improve an individual's efficacy perceptions based on their greatest requirements. Second, the fact that these interventions are directed towards individual team members means they can be used to increase collective efficacy outside of team settings. For example, an individual team player can view their specific intervention outside of training/competitive situations to reinforce beliefs in their team's capabilities at all times.

A final practical implication from the thesis comes from chapter four and the design implications that need to be considered when using observation interventions to increase individual collective efficacy perceptions. First, the results of the first study of chapter four indicate that observation interventions containing positive footage of just own team performance (i.e., not including opposition) lead to increased collective efficacy. To increase collective efficacy the greatest observation interventions should be centred on positive team performance (i.e., a success). For example, when considering training sessions for sports teams, a coach should only include video footage that depicts training tasks (e.g., drills/routines) being completed successfully, when attempting to increase collective efficacy using observation interventions. Second, the findings from study two show that observation interventions containing positive video footage of one's own team performing competitively increase collective efficacy greater than viewing positive footage of an unknown team/sport. Subsequently, a coach should employ positive self-review interventions (i.e., highlight videos) in-between competitive fixtures as a means to maximise a team's collective efficacy beliefs at all times. Lastly, strict criterion were followed when developing the observation interventions used for both studies discussed in chapter four. An individual's collective efficacy beliefs are based on all aspects of their team's performance for a given task (cf. Bandura, 1997, p.478). Therefore, to instigate the maximum possible increase in collective efficacy, the interventions used in this chapter displayed footage capturing overall team performance in a given setting. Specifically, the intervention included video footage of all members of the team, and examples of all actions produced during the entirety of the team's performance. As collective efficacy was successfully increased for both studies, it is recommended that practitioners adhere to similar guidelines when developing observation interventions in their specific team-setting.

5.4 Thesis limitations and recommendations for future research

In chapter two, the validity and reliability of the stem *'Rate your team's confidence in their ability to...'* was supported for use with single-item collective efficacy measures across different study designs in sport. However, if the operational stem is to be used across different sports there is a need for further testing to ensure its overall validity in this context. To use this stem for single-item measurement an item tail is required that comprises Bandura's (2006) recommendations that efficacy scales include information specific to the domain of functioning. Although the validity/reliability of the stem is evidenced for two different single-items in this thesis, future research is needed to examine the psychometric properties of the stem using single-item instruments across different settings (e.g., training, competition, off-season) and populations (i.e., teams from different sports/competitive levels) in sport. To further validate the stem, research should focus on the relations between collective efficacy and other constructs important to team functioning such as intragroup cooperation, communication, and player satisfaction (cf. Short et al., 2005). This will enhance understanding of the stem-based approach to single-item collective measurement in sports teams, potentially advocating its use as a collective efficacy assessment tool when multi-item instruments are not applicable.

Research examining individual collective efficacy perceptions has measured the construct in different ways depending on how it has been defined (cf. Feltz, Short, & Sullivan, 2008), with two prominent operational methods used in sport. The first assesses the individual's own perceptions of their team's capabilities, and the second assesses the individual's perceptions of what they believe the team thinks their capabilities are (cf. Dithurbide & Feltz, 2012). The single-item stem used in this thesis was adapted from the stem used with the CEQS (Short et al., 2005) to direct participants' focus towards the team belief rather than their beliefs in the team. This stem was chosen because it requires the individual to consider the emotions of their fellow teammates, linking collective efficacy to the MNS and CMS through the process of empathy. Moreover, the CEQS is the only collective efficacy measure that has been validated for use across different team sports. However, several bespoke collective efficacy measurement tools have used question stems that refer respondents towards their beliefs in the team (e.g., Spink, 1990; Feltz & Lirgg, 1998). Although the stem is considered valid/reliable in the contexts of this thesis, its measurement capabilities were not compared with a stem based on this other popular operational method used to measure collective efficacy in sport. Previous research indicates that asking an individual to consider their beliefs in their team and asking them to consider their teams' perceptions are equally suited to the measurement of collective efficacy (Short, Apostal, et al., 2002). To date, no research exists examining these two operational methods for the single-item measurement of collective efficacy in sport. Consequently, investigation is needed to compare the effectiveness of the single-item stem used in this thesis with a stem designed to measure a participant's beliefs in their team (e.g., '*Rate your confidence in your team's ability to…*': Feltz & Lirgg) to ensure that this stem-based approach to single-item collective efficacy measurement is as accurate as possible.

