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8 **The Relationship among Cohesion, Transactive Memory Systems and Collective**

9 **Efficacy in Professional Football Teams: A Multilevel Structural Equation Analysis**

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1   **Abstract**

2   We explored the interrelationship among cohesion, transactive memory systems (TMS), and

3   collective efficacy in professional football. Specifically, we tested the hypothesis that TMS

4   would mediate the relationship between cohesion and collective efficacy in football teams.

5   Furthermore, we explored the specific effects of task and social cohesion on TMS, under the

6   hypothesis that task cohesion would be a stronger predictor of TMS akin to previous literature

7   on the topic. Five-hundred and fifty-seven footballers (326 male and 231 female) representing

8   34 different teams competing in the Spanish League First and Second Division "b" participated

9   in the study. Multi-level structural equation modelling analysis revealed that TMS mediated

10   the cohesion-collective efficacy linkage. However, when examining the specific effects of task

11   and social cohesion our analysis suggested that cohesion was exogenous to both TMS and

12   collective efficacy, which in turn correlated with one another (i.e., reciprocal effect

13   relationship). Our findings also revealed that task cohesion had a stronger impact on TMS and

14   collective efficacy than social cohesion. Taken together, these findings suggest that the

15   relationship among cohesion and other team processes may yield equivalent and non-

16   equivalent models of different structural shapes. In practice, these findings highlight the need

17   to develop integrated team dynamics interventions as cohesion influences TMS, which in turn

18   influences collective efficacy and vice-versa. In other words, the higher the "togetherness", the

19   higher information sharing (TMS) and mutual trust in the team.

20

21   *Keywords*: cohesion, transactive memory systems, collective efficacy, football, group

22   dynamics.

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The Relationship among Cohesion, Transactive Memory Systems and Collective Efficacy in Professional Football Teams: A Multilevel Structural Equation Analysis

Various scholars have examined the linkage between cohesion and collective efficacy (Filho, Tenenbaum, & Yang, 2015; Kozub & McDonnell, 2000; Paskevich, Brawley, Dorsch, & Widmeyer, 1999; Spink, 1990), and their relationship with performance in sports (Benson, Šiška, Eys, Priklerová, & Slepička, 2016; Eys et al., 2015; Fransen et al., 2015). In this regard, there is emerging consensus that higher cohesion leads to higher collective efficacy (Heuzé, Raimbault, & Fontayne, 2006a; Leo, González-Ponce, Sánchez-Oliva, Amado, & García-Calvo, 2016b). Nevertheless, only a few studies have examined the input-output (i.e., antecedent; moderating and/or mediating; and outcome variables) mechanism between cohesion and collective efficacy.

Higher cohesion among teammates tends to encourage players to spend more time together, and communicate better and more frequently with each other about aspects of the game, thereby leading to the development of more accurate shared knowledge states within the team (Filho et al., 2015; Kozlowski & Chao, 2012; Leo, González-Ponce, Amado, Pulido, & García-Calvo, 2016a). In turn, this shared knowledge held by teammates about "who is aware of what information," also known as a transactive memory system (Fiore, Salas, & Cannon-Bowers, 2001, p. 385; Wegner, Erber, & Raymond, 1991), tends to generate a greater sense of shared efficacy beliefs (Lin & Chou, 2009). Therefore, the purpose of this study was to examine the role of transactive memory systems on the relationship between cohesion and collective efficacy.

Cohesion

Cohesion has been defined as "a dynamic process that is reflected in the tendency for 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.

1   213). This definition, which is congruent with Carron's and associates' model (Carron & Eys,

2   2012; Carron, Widmeyer, & Brawley, 1985), reflects the notion that team members hold (a)

3   collective beliefs about the group as a unit in terms of its closeness, resemblance, and affinity

4   (i.e., group integration; GI); and (b) individual beliefs regarding the degree to which the

5   group attracts them, thereby satisfying their needs and personal goals (i.e., individual

6   attraction to the group; ATG). Noteworthy, each of these classes of beliefs is further divided

7   into two categories, depending on whether they revolve around task (T) or social (S) matters

8   (Carron & Eys, 2012). Altogether, four aspects of team cohesion have been identified: (a)

9   Group Integration-Task (GI-T) and (b) Group Integration-Social (GI-S) which reflect,

10   respectively, members' beliefs about the degree to which the group is united to reach its

11   objectives and to socialize; and (c) Individual Attraction to the Group-Task (ATG-T) and (d)

12   Individual Attraction to the Group-Social (ATG-S) which reflect individual members'

13   attraction to the group for its objectives and social relationships, respectively.

14   **Collective Efficacy**

15   Collective efficacy pertains to "a group's shared beliefs in its capacities to organize

16   and execute actions to produce a desired goal" (Bandura, 1997, p. 476). Of note, collective

17   efficacy depends on a series of inputs, including group cohesion (Filho et al., 2015; Heuzé et

18   al., 2006a; Leo et al., 2015a; Paskevich et al., 1999; Short, Sullivan, & Feltz, 2005; Spink,

19   1990). According to Bandura (1997), these inputs help to create a shared collective efficacy

20   belief in the team, which in turn has been shown to influence performance outcomes in sports

21   (Beauchamp, 2007; Feltz & Lirgg, 1998; Leo et al., 2016b).

