Cohesion Team Mental Models and Collective Efficacy: Towards an Integrated Nomological Network of Team Sports

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COHESION TEAM MENTAL MODELS AND COLLECTIVE EFFICACY: TOWARDS AN INTEGRATED NOMOLOGICAL NETWORK OF TEAM SPORTS

By

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…not the answer yet.

“The answer my friend, is blowing in the wind.”

Bob Dylan
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ABSTRACT

A nomological network on team dynamics in sports consisting of a multi-framework perspective is introduced. The aim was to explore the interrelationship among cohesion team mental models (TMM), collective-efficacy (CE) and perceived performance potential (PPP). A secondary aim was to assess intra and inter team variability among these team level properties. Three hundred and forty college soccer players of both genders (178 female, 52.4%; and 162 male 47.6%) and representing 17 different teams (n = 8 female and 9 male) affiliated to the National Association of Intercollegiate Athletics (NAIA) agreed to participate in the study. The participants were 20.38 years old on average (SD = 2.12) and had 14.66 years (SD = 3.92) of experience in the sport. They responded to surveys on team cohesion (i.e., The Group Environment Questionnaire), TMM (i.e., Team Assessment Diagnostic Measure), CE (i.e., Collective Efficacy Questionnaire for Sports) and PPP (i.e., Team Outcome Questionnaire). Descriptive and structural equation modeling analyses indicated that cohesion, TMM and CE are conceptually and statistically interrelated constructs. Specifically, cohesion was found to be an exogenous variable predicting both TMM and CE beliefs. These former team attributes were found to predict PPP which in turn accounted for approximately 60% of the variance of objective performance scores as measured by teams’ season record. Altogether, findings of this study are congruent with the theoretical feasibility and statistical validity of an integrated view of team dynamics in sports. Applied implications involve the development of evidence-based protocols to enhance team PPP as related to cohesion, TMM and CE beliefs.

Keywords: team dynamics, cohesion, team mental models, collective efficacy, nomological network.
CHAPTER ONE
INTRODUCTION

Research on sport and exercise psychology has been mainly focused on the individual rather than on the team level of analysis (Carron, Hausenblas, & Eys, 2005). Nonetheless, the understanding of team dynamics is crucial to the advancement of athletic performance as successful team performance is not primarily dependent on individual expertise (Eccles, 2010; Salas, Rosen, Burke, Goodwin, & Fiore, 2006). Extant research on psychology and sociology reinforces the notion that “an expert team is not necessarily a team of experts” and that cognition is also a social, and a group-level phenomenon (Eccles & Tenenbaum, 2004, p. 562). The seminal works of Durkheim and Piaget exemplify how social interactions shape human cognition and influence society and societal rules (Levine, Resnick, & Higgins, 1993). Durkheim offered the notion of collective consciousness, which represents the values and norms shared by a particular society that form the basis for social integration. Piaget studied human cognitive functioning and concluded that social interactions are essential to the development of abstract reasoning among human beings (see Andersen & Serena, 2002).

Research in sport and exercise psychology has also shown that group level variables influence team performance (Carron & Hausenblas, 1998). Of particular interest, team cohesion, team mental models (TMM), and collective efficacy (CE) have been shown to influence team performance. Specifically, social and task cohesion have been found to be positively associated with team performance in sports (Carron, Eys, & Burke, 2007). TMM quality and accuracy have been also shown to enhance team productivity (Bourbousson, Poizat, Saury, & Sève, 2010; Poizat, Bourbousson, Saury, & Sève, 2009). The notion that successful teams have a strong sense of CE has also been supported by research in the field of sport and exercise psychology (Feltz, Short, & Sullivan, 2008).

Although research findings support the notion that cohesion, TMM, and CE are positively associated with team performance, scarce evidence exists on how these team-level attributes are interrelated (Klimoski & Mohammed, 1994; Mohammed, Ferzandi, & Hamilton, 2010). Specifically, a parsimonious nomological network involving these variables has not been tested yet. Hence, the notion of a parsimonious model (i.e., the simplest model, with as few parameters as possible, needed to explain a given phenomenon) has not been established in the field yet.
Statistical testing of conceptual models of cohesion and TMM are also scarce in the literature (Schutz, Eom, Smoll, & Smith, 1994; Ward & Eccles, 2006).

This study explores the interrelationship among team cohesion, TMM, and CE. “The seminal conceptualization of group dynamics in sports by Carron and Hauseblas (1998) (see Figure 1) offers the rationale for this study, which is based on current research on team cohesion, TMM, and CE in sports. Accordingly, the theoretical foundation of each one of these team’s attributes is addressed next. Upon the conclusion of the literature review, an innovative and integrated framework is presented and tested.

![Figure 1. “Conceptual Framework for Examining Sport Teams” by A. V. Carron and H. Hauseblas, 1998, Group dynamics in sport, p. 166. Copyright 1998 by Fitness Information Technology.](image-url)
CHAPTER TWO
LITERATURE REVIEW

Team Cohesion in Sports

Cohesion is one of the most vital group variables, and a vastly studied topic in the sport and exercise psychology domain (Carron & Brawley, 2008; Lott & Lott, 1965; Mudrack, 1989; Paskevich, Estabrooks, Brawley, & Carron, 2001). Defined as “a dynamic process that is reflected in the tendency of a group to stick together and remain united in the pursuit of its instrumental objectives and/or for the satisfaction of member affective needs” (Carron, Brawley, & Widmeyer, 1998, p. 213), cohesion is a multidimensional phenomenon that includes both social and task components (Carron, Eys, & Burke, 2007; Carron, Widmeyer, & Brawley, 1985). Social cohesion pertains to the degree to which members of a team interact with each other. Task cohesion refers to the degree to which members of a team remain united to achieve shared performance-related goals (see Carron et al., 2007). Based upon the notions of task and social cohesion, Widmeyer, Brawley and Carron (1985) proposed the Conceptual Model of Group Cohesion for Sport. This framework encapsulates both individual and group levels of analysis. The individual level of analysis (i.e., Individual Attractions to the Group) pertains to each athlete’s perception and feelings concerning his/her particular social and task attraction to the team. The team level of analysis (i.e., Group Integration) is based upon the “individual team member’s feelings about the similarity, closeness, and bonding within the team as a whole around the group task” (Widmeyer et al., 1985, p. 17). Thus, the Individual Attractions to the Group level represents “I, my, or me” beliefs and perceptions, whereas the Group Integration level represents “us, our, or we” beliefs and perceptions (see Carron & Brawley, 2008). These categories are further divided into social and task components. Hence, the Conceptual Model of Group Cohesion for Sport is composed of four dimensions: (a) Individual Attraction to the Group-Social (ATG-S), (b) Individual Attraction to the Group-Task (ATG-T), (c) Group Integration-Social (GI-S), and (d) Group Integration-Task (GI-T) (see Figure 2).
Paskevich et al. (2001) emphasized that the Conceptual Model of Group Cohesion for Sports is based on three main assumptions: (a) cohesion can be examined through the perceptions of individual group members, (b) social cognitions are represented at both the group and individual level of analysis, and (c) cohesion beliefs are both social and task related. These assumptions have been confirmed over the last 25 years of research in the sport and exercise psychology domain, thus lending empirical support to the validity of the Conceptual Model of Group Cohesion for Sport (Carron, Colman, Wheeler, & Stevens, 2002; Carron & Brawley, 2008). Research based on this conceptual model has revealed that environmental (e.g., level of completion, team size, sport type), personal (i.e., demographic attributes such as age and gender), and leadership factors (i.e., coaches’ behaviors and leadership style) influence team cohesion in sports (Carron & Chelladurai, 1981; Carron et al., 2005; Gruber & Gray, 1981; Cox, 2002; Iordanoglou, 1993; Widmeyer & Martens, 1978).

**Impact factors of team cohesion in sports.** Variables influencing team cohesion in sports have been mainly classified into one of three factors: (a) environmental, (b) leadership, and (c) personal (Carron et al., 2007; Paskevich, 2001). These factors are not all-inclusive or statistically and/or conceptually orthogonal, but represent some of the key variables that have been found to influence cohesiveness of team sports. In addition to these factors, cohesion has
also been hypothesized to be associated with performance in team sports (Iordanoglou, 1993; McGrath, 1984; Widmeyer & Martens, 1978; Zakrajsek, Abildso, Hurst, & Watson, 2007).

**Environmental factors.** Two environmental factors correlated with cohesion are: (a) level of competition, and (b) size of the team. Team cohesion has been studied across various skill/experience levels from high-school to professional sports (Bray & Whaley, 2001; Carron et al., 2002; Medeiros Filho, Dobersek, & Gershgoren, 2011). For instance, Gruber and Gray (1981) studied male varsity basketball players, and concluded that group cohesion scores vary across competition levels within a sport. Granito and Ray (1988) compared cohesion levels of college and high school football teams, and found task cohesion to be greater in high school teams. Altogether, these studies suggest that level of competition influences group cohesion.

Size of team also plays a role in cohesion dynamics. The general notion is that an increase in team size is associated with a decrease in team cohesion (Carron et al., 2005; Carron et al., 2007). This notion was initially tested by Widmeyer, Brawley and Carron (1990) in a series of studies accessing the impact of roster size on group cohesion. Widmeyer et al. (1985) examined a 3-on-3 recreational basketball league and reported that 3-person basketball teams presented higher levels of group cohesion than 6-person and 9-person basketball teams. They observed similar results when comparing volleyball competitions of 3 vs. 3, 6 vs. 6, and 12 vs. 12.

Type of sport has also been proposed to be an environmental factor of group cohesion. Interactive sports (e.g., soccer, basketball, lacrosse) require team members to interact and coordinate their performance in order to accomplish shared goals (see Grieve, Whelan, & Meyers, 2000). In coactive teams, functional coordination with other team members is not essential for the achievement of team goals. Instead, team success is based on individual performances, which accumulate into a total team score (e.g., swimming, track & field, bowling, archery, gymnastics).

**Leadership factors.** Leadership factors pertain to the impact of coaches’ behaviors on team cohesion. There is a general agreement that higher levels of social support and training/instruction behavior are associated with higher levels of cohesion (Chelladurai, 1990; Heuzé, Sarrazin, Masiero, Raimbaul, & Thomas, 2006). For example, Turman (2003) studied coaches’ behaviors associated with the development of group cohesion in team sports. He concluded that athletes value leadership styles based on instructional feedback (e.g., discussing
the qualities and weakness of the upcoming opponent team) and social support (e.g., offering motivational speeches).

**Personal factors.** Personal factors primarily include demographic attributes (e.g., age and gender) and role clarity. Medeiros Filho et al.’s (2011) meta-analytic review examined the effect of gender across languages and cultures on the cohesion-performance relationship. They concluded that gender is a cross-cultural factor of the cohesion-performance relationship in sports, and consequently, recommended that practitioners consider gender differences and identity when enhancing cohesiveness in team sports.

Aside from gender idiosyncrasies, cohesion tends to be higher when members’ attributes (e.g., age, experience level) are similar rather than dissonant (Carron et al., 2005). Role clarity is another personal attribute linked to cohesion levels in team sports. Simply put, when team members have clear performance expectations and assigned roles they tend to report higher levels of perceived group cohesion (Hoigaarda, Toftelanda, & Ommundsen, 2006). For example, Everett, Smith, and Williams (1992) examined the relationship among team cohesion, identifiability (i.e., the degree to which an athlete's performance level is publicized to self and others), and relay swimming performance times. They found that when roles are clearly assigned and easily identifiable athletes of team sports are less likely to engage in social loafing.

Team performance has also been hypothesized to influence performance and vice-versa (Iordanoglou, 1993; Widmeyer & Martens, 1978). Three meta-analytic reviews have previously attempted to resolve ambiguous findings concerning the direction and magnitude of the cohesion-performance relationship (i.e., Carron et al., 2002; Medeiros Filho et al., 2001; Mullen & Cooper, 1994). Mullen and Cooper’s meta-analysis (1994) examined 49 studies from general, military, and sport psychology. Results revealed a significant, positive, and small effect size for the cohesion-performance relationship (ES = .25, p < .01). Results for the sport domain were found to be highly significant and large in magnitude (ES = .60, p < .01). Results from this initial meta-analytic review must be considered with some caution because the true effect size in the population for different groups (e.g., military and sport psychology) is influenced by various idiosyncratic moderator variables. In a second meta-analytic review, Carron et al. (2002) specifically examined the magnitude and direction of the cohesion-performance relationship in sports. Likewise, Mullen and Cooper (1994) observed a large effect size (i.e., above .5) for the cohesion-performance relationship. Recently, Medeiros Filho et al. (2011) conducted a 10-year
retrospective meta-analysis (i.e., studies published from 2000 through 2010) and observed a moderate relationship between cohesion and performance in sports \((r = .33)\). Altogether, these studies support the notion that cohesion is indeed positively and moderately-strongly associated with performance in sports.

In short, group cohesion is linked to a number of environmental, leadership, and personal factors. There is also evidence suggesting that cohesion is linked to performance in team sports. Hence, studies aimed at examining group structure in general, and group cohesion in particular, should control for the potential influence of these factors on group cohesion (Feltz & Lirgg, 2001). Accordingly, the current study is designed to account for environmental and personal attributes of college athletes participating in a highly interactive sport (i.e., soccer).

This study is also designed to assess the relationship between cohesion and other group constructs, such as TMM and CE (Carron & Burke, 2007; Paskevich et al., 2001). Overall, scholars support the notion that team cohesion is an antecedent variable of both TMM and CE (Carron & Brawley, 2008; Carron & Hausenblas, 1998). This notion is based on the premise that shared social/affective and task/cognitive related knowledge precedes the development of TMM (Bergeles & Hatiharistos, 2003; Yen, Fan, Sun, Hanratty, & Dumer, 2006). There is also evidence suggesting that cohesion levels are positively associated with collective efficacy, role clarity, and role acceptance (Kjormo & Halvari, 2002; Lowther & Lane, 2002). For instance, Heuzé et al. (2006) examined group variables in female professional basketball and handball teams and noticed that cohesion and CE are interrelated constructs, and positively associated with team performance.