In chapter four an observation technique was used to enhance collective efficacy. However, there are a number of limitations with the intervention design. Specifically, both laboratory and field-based experimental designs were chosen to examine the effects of observation interventions towards collective efficacy in sports teams. Typically, nomothetic experimental designs (i.e., designs that explore group averages) such as these have been employed across the majority of sport psychology research to examine the effectiveness of psychological interventions such as imagery (e.g., Shearer et al., 2008) and self-talk (e.g., Theodorakis, Weinberg, Natsis, Douma, & Kaakas, 2000). The advantages of using such designs are that experimental conditions can be tightly controlled and they allow for the examination of intervention effect and statistical significance. However,, sport psychology researchers and practitioners have advocated the use of single-case study designs to facilitate an understanding of effective interventions in more applied settings (e.g., Hrycaiko & Martin, 1996; McDougall, 2013). Single-case research methods are important towards sport psychology because they provide a framework for understanding intervention effects across time with individuals/groups (Barker, Mellalieu, McCarthy, Jones, & Moran, 2013). Given that the majority of team sports involve multiple performances across a season, investigating the effects of repeated intervention use across an extended time period is important for understanding their application in performance settings. Single-case designs have been used to examine the effects of imagery on sport confidence (e.g., Callow, Hardy, & Hall, 2001), and self-modeling on self-efficacy (Ram & McCullagh, 2003), however, research has yet to investigate the effects of repeated group-based observation intervention use on collective efficacy in applied settings. Therefore, it is recommended that future studies employ single-case research methods to gain greater understanding of collective efficacy responses to observation interventions in sport.

Research on the relationship between observation and collective efficacy is in its infancy and at present it is unclear if collective efficacy responses may vary because of changes in observation intervention characteristics or some other mechanism. The development of the interventions used in chapter four were similar for both the laboratory- and field-based studies. Specifically, the interventions included footage from several performances that represented overall team performance for a given task. Based on the retention component governing observational learning (cf. Bandura, 1986) an individual's collective efficacy beliefs are only influenced by the team actions they remember. Consequently, the effect observation has upon collective efficacy may vary dependent on how recent the actions being displayed are, or the position of video clips within the overall observation intervention; neither of which were recorded in the experimental studies in this thesis. Future studies should seek to compare the effects of observation interventions containing positive video footage from more/less recent competitive fixtures as a means to increase collective efficacy in sports teams. Future investigations should also examine whether observation interventions containing the same overall video footage are more/less effective at increasing collective efficacy if the order of the individual video clips is changed. Specifically, there might be a primacy and recency effect such that the first and last clips shown are more memorable and hold the greatest impact on collective efficacy (cf. Greenlees, Dicks, Holder, & Thelwell, 2007). In sport, this could be tested by asking a coach to rank the complexity/skill level demonstrated in each of the video clips, and then include these clips in ascending (increasing in skill level) or descending order (decreasing in skill level) in the observation intervention. Such findings would advance understanding of the content that needs to be included in observation interventions and could be used to tailor practice sessions with sports teams. Based on the suggestions that collective efficacy is effected greatest by more recent events, if training is structured such that teams have success at the beginning and at the end, then it is more likely to improve collective efficacy both during and after sessions.

In chapter four observation interventions were tailored specifically to manipulate collective efficacy beliefs for team sports performers. The observation interventions were therefore developed with a specific purpose in mind. For example, the interventions for the positive condition in the first study of chapter four were developed using footage perceived as positive examples of team performance for the obstacle course task. In imagery research it is acknowledged that the same image can be interpreted differently across athletes, eliciting different individual reactions (Martin, Moritz, & Hall, 1999). However, this thesis did not consider whether the participants' perceptions of the observation interventions would be different to that of the research team, something that could have been assessed after the interventions were completed. Manipulation checks are commonly employed in experimental designs to determine whether a manipulation of an independent variable had its intended effect on the participants (Cozby, 2009). For example, within imagery research manipulation checks are commonly employed both during and at the end of an intervention to verify that the imagery is being used as intended (Cumming & Ramsey, 2009). These checks are normally designed with the specific needs of a particular study in mind and often employ open-ended questions as part of comprehensive interviews to gain a more in-depth account of the participants' view of the intervention (e.g., Callow, Hardy, & Hall, 2001; Jordet, 2005). Alternatively, studies have administered validated full-form questionnaires to fulfil this purpose (see e.g., Evans, Jones, & Mullen, 2004 for an example with an imagery intervention). In the case of observation interventions, the functions of observational learning questionnaire (FOLQ: Cumming et al., 2005) is potentially an appropriate measurement tool as it examines the various functions of modeling. Future studies employing observation-based interventions should utilize both interviews and the FOLQ as manipulation checks to gather further information about the participants' perceptions of the intervention and advance understanding of observation use.