22   Regarding the relationship between cohesion and collective efficacy, cohesion is

23   considered to be an antecedent of collective efficacy (Bandura, 1997; Kozub & McDonnell,

24   2000; Leo et al., 2016b). In fact, previous research has shown that team members who

1 perceive greater team cohesion develop stronger perceptions of collective efficacy (Filho et

2 al., 2015; Heuzé et al., 2006a; Leo et al., 2016b).

3   Previous regression-based studies have revealed that both task and social cohesion are

4 positively related to collective efficacy in team sports (Heuzé et al., 2006a; Kozub &

5 McDonnell, 2000; Leo et al., 2015a; Leo et al., 2016b; Paskevich et al., 1999; Spink, 1990).

6 However, the magnitude of the relationship between task and social cohesion and colletive

7 efficacy and other team processes depends on competitive level and sport type (Carron,

8 Colman, Wheeler, & Stevens, 2002). In amateur and youth sports, teammates constitute a

9 fundamental social group for players and, thereby, social cohesion has been found to predict

10 collective efficacy (Filho et al., 2015; Leo et al., 2016b). However, in professional teams,

11 players do not necessarily perceive their teammates as an important social group and,

12 thereby, social cohesion is not necessarily linked to collective efficacy (Kozub & McDonnell,

13 2000; Leo et al., 2015a; Paskevich et al., 1999). Furthermore, task cohesion has been found to

14 be more important in interactive team sports, which require players to continuously

15 cooperate, than in coactive sports wherein players have fewer opportunities to work together

16 on a team task (Carron et al., 2002; Filho, Dobersek, Gershgoren, Becker, & Tenenbaum,

17 2014a). Gender effects have also been found to influence cohesion and collective efficacy, as

18 men's and women's orientation towards cooperation tends to differ (Filho et al., 2014a; Feltz,

19 Short, & Sullivan, 2008).

20   Additionally, the relationship between cohesion and collective efficacy might depend

21 on other team processes. Previous studies have examined the influence of task and ego

22 motivational climates on the relationship between cohesion and collective efficacy (Heuzé,

23 Sarrazin, Masiero, Raimbault, & Thomas, 2006b; Fuster-Parra, García-Mas, Ponseti & Leo,

24 2015). However, to our knowledge, only one study has examined the linkage among

25 cohesion, collective efficacy and a team cognitive (i.e., what players know about the team)

1   construct (Filho et al., 2015). Specifically, Filho et al. (2015) proposed the Integrated

2   Framework of Team Dynamics, linking cohesion and collective efficacy to team mental

3   models and team performance. More specifically, Filho et al. (2015) observed that cohesion

4   was exogenous to both collective efficacy and team mental models, which in turn co-varied

5   and positively influenced team performance. In the present study, we were also interested in

6   the linkage among cohesion, collective efficacy and a team cognition construct similar to the

7   notion of team mental models, namely transactive memory systems.

8   **Transactive Memory Systems**

9   Transactive memory systems (TMS) is linked to the functioning of working teams

10   across performance domains (Peltokorpi, 2008). Specifically, TMS pertain to "a shared

11   system for encoding, storing, and retrieving information" (Wegner et al., 1991, p. 923), or

12   "the set of knowledge that each individual possesses and the intersubjective awareness of the

13   knowledge that is possessed by others –who knows what–" (Sánchez-Manzanares, Rico, Gil,

14   & Martín, 2006, p. 751). In practice, TMS can be seen in set-pieces in team sports (such as

15   corner kicks), or when a player produces a "no-look pass" to a teammate, illustrating their

16   shared awareness of the ongoing game situation. TMS develop as team members learn about

17   their fellow teammates' experiences, preferences, interests, and abilities (Argote & Guo,

18   2016). In other words, to maintain the effectiveness of TMS, team members must interact and

19   continually update information about each other's skills (Brandon & Hollingshead, 2004).

20   The construct of TMS is relevant to research on team dynamics because it attempts to

21   examine (a) the knowledge and skills provided by different members of a team; (b) the

22   quantity and quality of knowledge the team as a whole possesses; and (c) how knowledge and

23   skills are distributed within the team. To this extent, previous research has revealed that TMS

24   is manifested in three dimensions: (a) *specialization*, i.e., the existence in the team of a

25   differentiated structure of knowledge; (b) *credibility*, i.e., mutual trust among team members

1 about the validity of their knowledge; and (c) *coordination*, i.e., the team's capacity to

2 effectively integrate its actions and knowledge (see Gino, Argote, Miron-Spektor, &

3 Todorova, 2010; Michinov & Michinov, 2009; Moreland & Argote, 1998).

4   Noteworthy, the three reflective indicators of TMS are likely to improve if social

5 cohesion is enhanced in the team, as players that get along well are more likely to share

6 information with one another (Filho, Gershgoren, Basevitch, Schinke, & Tenenbaum, 2014c).