Although scholars concur that cohesion is intrinsically associated with other team level properties, a parsimonious nomological networking integrating these variables have not been tested yet (Klimoski & Mohammed, 1994). Accordingly, a major limitation of the literature on team cohesion in sports pertains to the lack of studies assessing intra and inter team variability on cohesion scores (Carron et al., 2007; Carron et al., 2005). Furthermore, scholars have advocated the need for further examination, and statistical validation, of the Conceptual Model of Group Cohesion for Sport in the sport setting. The potential moderating role of team cohesion on other team level attributes also constitutes an important and valid current line of investigation (Carron & Brawley, 2008).
Section Summary

The current study is based on the definition provided by Carron et al. (1998), thereby adopting the notion that cohesion is a multidimensional, dynamic, instrumental, and affective group property. Moreover, cohesion is examined through the leading framework in the area (i.e., Conceptual Model of Group Cohesion for Sport), and hence, conceptualized as having (a) an individual and a group level of analysis (i.e., individual attractions to the group and group integration), and (b) both task and a social orientations. Cohesion is also thought to be influenced by other group variables (e.g., environmental, leadership, and personal factors) such as TMM, which is reviewed next.
Team Mental Models in Sports

Strategic decisions are usually made by a team rather than an individual (Levine et al., 1993). Usually, society relies on teamwork (Andersen & Serena, 2002), and accordingly, scholars from various domains have emphasized the importance of studying team cognition to gain knowledge on how to promote effective teamwork and team decision making (Cannon-Bowers, Salas, & Converse, 1993; Medeiros Filho, Basevitch, Gershgoren, Schinke, & Tenenbaum, 2011). Of note, the term “Shared Mental Models” (SMM) has been the most used to denote research on team cognition (Cooke, Salas, Cannon-Bowers, & Stout, 2000; Yamaguchi, 2007). Nonetheless, this terminology limits both the epistemological and the nomological network of team cognition research (Lim & Klein, 2006). According to Mohamed et al., (2010), TMM is a better term to represent research on team cognition, as it conveys that “the locus of interest is on team functioning, and it is stated broadly enough to encompass both similarity and accuracy properties. In contrast, the term SMM highlights only sharedness, an ambiguous term that has been somewhat contentious in the field” (p.4). Cannon-Bowers and Salas (2001) have also noted that effective teams should possess different types of knowledge, such as: (a) shared/overlapping, (b) similar/identical, (c) compatible/complimentary, and (d) distributed. Accordingly, the present study is based on the notion of TMM rather than on the notion of SMM.

Defined as “the collective task and team relevant knowledge that team members bring to a situation” (Cooke et al., 2000, p.153), TMM are thought to provide a heuristic route (i.e., rule of thumb) to members of a given team, thus accelerating teamwork coordination and optimizing team decision making (Salas & Klein, 2001). Furthermore, research has consistently shown that TMM are a multi-factorial phenomenon based on (a) declarative, procedural, and strategic information (i.e., TMM’s forms); (b) task-specific and team related knowledge (i.e., TMM’s content), and (c) complex intra-team coordination mechanisms (see Eccles & Tenenbaum, 2007; Fiore, Salas, Cuevas, & Bowers, 2003; McPherson, 1999; Salas & Klein, 2001).

The forms of team mental models. Teammates may hold and share three main forms of knowledge (see Mohammed et al., 2010). Declarative knowledge refers to knowledge of “what to do,” and is usually expressed via spoken, written or depictive language (e.g., clipboard for technical/tactical planning). Declarative knowledge is important in the process of team decision making because teammates need to be able to identify “what to do” in order to optimize team performance. Indeed, research on effective peer and coaching leadership suggests instructional
feedback is an important component of effective leadership in team sports (Loughead & Hardy, 2005).

*Procedural knowledge* implies “know-how,” and is expressed through task performance (e.g., set plays in corner kicks). Procedural knowledge is associated with “how” teammates coordinate their actions in order to improve team performance (Klimoski & Mohammed, 1994). For instance, Banks and Millward (2007) investigated dyadic teams’ performance on a PC-based tank simulation game, and concluded that accurate procedural knowledge was positively associated with team performance. Moreover, set-pieces (i.e., rehearsed team maneuvers) have been shown to win games in interactive team sports (see Jones & Tranter, 1999; Shondell & Reynaud, 2002).

*Strategic knowledge* is a contextual and applied knowledge. It represents a team’s macro-level knowledge (i.e., general game plan), and refers to “these elements discussed in advance in order for a team to organize itself” (see Gréhaigne, Godbout, & Bouthier, 1999 p. 166). Accordingly, strategic knowledge is fundamental for team performance in sports as well as in other domains of human performance, such as business management and military maneuvering (Ensley & Pearce, 2001; Mathieu, Rapp, Maynard, & Mangos, 2010). In addition to strategic/macro-level team knowledge, Ward and Eccles (2006) suggested that TMM possess a micro-level (i.e., moment-to moment /situational-based models) feature. This micro-level feature represents team members’ individual and collective tactical knowledge and it is implemented under strong time constraint situations.

Macro-level TMM (i.e., strategic knowledge) has also been listed as action-plan profiles (i.e., pre-determined plans), whereas micro-level TMM (i.e., tactical knowledge) has also been described as current-event profiles (i.e., adaptive/situational knowledge) (see Ward & Eccles, 2006). There is preliminary evidence suggesting that macro-level team-related knowledge (i.e., general strategy and tactical plans) is more susceptible of improvement than micro-level (i.e., moment to moment; situation-based; current event profiles) team-related information (see Medeiros Filho, Gershgoren, Shipherd, & Basevitch, 2011). Nonetheless, both macro-

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1 “Tactics involve all orientation operations voluntarily executed during the game by players in order to adapt, to the immediate requirements of an ever-changing opposition, their spontaneous actions, or those organized through the predetermined strategy” (see Gréhaigne et al., 1999, p. 166).
level/action plan profiles and micro-level knowledge/current-event profiles have been linked to team expertise (Salas, Rosen, Burke, Goodwin, & Fiore, 2006).

The content of team mental models. TMM are primarily based on teammates’ (a) task-specific knowledge, and (b) team-related knowledge (see Cooke et al., 2000). Task-related knowledge is task-specific and idiosyncratically distributed among team members. Team-related knowledge refers to “knowledge held by teammates and their collective understanding of the current situation” (Cooke et al., 2000, p. 154), and involves communal understanding of team procedures, strategies, and contingency plans. According to Mohammed et al. (2010) task-related knowledge specifies “what needs to be accomplished” by each team member, whereas team-related knowledge refers to work coordination (i.e., “how work needs to be accomplished”). In fact, both task-specific and team related knowledge have been found to be associated with team performance. For instance, Mathieu, Heffner, Goodwin, Salas and Cannon-Bowers (2000) observed that both task-specific and team-related knowledge are important for team performance in computer based-flight-combat simulation.

The importance of team and task-related knowledge is also evident in soccer matches. For instance, goalkeepers possess highly task-specific knowledge which is essential to team performance (Ward & Eccles, 2006). On the other hand, team performance is also dependent on the tactical knowledge of all players who enter the pitch; thus, soccer players must hold common knowledge (i.e., team-related knowledge) regarding their team strategies (e.g., team formation such as 1-4-3-3 or 1-3-5-2) (see Jones & Tranter, 1999; Tenga, Holme, Ronglan, & Bahr, 2010). In addition to task-specific and team-related knowledge, teammates may also benefit from having communal knowledge on equipments, tools and technologies associated with team performance in a given domain (Cannon-Bowers et al., 1993).

Coordination mechanisms. Numerous scholars agree that TMM relies on coordinated division of labor, and thus, that individual knowledge and independent work is not the main predictor of team expertise (Entin & Serfaty, 1999; Fiore et al., 2003; Salas & Klein, 2001; Yen et al., 2006). In fact, team expertise has been linked to the optimization of coordination links and the avoidance of socio-cognitive coordination breakdowns (e.g., Ringelmann effect) (see Eccles & Tenenbaum, 2004; Salas et al., 2006). Within the sport domain there is also a general agreement that optimal team performance depends on interdependent contributions of various team members (Arrow, Poole, Henry, Wheelan, & Moreland, 2004; Eccles, 2010).
According to Eccles (2010) team sports require interdependent work, and hence, a differential division of labor. Specifically, Eccles noticed that team members are primarily related by (a) type of task, (b) location, and (c) time (accuracy). For instance, soccer players performing different tasks (e.g., goalkeepers, defenders, midfielders, forwards) and occupying different locations on the pitch (e.g., defensive field, offensive field) need to timely coordinate their actions in order to accomplish a desired outcome (e.g., a long pass). As Eccles (2010) posited: “the actions required in different areas of the pitch are different (e.g., defending vs. attacking), the assignment of different players to different pitch areas means that different players undertake different actions, which constitutes a differential division of labor” (p. 157).

The notion of transactive memory systems is also important to understand team coordination (Brandon & Hollingshead, 2004). Transactive memory theory states that teammates develop consensus regarding the distribution of their relative expertise and coordination processes (see Smith-Jentsch, Kraiger, Cannon-Bowers, & Salas, 2009, p. 181). Thus, transactive memory is an informational system that develops over time within a team and allows teammates to store, encode, and retrieve task-specific and team-related knowledge that enhances team coordination (Zhang, Hempel, Han, & Tjosvold, 2007). Aligned with the notion of transactive memory systems, Bourbousson et al. (2010) observed that mutual awareness is an essential factor for the establishment of coordination networking and a sense of collective functioning in basketball teams.

It is also important to note that communication is a crucial factor linking these transactive memory systems. Specifically, communication is important for the development of explicit and implicit coordination links (Eccles & Tenenbaum, 2004; Hutchins, 1995; Klimoski & Mohammed, 1994; Salas & Burke, 2005). Explicit coordination refers to verbal communication used to facilitate division of labor among teammates whereas implicit coordination pertains to the ability of teammates to articulate team level actions without the need for verbal communication (see Ward & Eccles, 2006; Eccles & Tenenbaum, 2007). Altogether, it is possible to state that verbal and non-verbal communication are essential to the establishment of team coordination links. For instance, Lausic, Tenenbaum, Eccles, Jeong, and Johnson (2009) noticed that winning tennis teams communicated more frequently than losing teams, thus suggesting that communication is associated with team coordination and performance. Entin and
Serfaty (1999) also noticed that naval teams adapt to highly stressful situations by creating implicit and explicit models of coordination.

Finally, it is important to notice that multiple contextual factors (e.g., interactive vs. coactive sports; open vs. closed environment; home field advantage phenomenon\(^2\)) may interfere with team coordination and performance. In fact, research has consistently shown that contextual variables impact team process and performance in sports (Balmer, Nevill, & Williams, 2003; Driskell & Salas, 2006; Janz, Colquitt, & Noe, 1997). Of particular importance, scholars seem to concur with the maxim “cognition is situated,” thus supporting the notion that TMM are context-dependent. In this regard, extant research on social and cognitive psychology has suggested that individual and team expertise are context-dependent (Eccles & Tenenbaum, 2007; Ericsson & Kintsch, 1995; Levine et al., 1993; Salas et al., 2006; Webber, Chen, Payne, Marsh, & Zaccaro, 2000). Accordingly, a successful working team may not be able to transfer its expertise into a different domain. Congruent with the notion that TMM is domain specific, the *Conceptual Framework of Coordination in Sport Teams* is introduced next.

**Conceptual Framework of Coordination in Sport Teams**

Eccles and Tenenbaum (2004) proposed that team coordination in sports is dependent upon shared knowledge that can be developed prior to (i.e., pre-process coordination), during (i.e., in-process coordination), or after team actions (i.e., post-process coordination) (see Figure 3). Such assertions are in line with current evidence suggesting that teams can enhance functioning by analyzing their performance prior, during or after task-related activities (Carron et al., 2005; Gréhaigne et al., 1999).

Regarding *pre-process coordination* actions, Eccles and Tenenbaum noticed that shared goals and game plans, along with clear specification of social roles, are essential to promote teamwork. In fact, there is a general agreement that role clarity, shared mental plans, and specific goal setting are essential to promote effective information sharing in working teams (Cannon-Bowers & Salas, 2001; Fiore et al., 2003; Klimoski & Mohammed, 1994). For instance, the importance of communal *pre-process* coordination has been verified in aviation and air traffic control studies (see Bearman, Paletz, Orașanu, & Thomas, 2010). For example, Bearman et al.

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\(^2\) Home-Advantage: “The consistent finding that home teams in sports competitions win over 50% of the games played under a balanced home and away schedule” (Courneya & Carron 1992, p. 13).
noticed that breakdowns in coordinated decision making in aviation are associated with team members’ incompatible goals, planning, and allocation of responsibilities.

Concerning *in-process coordination* actions, Eccles and Tenenbaum observed that verbal and non-verbal communication are important for the development of team mental schemata, and thus to the enhancement of coordinated collective actions. Other scholars have also emphasized that effective communication is associated with team coordination and performance (see Lausic et al., 2009; Salas & Klein, 2001). Eccles and Tenenbaum also pointed out that *in-process* actions are influenced by time pressure, thus requiring efficient decision making from team members. Furthermore, they acknowledged that their model is probabilistic in nature. A series of studies regarding *in-process coordination* in basketball reinforced the notion that TMM are dynamic rather than static, and a probabilistic rather than a deterministic phenomenon (see Bourbousson, Sève, & McGarry, 2010). Specifically, Bourbousson et al. observed that space-time movement patterns in basketball are very dynamic, and players usually tend to form dyadic combinations aiming to either establish defensive covering or offer offensive threat to the opposing team.

*Figure 3. “Conceptual Framework of Coordination in Sport Teams” by D. Eccles and G. Tenenbaum, 2004, Journal of Sport & Exercise Psychology, 26, p. 546. Copyright by Tayor & Francis.*
Finally, Eccles and Tenenbaum noticed that evaluation is linked to the development of shared knowledge in post-process actions, and that team functioning is a product of task-work/task-specific knowledge (i.e., specific knowledge required for particular players, such as a goalkeeper in soccer), and teamwork requirements (i.e., actions that are performed by all team members, such as defensive positioning during a corner kick). In this regard, Eccles and Tenenbaum’s framework is aligned with evidence suggesting that task work and team work knowledge evolve over time based on teammates’ recurrent interactions and evaluative thinking (see Lee & Johnson, 2008; Johnson & O’Connor, 2008; Medeiros Filho et al., 2011; Zhang et al., 2007). Altogether, Eccles and Tenebaum’s conceptual framework is aligned with the overall literature on TMM regarding the purpose, content, and coordination mechanisms pertaining to TMM. Moreover, Eccles and Tenebaum added the notion of pre, in, and post coordination mechanisms to the overall conceptualization of team cognition.