Another important issue that requires attention in future research on observation and collective efficacy is social desirability, which refers to the tendency to give overly positive self-descriptions (Paulhus, 2002). An individual's propensity to present himself or herself in a favorable light is problematic when using self-report methods as it can bias the answers of respondents and mask the true relationships between two or more variables (Ganster, Hennessey, & Luthans, 1983). This can involve either suppression or moderation of the relationship between two variables, highlighting its possible impact on collective efficacy results for the manipulation studies undertaken in this thesis (cf. Ganster et al.). Collective efficacy is positively related to team performance (Stajkovic et al., 2009) and high efficacy levels are thought to be a common characteristic of successful teams. Therefore, it is plausible that team sports players may report higher collective efficacy beliefs than are actually apparent in order to portray their team as successful. Across the manipulation studies this could have reduced the decrease in collective efficacy as a result of the negative interventions, and heightened the increase in collective efficacy resulting from the positive interventions. Social desirability was not accounted for in this thesis, but it is advised that future investigations control for its potential effects when using observation interventions to manipulate collective efficacy. A common approach is the use of a scale such as the Balanced Inventory of Desirable Responding scale (BIDR: Paulhus, 1991). Social desirability scores can be used to screen individuals prior to participation in the study, or to correct scores for participants once the study has been completed, thus controlling for its effects.

The results of the second study from chapter four show that collective efficacy is increased when viewing successful performance of one's own team, and successful performance of an unknown team/sport, this effect being greatest for own team performance. Simulation theory suggests that humans perceive how others feel or what they might do, by imagining how they would respond to the same situation (cf. Gallese & Goldman, 1998), this being easiest when viewing a familiar situation. Indeed, previous neuroscience research reports heightened activity in neural areas where the MNS is supposed to exist when an individual observes motor actions that they are familiar with (i.e., exist within their motor repertoire: Calvo-Merino et al., 2005, 2006). Based on the potential involvement of the MNS when developing collective efficacy perceptions, it is suggested that viewing known motor actions involved with a team sport may be the mechanism through which observation of team action influences collective efficacy. However, as the strongest sources of collective efficacy perceptions are mastery experiences (cf. Bandura, 1997) it is logical that viewing own team performance effects collective efficacy greater than viewing an unknown team performing the same actions. In this research programme observation of known team/sport was compared with observation of unknown team/sport, but observation of an unknown team from the same sport was not considered. It is recommended that future studies compare observation interventions displaying footage of own team performance against observation interventions displaying footage of unknown team performance from the same sport as a means to increase collective efficacy. This will provide further insight into the mechanisms through which observation of team actions influence individual collective efficacy perceptions, information that can be used to tailor group-based observation interventions for increasing collective efficacy more effectively.

Although there is strong evidence for the involvement of the MNS, CMS, and limbic system in the development of collective efficacy beliefs where individuals make judgments about shared beliefs through empathising with conspecifics (cf. Shearer, Holmes, et al., 2009), no research exists investigating the neurological processes involved with collective efficacy perceptions. While the observational learning process of social cognitive theory provides a probable account of how individuals form collective efficacy perceptions, and how observation of team action influences these perceptions, the high cost of such neuroscientific experimentation means any psychometric assessment or experimental manipulation used in this research must be thoroughly tested beforehand. Therefore, it was not possible to test the neuropsychological mechanisms underpinning collective efficacy in this thesis.

In the existing neuroscience literature, various methods have been used in combination with neuroimaging techniques to investigate the neural mechanisms associated with specific psychological processes (i.e., collective efficacy). Previous studies have utilized an array of experimental methods designed to evoke a desired psychological response. For example, when examining the neural processes involved with trust, Winston et al. (2002) showed participants images of trustworthy and untrustworthy faces whilst employing event-related fMRI. More recently, Dimoka (2011) demonstrated the successful integration of psychometric and neuroimaging assessment methods to accurately measure the neural activity for four specific psychological processes (trust, distrust, context-perceived usefulness, perceived ease of use). Based on the experimental and assessment methods listed, this thesis piloted an experimental design suited for fMRI use, which measures and manipulates individual collective efficacy perceptions. Across the two experimental chapters in this thesis collective efficacy was successfully measured and increased using a stem-based single-item scale and observation intervention, respectively. Consequently, the findings from this thesis allow future investigation of the neural correlates associated with collective efficacy. Specifically, collective efficacy can be measured and increased within an fMRI study design using the single-item stem and team-based observation interventions. Neuroscience research of this nature will help to not only provide a clearer understanding of collective efficacy beliefs but also serve to establish a stronger basis for developing conceptually accurate tools to measure and manipulate the construct.