7 Generally, the most effective teams are those whose members feel connected to one another,

8 as such connectedness allows them to share their expertise (Argote & Ren, 2012). High

9 integration among team members leads to closer interpersonal relations, thus favoring the

10 emergence of shared understanding and coordination within the team (Bourbousson, Poizat,

11 Saury, & Seve, 2010). Besides social interaction, TMS will also be enhanced with training,

12 particularly when team members learn how to perform a given task cooperatively (Argote &

13 Ren, 2012). Moreover, the existence of well-defined roles in the team promotes shared

14 understanding and coordination amongst team members performing an interdependent task

15 (Bosselut, McLaren, Eys, & Heuzé, 2012; Giske, Rodahl, & Høigaard, 2015). Therefore,

16 group cohesion is expected to antecede the development of TMS in sport teams. Teammates

17 need to develop task-related and social bonds in order "to come and stick together" (i.e.,

18 cohesion), so that they can develop an understading of "who knows what" (TMS) in order to

19 coordinate their actions in the natural world (Bourbousson et al., 2010; Leo et al., 2016a;

20 Williamson & Cox, 2014).

21   Teams with players who feel more integrated and attracted by the group may not only

22 develop greater TMS but also evolve higher levels of collective efficacy. In fact, Liang,

23 Moreland, and Argote (1995) argued that TMS is positively related to the collective level of

24 confidence shared among players, given that when group members have extensive shared

25 knowledge about the team, developing trust in the team is a natural process. As alluded to

1 previously, research on team sports has also shown that cohesion predicts team mental

2 models (Filho et al., 2015), which is similar to the notion of TMS (Fiore et al., 2001).

3 Research with hand-to-hand circus acrobats has identified that shared knowledge among

4 teammates and collective efficacy are intertwined team processes (Filho & Rettig, in press).

5 In the present study we were interested in examining the relationship among cohesion, TMS,

6 and collective efficacy.

7 **Aims and Hypotheses**

8   We aimed to examine the interrelationship among cohesion, TMS, and collective

9 efficacy through multilevel structural equation modelling. First, we aimed to test a model, as

10 informed by previous empirical and theoretical work (see Filho et al., 2015; Heuzé et al.,

11 2006a; Leo et al., 2016a), reflecting the notion that overall cohesion scores are related to

12 TMS and collective efficacy. In particular, we hypothesized that cohesion is an antecedent of

13 TMS, which in turn mediates the relationship between cohesion and collective efficacy in

14 professional football teams (H1). Furthermore, we also tested the specific effects of task and

15 social cohesion on TMS, while accouting for the influence of TMS on collective efficacy.

16 Specifically, we predicted that task cohesion would be a stronger predictor of TMS (H2).

17 **Method**

18 **Participants**

19   Five-hundred and fifty-seven professional football players competing in the Spanish

20 Soccer League participate in the study. All soccer clubs that were members of the men's

21 Second Division "b" (20 teams) and the women's First Division (16 teams) were invited to

22 take part in the study. A total of 18 teams competing in the Second Division "b" and 14 teams

23 competing in the First Division agreed to take part in the study. Three-hundred and twenty-

24 six male athletes, ranging in age from 16 to 37 years ($M = 25.31$, $SD = 4.58$), and 231 female

25 footballers, ranging in age from 15 to 36 years ($M = 22.37$, $SD = 4.49$), took part in the study.

Instruments

     Cohesion. The short Spanish version of the GEQ (Leo et al., 2015b) was used to assess cohesion. This scale has 12 items comprising four factors with three items each, namely *group integration-social* (GI-S; e.g., "The members of our team like to get together in situations other than trainings and matches"), *group integration-task* (GI-T; e.g., "The team members unite their efforts to achieve the goals during trainings and matches"), *individual attraction to the group-social* (ATG-S; e.g., "If there is any problem during the training sessions, all the players get together to overcome it"), and *individual attraction to the group-task* (ATG-T; e.g., "I like the way this team plays"). Players responded to all items on a nine-point scale ranging from *strongly disagree* (1) to *strongly agree* (9). The CFA showed acceptable model fit ($\chi^2 = 149.505$; df = 48; $p \leq .001$; CFI = .957; TLI = .941; RMSEA = .062; SRMR = .041). Furthermore, Cronbach's alpha coefficients were acceptable, with values of .85 for GI-S, .86 for GI-T, .83 for ATG-S, .78 for ATG-T, and .89 for the full scale.

     Transactive memory systems. To assess TMS, we used a questionnaire developed by Lewis (2003), and adapted to the sport contex by Leo, González-Ponce, Sanchez-Oliva, Pulido, and García-Calvo (2018). The questionnaire consists of 15 items organized in three factors: *specialization* (five items, e.g., "Different team members are responsible for expertise in different areas"), *credibility* (five items, e.g., "I was comfortable accepting procedural suggestions from other team members"), and *coordination* (five items, e.g., "Our team had very few misunderstandings about what to do"). Players responded to all items on a five-point scale ranging from *strongly disagree* (1) to *strongly agree* (5). The H-CFA showed acceptable model fit ($\chi^2 = 209.537$; df = 63; $p \leq .001$; CFI = .947; TLI = .912; RMSEA = .065; SRMR = .028). Furthermore, Cronbach's alpha coefficients were acceptable, with values of .77 for specialization, .85 for credibility, .79 for coordination, and .81 for the full scale.