A descriptive summary of the literature covered on TMM is presented in Table 1. In summary, TMM allow teammates to make predictions and establish heuristic routes when planning, executing, or evaluating teamwork. TMM are formed by declarative, procedural, and strategic information, and consist of task-specific and team-related knowledge. Moreover, TMM are based not only on shared/overlapping knowledge and on similar/identical, but also on heterogeneous/idiosyncratic, and distributed knowledge. TMM rely on coordinated division of labor, which is primarily developed via implicit and explicit communication channels. Team coordination in sports is thought to be a probabilistic phenomenon and to be influenced by pre, in (i.e., during), and post coordination processes. The current study is based on these characteristics of TMM, and on the notion that TMM are domain-dependent; thus, sport teams function differently than other working groups.

The existence of multiple labels to similar constructs indicates that scholars do not fully agree on the epistemological traits of TMM. Accordingly, the lack of a nomological and statistically parsimonious network linking TMM, and other team level attributes, constitutes a major gap in the current literature on TMM (Klimoski & Mohammed, 1994; Mohammed et al., 2010). Development and adaptation of methodological tools and instruments are also avenues for future research on the field (Johnson, Lee, O’Connor, Khalil, & Huang, 2009). Finally, there is also evidence suggesting that TMM are related to other team level properties such as collective
efficacy (Salas & Burke, 2005). Hence, studies exploring the interrelationship of TMM and other team level attributes are also needed.

Table 1

*Descriptive Summary of the Literature on TMM*

<table>
<thead>
<tr>
<th>Key Concepts</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Heuristic function</td>
<td>Purpose</td>
</tr>
<tr>
<td>2. Predictive/Anticipative function</td>
<td></td>
</tr>
<tr>
<td>1. Declarative knowledge</td>
<td>Form</td>
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<tr>
<td>2. Procedural knowledge</td>
<td></td>
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<tr>
<td>3. Strategic knowledge (macro-level knowledge)</td>
<td></td>
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<tr>
<td>4. Tactical knowledge (micro-level knowledge/current event profiles)</td>
<td></td>
</tr>
<tr>
<td>1. Shared/Overlapping knowledge</td>
<td>Types</td>
</tr>
<tr>
<td>2. Heterogeneous/Idiosyncratic knowledge</td>
<td></td>
</tr>
<tr>
<td>3. Compatible/Complimentary knowledge</td>
<td></td>
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<tr>
<td>4. Distributed knowledge</td>
<td></td>
</tr>
<tr>
<td>1. Task-specific knowledge</td>
<td>Content</td>
</tr>
<tr>
<td>2. Team related knowledge</td>
<td></td>
</tr>
<tr>
<td>1. Implicit communication links</td>
<td>Coordination</td>
</tr>
<tr>
<td>2. Explicit communication links</td>
<td>Mechanisms</td>
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<tr>
<td>3. Transactive memory systems</td>
<td></td>
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<tr>
<td>4. Processes</td>
<td></td>
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<tr>
<td>In, pre, and post coordination processes</td>
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</tr>
</tbody>
</table>

**Section Summary**

TMM provide a heuristic route to team decision making since teammates must hold idiosyncratic, communal/shared and distributed task-specific and team-related knowledge in order to obtain optimal performance in team sports. Moreover, TMM are based on task-specific and team-related knowledge, and expressed by different means (i.e., declarative, procedural, strategic knowledge, tactical knowledge). The current study is also grounded on Eccles and
Tenenbaum’s (2004) conceptual framework of coordination in sport teams. Hence, this study is congruent with the notion that team coordination is dynamic (pre, during, and post coordination process) and probabilistic in nature. TMM have also been linked to CE in sports. The notion is that team cognition enhances team level efficacy beliefs. Accordingly, current theoretical conceptualization of collective-efficacy in team sports is reviewed next.
Collective Efficacy in Sports

Collective Efficacy (CE) is a vastly studied group phenomenon associated with team process and outcomes (Goddard, Hoy, & Hoy, 2004; Zaccaro, Blair, Peterson, & Zazanis, 1995). The term CE was initially introduced by Bandura over twenty years ago (Bandura, 1986). At that time, Bandura noticed that CE refers to the group level equivalent to the notion of self-efficacy. Specifically, Bandura maintained that the notion of CE is important to better understand longevity and productivity of working groups (Bandura, 1986, 1992). As he observed, “the strength of families, communities, organizations, social institutions, and even nations, lies partly in people’s sense of CE that they can solve the problems they face and improve their life’s trough unified effort” (Bandura, 1997, p. 477).

The seminal definition of CE was offered by Bandura (1986) when he stated that “collective efficacy represents a sense of collective competence shared among individuals when allocating, coordinating, and integrating their resources in a successful concerted response to specific situational demands” (p. 309). A decade later, Bandura (1997) defined CE as, “a group’s shared belief in its conjoint capabilities to organize and execute the courses of action required to produce given levels of attainment” (p.4). This definition emphasized the notion that CE is (a) a situation-specific confidence, and (b) a group-level property.

Other definitions of CE are also available in the literature (see Stajkovic, Lee, & Nyberg, 2009, p. 817). Nonetheless, Bandura’s (1997) definition of CE is the most popular among scholars of both social psychology in general, and sport and exercise psychology in particular (Feltz et al., 2008). Accordingly, this study is based on Bandura’s (1997) definition of CE, and thus on the notion that CE is a situation-specific confidence, and “not simply the sum of the efficacy beliefs of individual members. Rather, it is an emergent group-level property” (Bandura, 1997, p.76). In fact, conceptual and anecdotal evidence supports the holistic notion that “the whole is greater than the sum of its parts.” As Feltz et al. (2008) stated, “the prevalence of underachieving and overachieving teams exemplifies the notion that the whole is greater (but not necessarily better) than the sum of its parts” (p. 123).

According to Bandura (1997), CE is the group equivalent to the notion of self-efficacy. He stated that “perceived personal and CE differ in the unit of agency, but in both forms

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3 Self-efficacy: “belief’s in one’s capabilities to organize and execute the course of action required to produce given attainments” (Bandura, 1997, p. 3).
efficacy beliefs have similar sources, serve similar functions, and operate through similar
processes” (1997, p. 478). Accordingly, the sources of self and CE are conceptually equivalent.
Thus, the four major sources of CE are: (a) past performance accomplishments, (b) vicarious
experiences, (c) verbal persuasion, and (d) physiological information. These sources are
presented and briefly discussed next. Unique sources of CE, pertaining to the sport domain (e.g.,
team size, team cohesion and leadership), are also addressed next. Figure 4 illustrates the sources
of CE reviewed in this section.

Figure 4. “Sources of Collective Efficacy in Sports” by A. V. Carron & L. R. Brawley, 2008,
Group dynamics in sport and physical activity, p. 223. Copyright by Human Kinetics.

**Past performance accomplishments.** Bandura noticed, “socio-cognitive theory
approaches the enhancement of human agency, whether in individual or collective form, in terms
of enablement” (1997, p. 477). In other words, past performance accomplishments represent the
major source of efficacy beliefs (i.e., accounts for most of the variability on efficacy scores)
because it is rooted on the notion of mastering experiences/enablement. Specifically, successful
experiences are thought to raise the level of one’s self-efficacy. The reverse is also true, and
hence, unsuccessful experiences are negatively related to one’s self-efficacy beliefs.

Research findings support the notion that performance accomplishments are the most
important source of efficacy information (Feltz & Lirgg, 1998; Myers, Feltz, & Short, 2004;
Salanova, Llorens, Cifre, Martínez, & Schaufeli, 2003; Whitney, 1994). For instance, Edmonds,
Tenenbaum, Kamata, and Johnson (2009) found a moderate to strong relationship between
previous performance accomplishments and perceived CE among competing adventure racing teams. Magyar, Feltz, and Simpson (2004) also investigated individual and crew level determinants of CE in rowing, and found that past performance accomplishments is the most important predictor of boat-level CE scores. Furthermore, in a recent meta-analytical review on the topic, Stajkovic et al. (2009) reported a strong relationship between performance accomplishments and CE.

Bandura (1997) refers to performance as an achievement that must be specified by descriptive indicators (e.g., number of shots in basketball, percentage of successful first serves in tennis), position/place in a competition, or a judge’s numerical rating. It is also important to notice that the relationship between CE and performance is considered to be bidirectional in nature (i.e., reciprocal causation) (see Bandura, 1997). Importantly, the term causation is used by Bandura to imply “functional dependence between events” (p. 5) rather than statistical and/or empirical determinism. Hence, reciprocal causation describes the notion that CE leads to better performance and vice-versa. For instance, Myers, Payment and Feltz (2004) examined the reciprocal relationship between team performance and CE in women’s ice hockey and found that previous performance was positively associated with CE perceptions. The notion of reciprocal causation has also been verified in studies outside the sport domain (see Goddard et al., 2007; Little & Madigan, 1997). Additionally, research has also shown that vicarious experiences are positively related to CE (Prussia & Kinicki, 1996; Schunk & Zimmerman, 1997).

**Vicarious experiences.** Vicarious experiences pertain to efficacy information derived from observation and comparison with other people. Modeling of socio-cognitive behaviors and skilled performance, from a model with whom the observer(s) identifies with, has the potential to convey efficacy information about one’s own performance. Accordingly, previous research in sport science has shown that athletes watching skilled models (e.g., other athletes, coaches) are likely to experience enhanced performance levels and self-efficacy beliefs (Cassidy, 2007; Cushion, 2007; Myers, Beauchamp, & Chase, 2011). For instance, vicarious experiences have been found to influence children’s and adolescents’ interest for sports and music-related activities, as well as their motivational and self-efficacy beliefs (Simpkins, Vest, Dawes, & Neuman, 2010). Scholars from other domains also concur that vicarious experiences impact group level perceptions of confidence, and consequently, people’s tendency in emulating both proactive (i.e., altruistic group behaviors, such as “fair play” in team sports) or anti-social
behaviors (e.g., aggressive group behaviors, such as hooliganism) (see Barchia & Bussey, 2011; Eitzen, 2009; Quaintance, Arnold, & Thompson, 2010; Wear & Zarconi, 2008). Finally, replications of athletic programs by other athletic institutions (e.g., colleges, sport clubs, national Olympic committees) exemplify that efficacy beliefs are also applicable to the group level of analysis.

**Physiological information.** Physiological information refers to people’s cognitive appraisal about their physiological states associated with a specific task demand. Simply put, if people appraise their physiological states as positive in nature, self-efficacy is enhanced. Conversely, if people associate their physiological states with poor performance, self-efficacy is diminished (see Feltz & Lirgg, 2001). It is important to note that athletes have their own idiosyncratic interpretation of what constitutes a positive or negative physiological experience (Hanin, 1997, 2007). For instance, in their classical study on competitive state anxiety, Jones and Swain (1992) examined differences in the direction and intensity of competitive state anxiety responses (e.g., heart rate) among basketball, soccer, rugby and field hockey players. They concluded that athletes’ idiosyncratic appraisal regarding the direction of their somatic anxiety symptoms (i.e., positive or negative), is an important factor pertaining to their overall athletic performance.

Also important, research has consistently shown that physiological responses are linked to confidence levels (Carre & Putnam, 2010; Hanin, 1997). For instance, there is compelling evidence suggesting that physiological markers (e.g., testosterone levels) are positively related to confidence and aggressiveness tendencies among males (see Carre, Gilchrist, Morrissey, & McCormick, 2010; Garbarino, Slonim, & Sydnor, 2011). Specifically, there is evidence suggesting that testosterone levels fluctuate among fans attending sport events. Moreover, testosterone and self-esteem were found to (a) increase among fans watching their favorite teams winning competitive sporting events, and (b) decrease among fans watching their favorite teams loosing competitive sporting events. Shearer, Holmes and Mellalieu (2009) have recently suggested that shared confidence levels among teammates are a physiological plausible concept that would operate via a neurological network named “mirror neuron system.”

4“Mirror neurons are visuomotor neurons that fire both when an action is performed, and when a similar or identical action is passively observed” (Molenberghs, Cunnington, & Mattingley, 2009 p.975).
empirical evidence also suggests that verbal persuasion is an important source of team efficacy information (Goddard et al., 2007; Feltz et al., 2008).

**Verbal persuasion.** Verbal persuasion is another major source of tangible efficacy information for an individual or group of individuals (Bandura, 1997). The strength of the persuasion depends on the expertise and credibility of the persuader (Bandura, 1997). In fact, positive self-talk is positively linked to one’s efficacy beliefs, and there is evidence suggesting that positive feedback from peers and coaches enhances one’s efficacy beliefs (Feltz & Lirgg, 2001). Conversely, negative verbal persuasion (e.g., trash talking) may have a detrimental impact of one’s self-efficacy perceptions. For instance, trash-talking has been found to negatively impact performance and self-efficacy beliefs in a simulated football video-game competition (Conmy, 2008). Moreover, athletes and referees verbally insulted by large crowds may have their efficacy beliefs and athletic performance impaired (see Courneya & Carron, 1992).

There is also compelling evidence regarding the impact of crowd behavior on teammates’ confidence levels and on team’s process and performance (Andersen & Serena, 2002; Zajonc, 1965). For example, Balmer et al., (2003) noticed that home crowds invigorate home teams’ efficacy beliefs, thus contributing to the well-acknowledged home advantage phenomenon. Finally, there is initial evidence suggesting that motivational speeches offered by coaches and team leaders are an important source of verbal persuasion leading to higher levels of perceived CE (see Vargas & Short, 2011). For example, Vargas and Short noticed that coaches’ pre-game speeches have been found to positively impact team’s performance, and met athletes psychological, emotional, and performance related needs.

**Unique sources of efficacy information.** Theoretically, CE is primarily based on the same antecedents of self-efficacy. Nonetheless, Carron and Hauseblas (1998) proposed that CE is also dependent on team size, leadership and cohesion. To date, however, no evidence supports the proposition that CE is related to team size. Nonetheless, scholar seems to agree that CE and performance are negatively related to team size (Carron et al., 2005; Carron & Brawley, 2008; Widmeyer et al., 1990). Indeed, research has consistently shown social loafing is a common practice in large teams. For instance, the Ringelman effect has been found to be a robust phenomenon for both motor and cognitive tasks (Levine et al., 1993).

Of note, aligned with Feltz’ et al. (2008) recommendation for research on CE in sports, team size is used as a control variable in such studies.
Two other unique sources of CE related to the sport domain are team leadership and team cohesion. Team leaders (e.g., coaches, team captains) are considered to be a major source of CE for a given team (Kavussanu, Boardley, Jutkiewicz, Vincent, & Ring, 2008; Loughead & Hardy, 2005; Myers, Feltz, Chase, Reckase, & Hancock, 2008). In this regard, Feltz, Chase, Moritz and Sullivan (1999) reported that high-efficacy coaches tend to exhibit coaching styles that are preferred by athletes, and usually offer more positive reinforcement and instructional feedback. Likewise, high-efficacy team leaders possess positive communication patterns, and are sources of confidence during stressful situations (see Moran & Weiss, 2006).