6.0 Chapter Six: References

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Appendices

Appendix A: Ethics Application Form

SPORT AND EXERCISE SCIENCE
SCHOOL OF ENGINEERING, SWANSEA UNIVERSITY
ETHICAL ADVISORY COMMITTEE

APPLICATION FOR ETHICAL COMMITTEE APPROVAL OF A RESEARCH PROJECT

1. DRAFT TITLE OF PROJECT

Measuring the effects of observation upon collective efficacy perceptions

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2. NAMES AND STATUS OF RESEARCH TEAM

Adam Bruton, Postgraduate Student
Dr. David Shearer, Supervisor
Dr. Stephen Mellalieu, Supervisor

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3. RATIONALE

When experiencing social situations in human life individuals are required to group together and work towards collective objectives. Individuals within these groups will naturally hold beliefs regarding the group's progression towards these objectives, these beliefs were named collective efficacy. Bandura defined collective efficacy as *"a group's shared belief in its conjoint capabilities to organise and execute the course of action required to produce given levels of attainment"* (Bandura, 1997, *p. 477*).

Collective efficacy has been identified as a common trait within successful sports teams, impacting both effort and persistence levels within a group (Bandura, 1997). Indeed, past research concerning collective efficacy has shown a positive relationship with overall team performance across a variety of domains (Feltz, & Lirgg, 1998; Greenlees, Graydon, & Maynard, 1999; Hodge, & Carron, 1992; Myers, Feltz, & Short, 2004; Watson, Chemers, & Preiser, 2001). Given that athletes often compete in teams or are part of groups (e.g., a training group), sport provides an ideal environment to study collective efficacy, while remaining transferable to all other group domains.

Despite the suggested importance of collective efficacy, Zaccaro, Blair, Peterson, and Zazanis (1995) and Maddux (1999) have both outlined the inconsistent manner in which collective efficacy has been conceptualized, operationalized, measured, and analyzed within previous research. This lack of consensus surrounding the construct makes across-study comparison difficult, as it is unclear whether studies have measured the same or merely similar constructs. Keil, Holmes, Bennett, Davids, and Smith (2000) suggested that understanding of any psychological concept will continue to be limited unless a better understanding of their neuroscientific mechanisms is developed. To date, no research has considered the specific neurological mechanisms that underpin collective efficacy perceptions (Shearer, Holmes, &

Mellalieu, 2009).

Recent neuroscience research has identified that the mirror-neuron system (MNS; Rizzolatti et al., 1988) and the cortical midline structures (CMS) are active during both observation and action (see Uddin, Iacoboni, Lange, & Keenan, 2007). It is likely that collective efficacy perceptions are formed through the observation of other team-mates or group members (see Shearer et al., 2009) suggesting that individual efficacy beliefs might also originate in the MNS and CMS. If collective efficacy perceptions are formed as described, it should be possible to measure the brain activity associated with this using fMRI. Specifically, due to the presence of affective bonds (Bandura, 1997), brain activity and collective efficacy perceptions should differ when observing photos or videos of 'team-mates' vs 'strangers' performing the same actions. Given the speculative nature of this research and the expense of fMRI scanning time, it is imperative that all intended methods be pilot tested. This programme of research will validate a short form measure of collective efficacy constructed for use with fMRI (button press system), and assess the capabilities of both photos and videos in the manipulation of collective efficacy perceptions.

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5. AIMS and OBJECTIVES

The study aims to pilot an experimental design suitable for fMRI use that manipulates collective efficacy perceptions in such a manner that the traditional subtraction logic of fMRI can be used to study the brain activity associated with collective efficacy.

Objective 1
Develop and validate a single-item measure of collective efficacy suitable for use in an MRI scanner.

Objective 2
Use a controlled lab task to investigate the effects of group-related photos and group-related videos upon an individual's collective efficacy perceptions, identifying the most effective relationship.

Objective 3
Use a field-based task to investigate the effects of familiarity with photo and video content upon an individual's collective efficacy perceptions.

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6. METHODOLOGY

Study 1

Following ethical approval members of both university and local sports teams (>18 yrs of age, Male and Female, N = ≥ 300) will be recruited to take part in the study. All participants will be members of interactive team sports (e.g., rugby, football, hockey, netball) to ensure that affective bonds are maximised. Two measures will be used:

The Shortened Measure of Collective Efficacy: This will be designed both by considering previous methods of measurement (see Shearer et al., 2009) and the requirements of answering questions in an *f*MRI scanner (i.e., suitable for a button press response system).

The Collective Efficacy Questionnaire for Sport (CEQS; Short, Sullivan, & Feltz, 2005): This will be used as a gold-standard measure of collective efficacy by which to validate the single-item measure. To date, the CEQS is the only published validated collective efficacy scale for use in sport. The CEQS is a 20-item questionnaire consisting of five factors, namely: effort, persistence, ability, preparation, and unity.

To design the single item measure of collective efficacy, a detailed review of the literature will be made, assessing the different methods of measuring collective efficacy currently available. A panel of group dynamics experts will then agree on a single-item measure of collective efficacy that measures an individual's perception of their team's collective efficacy. This single-item will be tested in a small pilot group of team athletes to ensure relevance. Following this, a questionnaire pack that contains a demographic sheet (e.g., age, sport played, experience etc) and both the single item measure and the CEQS will be administered to >300 participants of team sports. Once recorded, data will be screened for homogeneity of variance and the assumptions for the use of parametric statistics. Simple linear regression will be used to examine the predictive relationship between the scores from the single-item measure and the CEQS.

