Coaching Shared Mental Models in Soccer: A Longitudinal Case Study

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This study was aimed at capturing the components comprising shared mental models (SMM) and the training methods used to address SMM in one athletic program context. To meet this aim, two soccer coaches from the same collegiate program were interviewed and observed extensively during practices and games throughout the 2009–2010 season. In addition, documents (e.g., players’ positioning on free kicks sheet) from the soccer program were reviewed. The data were analyzed inductively through a thematic analysis to develop models that operationalize SMM through its components, and training. *Game intelligence* and *game philosophy* were the two main operational themes defining SMM. Moreover, four themes emerged for SMM training: (a) the setting, (b) compensatory communication, (c) reinforcement, and (d) instruction. SMM was embedded within a more comprehensive conceptual framework of team chemistry, including emotional, social, and cognitive dimensions. Implications of these conceptual frameworks are considered for sport psychologists and coaches.

**Keywords:** shared mental models, athlete, coaching, reinforcement, communication

Shared mental models (SMM) pertain to “knowledge structure(s) held by each member of a team that enables them to form accurate explanations and expectations . . . and in turn, to coordinate their actions and adapt their behavior to demands of the task and other team members” (Cannon-Bowers, Salas, & Converse, 1993, p. 228). The cognitive concept of SMM has been used to study team operations in the

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military, education, industry, and high-technology developers (see Johnson & Lee, 2008; Levesque, Wilson, & Wholey, 2001; Mathieu, Heffner, Goodwin, Salas, & Cannon-Bowers, 2000; Zhou & Wang, 2010). However, sport studies utilizing SMM remain scarce. Despite this scarcity, formative conceptual contributions have been proposed by Eccles and Tenenbaum (2004, 2007), Eccles and Johnson (2009), Eccles (2010), and a special issue in the *International Journal of Sport and Exercise Psychology* (IJSEP, 2006).

**Shared cognition**, used as a synonym for SMM, was claimed to have an important role in the performance of team sports, such as soccer (Eccles, 2010), basketball (Webber, Chen, Payne, Marsh, & Zaccaro, 2000), and football (Eccles & Tenenbaum, 2004), where athletes perform under time constraints and physiological restrictions in dynamic (e.g., movements of teammates, opponents, and the ball) and judgmental (e.g., fans, TV viewers, coaches, and team’s owner) environments. In team sports, many actions are responsive to situational changes, leaving little time for overt communication (Reimer, Park, & Hinsz, 2006). In addition, when performing under time and workload pressure, SMM becomes a necessity in securing a high level of attainment where coordination breakdowns often transpire (Kidd, 1961; Klimoski & Mohammed, 1994; Stout, Salas, & Fowlkes, 1997). Yukelson (2006) quoted a National Collegiate Athletic Association (NCAA) Division I football players who disclosed, “If I can walk up the line of scrimmage and know that the offensive tackle next to me is thinking the same thing I am, has internalized what needs to be done on this particular play . . . then I know with great confidence, we are going to execute the upcoming play with precise timing, intensity, and cohesiveness” (p. 174). This quote captures both the essence of SMM and its importance to team performance.

Although shared cognitions, emotions, and attitudes in team sports are considered crucial components to overall functioning in a competitive sport setting, Eccles and Tenenbaum (2004) posited that it remains a challenge for investigators to capture this complex phenomena. In terms of shared cognition, the challenge is augmented by the fact that perhaps the term *shared mental model* is less favorable in the applied context due to its scientific connotation. Instead, parallel terms, including *chemistry* or *being in sync*, are used by coaches and players to explain aspects of a SMM. An inductive qualitative approach was deemed appropriate to capture the coaches’ perception of SMM and its integration into their competitive teams’ training program.

The theoretical framework guiding the forthcoming research questions and methodology was proposed by Eccles and Tenenbaum (2004). According to their framework, team coordination is dependent upon shared understanding developed before, during, and after (pre, in-, and postprocess shared understanding, respectively) team actions. This framework is in line with our view that team members can enhance performance by analyzing actions prior, during, or after task-related activities (see also Carron, Hausenblas, & Eys, 2005). Eccles and Tenenbaum (2004) stated that shared goals and game plans are essential to promote *preprocess* shared understanding. There is a general agreement that role clarity (i.e., team members’ understanding of their contributive social and cognitive responsibilities to the team), shared mental plans, and goals promote effective information sharing in working teams (Klimoski & Mohammed, 1994; Reimer et al., 2006; Schinke, Draper, & Salmela, 1997). In nonathletic
settings, several routes to enhance shared cognition in the pre-process phase have included team-interaction training (Stout et al., 1997), leader briefing (Marks, Zaccaro, & Mathieu, 2000), and cross training (Volpe, Cannon-Bowers, Salas, & Spector, 1996).