Cohesion is also considered to be an antecedent of CE (Carron, & Hausenblas, 1998; Carron et al., 2005; Feltz et al., 2008). For instance, Bloom, Stevens and Wickwire (2003) examined coaches’ perception on team cohesion and performance, and concluded that expert sport coaches believe that team cohesion is essential for team performance. Recently, Heuze, et al., (2006) observed that group integration task scores predict CE scores among elite female basketball players. In short, research findings have consistently shown that cohesion is positively linked to CE, and scholars have even proposed that interventions designed to increase cohesion would possibly impact team members’ perceived CE (Mach, Dolan, & Tzafrir, 2010).

Finally, research on CE in sports has consistently ignored the inherently nested data structure underlying the notion of team efficacy (Feltz & Lirgg, 2001; Seltzer, Choi, & Thum, 2003). Thus, future studies should be designed to assess for inter and intra group variability on CE beliefs. The interrelationship of CE and other team attributes are also important as applied sport psychologists are interested in developing interventions that impact not only confidence beliefs, but also team cohesiveness and team schemata.

Section Summary

This conceptual framework is based on the notion that collective efficacy is a situation-specific group level confidence belief influenced by multiple sources (e.g., past performance accomplishments, vicarious experiences, verbal persuasion, physiological information, team size, team cohesion, team leadership). This concept is also aligned with current measurement trends in research pertaining to efficacy beliefs of sport teams. The current study is based on a multi-level approach, thus accounting for the inherently nested data structure underlying the notion of team efficacy (see Feltz et al., 2008; Moritz & Watson, 1998; Sheared et al., 2009).
The Present Study

The present study is an initial attempt to conciliate multiple frameworks on team dynamics in sports. This is in line with the recommendation of numerous scholars regarding the importance of examining the nomological network involving team cohesion, TMM, and CE in sports (Bandura, 1997; Feltz et al., 2008; Goddard et al., 2007; Peterson, Mitchell, Thompson, & Burr, 2000; Stajkovic et al., 2009; Zaccaro et al., 1995). Specifically, the aim was to clarify the concept of team dynamics in sports by potentially establishing a statistically parsimonious model inter-relating these team properties. The conceptualization proposed herein (see Figure 5) advances the literature by offering an innovative, but still conceptually grounded (see Carron & Hausenblas, 1998), framework on team dynamics in sports. An alternative model based on the literature is also presented in an attempt to provide a singular explanation for the conceptual linkage involving cohesion, TMM, and CE in team sports.

Proposed model. The model proposed herein is a modification of Carron and Hausenblas (1998) original framework on team dynamics in sports (see Figure 5). Specifically, the model proposed is based on the notion that cohesion and TMM are nested within a major construct, herein labeled team processes (TP). Cohesion is conceptualized as having social and task dimensions, while TMM is hypothesized to reflect teammates’ (a) coordination links, (b) communication dynamics, and (c) resource sharing. The proposed model is congruent with the notion that TMM and cohesion share similarities, especially concerning task and social variables (Klimoski & Mohammed, 1994; Mohammed et al., 2010), but also possess idiosyncratic meanings and factors. Indeed, scholars concur that cohesion and TMM are constructs based on the macro-notion of socio-cognition, thus relying on social and task congruence (Cannon-Bowers & Salas, 200; Salas & Burke, 2005). Nonetheless, cohesion and TMM also reflect unique properties of TP; cohesion portrays the idea of “team bonding,” whereas TMM is grounded on the notion of “coordination links” (Eccles & Tenebaum, 2004).

Empirical reasons also support the modified model herein proposed. Results from a pilot study suggested that cohesion and TMM are correlated and impact CE, which in turn impacts performance. Specifically, results indicated that two sub-dimensions of TMM (i.e., general task and team knowledge, attitude towards teammate task) were highly correlated with social and task cohesion (i.e., individual attraction to the group-task, group integration-social). These results suggest both conceptual and statistical overlapping (i.e., multicollinearity) involving these team dynamics.
level properties. Item and content analysis also indicated that cohesion and TMM have overlapping social and task sub-dimensions. Accordingly, the “conceptually equivalents factors” representing task and social cohesion in the Team Assessment Diagnostic Measure instrument (i.e., general task and team knowledge, attitude towards teammate task) were not utilized in this study. Instead, TMM was conceptualized as representing teammates’ (a) general task and communication (GTC), (b) team dynamics interactions (TDI), and (c) team resources and working environment (TRWE).

![Nomological Network of Team Dynamics in Sports – Structural Model](image)

**Figure 5.** Nomological Network of Team Dynamics in Sports – Structural Model

Note: Cohesion: Individual Attraction to the Group-Social (ATG-S), Individual Attraction to the Group-Task (ATG-T), Group Integration-Social (GI-S), Group Integration Task (GI-T). TMM: General Task and Communication (GTC), Team Dynamics Interactions (TDI), Team Resources and Working Environment (TRWE). CE: Ability (ABI), Effort (EFF), Persistence (PER), Preparation (PRE), Unity (UNI). Perceived Performance Potential (PPP).
Figure 6. Nomological Network of Team Dynamics in Sports – Measurement Model
Note.: Cohesion: Individual Attraction to the Group-Social (ATG-S), Individual Attraction to the Group-Task (ATG-T), Group Integration-Social (GI-S), Group Integration Task (GI-T), TMM: General Task and Communication (GTC), Team Dynamics Interactions (TDI), Team Resources and Working Environment (TRWE). CE: Ability (ABI), Effort (EFF), Persistence (PER), Preparation (PRE), Unity (UNI). Perceived Performance Potential (PPP).

Alternative model. The framework proposed herein is not a definitive answer to team dynamics in sports. Figure 7 represents an alternative hypothetical relationship among cohesion, TMM, CE, and PPP. In essence, Figure 7 mirrors Carron and Hausenblas (1998) classical conceptualization of team dynamics in sports. Accordingly, this model postulates that (a) cohesion is an antecedent variable of TMM, and (b) TMM mediates the relationship between cohesion and CE. In addition to being grounded in The se by minal conceptualization of team dynamics in sports Carrons’ and Hausenblas’ (1998), these directional paths are aligned with an extant evidence suggesting that team cohesion, TMM and CE are intrinsically related constructs (Carron et al., 2007; Feltz et al., 2008; Mohammed et al., 2010). Finally, this model also postulates that CE has a direct impact on team performance. In this regard, research findings have shown that CE has a positive effect on performance (Carron et al., 2002; Lowther & Lane, 2002; Mohammed et al., 2010; Stajkovic et al., 2009; Yen et al., 2006).
Hierarchical linear modeling techniques (e.g., computation of intra-class correlation coefficients) were also implemented to assess intra and inter team variability in cohesion, TMM, and CE scores of college soccer teams. This is in line with the importance of properly examining nested data in social sciences in general and in sport and exercise psychology in particular (see Conroy, Kaye, & Schantz, 2008; Feltz & Lirgg, 2001; Raudenbush & Bryk, 2002). Finally, this study further examined the psychometric properties of leading instruments related to cohesion, TMM, and CE, thus contributing to the accumulation of knowledge regarding these measurement tools.
Purpose and hypotheses. The focus on this study was on how cohesion and other group properties are interrelated in a factorial and structural fashion. Specifically, the primary purpose of this study was to empirically test, through confirmatory and structural equation modeling analyses, an integrated view of team dynamics in sports. The hypotheses which follow are based on the revised literature on team cohesion, TMM, CE in sports, and on the classical conceptualization of team dynamics in sports proposed by Carron and Hausenblas (1998). In particular, the hypotheses are consistent with research suggesting that (a) CE is an outcome group level variable (Bandura, 1997), (b) TMM evolves over time as a product of teammate’s opportunities to interact (Eccles & Tenenbaum 2004; Salas & Klein 2011,), and (c) personal factors (e.g., gender) influence team dynamics (see Carron et al., 2005; Carron & Brawley, 2008). Of note, these hypotheses were not thought to be exhaustive as the inherent exploratory nature of this study could allow for “a posteriori” hypotheses and research questions.

H1: The hypothesized models will demonstrate adequate fit, thereby supporting an integrated view of team dynamics in sports.

H2: Path coefficients will vary according to gender.

H3: College soccer teams will differ in their aggregated scores on team cohesion, TMM and CE.
CHAPTER THREE

METHOD

Design

The current study consisted of a positivist and quantitative approach for examining team dynamics in sports. Specifically, a cross-sectional survey design was deemed the most appropriate to address the study’s aims (see Creswell, 2008). This methodological approach allows for group comparisons, inferential conclusions, and the possibility of examining the interrelationship among theoretical latent constructs (Cooke et al., 2000).

Power Analysis

An a priori power analysis was conducted for testing model fit as a whole. More specifically, the number of participants needed to adequately test the null hypothesis (i.e., $\Sigma = \Sigma$ reproduced) was identified. Power was set at .80, $\alpha = .05$, and root mean square error approximation (RMSEA) was .00 for the null hypothesis and .05 for the alternative hypothesis. The model’s degrees of freedom ($df = 62$) was computed by subtracting the number of parameters estimated from the total number of observations (see Kline, 2011; MacCallum, Browne, & Sugawara, 1996). An online application was utilized to generate an “R-code” specifying the minimal sample size needed to provide sufficient power (i.e., .80) to reject the proposed model in case it is false (see Preacher, 2011). Findings suggested that the minimum sample size for this study should equal 214 participants (see Appendix C).

Participants

Institutional Review Board approval was obtained prior to the commencement of this study. Participants were educated about the overarching theme of the study and signed an informed consent form. Three hundred and forty college soccer players of both genders (178 female, 52.4%; and 162 male 47.6%) representing 17 different teams (8 female and 9 male) affiliated to the National Association of Intercollegiate Athletics (NAIA) agreed to participate. The 17 teams represented in this study were from nine different states (Alabama, California, Florida, Iowa, Kansas, Kentucky, Michigan, Montana, and Ohio).

Participants were 20.38 years old on average ($SD = 2.12$) and had 14.66 years ($SD = 3.92$) of experience in the sport. On average, the participants had been playing for their

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5 The observed covariance matrix in the population is not different from the reproduced covariance matrix.
respective teams for 2.4 years ($SD = 1.11$). They had played a median of 20 matches ($M = 19.7$, $SD = 1.39$) over the season before taking part in the study. The participants were primarily in their junior (i.e., 33.2%) and freshman (i.e., 29.7%) years. Sophomores and seniors represented 16.9% and 19.8% of the total sample size, respectively. The majority of participants (i.e., 61.3%) reported themselves as “starters”, whereas 38.7% identified themselves as “substitutes”. Goalkeepers constituted 11.1% of the total sample size; defenders, midfielders and offensive players represented 30.1%, 36.1% and 22.7%, respectively.

Participants were from 34 countries (see Appendix D) and five different continents (i.e., Africa, America, Asia, Australia and Europe). Overall, 66.8% of the total sample size were American citizens, whereas the remaining 33.2% were international student-athletes. Participant’s self-reported race showed predominance of Caucasians (70.6%) and “other races” (15.2%). Black/Afro-Americans represented 6.6%, and Hispanic/Latinos represented 4.2% of the total sample size. American Indian/Alaskan Native represented .09% (n = 3). Two Japanese (n = 2) and one Korean also participated in this study. Five student athletes (i.e., 1.5%) choose not to report their racial background.

**Instruments**

Five instruments were used to operationalize the model illustrated in Figure 5. A demographic form was utilized to collect normative data. The Group Environment Questionnaire (GEQ) was administered to measure cohesion scores. TMM scores were assessed through the Team Assessment Diagnostic Measure (TADM). Teammates’ sense of efficacy was measured via the Collective Efficacy Questionnaire for Sports (CEQS). The Team Outcome Questionnaire (TOQ) was used to measure perceived performance potential (PPP). These instruments are presented in the Appendixes (Appendix E-I). The specific items for each subscale are given in Appendix J.

**Demographic Questionnaire** (Appendix E). Participants’ age, nationality, ethnicity, field position, years of experience in soccer, and months of participation in their respective teams was obtained. This information was deemed important to characterize the study’s sample. This information was also used to compare differences across genders.

**Group Environment Questionnaire** (GEQ; Widmeyer et al., 1985; Appendix F). The GEQ is an 18-item measure, with anchors ranging from 1 (i.e., *strongly disagree*) to 9 (i.e., *strongly agree*), designed to assess the degree of cohesion among team members in the following
four dimensions: (a) Individual Attraction to the Group-Social (ATG-S), (b) Individual Attraction to the Group-Task (ATG-T), (c) Group Integration-Social (GI-S), and (d) Group Integration Task (GI-T). The GEQ is a conceptually-driven and the primary choice of sport psychologists interested in studying cohesion in team sports for the past 25 years (Carron et al., 2002; Carron et al., 2007; Cox, 2002). Hence, this instrument was considered appropriate to represent the measurement tool pertaining to team cohesion in the current study.

Extensive empirical evidence supports the psychometric properties of the instrument, and its applicability in assessing cohesion in team sports (Carron et al., 1998). Carron et al. reported extensive data suggesting the content and concurrent validity of the GEQ. There is also evidence in favor of the predictive validity of the GEQ. More specifically, studies have shown that cohesion level as measured by the GEQ is positively related with CE, role clarity and role acceptance scores (Kjormo & Halvari, 2002; Lowther & Lane, 2002). Carron et al. (1998) have also reported that Cronbach-alphas for the four hypothetical dimensions of the GEQ are for the most part satisfactory (i.e., $\alpha \geq .70$). In this study, Cronbach-alpha coefficient ranged from .56 to .75 and the entire scale’s alpha reliability was .85.

**Team Assessment Diagnostic Measure** (TADM; Sikorski, 2009; Appendix G). The TADM was designed to measure sharedness of team-related knowledge. This instrument, initially developed by Johnson et al. (2007), was recently adapted by Sikorski (2009). The TADM underwent through a rigorous scale development procedure composed of various stages (i.e., development of initial instrument, content validation, descriptive analysis, exploratory factor analysis, conceptualization of factor structure, and confirmatory factor analysis), and revealed adequate psychometric properties. Accordingly, this instrument was chosen to be the measurement tool pertaining to team mental models in the present study.