1   **Collective efficacy.** To assess collective efficacy, we used the Football Collective

2   Efficacy Questionnaire developed by Leo et al. (2014). This instrument starts with a stem

3   phrase (i.e., "Our team's confidence in our capability to…") and has a total of six items

4   referring to specific football situations (e.g., "…resolve game situations in the attacking

5   phase"), which are all grouped into a single factor. The questionnaire uses a five-point likert

6   scale ranging from *bad* (1) to *excellent* (5). The CFA showed acceptable model fit (χ^2 =

7   29.961; df = 9; $p \leq .001$; CFI = .972; TLI = .954; RMSEA = .065; SRMR = .029). The

8   Cronbach's alpha coefficient was acceptable for the full scale, $\alpha = .81$.

9   **Procedure**

10   Institutional ethical approval was secured prior to the commencement of data

11   collection. All participants were treated according to the American Psychological Association

12   ethical guidelines regarding consent, confidentiality, and anonymity of responses. To arrange

13   data collection meetings, we contacted the clubs and coaches of all teams participating in the

14   women's First Division and the men's Second Division "b" Spanish football leagues,

15   respectively. Noteworthy,a cross-sectional design was used and a single data collection

16   assessment was completed during the middle of the season to ensure the teams had developed

17   a sense of cohesion, collective efficacy and TMS. Coaches and team representatives were

18   briefed on the objectives and procedures of the study. Dates and times for data collection

19   were arranged with those teams willing to take part in the study. At data collection, the

20   players were informed about the research aims and methods, and ensured that participation

21   was voluntary and that their answers would remain confidential. Participants completed

22   questionnaires in the locker room, and without the presence of the coach. The process took

23   approximately 30 minutes. The principal investigator was present at the time the players

24   completed questionnaires, and answered all questions posed by the participants.

25

Data Analysis

With respect to the main analysis, we initially examined the measurement model to assess the relationships between the observed indicators and their respective latent constructs. Factor scores from the subscales were used as indicators for the latent factor cohesion, TMS and collective efficacy. Subsequently, we used Multilevel Structural Equation Modelling (MSEM) to test the hypothesized and relevant alternative models. Of note, robust maximum likelihood (MLR) was used as this estimation method procedure is robust to the Likert nature of the questionnaire items and non-normal data distribution (Muthén & Muthén, 1998-2018).

To assess the models' fit, we used the following indices: chi-square (χ^2), comparative fit index (CFI), Tucker Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). According to Schumacker and Lomax (1996), incremental indexes (CFI and TLI) indicate acceptable fit when values of .90 or higher are obtained. Regarding RMSEA and SRMR, .08 or .06 have been established as acceptable cut-off points (Hu & Bentler, 1999).

Results

Descriptive Statistics, Correlations and Cronbach's Alpha Coefficients

Means, standard deviations, correlations and Cronbach's alpha coefficients for each variable are presented in Table 1. Scales demonstrated acceptable internal consistency (i.e., α > .70). Regarding the mean values, in general, the participants reported scores above the midpoint of the scale for cohesion, TMS and collective efficacy.

Multilevel Structural Equation Modelling

Intraclass correlation indicates the total amount of variance in a given variable of interest that is due to group-level effects. In this study, coefficients for each subscales were all above .14 (range = .14 – .27; see Table 1), indicating the need for multilevel analysis. To this extent, multilevel structural equation modelling should start with the model labelled as

1   maximal model, which consists of two levels (i.e. between and within levels; see Stapleton,

2   2006). This model is meant to decompose the observed covariance matrix into two

3   components: (a) the covariance matrix for the between level, and (b) the covariance matrix

4   for the within level. First, we tested the multilevel model with random intercepts and random

5   slopes. The maximal model did not converge to a solution. Then, we tested the multilevel

6   model with random intercepts and fixed slopes, and again the model did not converge to a

7   solution. This is likely due to the small sample size for the between level (i.e., 31 teams) and

8   the homogeneity of the sampled teams (i.e., all teams participated in two professional

9   leagues). Specifically, when the simple size for the between level is small (< 100) and

10   homogenous, the model tends to encounter convergence problems as the variance for the

11   between-level parameters tends to be small (Maas & Hox, 2005). Due to the previous results,

12   we tested another model targeting the individual level of analysis, and the information about

13   the nesting of individuals within teams was incorporated via correction of standard errors of

14   the parameters, using the Mplus COMPLEX instruction (Muthén & Muthén, 1998-2018).

15   This procedure allowed us to control for the nesting of players within teams.

16   **Hypothesized model 1.** Initially, we used a two-step model-building (Anderson &

17   Gerbing, 1988) to test the proposed model (Figure 1). Confirmatory factor analysis was

18   carried out to test the measurement model in step 1. The fit indices indicated that the

19   measurement model adequately described the data ($\chi^2 = 458.736$; df $= 182$; $p \leq .001$; CFI $=$

20   .941; TLI $= .932$; RMSEA $= .052$; SRMR $= .053$) with acceptable factor loadings (from .57

21   to .91). In the second step we used MSEM to analyse the relationship among cohesion, TMS,

22   and collective efficacy. We included cohesion as an independent variable, TMS as a

23   mediator, and collective efficacy as an outcome variable (Figure 1). Results of the SEM

24   analysis revealed that the hypothesized model 1 represented a good fit to the data ($\chi^2 =$

25   460.085; df $= 183$; $p \leq .001$; CFI $= .941$; TLI $= .932$; RMSEA $= .052$; SRMR $= .053$). Figure

1 shows the standardized results of the model, which revealed that (a) cohesion was a strong positive predictor of TMS ($\beta = .858$, $p < .001$, $R^2 = .736$), and (b) TMS predicted collective efficacy ($\beta = .771$, $p < .001$, $R^2 = .594$).