Study 2

Participants (>18 yrs of age, male and Female, *N*= > 40) will be an opportunity sample of students from Swansea University who currently compete in team sport events. Two measures will be used; *The Shortened Measure of Collective Efficacy* and *The Collective efficacy Questionnaire for Sport* (CEQS; Short, Sullivan, & Feltz, 2005). The study will use a mixed groups design to measure the effects of both photos and video stimuli on individual collective efficacy perception, Where *stimuli type* (photo/video/control) will act as the between groups independent variable and *trial number* (Pre manipulation/ post manipulation/ post intervention) the within groups variable. Participants will be recruited via opportunity sampling with participants placed into teams of three with people whom they are already familiar (i.e., not strangers). Each group will be randomly allocated to one of three experimental treatment groups (i.e., control, video, or photo).

The team task used will be similar to that implemented by Hodges and Carron (1992) in their early experiment on collective efficacy. Specifically, each team member will take turns to hold a medicine ball aloft with arms held out in front of the body at 90 degrees for as long as possible. A team score will be calculated based on the cumulative time for all three group members. The task will be completed in a psychology laboratory at Swansea University, and each team will perform in isolation. During practice, photos and video will be recorded, used within intervention methods for collective efficacy. Collective efficacy will be measured for the first time (pre manipulation) and participant's informed of the between-teams competitive nature of the task. False negative feedback will be provided; lowering each teams perceptions of their collective efficacy prior to the intervention. The collective efficacy measure will be completed for the second time (pre intervention). Upon completion, the participant's respective intervention strategies will be administered. The video group will view a 2-minute video of their best performances from the practice session, the photo group will watch a 2-minute slide show of their best performances and the control will watch a video of team related sport (e.g., footage from the football world cup). Following intervention a final measure of collective efficacy will be taken. 30 minutes after the initial trial, the final trial will be completed and the participants debriefed about the real purpose of the experiment. A Mixed 3 (video/photo/control) x 3 (pre manipulation / pre intervention / post intervention) model ANOVA will be used to examine any significant difference in collective efficacy scores, with planned contrasts used for post-hoc analysis.

Study 3

Participants (>18 yrs of age, Male, *N*= < 40) will be an opportunity sample of students from Swansea University who currently compete in team sport events. Two measures will be used; *The Shortened Measure of Collective Efficacy* and *The Collective efficacy Questionnaire for Sport* (CEQS; Short, Sullivan, & Feltz, 2005). The study will use a mixed groups design to measure the effects of both photos and video stimuli on individual collective efficacy perception, Where *familiarity with stimuli content* (familiar photo/familiar video/unfamiliar photo/unfamiliar video) will act as the between groups independent variable and *trial number* (Pre intervention/ post intervention) the within groups variable. Participants will be recruited via opportunity sampling, half the participants will be recruited from the same university sports team (e.g., Men's basketball) and allocated to either the *familiar photo* or *familiar video* group, and half the participants recruited from other interactive sports teams at the same institution (e.g., football, rugby, hockey etc) and allocated to either the *unfamiliar photo* or *unfamiliar video* group.

Still photographs and video footage will be collected over the course of a competitive season for a university sports team. Once collected all footage/images will be used to develop a team-specific video intervention based on positive team actions (i.e., successful plays, team interactions, positive reactions to scores etc). Once the collective efficacy intervention is developed the experimental task will begin. Collective efficacy will be measured for the first time (pre intervention). Upon completion, the participant's intervention strategies will be administered. Both the experimental groups will view either a 2-minute video or 2-minute slide show of still images displaying the *familiar* group's best performances from the season. Following intervention a final measure of collective efficacy will be taken and the participants debriefed about the real purpose of the experiment. A Mixed 4 (familiar photo/ familiar video/ unfamiliar photo/ unfamiliar video) x 2 (pre-intervention/ post-intervention) model ANOVA will be used to examine any significant difference in collective efficacy scores, with planned contrasts used for post-hoc analysis.

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7. LOCATION OF THE PREMISES WHERE THE RESEARCH WILL BE CONDUCTED.

The Research will be carried out on the premises of Swansea University, and facilities used by local sports teams in and around the city of Swansea.

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8. SUBJECT RISKS AND DISCOMFORTS

In study 1 the subjects will not be experiencing anything physically or psychologically different than what can be expected in their usual training programme and sports participation. Study 2 will require participants to participate in a psychological intervention; this will cause no psychological harm and will include basic techniques often experienced during sports performance in general. In study 2 participants will be taking part in an experimental task, this is controlled within a lab-based environment and will not place the subjects in danger of any physical harm.