This 15-item questionnaire, with anchors ranging from 1 (i.e., *strongly disagree*) to 5 (i.e., *strongly agree*), comprises the following five factors (a) General Task and Team Knowledge (GTTK), (b) General Task and Communication Skills (GTC), (c) Attitudes Toward Teammates and Task (GTT), (d) Team Dynamics and Interactions (GTI), and (e) Team Resources and Working Environment (TRWE). These factors were found to have satisfactory reliability coefficients (i.e., $\alpha \geq .75$) and to account for 82% of the variance on sharedness of team-related knowledge (Johnson et al., 2007). In this study, Cronbach-alpha coefficient ranged from .74 to .84 and the entire scale’s alpha reliability was .91.
Collective Efficacy Questionnaire for Sports (CEQS; Short, Sullivan, & Feltz, 2005; Appendix H). The CEQS was designed to capture team member’s beliefs regarding their team capabilities in sport relevant tasks. Short et al. (2005) noticed that the CEQS was developed in three stages (i.e., development of initial instrument, exploratory factor analysis, and confirmatory factor analysis) and was “tailored to team sport functioning in general, and therefore, can be used across sports” (p. 198). This measurement is therefore factorial and conceptually grounded, and thus deemed appropriate to the purposes of the present study.

The CEQS is a 5-factor instrument containing 20 items measuring, on a Likert-type scale ranging from 1 (i.e., not at all confident) to 10 (i.e., extremely confident) athletes’ confidence level in their team’s (a) ability, (b) effort, (c) preparation, (d) persistence, and (e) unity capabilities. Short et al. (2005) reported data demonstrating the reliability and discriminant, convergent and predictive validity of the CEQS. In the current study, Cronbach-alpha coefficient ranged from .83 to .89, and the entire scale alpha reliability was .95.

Team Outcome Questionnaire (TOQ; see Coleman, 2011; Appendix I). The TOQ consists of 9 items that describe goals related to team skills, strategy, effort, competitive outcomes, and fitness. These areas were selected based on a content analysis of team performance expectations conducted by Brawley, Carron and Widmeyer (1992). The TOQ uses a Likert-type scale ranging from 0 (i.e., low expectations) to 4 (i.e., high expectations) to measure perceived performance potential (PPP) in team sports. Exploratory factor analysis was used in a pilot study aiming at determining the number of factors to extract. Eigenvalues ≥ 1.00 and scree plots break patterns served as the criteria for extraction (see Thompson, 2004). Final solution resulted in a unidimensional scale with homogeneous items accounting for 54.71% of the variability on team performance expectation. Internal consistency across all items was satisfactory resulting in a Cronbach’s Alpha coefficient of .89.

The TOQ was utilized to assess perceived performance potential (PPP). PPP is cross-domain topic pertaining to performance of working teams in business, sports and the military (Borman, 1982; Stumpf, Doh, & Tymon, 2010). The notion of PPP is also congruent with a current probabilistic rather than deterministic view of performance in sports (Kamata, Tenenbaum, & Hanin, 2002). Furthermore, this measure is consistent with the model proposed herein given that cohesion, TMM and CE scores represent self-perceptions of the respondents.
Two measures of objective performance were correlated with the TOQ scores to allow for a validity check of the subject notion of PPP.

**Objective performance.** NAIA final year ranking and team’s season record (i.e., mean points as measured by the number of wins, ties and losses) were obtained from the NAIA official website. This is consistent with the notion that different performance measures vary in their validity to assess different socio-psychological related variables (see Hanin, 1997; Kamata et al., 2002).

**Procedures**

NAIA college soccer coaches received an email detailing the objectives of the project. Telephone calls and personal contact were posteriorly arranged aiming to build rapport with the soccer coaches. Upon permission from the coaches, a time was scheduled to meet their respective players. The players were informed about the rationale and objectives of the study and asked to sign the written informed consent.

Following the completion of the consent form, participants received a package containing a copy of the GEQ, TADM, CEQS, TOQ, and the demographic information form. Questionnaires were presented in a randomized order in an attempt to control for learning, familiarization and motivational effects (Creswell, 2008). Participants were instructed to complete each questionnaire individually, and to be honest and serious in their responses. They received pens, the questionnaires, and an envelope to confidentially return their responses upon completion. The questionnaires were administered in a quiet environment (i.e., meeting rooms, hotels’ lobby) to secure the comfort and privacy of the participants. Coaches did not remain in the room during data collection.

Data was collected at the end of the season. Participants had played a median of 20 matches \(M = 19.7, SD = 1.39\) over the season before taking part in the study. This is consistent with the notion that a group of individuals undergo a process of development before becoming a team, and evolving a sense of cohesion, CE, and team-related knowledge (Tuckman 1965, as cited by Weinberg & Gould, 2011). In particular, data was collected one day prior to a decisive playoff game at a NAIA’s regional conferences tournament and during the NAIA national tournaments for men’s and women's soccer. This was to gain players’ input on cohesion, TMM, CE and PPP immediately prior to a decisive match. In this regard, research has shown that reliability of athletes’ introspective reports tends to be higher immediately prior to a major
competitive event (D’Urso, Petrosso, & Robazza, 2002; Tenenbaum, Lloyd, Pretty, & Hanin, 2002).

Data Analysis

Descriptive analyses along with structural equation modeling applications constituted the statistical procedures implemented in this study. The following software packages were utilized (a) PASW Statistic package 19.0, (b) Mplus 5.0, and (c) Hierarchical Linear and Nonlinear modeling for Windows (Student Version 7.0).

Descriptive analysis. Descriptive analyses were used to examine participants’ demographic characteristics and cohesion, TMM, CE and PPP levels. Intra-item analyses were performed in an attempt to detect, and potentially remove, problematic items across the scales. Furthermore, correlations among all of the variables were computed to assess the relationship among the subscales of each one of the instruments utilized in this study. Cronbach's alpha coefficients were estimated for each scale and respective subscales. Additionally, intra-item correlations were computed for each subscale of the GEQ, TADM, CEQS and TOQ.

Structural equation modeling (SEM). Confirmatory factor analysis with robust maximum likelihood (MLR) was utilized to adjust for non-normality characteristics of the data (see Finney & DiStefano, 2006). Though continuous data was utilized in this study (i.e., the average of scores across the set of items composing the GEQ, TADM, CEQS, and TOQ subscales) visual inspection of Q-Q plots suggested the data were not normally distributed. Furthermore, item-level analysis revealed kurtosis values were above the recommended cut off points of +/- 3 for multivariate analyses (Creswell, 2008) (see Appendix K). Factor loadings for each instrument were obtained to determine the factorial validity of each scale and respective subscales. Subsequently, a two-step SEM approach was adopted to examine the fit of the proposed model (see Anderson & Gerbing, 1988). The first step consisted of evaluating and revising the measurement model. The second step consisted of evaluating and revising the full structural model. Upon establishment of a base line model, a multiple-sample CFA was utilized to test H2. This technique allowed for examining model fit across gender. Chi-square ($\chi^2$), comparative fit index (CFI), root mean square error approximation (RMSEA) and standardized root mean square residual (SRMR) were utilized to evaluate model-data fit. The following cutoff points were considered: (a) CFI greater than .90, (b) RMSEA smaller than .08, and (c) SRMR smaller than .10 (see Hu & Bentler, 1999).
CHAPTER FOUR
RESULTS

This section is organized in the following sub-headings: (a) demographic, (b) descriptive and psychometric, (c) SEM, and (d) multi-sample CFA analyses. First, participants’ ethnic background and soccer experiences are presented and compared across genders. Subsequently, descriptive and psychometric properties pertaining to the GEQ, TADM, CEQS and TOQ are reported. Next, findings regarding the nomological network proposed herein are described in a step-by-step fashion. Finally, the results for the multi-sample CFA analyses are presented.

Demographic Analyses

Participants’ soccer experience and profile. On average, the participants had been playing for their respective teams for 2.4 years ($SD = 1.11$). They had played a median of 20 matches ($M = 19.7$, $SD = 1.39$) over the season before taking part in the study. “Starters” represented 58.8% of the female sample size, and 64.2% of the male sample size (see Figure 9). Starters showed higher means for “attraction to group task” as measured by the GEQ, $t (233) = -5.59, p < .01$. No other statistical effects were observed between participants’ soccer profile and cohesion, TMM, CE or PPP indicators. The majority of the players were midfielders (36.1%) or defenders (30.1%). Men’s and women’s soccer teams differed in their proportion of players by field position, $\chi^2 = 25.41, df = 3, p < .001$ (see Figure 10). Female soccer teams showed a higher distribution of offensive players than male soccer teams. These demographic differences among female and male soccer teams warranted adoption of multiple-sample SEM as alluded previously. Empirical and theoretical evidence are also congruent with the notion that gender influences team dynamics in sports (Carron et al., 1985; Carron et al., 2005).
**Figure 9.** Percent of Substitutes and Starters by Gender.

**Figure 10.** Participants’ Field Position by Gender.
Descriptive and Psychometric Analyses

Estimates of internal consistency reliability using Cronbach’s alpha are presented in Table 2. The total reliability obtained for each scale was adequate (i.e., $\alpha \geq .85$). The alpha reliability coefficients ranged between .56 - .75 for the GEQ, .74 - .84 for the TADM, .83 - .89 for the CEQS. Items 17 (i.e., “Overcome distractions”) and 19 (i.e., “Devise a successful strategy”) were excluded from the CEQS questionnaire due to a small correlation with the other items represented in the “Effort” and “Preparation” subscales, respectively. To exemplify, the Cronbach’s alpha for “Effort” and “Preparation” were low as .50 before the exclusion of these items. Alpha-coefficients for the GEQ subscales were not ideal; especially for the ATG-T (.56) and ATG-S (.63) subscales. Item-analysis did not warrant the removal of any item. Conceptual and instrument development revisions may be needed in a future study.

Inter-item correlation coefficients among the subscales of each instrument adopted in this study (i.e., GEQ, TMM, CEQS, Performance scale) are also given in Table 2. These coefficients are fairly high, thereby suggesting that (a) these subscales measure a similar theoretical construct (i.e., cohesion, TMM, CE, and PPP), and (b) the composite scores of these scales are reliable measures of cohesion, TMM, CE, and PPP, respectively. Table 2 also presents the means, standard deviations, and ranges for the total GEQ, CEQS, TADM and TOQ.

Figure 11 shows mean values and 95% CI for combined cohesion, TMM, CE and performance scores for each team. Descriptive statistics for all of the subscales by team are provided in Appendix L and Appendix M. Figure 12 shows mean values and 95% CI for the subscales of the GEQ, TADM, CEQS, and TOQ by team. Exception of the GI-S, all of the intra-class correlation coefficients across subscales were relatively low (ICC < .20 see Table 3), thus not warranting the adoption of hierarchical models of analysis (see Raudenbush & Bryk, 2002).
Table 2
Descriptive Statistics and Reliability Estimates for the GEQ, TADM, CEQS and TOQ

<table>
<thead>
<tr>
<th>Scale</th>
<th>Descriptive Statistics</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>M</td>
<td>SD</td>
<td>Range</td>
</tr>
<tr>
<td>GEQ</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATG-T(^a)</td>
<td></td>
<td>6.96</td>
<td>1.59</td>
<td>2-9</td>
</tr>
<tr>
<td>ATG-S(^b)</td>
<td></td>
<td>7.29</td>
<td>1.45</td>
<td>1-9</td>
</tr>
<tr>
<td>GI-T(^c)</td>
<td></td>
<td>6.79</td>
<td>1.44</td>
<td>2-9</td>
</tr>
<tr>
<td>GI-S(^d)</td>
<td></td>
<td>6.70</td>
<td>1.65</td>
<td>1-9</td>
</tr>
<tr>
<td>Total GEQ</td>
<td></td>
<td>6.94</td>
<td>1.19</td>
<td>3-9</td>
</tr>
<tr>
<td>TADM</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GTC(^e)</td>
<td></td>
<td>3.84</td>
<td>.68</td>
<td>2-5</td>
</tr>
<tr>
<td>TDI(^f)</td>
<td></td>
<td>3.89</td>
<td>.65</td>
<td>2-5</td>
</tr>
<tr>
<td>TRWE(^g)</td>
<td></td>
<td>3.99</td>
<td>.64</td>
<td>1-5</td>
</tr>
<tr>
<td>Total TADM</td>
<td></td>
<td>3.91</td>
<td>.59</td>
<td>2-5</td>
</tr>
<tr>
<td>CEQS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ability</td>
<td></td>
<td>8.30</td>
<td>1.36</td>
<td>3-10</td>
</tr>
<tr>
<td>Effort</td>
<td></td>
<td>8.44</td>
<td>1.35</td>
<td>3-10</td>
</tr>
<tr>
<td>Persistence</td>
<td></td>
<td>8.27</td>
<td>1.41</td>
<td>2-10</td>
</tr>
<tr>
<td>Preparation</td>
<td></td>
<td>8.53</td>
<td>1.32</td>
<td>2-10</td>
</tr>
<tr>
<td>Unity</td>
<td></td>
<td>8.05</td>
<td>1.43</td>
<td>2-10</td>
</tr>
<tr>
<td>Total CEQS</td>
<td></td>
<td>8.33</td>
<td>1.20</td>
<td>3-10</td>
</tr>
<tr>
<td>TOQ</td>
<td></td>
<td>3.29</td>
<td>.54</td>
<td>1-4</td>
</tr>
</tbody>
</table>

Note.: \(^a\) Individual Attraction to the Group-Social. \(^b\) Individual Attraction to the Group-Task. \(^c\) Group Integration-Social. \(^d\) Group Integration Task. \(^e\) General Task and Communication. \(^f\) Team Dynamics Interactions. \(^g\) Team Resources and Working Environment.
Figure 11. Means and 95% CI for Cohesion, TMM (upper panels), CE and PPP (lower panel) Composite Scores by Team.
Figure 12. Means and 95% CI for the GEQ, TADM (upper panels), and CE subscales (lower panel) by Team.
Table 3

Intra-Class Correlation Coefficients for the GEQ, TADM, CEQS and TOQ Subscales

<table>
<thead>
<tr>
<th>Scale</th>
<th>Intra-Class Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEQ</td>
<td></td>
</tr>
<tr>
<td>ATG-T</td>
<td>.13</td>
</tr>
<tr>
<td>ATG-S</td>
<td>.11</td>
</tr>
<tr>
<td>GI-T</td>
<td>.14</td>
</tr>
<tr>
<td>GI-S</td>
<td>.29</td>
</tr>
<tr>
<td>TADM</td>
<td></td>
</tr>
<tr>
<td>GTC</td>
<td>.13</td>
</tr>
<tr>
<td>TDI</td>
<td>.12</td>
</tr>
<tr>
<td>TRWE</td>
<td>.12</td>
</tr>
<tr>
<td>CEQS</td>
<td></td>
</tr>
<tr>
<td>Ability</td>
<td>.16</td>
</tr>
<tr>
<td>Effort</td>
<td>.12</td>
</tr>
<tr>
<td>Persistence</td>
<td>.10</td>
</tr>
<tr>
<td>Preparation</td>
<td>.13</td>
</tr>
<tr>
<td>Unity</td>
<td>.10</td>
</tr>
<tr>
<td>Total CEQS</td>
<td>.13</td>
</tr>
</tbody>
</table>

Correlation coefficients among GEQ, CEQS, TADM and TOQ composite scores ranged from .51 to .71 (Table 4), thereby offering initial evidence of discriminant validity. A correlation matrix among the subscales of these instruments is presented in Table 5. Correlation coefficients were higher among the subscales of each instrument, thus offering evidence of convergent validity. Coefficients ranged from (a) .35 - .62 for the GEQ and TADM, (b) .29 - .62 for the GEQ and CEQS, and (c) .36 - .66 for the TADM and CE. Correlations for the TOQ ranged from .31 - .54 with the GEQ, .53 - .56 with the TADM, and .53 - .61 with the CEQS. Correlation coefficients among the TOQ and objective performance measures were positive and moderate-to-high (Table 6), hence supporting the predictive validity of this instrument. Altogether, these findings support the notion that cohesion, TMM, CE and PPP are interrelated but not identical.
constructs (i.e., convergent-discriminant validity), thereby warranting the examination of the nomological network proposed herein.