To ensure that the hypothesized model provided the best fit indices, one meaningful alternative model was tested (Hershberger, 2006). We replaced the direct effect from TMS to collective efficacy with the correlation between their disturbances. Accordingly, TMS and collective efficacy hypothesised were as sharing covariance rather than representing a linear process. This model was tested because there is previous empirical evidence suggesting that cohesion predicts collective efficacy in team sports (Filho et al., 2015; Heuzé et al., 2006a; Kozub & McDonnell, 2000; Leo et al., 2015a; Leo et al., 2016b). Results showed that cohesion was a strong positive predictor of TMS ($\beta = .863$, $p < .001$, $R^2 = .745$) and collective efficacy ($\beta = .650$, $p < .001$, $R^2 = .423$), and the alternative model had acceptable fit of the data ($\chi^2 = 458.738$; df = 182; $p \leq .001$; CFI = .941; TLI = .932; RMSEA = .052; SRMR = .053). Thus, the final step consisted of conducting a χ^2 difference test ($\Delta \chi^2$) to determine whether the hypothesized model fit the data significantly better than the alternative model. A non-significant effect was observed ($\Delta\chi^2(1) = 1.208$, $p = .272$), suggesting that the alternative model did not fit significantly better than the hypothesized model 1. In other words, the hypothesized model was not better than the alerntive model.

Hypothesized model 2. To test whether cohesion factors predicted TMS, we tested a model with the four cohesion factors as antecedents of TMS and collective efficacy as the outcome variable (Figure 2). The hypothesized model 2 showed an adequate fit to the data ($\chi^2 = 400.390$; df = 178; $p \leq .001$; CFI = .952; TLI = .944; RMSEA = .047; SRMR = .043). A χ^2 difference test revealed that this model fit the data better than the hypothesized model 1, $\Delta\chi^2(1) = 58.348$, $p < .001$. In particular, model 2 revealed that only task cohesion factors, GI-T ($\beta = .650$, $p < .001$) and ATG-T ($\beta = .271$, $p < .001$), predicted TMS ($R^2 = .744$).

1   Furthermore, TMS was found to predict collective efficacy ($\beta = .772$, $p < .001$; $R^2 = .596$).

2   Finally, our analysis revealed a somewhat unexpected effect insofar that GI-S was found to

3   negatively predict TMS, albeit the observed effect was low ($\beta = -.136$, $p < .01$). We reasoned

4   that social cohesion at the team-level of analysis (GI-S) can be related to "groupthink" and

5   we expand on the implications of this unexpected finding in the discussion section.

6   **Alternative model 2**. We ran an alternative model with the same paths of the

7   hypothesized model, except that we replaced the direct effect from TMS to collective

8   efficacy with a correlation between these variables. Results showed that task cohesion (GI-T

9   and ATG-T, $\beta = .258$ - $.674$, $p < .001$) predicted TMS ($R^2 = .749$) and collective efficacy (R^2

10   $= .429$). This alternative model 2 had an acceptable fit of the data as the hypothesized model

11   2 ($\chi^2 = 408.062$; df = 176; $p \leq .001$; CFI = .950; TLI = .941; RMSEA = .049; SRMR = .045).

12   A $\chi2$ difference ($\Delta \chi2$) test revealed that this alternative model represented a significantly

13   better fit to the data than the hypothesized model 2, $\Delta\chi^2(1) = 7.864$, $p < .01$).

14   **Invariance test**

15   Invariance analysis was conducted (see Bentler, 1995) to examine whether the final

16   alternative model 2 was equivalent across gender. First, the measurement models by gender

17   were estimated and showed appropriate fit for both genders. For the male group, $\chi^2 =$

18   336.568; df = 174; $p \leq .001$; CFI = .936; TLI = .923; RMSEA = .054; SRMR = .045. For the

19   female group, $\chi^2 = 347.249$; df = 174; $p \leq .001$; CFI = .919; TLI = .903; RMSEA = .056;

20   SRMR = .064. Second, the invariance model, in which the hypothesized model is fitted for

21   both genders concurrently, did not converge. Noteworthy, the fact that the measurement

22   models for both groups showed acceptable fit suggests that the latent variables under analysis

23   have the same meaning for both males and females (Schmitt & Kuljanin, 2008). The fact that

24   the structural models did not converge suggests that the tested relationship among the latent

1   variables (Alternative Model 2) for males and females does not differ significantly

2   (Hershberger, 2006).

3   **Discussion**

4   The purpose of this study was to examine the interrelationship among cohesion, TMS,

5   and collective efficacy in professional football. We hypothesized (H1) that TMS would

6   mediate the relationship between cohesion and collective efficacy in professional football

7   teams. Our results did not support H1 but rather revealed that a non-mediation model, in

8   which collective efficacy and TMS co-vary, is better than the originally proposed model in

9   which TMS mediated the relationship between cohesion and collective efficacy. Together,

10   the final model suggests that cohesion leads to TMS, and that TMS and collective efficacy

11   share a reciprocal effect rather than a causal relationship. Moreover, correlational analysis

12   revealed that cohesion, TMS, and collective efficacy were positively correlated. These

13   findings are in line with previous evidence in sport psychology on the positive relationship

14   among cohesion, shared knowledge states (e.g., TMS and team mental models), and

15   collective efficacy (Filho et al., 2015; Heuzé et al., 2006a; Leo et al., 2015a; Leo et al.,

16   2016a). In practice, these findings highlight the importance of systemic applied interventions

17   that enhance "coming and staying together" (i.e., cohesion), sharing of information within the

18   team (i.e., TMS), and trusting one another and "the team as a whole" (i.e., collective

19   efficacy). In other words, cohesive teammates are more likely to share information with and

20   have confidence in one another.