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9. INFORMATION SHEET AND INFORMED CONSENT

The submission should be specific about the type of consent that will be sought:

Have you included a Subject Information Sheet for the participants of the study ?
YES

Have you included a Subject Consent Form for the participants of the study?
YES

If written consent will not be obtained, explain why.

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10. COMPUTERS

Are computers to be used to store data?

YES

If so, is the data registered under the Data Protection Act?

YES

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11. STUDENT DECLARATION

Please read the following declarations carefully and provide details below of any ways in which your project deviates from them. Having done this, each student listed in section 2 is required to sign where indicated.

1. I have ensured that there will be no active deception of participants.
2. I have ensured that no data will be personally identifiable.

3. I have ensured that no participant should suffer any undue physical or psychological discomfort

4. I certify that there will be no administration of potentially harmful drugs, medicines or foodstuffs.

5. I will obtain written permission from an appropriate authority before recruiting members of any outside institution as participants.

6. I certify that the participants will not experience any potentially unpleasant stimulation or deprivation.

7. I certify that any ethical considerations raised by this proposal have been discussed in detail with my supervisor.

8. I certify that the above statements are true with the following exception(s):

Student signature: (include a signature for each student in research team)

Adam Bruton

Date: 23/09/10

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12. SUPERVISOR'S DECLARATION

In the supervisor's opinion, this project (delete those that do not apply):

- ~~Does not raise any significant issues.~~
- Raises some ethical issues, but I consider that appropriate steps and precautions have been taken and I have approved the proposal.
- ~~Raises ethical issues that need to be considered by the Departmental Ethics Committee.~~
- ~~Raises ethical issues such that it should not be allowed to proceed in its current form.~~

Supervisor's signature: D. Shearer Date: 23/09/10

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13. ETHICS COMMITTEE DECISION (COMMITTEE USE ONLY)

ETHICAL APPROVAL: GRANTED REJECTED (delete as appropriate)

The ethical issues raised by this project have been considered by members of the Departmental Ethical Approval Committee who made the following comments:

....
....
....
....
....
....
....
....

Please ensure that you take account of these comments and prepare a revised submission that should be shown to your supervisor/ resubmitted to the Department Ethical Approval Committee (delete as appropriate).

Signed: Date:

(Chair, Departmental Ethics Advisory Committee)

SPORT AND EXERCISE SCIENCE
SCHOOL OF ENGINEERING, SWANSEA UNIVERSITY

SUBJECT INFORMATION SHEET

Date :

Contact Details:

Adam Bruton, 487425@swansea.ac.uk

1. Study title

Assessing the psychological effects of visual stimuli

2. Invitation paragraph

You are being invited to take part in a research study. Before you decide it is important for you to understand the reasons behind the research being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part, thank you for reading this.

3. What is the purpose of this study?

This study will test two types of visual stimuli (photographs and video and their effects upon team performance and dynamics. The aim is to identify which of these visual stimuli has the greatest effect.

4. Why have I been chosen?

You have been chosen to participate in this study as you are a Swansea University Student currently competing in team sport.

5. What will happen to me if I take part?

The research will take place over 2 days. On the first day of the experiment the participants will be grouped into teams of 3 accordingly. Once grouped the research team will provide a full explanation and demonstration of the experimental task to each group individually, followed by a 15 minute practice session for each of the teams. The teams will then be instructed to return 7 days later, the 3 experimental trials will be recorded on this day. Questionnaires will be administered for each of the trials and the visual stimuli will be utilised prior to the final trial.

6. What are the possible disadvantages of taking part?

The risks involved in this study are minimal as you will not be undertaking anything too strenuous physically or psychologically.

7. What are the possible benefits of taking part?

The information gained from the study may help to further understand important psychological characteristics within a team/group and support potential methods to improve these characteristics for future performance.

8. Will my taking part in the study be kept confidential?

All information that is collected about you during the course of the research will be kept strictly confidential. Any information about you that is used will have your name and address removed so that you cannot be recognized from it, complying with the Data Protection Act.

Appendix B: Team Sports Questionnaire (validation study one)

1. Team Sport Questionnaire

Thank you for agreeing to take part in my study. Listed below and on the following pages are a number of questions and statements relating to your team sport participation. Please answer in accordance with the instructions at the top of each page. Your answers will remain strictly confidential and you are welcome to withdraw at any point. By competing the questionnaires you are agreeing to give your informed consent for me to use the data for my study. THANKS AGAIN, your responses will be very useful and assist in the completion of my studies.