### Table 4

**Matrix Correlation among GEQ, TADM, CEQS, and TOQ Composite Scores**

<table>
<thead>
<tr>
<th></th>
<th>TADM</th>
<th>CEQS</th>
<th>TOQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEQ</td>
<td>.71**</td>
<td>.61**</td>
<td>.51**</td>
</tr>
<tr>
<td>TADM</td>
<td>.67**</td>
<td>.60**</td>
<td></td>
</tr>
<tr>
<td>CEQS</td>
<td>.60**</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 6
Matrix Correlation among TOQ and Objective Performance Measures

<table>
<thead>
<tr>
<th></th>
<th>Teams’ Season Record</th>
<th>NAIA Final Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOQ</td>
<td>.77**</td>
<td>.55*</td>
</tr>
<tr>
<td>Teams’ Season Record</td>
<td></td>
<td>.67**</td>
</tr>
</tbody>
</table>

*p < .05; ** p < .01

SEM Analyses

A step-by-step approach was utilized to test the fit of the hypothesized full structural model proposed in Figure 5. The first step consisted of evaluating the measurement model. The second step consisted of evaluating and revising the structural model (Kline, 2004). Robust maximum likelihood (MLR) was utilized to adjust for the non-normality characteristics of the data (see Finney & DiStefano, 2006). Though continuous data was utilized in this study (i.e., the average of scores across the set of items composing the GEQ, TADM, CEQS, and TOQ subscales) visual inspection of Q-Q plots suggested the data were not normally distributed (see Appendix J). Furthermore, in all tested models, the error variance of PPP was fixed to zero in order to conform to identification assumptions (see Kline, 2004). Chi-square ($\chi^2$), comparative fit index (CFI), root mean square error approximation (RMSEA) and standardized root mean square residual (SRMR) were used to evaluate model-fit (see Hu & Bentler, 1999). The following cutoff points were considered: (a) CFI greater than .90, (b) RMSEA smaller than .08, and (c) SRMR smaller than .10 (see Hu & Bentler, 1999). The tested models are presented next and numerically and graphically summarized in Table 7 and Figure 13, respectively.

**Measurement model 1.** This model allowed for 61 degrees of freedom (df), with $\chi^2$ (61) = 118.46, $p < .01$ and a S-B correction factor of 1.16. Fit statistics were, $CFI = 97$, $RMSEA = .05$, and $SRMR = .04$. These fit indices suggested good fit to the data. Standardized factor loadings were significant and moderate-to-high ranging from .53 to .92, thus allowing for further evidence of convergent validity. Modification indices did not suggest any theoretical or statistically meaningful adjustments. Hence, the structural model was evaluated in a second step.
**Structural model 1.1.** The structural model introduced in Figure 5 was based on the notion that cohesion and TMM are nested within a major construct herein labeled *team processes*. This model allowed for 62 degrees of freedom (df), with $\chi^2 (62) = 126.64$, $p < .01$ and a S-B correction factor of 1.17. Fit statistics were $CFI = .97$, $RMSEA = .05$, and $SRMR = .04$. These values suggested a reasonable model fit to the data. However, a $\chi^2$ difference test confirmed that the structural model represented a misfit to the data when compared to the measurement model, $\chi^2_{S-B difference test} (1) = 6.04$, $p < .01$. Modification indices did not offer a plausible theoretical or statistical route to improve this model. Thus, an alternative model (see Figure 7) tested the integrated view of team dynamics proposed herein.

**Measurement model 2.** This model mirrors the seminal conceptual framework for examining sport teams proposed by Carron’s and Hausenbla’s (1998) (see Figure 1). The tested model allowed for 60 degrees of freedom, with $\chi^2 (60) = 113.69$, $p < .01$ and a S-B correction factor of 1.16; $CFI = .98$, $RMSEA = .05$, and $SRMR = .04$. Taken together, these fit indices suggested good model data fit. Factor loadings were appropriate and ranged from .53 to .92 (see Figure 13). The modification indices did not suggest theoretical reasonable adjustments. Hence, the next step consisted of evaluating the structural model.

Table 7

*Fit Indices for the Proposed Nomological Network on Team Dynamics in Sports*

<table>
<thead>
<tr>
<th>Model</th>
<th>$\chi^2_{S-B}$</th>
<th>S-B factor</th>
<th>$p$-value</th>
<th>df</th>
<th>CFI</th>
<th>RMSEA</th>
<th>SRMR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nested - Team Processes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measurement Model 1</td>
<td>118.46</td>
<td>1.16</td>
<td>&lt;.01</td>
<td>61</td>
<td>.97</td>
<td>.04</td>
<td>.04</td>
</tr>
<tr>
<td>Structural Model 1.1</td>
<td>126.64</td>
<td>1.17</td>
<td>&lt;.01</td>
<td>62</td>
<td>.97</td>
<td>.05</td>
<td>.04</td>
</tr>
<tr>
<td>Non-Nested</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measurement Model 2</td>
<td>113.69</td>
<td>1.16</td>
<td>&lt;.01</td>
<td>60</td>
<td>.98</td>
<td>.05</td>
<td>.04</td>
</tr>
<tr>
<td>Structural Model 2.1</td>
<td>197.37</td>
<td>1.17</td>
<td>&lt;.01</td>
<td>63</td>
<td>.93</td>
<td>.08</td>
<td>.07</td>
</tr>
<tr>
<td>Structural Model 2.2</td>
<td>114.14</td>
<td>1.16</td>
<td>&lt;.01</td>
<td>61</td>
<td>.98</td>
<td>.05</td>
<td>04</td>
</tr>
</tbody>
</table>

44
Figure 13. Nomological Network of Team Dynamics in Sports

Figure 14. Final Measurement (upper panel) and Structural Models (lower panel).

**Note:** Standardized values.

Cohesion: Individual Attraction to the Group-Social (ATG-S), Individual Attraction to the Group-Task (ATG-T), Group Integration-Social (GI-S), Group Integration Task (GI-T), TMM: General Task and Team knowledge (GTTK), General Task and Communication (GTC), Attitude Towards Teammate Task (ATT), Team Dynamics Interactions (TDI), Team Resources and Working Environment (TRWE). CE: Ability (ABI), Effort (EFF), Persistence (PER), Preparation (PRE), Unity (UNI), Perceived Performance Potential (PPP).
Multiple-Sample CFA

The multiple-sample analysis procedure by gender followed a step-by-step approach as described in Kline (2004). In essence, an unconstrained model was tested (step 1) and subsequently compared with a constrained model (step 2). These models are described next and summarized in Table 8.

Measurement models by gender. Idiosyncratic models by gender yielded different fit indices. In particular, the measurement model for females allowed 60 degrees of freedom, with $\chi^2 (60) = 118.54$ $p < .01$, and a S-B correction factor of 1.09. Fit indices were $CFI = .95$, $RMSEA = .07$, and $SRMR = .05$. The model considering data from men’s soccer teams allowed 60 degrees of freedom, with $\chi^2 (60) = 70.84$ $p < .01$, and a S-B correction factor of 1.15. Fit indices were $CFI = .99$, $RMSEA = .03$, and $SRMR = .04$. Though both models demonstrated reasonable fit, further constrained models were considered to test for measurement and structural invariance across genders.

Unconstrained measurement model. In the first step of the multiple-sample analysis an unconstrained model was examined. This model allowed for 120 degrees of freedom, with $\chi^2 (120) = 188.25$ $p < .01$, and a S-B correction factor of 1.12. Fit indices were $CFI = .97$, $RMSEA = .06$, and $SRMR = .04$. Taken together, these fit indices indicate adequate fit. Thus, the constrained measurement model was analyzed in a second step.

Constrained measurement model. The second step of the analysis included a constrained model in which the factor loadings were equalized across groups. This model allowed for 129 degrees of freedom, with $\chi^2 (129) = 194.29$ $p < .01$ and a S-B correction factor of 1.14; $CFI = .97$, $RMSEA = .05$, and $SRMR = .06$. A $\chi^2$ difference test revealed a non-significant change in chi-square when compared to the unconstrained measurement model, $\chi^2$ S-B difference test $(9) = 7.55$, $p > .05$. Accordingly, there was evidence of measurement invariance (i.e., factor loadings invariance) across genders. A multiple-sample SEM tested whether the structural model differed across gender.

Unconstrained structural model. This model allowed for 131 degrees of freedom, with $\chi^2 (131) = 195.25$ $p < .01$, and a S-B correction factor of 1.14; $CFI = .97$, $RMSEA = .05$, and $SRMR = .06$. These fit indices indicated adequate fit. Thus, the constrained structural model was analyzed in a second step.
**Constrained structural model.** This model allowed for 136 degrees of freedom, with $\chi^2 (136) = 201.89, p <.01$ and a S-B correction factor of 1.15. Furthermore, $CFI = .97$, $RMSEA = .05$, and $SRMR = .08$. A $\chi^2$ difference test revealed a non-significant change in chi-square when compared to the unconstrained measurement model, $\chi^2_{S-B \text{ difference test}} (5) = 6.80, p >.05$. Accordingly, the structural component of the model did not show evidence for gender specificity. Altogether, results of this study indicate that both the measurement and structural models are the same across genders.

<table>
<thead>
<tr>
<th>Table 8</th>
<th>Fit Indices for the Tested Multiple-Sample Models</th>
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</thead>
<tbody>
<tr>
<td><strong>Model</strong></td>
<td>$\chi^2_{S-B}$</td>
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<tr>
<td><strong>Model by Gender</strong></td>
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<tr>
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<tr>
<td>Measurement ♂</td>
<td>70.84</td>
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</table>

**Section Summary**

Demographic analyses indicated expressive nationality and ethnic diversity among the soccer teams surveyed. Congruent with the demands of college sports, the surveyed student-athletes reported extensive prior experience in soccer competitions. Starters were more likely to report higher levels of “attraction to group task” and women’s soccer teams showed a higher proportion of offensive players than male soccer teams. The total reliability obtained for the scales utilized in this study was adequate (i.e., $\alpha \geq .85$). However, the GEQ subscales warrant major future measurement revisions as noticed elsewhere (see Schutz et al., 1994). Descriptive
analyses support the notion that cohesion, TMM, CE, and PPP are interrelated constructs, and that PPP is predictive of objective performance measures (i.e., PPP-Team’s Season Record, $R^2 = .59$; NAIA Final Ranking, $R^2 = .30$). Perhaps more importantly, the primary hypothesis of this study was verified through the statistical validation of a non-equivalent SEM model. Accordingly, results of this study are congruent with the theoretical feasibility and statistical validity of an integrated view of team dynamics in sports; cohesion antecedes TMM and CE which subsequently affects performance. H2 was not supported given the lack of measurement and structural idiosyncrasy across genders. H3 was also not verified as intra-class correlation coefficients for the GEQ, TADM, and CEQS subscales did not suggest prevalence of group heterogeneity. The theoretical and applied implications of these findings are discussed next.
CHAPTER FIVE
DISCUSSION

The main purpose of this study was to examine team dynamics based on a multi-framework perspective. More specifically, the interrelationship among cohesion, TMM, CE and PPP was explored via SEM analysis. Findings are congruent with the primary hypothesis of the study, thereby supporting the notion that cohesion, TMM and CE are interrelated group properties associated with performance in team sports. Results have also revealed expressive diversity among the soccer teams surveyed.

Teammates and Team Diversity

The athletes participating in this study had approximately two years of experience with their teams, and a median of 20 matches in the season. Therefore, it is plausible to infer that the surveyed athletes had enough time to evolve a sense of cohesion, TMM, and CE. The competitive level of the surveyed athletes may also be seen as indicative of skilled performance. In addition to representing the best teams in their conferences, the surveyed athletes reported, on average, over 10 years of prior experience in soccer competitions. This is congruent with the current view on expertise in sports, which holds that extensive years of deliberate practice antecede participation in highly competitive sport tournaments (Ericsson, 2007). According to Hanin (1997), higher skilled athletes are also more likely to offer reliable reports on survey based studies.

Demographic analyses indicated expressive nationality diversity among the soccer teams surveyed. Male teams showed a higher proportion of international athletes when compared with women’s soccer teams. This demographic imbalance may reflect a still patriarchic society, in which international playing opportunities are skewed towards the male population (Hargreaves, 1999). This difference may also be sport-specific, as soccer is a male-dominated sport around the world (Clark, 2011; Votre & Mourao, 2003). The representative number of student-athletes that identified themselves as members of “other races” may also reflect the internationality of the surveyed population. Players from Brazil identified themselves as “Brazilians”; Sweden declared they were “from Sweden,” and many Mexicans refused the U.S.A. census labeling for “Latino/Hispanics”; instead they wrote “Mexican.” These findings illustrate the complexity of biopsychosocial ethinemental categorization and reinforce the importance of studies addressing cross-cultural dynamics in sport and exercise psychology (Martin, Lavallee, Kellmann, & Page, 2004).
The globalization of many sport leagues around the world is another indicative of the importance of studies addressing multiculturalism in team sports (Fisher, Roper, & Butryn, 2009).