Concerning in-process shared understanding, Eccles and Tenenbaum (2004) postulated that verbal and nonverbal communication is required to coordinate collective actions. Other scholars (e.g., Salas & Klein, 2001; Yukelson, 2006) also have emphasized that effective communication is associated with increased homogeneity and agreement concerning beliefs, cognitions, affect, and behaviors. Nevertheless, it should be noted that reliance on communication may imply a lack of SMM (i.e., the players need to communicate to understand one another; see Entin & Serfaty, 1999; Kidd, 1961). Furthermore, communication may reveal future actions to the opponents. When team members can coordinate through shared schemas, communication can be minimized, preventing the disclosure of strategies outside of the team. Eccles and Tenenbaum also pointed out that in-process actions are influenced by time pressure, leaving team members limited planning time, and therefore requiring fast, decisive action. Coordination and adaptation training was proposed as an effective strategy to meet these in-process challenges by transitioning from explicit to implicit coordination (Cannon-Bowers & Salas, 1998). Team monitoring and backing-up behaviors also were offered as an appropriate training program during the in-process phase (Porter, Gogus, & Yu, 2010).

Finally, Eccles and Tenenbaum noted that postprocess evaluation is linked to the development of shared understanding. Therefore, verbal debriefing (e.g., sharing experiences among players and personal reflections in a group setting) can be employed as well as visual evaluation (e.g., video analysis). These strategies correspond to both self-correction training (Blickensderfer, Cannon-Bowers, & Salas, 1997) and guided team reflexivity (Gurtner, Tschan, Semmer, & Nägele, 2007). Despite the various possible routes to facilitate shared cognition postperformance outside of sport settings, little is known about its actual facilitation in sport. Our objective was to delineate, based on an entire competitive season, how two coaching staff members in one sport team integrate SMM components to work in situ.

Although this study was guided by Eccles and Tenenbaum’s conceptual framework, the term SMM was favored over their suggested term shared knowledge. In our opinion, the term SMM better represents the predictive probabilistic nature and the uncertainty level involved in a sport team’s decision making.

**Method**

Observations were sought to establish a model representing the coaches’ SMM training methods. Semistructured interviews were conceived, primarily to explore how the coaching staff perceived SMM components to work as part of a SMM process. This combination of qualitative methods was essential to delineate training processes with the components intended by the coaches (Tenenbaum, Gershgoren, & Schinke, 2011). Because the scientific concept of SMM in sport psychology has received scant attention, a conventional postpositivist qualitative approach akin to the work of Gauthier, Schinke, and Pickard (2006) was chosen to guide the inquiry, and permit an inductive-deductive approach to broaden and deepen its
theoretical tenets. Building upon previous work, where typically only interviewing was employed in related studies, the investigators also decided to observe their coach participants, and examine documents relating to their coaching practices (i.e., training plans, schedules). Hence, the present submission entails a qualitative mixed methods approach.

Though epistemologically informed, postpositive qualitative methods typically require saturation across participants in the development of themes, subthemes, and models. We propose that information-rich case studies might also be employed (provisionally) through a longitudinal design with a few select participants. Such case studies can offer the reader insight into how one or a few participants employ cognitive processes as part of their work in situ. Chase and Simon’s (1973) work on expertise is an example of a well-cited study that was based on merely three participants, a single participant from each of the three skill levels. In the current study, two coaches were targeted. Coaches play a central role in developing SMM in their team through leadership. To ensure data quality, a criterion sample was set. The criteria included the following: (a) the team’s level, (b) the players’ ages, and (c) the coaches’ training level and experience.