***1. Name:**

***2. Age:**

***3. Gender:**

***4. What team sport do you play?**

***5. How many years have you been playing team sport?**

***6. How many teams have you been part of throughout your participation within this sport?**

***7. For what duration have you been an active member of your current team? (e.g. 1 year and 6 months)**

***8. Please list your teams last 3 results from competitive matches (i.e. WIN/DRAW/LOSS and the score (e.g. 2-1))**

1.

2.

3.

Appendix C: Single-Item Measure of Collective Efficacy

(validation studies one and three)

On a scale between 0 and 100, rate YOUR TEAM'S CONFIDENCE in their ability to perform to a high level, in order to achieve success in their next competitive performance.

NOT CONFIDENT AT ALL	COMPLETELY CONFIDENT
0	100

SCORE .____.

Appendix D: Single-Item Measure of Collective Efficacy (validation study two)

On a scale between 0 and 100, rate YOUR TEAM'S CONFIDENCE in their ability to complete the obstacle course in the shortest possible time.

NOT CONFIDENT AT ALL	COMPLETELY CONFIDENT
0	100

SCORE . ____ .

Appendix E: Collective Efficacy Questionnaire for Sports (Short et al., 2005)

- Team confidence refers to a team's shared belief in its abilities to perform certain team skills during a competition. Rate your team's confidence on the 20 items in terms of your upcoming performance.
- Rate your team's confidence, in terms of upcoming competition, that your team has the ability to:

1. Outperform the opposition	0	1	2	3	4	5	6	7	8	9
	NOT AT ALL CONFIDENT									COMPLETELY CONFIDENT
2. Resolve conflicts	0	1	2	3	4	5	6	7	8	9
	NOT AT ALL CONFIDENT									COMPLETELY CONFIDENT
3. Perform under pressure	0	1	2	3	4	5	6	7	8	9
	NOT AT ALL CONFIDENT									COMPLETELY CONFIDENT
4. Be ready	0	1	2	3	4	5	6	7	8	9
	NOT AT ALL CONFIDENT									COMPLETELY CONFIDENT
5. Show more ability than other teams	0	1	2	3	4	5	6	7	8	9
	NOT AT ALL CONFIDENT									COMPLETELY CONFIDENT

6. Be united	0	1	2	3	4	5	6	7	8	9
	NOT AT ALL CONFIDENT									COMPLETELY CONFIDENT
7. Persist when obstacles are present	0	1	2	3	4	5	6	7	8	9
	NOT AT ALL CONFIDENT									COMPLETELY CONFIDENT
8. Demonstrate a strong work ethic	0	1	2	3	4	5	6	7	8	9
	NOT AT ALL CONFIDENT									COMPLETELY CONFIDENT
9. Stay in contention when it seems like your team isn't getting any breaks	0	1	2	3	4	5	6	7	8	9
	NOT AT ALL CONFIDENT									COMPLETELY CONFIDENT
10. Perform to its capabilities	0	1	2	3	4	5	6	7	8	9
	NOT AT ALL CONFIDENT									COMPLETELY CONFIDENT

11. Perform well without your best player

0 1 2 3 4 5 6 7 8 9

NOT AT ALL CONFIDENT — COMPLETELY CONFIDENT

12. Mentally prepare for this competition

0 1 2 3 4 5 6 7 8 9

NOT AT ALL CONFIDENT — COMPLETELY CONFIDENT

13. Keep a positive attitude

0 1 2 3 4 5 6 7 8 9

NOT AT ALL CONFIDENT — COMPLETELY CONFIDENT

14. Perform more skilfully than the opponent

0 1 2 3 4 5 6 7 8 9

NOT AT ALL CONFIDENT — COMPLETELY CONFIDENT

15. Perform better than the opposing team(s)

0 1 2 3 4 5 6 7 8 9

NOT AT ALL CONFIDENT — COMPLETELY CONFIDENT

16. *Show enthusiasm*

0	1	2	3	4	5	6	7	8	9
NOT AT ALL CONFIDENT									**COMPLETELY CONFIDENT**

17. Overcome distractions

0	1	2	3	4	5	6	7	8	9
NOT AT ALL CONFIDENT									**COMPLETELY CONFIDENT**

18. Physically prepare for this competition

0	1	2	3	4	5	6	7	8	9
NOT AT ALL CONFIDENT									**COMPLETELY CONFIDENT**

19. Devise a successful strategy

0	1	2	3	4	5	6	7	8	9
NOT AT ALL CONFIDENT									**COMPLETELY CONFIDENT**

20. Maintain effective communication

0	1	2	3	4	5	6	7	8	9
NOT AT ALL CONFIDENT									**COMPLETELY CONFIDENT**

Appendix F: Group Environment Questionnaire (Carron et al., 1985)

Instructions to Respondents

This questionnaire is designed to assess your perceptions of your athletic team. There are no right or wrong answers so please give your immediate reaction. Some of the questions may seem repetitive but please answer ALL questions. Your candid responses are very important to us. Your responses will be kept in strict confidence. Neither your coach nor anyone other than the researcher will see your responses.