Starters represented the majority of the surveyed population probably because substitutes are less likely to travel and participate in the final stages of major competitions (Woods, & Thatcher, 2009). Budget control and tournament regulations usually allow for 18 athletes per team (i.e., 11 starters and 7 substitutes). Perhaps more importantly, starters reported a higher level of “attraction to group task” as measured by the GEQ. Starters are probably clearer of their roles than non-starters as playing time offer opportunities to evolve task related knowledge (Bourbousson et al., 2010). This finding reinforces the importance of competition opportunities determining team-related schema development. Indeed, time on competition has been found to be a key variable on the development of expert performance across domains (see Deakin, Côté, & Harvey, 2006; Ericsson et al., 1993; Ericsson, 2007). For instance, Law, Côté, and Ericsson (2007) observed that expert figure skaters have a significantly higher competitive experience than their less accomplished counterparts. High-profile young soccer players have also more appearances in national and international competitions than lower skilled players (Kannekens, Elferink-Gemser, & Visscher, 2009).

The lack of effect of other demographic factors on cohesion, TMM, CE and PPP scores may be linked to the homogeneity of the sampled population. The majority of the teams \( n = 12 \) were among the top 16 teams at the NAIA conference, and the remaining teams \( n = 5 \) were region finalists. Descriptive statistics indicated fairly high means for cohesion, TMM, CE and performance expectation across teams. Hence, participants perceived their teams as coordinated, confident, and cohesive units. This is congruent with the overall notion that higher ranked teams possess higher levels of social and task cohesion and more sophisticated coordination links and efficacy beliefs (Carron et al., 2007; Feltz et al., 2008; Salas et al., 2005). Noteworthy, the performance similarity among the surveyed teams may explain the relatively low intra-class correlation coefficients, thereby justifying the absence of further multi-level data modeling.

**Nomological Network of Team Dynamics in Sports**

The total reliability obtained for the scales utilized in this study was adequate (i.e., \( \alpha \geq .85 \)). Reliability and factor loading scores for the TADM suggest that this instrument is also applicable to the sport domain. Reliability scores for the CEQS are also consonant with the findings reported by Short et al. (2005). The low reliability values obtained for two subscales of
the GEQ (i.e., ATG-T, ATG-S) suggest that this instrument needs a major psychometric revision (Schutz et al., 1994). Though conceptually sound, this instrument is not representative of current scale development standards (see Worthington & Whittaker, 2006). Recurrent use of negative sentences and inconsistent use of negative scoring are major problems pertaining to the GEQ.

The observation of moderate to high correlation coefficients among sub-factors of cohesion, TMM and CE offered initial validation to the integrated view of team dynamics in sports proposed. Nonetheless, the hypothesized full-structural model was not found to be statistically valid. Specifically, results were not supportive of a macro-notion of team processes; cohesion, TMM, and CE were found to be idiosyncratic team attributes. Accordingly, the final measurement model obtained is congruent with the theoretical conceptualization for examining sport teams offered by Carron and Hausenblas (1998).

The linear fashion tested in the Structural Model 2.1 was not found to be statistically valid. Non-Equivalent Structural Model 2.2 represented an improvement from Structural Model 2.1, as this revised model represents a cyclical rather than a linear interpretation of team dynamics in sports. Final Structural Model 2.3 allowed adequate model fit by incorporating the notion that both TMM and CE have a direct impact on PPP. This final model supports the notion of an integrated and parsimonious nomological network of team dynamics in sports. In particular, this model is grounded in the notion that (a) cohesion predicts TMM scores and CE efficacy beliefs, and (b) TMM and CE are correlated, mediate the CO-PPP relationship, and have a direct impact of moderate magnitude on PPP.

The new integrated view of team dynamics in sports presented is consistent with an extensive body of literature on the predictive power of task-shared knowledge and CE on performance measures (Entin & Serfaty, 1999; Fiore et al., 2003; Salas & Klein, 2001; Feltz et al., 2008; Bandura, 1997). Additionally, this final model reflects the notion that cohesion antecedes team processes (TMM) and outcomes (CE), thereby lending support for Carron and Hausenblas (1998) seminal conceptualization of team dynamics in sports. Indeed, research has consistently shown that teammates’ agreement on social and task-related behaviors may antecede the development of team mental “schemas” and group-level confidence. Tuckman (1965 as cited by Weinberg & Gould, 2011) noticed that a sense of unified norm (i.e., norming stage) antecedes the development of shared beliefs, team-knowledge and performance-related goals. More recently, Eccles and Tenenbaum (2004) posited that the allocation of social and task
responsibilities antecede the development of implicit and explicit coordination links in sport teams. Empirical evidence is also in favor of the notion that cohesion scores predict CE beliefs in team sports (Heuzé et al., 2004).

The final model illustrated in Figure 14 is also congruent with the notion that CE is influenced by a myriad of other team level attributes (Bandura 1997; Shearer, Holmes & Mellalieu, 2009; Zacarro et al., 1995). In particular, CE beliefs were found to be anteceded by cohesions scores and correlated with TMM scores. In this regard, Bandura (1997) posited that cohesion is a major source of CE, which is also associated with socio-cognitive variables, such as TMM. Hence, training sessions tailored to evolve team coordination and communications links are likely to enhance a team’s efficacy beliefs while also impacting team performance.

Furthermore, the model proposed is statistically valid and supports the tested notion that TMM is represented by coordination, communication, and team’s resources networking. This may be seen as an initial step towards clarifying the unique antecedents of TMM - where the epistemological traits and anteceding variables are not yet clear (Cooke et al., 2000; Webber et al., 2000). More specifically, different authors have proposed numerous conceptual frameworks describing hypothetical variables underlying the notion of TMM. Though conceptually appealing, these frameworks are primarily based on face-validity, thereby lacking statistical corroboration (Lim & Klein, 2006; Mohamed et al., 2010). Future studies should therefore deeper the analysis of TMM in an attempt to establish the unique variables anteceding this group level phenomenon. Future studies should also target the antecedents of CE in sports in general, and the factorial structure of the CEQS in particular. For instance, the notion of “team unity” proposed by Short et al. (2005) as a sub-dimension of the CEQS may be viewed as equivalent to the notion of “social cohesion.” Targeting different sports and skill-levels may also expand the integrated view of team dynamics proposed herein.

The magnitude of the path coefficients among cohesion, TMM, CE and PPP are indicative of the importance of considering these variables in a holistic rather than fragmented view. Furthermore, PPP accounted for approximately 60% of the variance of objective performance scores as measured by teams’ season record. These findings illustrate the importance of (a) investing on the development of team cohesion in sports as this team attribute antecedes TMM and CE, and (b) TMM to team performance and confidence.
From an applied standpoint, findings from this study suggest that team expertise starts with the establishment of positive social relations (social cohesion), and clear task expectations (task cohesion). The large effect size of the cohesion-TMM and cohesion-CE relationships exemplifies the importance of performance enhancement activities aimed at improving team cohesiveness. Following the establishment of minimal cohesiveness levels, teammates are able to advance team-related schemas and a collective sense of confidence. Furthermore, TMM quality and CE beliefs are positively correlated and have a direct impact on PPP which was found to be a significant predictor of objective performance measures.

Team cohesion representing the initial stage of the proposed conceptual framework reinforces the importance of preventing social isolation and attachment problems in team sports (Hardy, Eys, & Carron, 2005). Low social cohesion may create negative affect and aggravate communication problems, thereby hindering the development of TMM. Similarly, low task cohesion may decrease members’ contribution and perceived responsibility, thus resulting in lack of effort and inefficient coordination mechanisms. Organizational and individual orientations aimed at preventing the development of “social cliques”, along with the establishment of challenge goals and group-level productive norms, are important in building team cohesion (Carron et al., 2005).

The notion that TMM and CE are positively correlated is consistent with research findings on working groups’ coordination links and efficacy beliefs (Mathieu et al., 2010; Peterson et al., 2000). For instance, Peterson et al. (2000) observed that college work groups’ agreement and accuracy rate are positively related to CE levels. In principle, more confident team members are more likely to engage in proactive information sharing and evolve positive communication patterns. Mathieu et al. (2010) found that communication breakdowns are less likely to happen in highly confident military units. Within the sport context, Lausic et al. (2009) observed that more successful teams possess more homogenous models of communicating emotional and action verbal and non-verbal messages. Hence, performance enhancement consultants should target vicarious and verbal persuasion techniques (e.g., video-analysis, audio media, motivational lectures) aiming at concomitantly addressing teammates’ confidence beliefs and verbal and non-verbal communication skills.

Men’s and women’s soccer teams differed in their distribution of players by positions. In particular, women’s teams showed a higher proportion of offensive players than male teams.
These differences warranted adoption of multiple-sample SEM procedures aimed at testing for gender invariance. Though results of this study revealed measurement and structural invariance across genders, a further study addressing a more heterogeneous sample may reveal gender effects on team level properties. Noteworthy, the analysis herein performed targeted the covariance structure only (i.e., loadings, path coefficients). Accordingly, it is plausible that males and females have different means on the latent variables. Again, the athletes’ surveyed represented the top performers in their conference, thereby a ceiling-effect on athletes’ mental skills may have “masked” a gender effect on the nomological network herein proposed. Accordingly, it is likely that a future study may reveal a different interrelationship among cohesion-TMM-CE-PPP. In particular, CE may have a larger impact on PPP for women’s soccer teams, whereas TMM may be better predictor of performance for men’s soccer teams. In this regard, research has shown that males are more about the “task and strategy,” whereas females prioritize a collective sense of confidence (Lirgg, 1991; Shondell & Reynaud, 2002).

Finally, it is important to consider the results of this study within time constraints given that teammates’ time of interaction is an important factor pertaining to the study of team dynamics in sports (Brandon & Hollingshead, 2004; Cannon-Bowers & Salas, 2001). In essence, results of this study represent teammates’ interaction patterns, among college soccer players, at the end of the competitive season. Accordingly, scholars and practitioners should use caution in applying the findings of this study to different periods within a competitive season.

**Conclusions, Limitations and Future Directions**

In conclusion, findings from this study are aligned with H1 in supporting the factorial and conceptual validity of integrated nomological network involving team cohesion, TMM, CE, and PPP. Specifically, cohesion was found to be an exogenous variable moderating both TMM and CE beliefs. These former team attributes were found to predict PPP, which in turn accounted for approximately 60% of the variance of objective performance scores as measured by teams’ season record. Findings of this study did not warrant multi-level modeling analysis while also not revealing gender effect on team PPP, thus not supporting H2 and H3 respectively.

Given that soccer players participating at the final stages of the NAIA college conference constituted the targeted sample, caution is warranted in generalizing the findings of this study to other interactive sports and competition levels. Also, this study represents a positivist and quantitative account of team dynamics in college soccer teams. Thus, findings constitute a “snap-
shot”/cross-sectional cut of team dynamics and may not be generalized for different time frames (e.g., pre-season dynamics). Another limitation pertains to the non-inclusion of the interrelationship between coaches’ leadership behaviors and team cohesion in sports. Coaching leadership is a vast topic and has been extensively studied elsewhere (see Martens, 2004).

Despite the above listed limitations, this study advanced the literature by proposing and testing a parsimonious and empirically valid nomological network inter-relating team-level socio-cognitive constructs. In fact, since Klimoski’s and Mohammed’s (1994) seminal paper on TMM entitled “Team mental model: Construct or metaphor?” innumerous authors have emphasized the importance of a parsimonious and empirically valid nomological network involving the conjoint consideration of various team related socio-cognitive constructs (see Bandura, 1997; Goddard et al., 2007; Feltz et al., 2008; Stajkovic et al., 2009; Zaccaro et al., 1995). Further, findings from the present study may also serve as guidelines for performance psychologists interested in working groups in general and highly interactive sports in particular.

As alluded to previously, targeting different populations may allow further revisions of the integrated view on team dynamics proposed. Implementation of longitudinal-growth models of analysis may also reveal how team dynamics change over the span of a competitive season. The adoption of the expert-novice paradigm along with the expert performance approach (Ericsson 2007) may reveal inherent differences among expert and dysfunctional teams while also allowing implementation of hierarchical models of analysis. Furthermore, multi- and cross-cultural studies are needed as team members’ language, ethnicity and location influences team cohesion and information sharing (Carron et al., 202; Fisher et al., 2009). Finally, measurement revisions on the instruments adopted in this study may strengthen the validity of a statistically parsimonious view of team performance in sports.
APPENDIX A: INFORMED CONSENT FORM

Dear participant:

I am a doctoral student in the department of Educational Psychology and Learning Systems, Sport Psychology program at Florida State University. I am conducting a research entitled “Shared Mental Models, Collective-Efficacy, Cohesion and Team Performance in College Soccer Teams: A Multi-level Analysis”. The purpose of this research is to examine the impact of group dynamics on team performance in collegiate soccer teams.

You will be asked to respond to 3 different surveys containing questions about your perceptions regarding your team’s (a) coordination dynamics, (b) confidence level, and (c) cohesion level. You will also be asked to respond to a demographic questionnaire and to a survey on your previous experience as a soccer player. The total time commitment would be about 1 hour.

We do not anticipate any risks to the health and safety of participants in the current project. Participants will only respond to a number of questions on the degree of shared knowledge (shared mental models), cohesiveness and collective-efficacy in their respective teams. Participation in this research will benefit researchers and practitioners in understanding the impact of various group dynamics variables, such as team coordination and cohesion levels, in optimal performance in soccer teams. Furthermore, participants will have an opportunity to reflect on interaction patterns of their respective teams (i.e., group dynamics aspects, such as group cohesion and confidence). These reflections may lead to insights regarding behaviors and attitudes that may facilitate your performance in particular and your team performance in general.

Your participation in this study is voluntary. You may choose not to participate or to withdraw from the study at any time for any reason with no consequences. You may also choose to omit or not respond to questions in any of the questionnaires. Information gained in this study will remain confidential to the extent allowed by law. More specifically, during the study, all the questionnaires will be stored in a locked filing cabinet and access to any virtual data (e.g., computerized versions of the questionnaires) will be password protected. After completion of the study, all electronic data will be permanently stored as part of a database in a searchable electronic form and made available to other researchers for analysis purposes only. The results of this study may be published, but your name will not be used.

If you have any question about your rights as a participant in this research project, or if you feel that you have been placed at risk, you can contact the Chair of the Human Subjects Committee (humansubjects@magnet.fsu.edu), Institutional Review Board, through the Office of the Vice President for Research at (850) 644-8633.