Researchers’ Assumptions

The researchers held several assumptions that informed this project. First, it was assumed that SMM occurs in well-trained teams. Shared understanding is derived through hours accumulated by a team as they train and compete together. Such understanding is more than modes of verbal communication. Through hours of well-structured drills and comprehensive education provided by a competent coaching staff, the athletes learn to share strategies and anticipate their implementation, be those strategies spoken or unspoken. Second, cognition in sport is best gleaned from athletes from the latter years of adolescence and onward. Third, according to postpositivism, researchers can seek to be objective and suspend their values throughout the research process (Patton, 2002). Nevertheless, several additional measures were taken to further augment objectivity. Therefore, although the research team did not engage in a reflexive interview in advance of the project, they did discuss their personal biases as a group in advance of data collection and remained aware of these biases during the data collection and analysis to centralize the participants’ explanations. Furthermore, they sought to minimize these biases through nonjudgmental supportive listening where the researcher seeks out the participant’s perspective and supports that perspective to gain a deeper understanding of the participant’s lived experience (Patton, 2002).

Participants

Two coaches from a single soccer program were chosen as the participants. These coaches were the head coach and the assistant coach of the male and female collegiate soccer teams. The head coach had more than 10 years of experience, with an Advanced National Diploma from the National Soccer Coaches Association in America (NSCAA). The assistant coach held a United States Soccer Federation (USSF) National D Coaching License, had 3 years of experience at the collegiate level, and was the director of a soccer club.
Data Collection

Data were collected throughout a full training season (i.e., the 2009–2010 season). The first author followed the coaches throughout two semesters (i.e., fall and spring). While the fall semester pertained to competition, the spring semester was geared toward training and preparation for the following year. It should be noted that neither coach worked at an institution where the coauthors worked, thus ensuring their anonymity. In advance of the project, the lead researcher assured the two coaches that their anonymity would be protected. Subsequently, the coaches signed their consent forms and engaged in the project. The data were comprised of interviews, observations, and archived records, gathered upon institutional review board approval.

Observations. Throughout the coaching year, the first author observed team practices, as well as official and scrimmage games for the duration of 30 hr. In addition, he attended team meetings held before training and at games during half-time; he also attended posttraining and postgame, and recorded all visual instructions. During practices, the researcher focused initially on environmental aspects such as the field’s surroundings and equipment (e.g., cones, balls). Notes regarding verbal and nonverbal communication between the coaches and the players, and among the players were recorded during performances. During games (i.e., official or scrimmage), the researcher registered minute-by-minute descriptions of events (which included movements of teammates and opponents) and verbal and nonverbal communication on the field and between the coaches and the players. Data collection ended when the first author achieved saturation, at which point no new findings were identified.

Semistructured interviews. The interviews were semistructured, allowing the researchers to engage in flexible questioning derived from a preexisting interview guide (Patton, 2002). Patton’s technique of probing through follow-up questions (i.e., detail probes, elaboration probes, clarification probes, and contrasting probes) was employed to facilitate in-depth and comprehensive explanations. The questions for each participant’s initial interview included six open-ended questions. These questions were developed based on Eccles and Tenenbaum’s (2004) conceptual framework. The interview guide started with a short introduction to explain the research topic. Applied terms, such as team chemistry and being in sync were used to clarify the term SMM. The first interview with the head coach took place at his office just before his team’s game. The assistant coach was interviewed at his home. Upon the coaches’ request, only notes were taken during the interviews.

The second interviews centered on emergent aspects from the observation data, including questions pertaining to activities during practice and games, which facilitate SMM. These interviews consisted of five questions that allowed the coaches to clarify and expand on the observation data, and in some cases, to correct the researchers’ provisional interpretations. Supplemental questions were posed according to the unique course of the interview, again via probing questions. Provisional associations among categories derived from the earlier data were shared with the coaches, and feedback was sought as the latter part of the interview discussions. The second interviews afforded data elaboration where such elaboration was perceived by the authors as needed, while also serving to validate the associations.
among the emergent categories. The interviews took place following initial data collection and analysis. The content from the interviews were approved by the coaches as part of the member check.

**Documents.** Throughout the inquiry, documents were collected. The documents included copies of the head coach’s sketches made on the team’s board at the locker room before games, on half-time breaks, or after games. In addition, a document containing the team formation in various free kicks and corner kicks was obtained. The documents were complemented by written or verbal explanations. For example, placements of players before a corner kick were drawn, and respective written instructions were underlined. An additional example was drawn on the team board to support the coaches’ verbal instructions.