21   We also tested the specific effects of task and social cohesion on TMS. To this end,

22   we hypothesized (H2) that task cohesion would be a stronger predictor of TMS than social

23   cohesion. Our analysis revealed that task cohesion at both the individual and group level of

24   analysis was a stronger predictor of TMS than social cohesion. These findings are congruent

25   with previous research showing that task cohesion is oftentimes more important to team

1   functioning and performance than social cohesion (see Carron et al., 2002). To this extent,

2   Carron and Brawley (2000) have long noted that "Cohesion has an instrumental basis. All

3   groups – musical groups, work groups, sport groups, committee, form for a purpose. Even

4   groups that may be considered purely 'social' in nature have an instrumental basis for their

5   formation" (p. 95). Noteworthy, the fact that task cohesion was found to be a stronger

6   predictor of TMS in the present study might also reflect our sample of professional sport

7   teams, which by definition "come and remain united" (cohesion) to perform a task. Social

8   cohesion might be more important in less competitive environments, or when task cohesion is

9   similar across competitive teams (Filho, Gershgoren, Basevitch, & Tenenbaum, 2014b).

10   Our analysis also revealed that perceived cohesion at the team level of analysis (GI-T)

11   was a stronger predictor of TMS than task cohesion at the individual level of analysis (ATG-

12   T). Therefore, group-level effects ("we beliefs") might be more important to team

13   functioning than individual-level effects ("I beliefs"), thereby highlighting the importance of

14   multi-level analytical approaches in the study of nested data sets (Muthén & Muthén, 1998-

15   2018). In fact, team processes, such as cohesion and TMS, are emergent states insofar that

16   they arise from "the team as a whole" rather than from any single team member (Grossman,

17   Friedman, & Kalra, 2017). In practice, our findings suggest that the overall "we perception of

18   cohesion" within a team is more important in triggering the development of TMS than

19   individual players' feeling about their bonds to the team.

20   It is also important to note that social cohesion at the team level of analysis (GI-S)

21   was found to be weakly yet negatively related to TMS. These apparently contradictory

22   findings resonate with the well-established notion of "groupthink" (see De Wit, Greer, &

23   Jehn, 2012). High levels of social cohesion can prevent individuals from searching for better

24   action plans, sharing knowledge, and disputing non-optimal decision-making in team

25   settings. In fact, this so called "too much of good thing effect" for team processes has been

1 observed before and illustrates the complexity and non-linearity of team dynamics in sports

2 and beyond (Pierce & Aguinis, 2013). Put plainly, high levels of social cohesion might be

3 functional for some teams and performance contexts but counter-productive for other teams

4 and contexts. For instance, professional sport teams, which were the sampled population in

5 this study, focus primarily on the task and thus might be less susceptible to compromising

6 task performance at the expense of social cohesion. On the other hand, groupthink might be

7 more likely to occur in teams primarily united by the social need to belong (e.g., recreational

8 sport teams). Longitudinal studies are promising avenues of future research to explore

9 whether the relationship between social cohesion with other team processes is indeed non-

10 linear and moderated by other factors such as performance level and sport type (e.g., coactive

11 and interactive).

12   In the present study, we abided by current guidelines on structural equation modelling

13 and tested for alternative models. When considering the aggregated scores for cohesion (H1),

14 our analysis revealed that the hypothesized model wherein TMS mediated the relationship

15 between cohesion and collective efficacy was not superior to an alternative model wherein

16 cohesion was exogenous to TMS and collective efficacy, which in turn were found to share a

17 recirprocal effects relationship (Figure 1). When testing the specific effects of cohesion (H2),

18 our analysis suggested that TMS does not mediate the relationship between cohesion and

19 collective efficacy. Rather, social and task cohesion were found to antecede TMS and

20 collective efficacy, which in turn were found to co-vary (Figure 2). Together, these findings

21 corroborate the notion that cognitive team processes (e.g., TMS, team mental models) and

22 collective efficacy share a reciprocal effect rather than a causal relationship (Filho et al.,

23 2015).

24   Methodologically, this pattern of findings suggests that the analysis of aggregated and

25 non-aggregated data may lead to different conclusions in the study of input-output relations.

Theoretically, these findings corroborate previous input-output models proposed in the literature (Carron & Eys, 2012; Filho et al., 2015), insofar that the relationship between cohesion and other team processes may yield alternative (equivalent and non-equivalent) models. Above all, the relationship among team processes is dynamic rather than "one-size fits all", and thus practitioners must develop systemic interventions tailored to the specific needs of a given team and aimed at concomitantly addressing cohesion, TMS, and collective efficacy beliefs. In particular, the relationship among team processes hinges on individual, team, and contextual factors (Grossman et al., 2017). For a given team (made up of a set of individuals) in a given performance context, cohesion might lead to the development of TMS, whereas in other circumstances cohesion and TMS might co-vary. Similarly to how chemical molecules bind differently to one another depending on a set of circumstances (e.g., temperature, pressure) team processes might relate differently to one another given different circumstances; indeed, that is likely why practitioners speak of "team chemistry" when discussing the relationship among various team processes (see Filho, 2015).