Items

The following questions are designed to assess your feelings about YOUR PERSONAL INVOLVEMENT with this team. Please CIRCLE a number from 1 to 9 to indicate your level of agreement with each of the statements.

1. I do not enjoy being a part of the social activities of this team.	0	1	2	3	4	5	6	7	8	9
	Strongly Disagree									**Strongly Agree**
2. I'm not happy with the amount of playing time I get.	0	1	2	3	4	5	6	7	8	9
	Strongly Disagree									**Strongly Agree**
3. I am not going to miss the members of this team when the	0	1	2	3	4	5	6	7	8	9
season ends.	**Strongly Disagree**									**Strongly Agree**
4. I'm unhappy with my team's level of desire to win.	0	1	2	3	4	5	6	7	8	9
	Strongly Disagree									**Strongly Agree**
5. Some of my best friends are in this team.	0	1	2	3	4	5	6	7	8	9
	Strongly Disagree									**Strongly Agree**
6. This team does not give me enough opportunities to improve	0	1	2	3	4	5	6	7	8	9
my personal performance.	**Strongly Disagree**									**Strongly Agree**

7. I enjoy other parties more than team parties.	0	1	2	3	4	5	6	7	8	9
	Strongly Disagree									**Strongly Agree**
8. I do not like the style of play in this team.	0	1	2	3	4	5	6	7	8	9
	Strongly Disagree									**Strongly Agree**
9. For me this team is one of the most important social groups to which I belong.	0	1	2	3	4	5	6	7	8	9
	Strongly Disagree									**Strongly Agree**

The following questions are designed to assess your perceptions of YOUR TEAM AS A WHOLE. Please CIRCLE a number from 1 to 9 to indicate your level of agreement with each of the statements.

10. Our team is united in trying to reach its goals for performance.	0	1	2	3	4	5	6	7	8	9
	Strongly Disagree									**Strongly Agree**
11. Members of our team would rather go out on their own than get together as a team.	0	1	2	3	4	5	6	7	8	9
	Strongly Disagree									**Strongly Agree**
12. We all take responsibility for any loss or poor performance by our team.	0	1	2	3	4	5	6	7	8	9
	Strongly Disagree									**Strongly Agree**
13. Our team members rarely party together.	0	1	2	3	4	5	6	7	8	9
	Strongly Disagree									**Strongly Agree**

14. Our team members have conflicting aspirations for the team's performance.	0	1	2	3	4	5	6	7	8	9
	Strongly Disagree									Strongly Agree
15. Our team would like to spend time together in the off-season.	0	1	2	3	4	5	6	7	8	9
	Strongly Disagree									Strongly Agree
16. If members of our team have problems in practice, everyone wants to helps them so we can get back together again.	0	1	2	3	4	5	6	7	8	9
	Strongly Disagree									Strongly Agree
17. Members of our team do not stick together outside of practices and games.	0	1	2	3	4	5	6	7	8	9
	Strongly Disagree									Strongly Agree
18. Our team members do not communicate freely about each athlete's responsibilities during competition or practice	0	1	2	3	4	5	6	7	8	9
	Strongly Disagree									Strongly Agree

Appendix G: UK Teamwork Experiment Information Sheet

UK Teamwork Experiment

This experiment requires all participants to take part in an obstacle-course based task in teams of three, focusing on the importance of teamwork towards performance. Each team will take part in one video-recorded practice trial on the first day of participation, roughly three weeks later each team will complete various team-orientated questionnaires and take part in their competitive trial, this data being entered into the UK-wide competition.

A full verbal explanation and visual demonstration of the task will be provided before participation, any participant is free to exclude themselves from the study at any time.

If you are willing to take part in the study please provide your name and signature below.

	Name	Signature
Participant 1		
Participant 2		
Participant 3		

	Time
Practice 1	

Appendix H: Example Participant Consent Form

COLLEGE OF ENGINEERING
SPORT & EXERCISE SCIENCE
PARTICIPANT CONSENT FORM

Contact Details:
Adam Bruton
[redacted]
487425@swansea.ac.uk

Project Title: Team confidence in sport.

Please initial box

1. I confirm that I have read and understood the information sheet dated ....../....../...... (version number ....) for the above study and have had the opportunity to ask questions. ☐

2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected. ☐

3. I understand that sections of any of data obtained may be looked at by responsible individuals from Swansea University or from regulatory authorities where it is relevant to my taking part in research. I give permission for these individuals to have access to these records. ☐

4. I agree to take part in the above study. ☐

Name of Subject	Date	Signature
Name of Person taking consent	Date	Signature
Researcher	Date	Signature