_______________________________________                               _______________________
Participant Name (Print)                                                                                          (Date)

_______________________________________
Participant Name (Signature)
APPENDIX B: IRB APPROVAL MEMORANDUM

Office of the Vice President For Research
Human Subjects Committee
Tallahassee, Florida 32306-2742
(850) 644-8673 · FAX (850) 644-4392

APPROVAL MEMORANDUM

From: Thomas L. Jacobson, Chair

Re: Use of Human Subjects in Research
Shared Mental Models and Team Performance in College Soccer Teams: A Multi-level Analysis

The application that you submitted to this office in regard to the use of human subjects in the proposal referenced above have been reviewed by the Secretary, the Chair, and one member of the Human Subjects Committee. Your project is determined to be Expedited per per 45 CFR § 46.110(7) and has been approved by an expedited review process.

The Human Subjects Committee has not evaluated your proposal for scientific merit, except to weigh the risk to the human participants and the aspects of the proposal related to potential risk and benefit. This approval does not replace any departmental or other approvals, which may be required.

If you submitted a proposed consent form with your application, the approved stamped consent form is attached to this approval notice. Only the stamped version of the consent form may be used in recruiting research subjects.

If the project has not been completed by 5/17/2012 you must request a renewal of approval for continuation of the project. As a courtesy, a renewal notice will be sent to you prior to your expiration date; however, it is your responsibility as the Principal Investigator to timely request renewal of your approval from the Committee.

You are advised that any change in protocol for this project must be reviewed and approved by the Committee prior to implementation of the proposed change in the protocol. A protocol change/amendment form is required to be submitted for approval by the Committee. In addition, federal regulations require that the Principal Investigator promptly report, in writing any unanticipated problems or adverse events involving risks to research subjects or others.

By copy of this memorandum, the Chair of your department and/or your major professor is reminded that he/she is responsible for being informed concerning research projects involving human subjects in the department, and should review protocols as often as needed to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

This institution has an Assurance on file with the Office for Human Research Protection. The Assurance Number is FWA00000168/IRB number IRB00000446.

HSC No. 2011.5990
## APPENDIX C: POWER ANALYSIS

### Compute Sample Size for RMSEA

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<tr>
<td>Desired Power</td>
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<td>Alt. RMSEA</td>
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</table>

### R Code

```r
# Computation of minimum sample size for test of fit
rmsea0 <- 0 # null hypothesized RMSEA
rmseaa <- 0.05 # alternative hypothesized RMSEA
d <- 62 # degrees of freedom
alpha <- 0.05 # alpha level
desired <- 0.8 # desired power

# Code below need not be changed by user
# Initialize values
pow <- 0.0

# Begin loop for finding initial level of n
while (pow < desired) {
  n <- n + 100
  ncp0 <- (n - 1) * d * rmsea0^2
  ncpa <- (n - 1) * d * rmseaa^2
  # Compute power
  if (rmsea0 < rmseaa) {
    cval <- qchisq(alpha, d, ncp=ncp0, lower.tail=F)
    pow <- pchisq(cval, d, ncp=ncpa, lower.tail=F)
    cval <- qchisq(1-alpha, d, ncp=ncp0, lower.tail=F)
  }
  if (pow < desired) {
    foo <- -1
  } else {
    foo <- 1
  }
  minn <- newn
}
print(minn)
[1] 214.0625
```
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<td>1.5</td>
</tr>
<tr>
<td>Sweden</td>
<td>11</td>
<td>3.2</td>
</tr>
<tr>
<td>Trinidad and Tobago</td>
<td>2</td>
<td>.6</td>
</tr>
<tr>
<td>Uganda</td>
<td>3</td>
<td>.9</td>
</tr>
<tr>
<td>Ukraine</td>
<td>1</td>
<td>.3</td>
</tr>
<tr>
<td>USA</td>
<td>224</td>
<td>65.9</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>1</td>
<td>.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>340</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>
APPENDIX E: DEMOGRAPHIC INFORMATION

Participant #: Pseudonym: Date / /  
Team:  

1. Sex: ( ) Male ( ) Female

2. Date of birth: / / (mm/dd/yyyy)

3. Nationality
   ( ) American ( ) Other print nationality

4. What is your 1’s race? Mark one or more options.
   ( ) White ( ) Black American Am., or Negro
   ( ) American Indian or Alaskan Native — print name of enrolled or principal tribe
   ( ) Asian Indian ( ) Japanese ( ) Native Hawaiian ( ) Chinese ( ) Korean
   ( ) Filipino ( ) Vietnamese ( ) Samcan ( ) Guamanian or Chamorro
   ( ) Other Asian — print race, for examples, Hmong, Laotian, Thai, Pakistani, and so on
   ( ) Other Pacific Islander — print race, for examples, Fijian, Tongan, and so on
   ( ) Some other race — print race

5. Hometown

6. Class ( ) Freshman ( ) Sophomore ( ) Junior ( ) Senior

7. Last College ( ) Not applicable

8. Last School (High-School)

9. Current height: (cm)

10. Current weight: (lbs)

11. For how many seasons have you been a competing member on this team? __

12. Are you typically a starter on this team (check one)? ( ) Yes ( ) No

13. Number of games started last season

14. Number of games you participated in the last season

15. Are you primarily left or right handed? Right Left Both (please circle one)

16. Are you primarily left or right footed? Right Left Both (please circle one)

17. In which position(s) do you usually play in your team? 

18. How old were you when you started playing soccer? ________ years ________ months
APPENDIX F: GEQ

Participant #: __________________ Pseudonym: ______________________________ Date __/__/___
Team: ______________________________

Group Environment Questionnaire

Directions: The Group Environment Questionnaire (GEQ) helps you assess your perceptions of an athletic team of which you are a member. There is no right or wrong answer, so please give your immediate reaction. Some of the questions may seem repetitive, but please answer them all and be as honest as possible.

The following questions help assess your feelings about your personal involvement with your team. On a scale of 1 through 9, 1 indicating complete disagreement, and 9 indicating the strongest agreement, answer each question.

1. I do not enjoy being part of the social activities of this team.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly</td>
<td>Agree</td>
<td>Disagree</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. I’m unhappy about the amount of playing time I get.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly</td>
<td>Agree</td>
<td>Disagree</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. I am not going to miss the members of this team when the season ends.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly</td>
<td>Agree</td>
<td>Disagree</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. I’m unhappy with my team’s level of desire to win.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly</td>
<td>Agree</td>
<td>Disagree</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. Some of my best friends are on this team.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly</td>
<td>Agree</td>
<td>Disagree</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. This team does not give me enough opportunities to improve my personal performance.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly</td>
<td>Agree</td>
<td>Disagree</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7. I enjoy other parties more than team parties.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly</td>
<td>Agree</td>
<td>Disagree</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8. I like the style of play on this team.
9. This team is one of my most important social groups.

1  2  3  4  5  6  7  8  9
Strongly Disagree  Strongly Agree

10. Our team is united in trying to reach its performance goals.

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.

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.

1  2  3  4  5  6  7  8  9
Strongly Disagree  Strongly Agree

13. Our team members rarely party together.

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.

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.

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 help them so we can get back together again.

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.

1  2  3  4  5  0  7  8  9
Strongly Disagree  Strongly Agree

18. Our team members do not communicate freely about each athlete’s responsibilities during competition or practice.

1  2  3  4  5  6  7  8  9
Strongly Disagree  Strongly Agree
APPENDIX G: TADM

Participant #: ______  Pseudonym: ____________________________  Date __/__/____
Team: _______________________________________________________

Team Assessment Diagnostic Inventory

**Directions:** Team Assessment Diagnostic Inventory (TADI) helps you to assess your perceptions of an athletic team of which you are a member. There is no right or wrong answer, so please give your immediate reaction. Some of the questions may seem repetitive, but please answer them all and be as honest as possible.

The following questions help assess your feelings about your personal involvement with your team. On a scale of 1 through 5, 5 indicating the strongest agreement, and 1 indicating the strongest disagreement, answer each question.

<table>
<thead>
<tr>
<th>Question</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>My team usually discusses our goal and attains the agreement of each other.</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
</tr>
<tr>
<td>My team knows specific strategies for completing various tasks.</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
</tr>
<tr>
<td>My team knows the general process involved in carrying out our tasks.</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
</tr>
<tr>
<td>My team communicates with each other while performing our tasks.</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
</tr>
<tr>
<td>My team communicates with each other throughout our tasks.</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
</tr>
<tr>
<td>My team consistently demonstrates effective listening skills.</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
</tr>
<tr>
<td>My team likes to do various team tasks.</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
</tr>
<tr>
<td>My team encourages each other in order to improve our outcomes.</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
</tr>
<tr>
<td>Statement</td>
<td>Strongly agree</td>
<td>Agree</td>
<td>Neutral</td>
<td>Disagree</td>
<td>Strongly disagree</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>----------------</td>
<td>-------</td>
<td>---------</td>
<td>----------</td>
<td>-------------------</td>
</tr>
<tr>
<td>My team takes pride in our work.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My team is likely to make decisions together.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My team understands how we can exchange information for doing our tasks.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My team solves problems that occur while doing our tasks.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My team creates a safe environment to openly discuss any issue related to the team’s success.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My team has the right experience so that a critical mass of experienced people is available on the team.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My team knows the environmental constraints when we perform our tasks.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**APPENDIX H: CEQS**

Participant #: _____  Pseudonym: ____________________________  
Date: _____/____/_____  
Team: ____________________________

**Collective Efficacy Questionnaire for Sports**

*Directions: Rate your team’s confidence, in terms of the upcoming game or competition, that your team has the ability to...*

<table>
<thead>
<tr>
<th>Statement</th>
<th>Not at All confident</th>
<th>Extremely Confident</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Outplay the opposing teams</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>2. Resolve conflicts</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>3. Perform under pressure</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>4. Be ready</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>5. Show more ability than the other team</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>6. Be united</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>7. Persist when obstacles are present</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>8. Demonstrate a strong work ethic</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>9. Stay in the game when it seems like your team isn’t getting any breaks</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>10. Play to its capabilities</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>11. Play well without your best player</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>12. Mentally prepare for this competition</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>13. Keep a positive attitude</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>14. Play more skillfully than the opponent</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>15. Perform better than the opposing teams</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>16. Show enthusiasm</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>17. Overcome distractions</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>18. Physically prepare for this competition</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>19. Devise a successful strategy</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>20. Maintain effective communication</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX I: TOQ

Participant #:  
Pseudonym: ________________________________
Date ___/___/___
Team: ________________________________

Team Outcome Questionnaire

This questionnaire is designed to assess your expectations concerning your team’s performance for this season. Using the scale below, indicate to what degree you believe your team will be able to achieve each goal over the course of this season.

<table>
<thead>
<tr>
<th>Not at all</th>
<th>To a small degree</th>
<th>To a modest degree</th>
<th>To a great degree</th>
<th>Completely</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

My team will:

1. Accumulate its potential amount of victories.................................................... __
2. Work as hard as possible in practice............................................................... __
3. Perform in games with great effort................................................................. __
4. Compete with a high quality of play................................................................. __
5. Reach its potential level of physical fitness..................................................... __
6. Coordinate its actions during games................................................................. __
7. Reach its potential in tournaments or playoffs................................................. __
8. Achieve the skills critical to perform in my sport.............................................. __
9. Execute its strategy effectively........................................................................... __
APPENDIX J: ITEMS ORGANIZED BY DIMENSION

GEQ

Attraction to Group Task

I’m unhappy about the amount of playing time I get.

I’m unhappy with my team’s level desire to win.

Some of my best friends are on this team.

I like the style of play on this team.

Attraction to Group Social

I do not enjoy being part of the social activities of this team.

I am not going to miss the members of this team when the season ends.

Some of my best friends are on this team.

I enjoy other parties more than team parties.

This team is one of my most important social groups.

Group Integration Task

Our team is united trying to reach its performance goals.

We all take responsibility for any loss or poor performance by our team.

Our team members have conflicting aspirations for the team’s performance.

If members of our team have problems in practice, everyone wants to help them so we can get back together soon.

Our team members do not communicate freely about each athlete’s responsibilities during competition or practice.

Group Integration Social

Members of our team would rather go out on their own than get together as a team.

Our team members rarely party together.

Our team would like to spend time together in the off-season.

Members of our team do not stick together outside practices and games.
**TADM**  

**General Task and Team Knowledge**  
My team usually discusses our goals and attains the agreement of each other.  
My team knows specific strategies for competing various tasks.  
My team knows the general process involved in carrying out our tasks.  

**Attitudes Towards Teammates Task**  
My team likes to do various team tasks.  
My team encourages each other to improve our outcomes.  
My team takes pride in our work.  

**General Task and Communication Skills**  
My team communicates with each other while performing our tasks.  
My team communicates with each other throughout our tasks.  
My team consistently demonstrates effective listening skills.  

**Team Dynamics Interactions**  
My team is likely to make decisions together.  
My team understands how we can share information for doing our tasks.  
My team solves problems that occur while doing our tasks.  

**Team Resources and Working Environment**  
My team creates a safe environment to openly discuss any issue related to the team’s success.  
My team has the right experience so that a critical mass of experiences people is available on the team.  
My team knows the environmental constrains when we perform our tasks.
CEQS

Ability
Outplay opposing teams.
Show more ability than the other team.
Play more skillful than the opponent.
Perform better than the opposing team.

Effort
Demonstrate a strong work ethic.
Play to its capabilities.
Show enthusiasm.
Overcome distractions.

Persistence
Perform under pressure.
Persist when obstacles are present.
Stay in the game when it seems like your team isn’t getting any breaks.
Play well without your best player.

Preparation
Be ready.
Mentally prepare for this competition.
Physically prepare for this competition.
Devise a successful strategy.

Unity
Resolve conflicts.
Show more ability than the other team.
Keep a positive attitude.
Maintain effective communication.
## APPENDIX K: SKEWNESS AND KURTOSIS VALUES

<table>
<thead>
<tr>
<th>Item</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
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<td>co2</td>
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<tr>
<td>co3</td>
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<td>1.98</td>
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<tr>
<td>co4</td>
<td>-1.83</td>
<td>2.45</td>
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<td>co5</td>
<td>-1.25</td>
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<td>co6</td>
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<td>co9</td>
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<td>1.35</td>
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<td>co10</td>
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REFERENCES


Edson Medeiros Filho holds a bachelor and master of sciences degree in Sport Sciences and a doctoral degree in Educational Psychology with an emphasis on Sport and Exercise Psychology. Throughout his academic career, Edson has developed advanced skills in quantitative, qualitative and biofeedback research methodology. He is particularly interested in studying how expert individuals and “expert teams” acquire and evolve complex mental and socio-cognitive representations. Edson is also interested in coaching, peace psychology, and bounded ethicality. A Fulbright Scholar recipient, Edson Medeiros Filho has received distinguished awards for his scientific and applied contributions to the domain of Sport and Exercise Psychology.