Limitations & Future Research

First, our study is cross-sectional and cause-and-effect relationships as well as time bounded effects cannot be established. Experimental work, comparing established and newly formed teams, might illuminate the means-to-end relationships (i.e., what comes first) among cohesion, TMS, and collective efficacy. In this regard, future research is also needed to differentiate theoretically proximal concepts such as shared mental models, TMS, and team coordination. Longitudinal studies might reveal how and why the relationship among team processes fluctuates (increases or decreases) due to performance and other factors (e.g., home field advantage; low- and high-pressure contexts).

Second, our findings cannot be generalized beyond professional team sports. Accordingly, continued research comparing teams at different competitive levels (e.g.,

1   recreational, college, professional) is important, as the linkage among different team

2   processes (e.g., cohesion, TMS, collective efficacy) might differ due to performance pressure.

3   It is also worth exploring whether the relationship among team processes (e.g., cohesion,

4   TMS, and collective efficacy) vary due to individual (e.g., role within the team), team (e.g.,

5   size of the team), and contextual factors (e.g., cultural effects). To this extent, individual

6   factors, team factors, and contextual factors are thought to interact and together influence

7   team dynamics (Grossman et al., 2017). For instance, playmakers (i.e., players in centralized

8   positions) perceive team performance differently than others (Filho et al., 2014b), and there is

9   also evidence that team size, as well as cultural background and nationality, influences team

10   dynamics in sports (for a review see Carron & Eys, 2012). Finally, comparing high and low

11   performing teams (i.e., the expert novice paradigm) is paramount to identify the mechanisms

12   underpinning optimal performance in team settings, and consequently to advance evidence-

13   based guidelines to develop high-performing teams

14   **Conclusion & Applied Implications**

15   To conclude, we reinforce the importance of systemic interventions addressing the

16   linkage between cohesion, TMS, and collective efficacy. Notwithstanding, although the

17   overall pattern of correlation among cohesion, TMS and collective efficacy was positive,

18   when we analyzed the inter-relationships among these constructs via structural equation

19   modelling our results revealed that GI-S was a negative predictor of TMS. Thus, practitioners

20   must be aware of the "too much of a good thing effect" for social cohesion, and recognize

21   that at times excessive "togetherness" might lead to "groupthink" and preclude rather than

22   propel optimal team functioning in professional football. This aside, enhancing cohesiveness

23   will positively influence the development of shared knowledge states which in turn influence

24   the development of collective efficacy, and vice-versa. Noteworthy, specific

25   recommendations to enhance cohesion, team knowledge and efficacy beliefs are available in

1   the literature (see Argote & Guo, 2016; Carron & Eys, 2012; Short et al., 2005), and we thus

2   invite practitioners to study the so called "reflective indicators" of various team processes

3   (e.g., social and task cohesion; specialization and creditability for TMS; preparation and skill

4   mastery for collective efficacy) in order to be able to propose integrated interventions that

5   unite team members, while facilitating the sharing of information and development of mutual

6   confidence within sport teams.

7

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Table 1

Means, standard deviations, intraclass correlation coefficients, correlations, and Cronbach's alpha's

	M (SD)	ICC	1	2	3	4	5	6	7
1. GI-S	6.63 (1.85)	.21	.85						
2. GI-T	7.11 (1.69)	.14	.60***	.86					
3. ATG-S	6.82 (1.73)	.25	.53***	.62***	.83				
4. ATG-T	6.79 (1.66)	.15	.31***	.38***	.45***	.78			
5. Cohesion	6.84 (1.35)	.23	.79***	.83***	.83***	.67***	.89		
6. TMS	3.91 (0.57)	.27	.40***	.55***	.68***	.51***	.68***	.89	
7. Collective efficacy	3.55 (0.64)	.25	.32***	.40***	.52***	.41***	.53***	.62***	.81

Note. $^*p < .05$; $^{**}p < .01$ $^{***}p < .001$. Cronbach's alpha coefficients are on the diagonal. GI-S = Group Integration-Social, GI-T = Group Integration-Task, ATG-S = Individual Attraction to the Group-Social, ATG-T = Individual Attraction to the Group-Task, and TMS = Transactive memory systems.
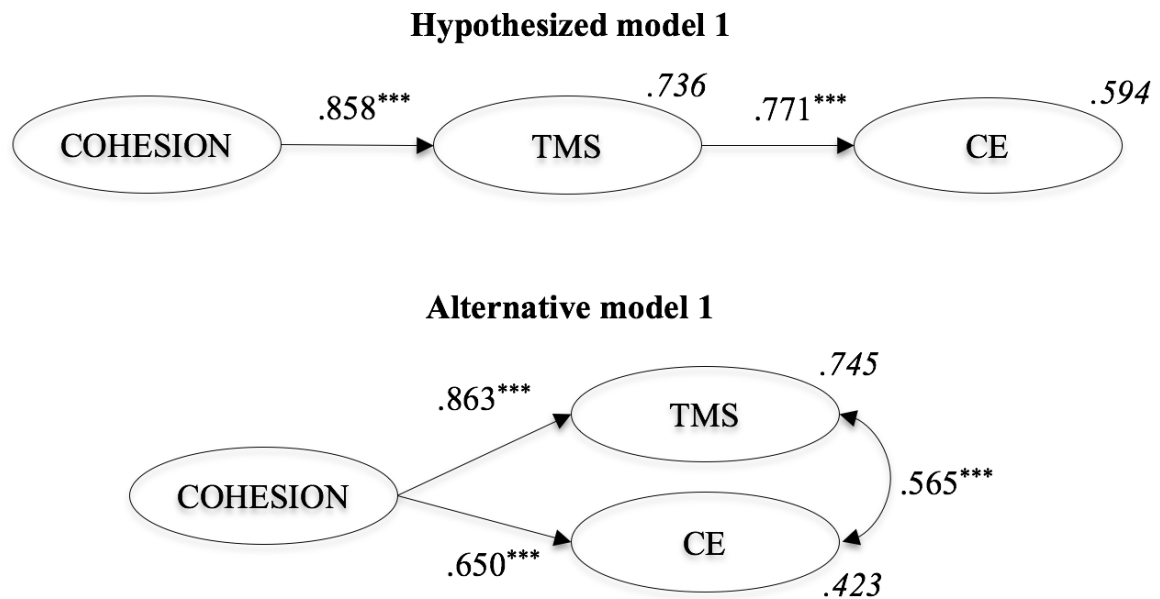
Hypothesized model 1

Alternative model 1

Figure 1. Hypothesised models of group processes.

Note. ***p < .01. Standardized coefficients are presented and proportions explained variance are presented in italics. TMS = Transactive memory systems, and CE = Collective efficacy.
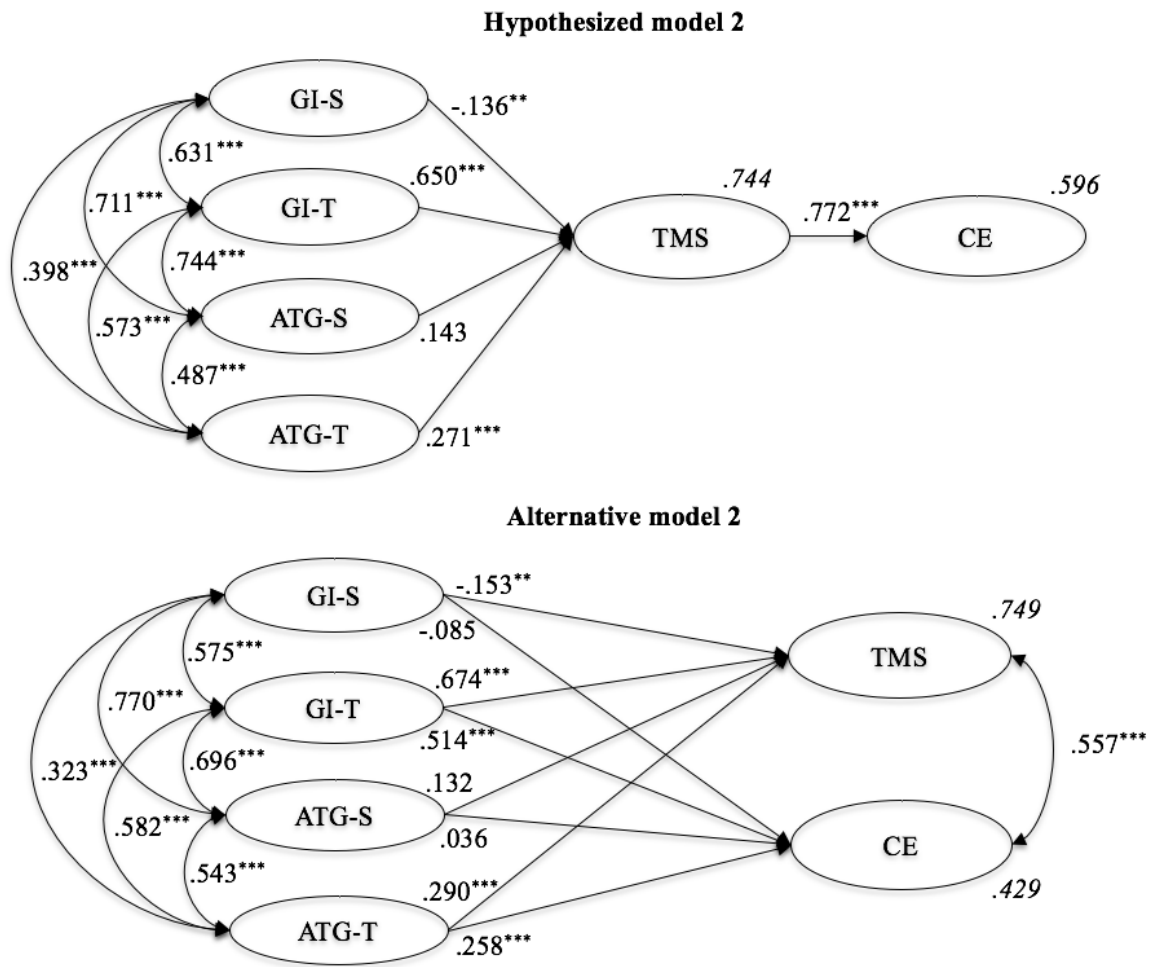
Figure 2. Alternative models of group processes.

Note. ***p < .01. Standardized coefficients are presented and proportions explained variance are presented in italics. GI-S = Group Integration-Social, GI-T = Group Integration-Task, ATG-S = Individual Attraction to the Group-Social, ATG-T = Individual Attraction to the Group-Task, and TMS = Transactive memory systems, and CE = Collective efficacy.