**Data Analysis**

All of the data were then integrated, including the interviews, observations, and documents. Inductive and deductive content analyses were employed, as suggested by Vazou, Ntoumanis, and Duda (2005) and featured in the work of Schinke, Gauthier, Dubuc, and Crowder (2007). Initially, an inductive content analysis was performed by the first author. The raw data were read in depth and a postpositive coding procedure (i.e., creating meaningful units; MUs) was employed during the initial interpretation stage. Overall, 313 MUs were obtained through interviews (105 MUs), observations (192 MUs), and documents (16 MUs). Next, codes were grouped into higher order categories. With respect to deductive content analysis, previous knowledge of the cognitive-behavioral linkage was considered while analyzing the observations. For example, when reinforcement was provided by coaches or peers, it was assumed that the targeted behavior had a higher probability to be repeated. Once the categories were determined, the researcher examined the data while keeping the models in mind to verify that all the MUs were integrated. During data analysis, consensus was sought among the authors. The processes used to achieve consensus are provided below.

**Trustworthiness**

Lincoln and Guba’s (1985) trustworthiness guidelines were employed to enhance this project. Credibility was enhanced through prolonged engagement, triangulation, member checks, and peer debriefing techniques. Prolong engagement was sought throughout the year-long investigation. The first author developed a strong rapport with the participants through the prolonged engagement, which allowed for more openness during the second interview and also during the observations. Further, the extensive engagement allowed the lead researcher to follow-up on provisional associations among the data and search for consistencies in terms of behavioral patterns. Data triangulation was achieved by gathering multiple data types and also through successive interviews. Given the approach employed within this project, and also the intent to delineate a SMM, the triangulated data increased the likelihood that the forthcoming results were relatively accurate of the participants’ cognitive processes. Member checks were employed twice during the analysis. The interviews, and subsequently, the models, were sent to the coaches and confirmed as accurately fitting their viewpoints. Next, following guidelines
proposed by Cresswell and Eklund (2007), peer debriefing was conducted with the second author, who served as an independent researcher and critically examined the completed conceptual framework. To meet this end, the second author reviewed the raw data and the emergent models, and challenged the first author regarding their differences in opinion and biases. Disagreements were discussed by using the raw data until consensus was achieved.

Results

Two aspects of SMM, components and training methods, were the core interest of this study in the form of cognitive-behavioral linkages. The core concepts of these aspects are presented in Figures 1 and 2 and are followed by representative data from the interviews, observations, and team-related documents, chosen by the first and second authors.

Components of SMM

Figure 1 illustrates two main themes, which emerged from the data pertaining to the components of SMM. The first theme pertains to how game intelligence is associated with SMM implementation. The coaches revealed four categories for the importance of game intelligence in implementing SMM. These categories included: (a) anticipation (7 MUs), (b) creativity (4 MUs), (c) knowing each other’s abilities (3 MUs), and (d) experiences in soccer (3 MUs). The second theme centered on how shared game philosophy is related to peak SMM. Game philosophy related to a global perspective of the team’s game style (e.g., offensive vs. defensive, preferred formation). Three categories of game philosophy related to SMM emerged from the data. These categories were: (a) tactical understanding (12 MUs), (b) agreement between the coaches and the players (13 MUs), and (c) agreement among the players (15 MUs). Tactical understanding had only practice as a subcategory. Subcategories for the latter two categories were recruitment and practice. Examples of MUs from the data follow.

Game Intelligence and SMM Implementation

Anticipation. Anticipation is the ability to predict upcoming events based on current information. The assistant coach stated, “On the field, it is more related to game intelligence. I know what every player on the field will do if X happens.” He added, “You know the movements on the field according to the tactics formation.”

Creativity. Creativity is the ability to solve problems or create opportunities in an innovative and unexpected way. The head coach pointed out, “The more creative players have the ability to change the structure in order to get an advantage.” Later, he supplemented, “Hockey and basketball are more similar to soccer because they are geared more towards creativity. The players are the ones who are making the calls in soccer.”

Knowing each other’s abilities (advantages and disadvantages). “Initially, every player needs to know his place and do his part in the deal. . . . then, he should strive to understand what other players bring to the table and how they bring it,”
claimed the head coach pertaining to players’ abilities. The assistant coach reflected, “You know that a player will go or not because he or she are fast or not.”

Experiences in soccer. This term refers to the length and quality of participation in the sport. “[Game intelligence] is something that builds throughout the years, and the players need to know how to bring this knowledge to their tactics,” said the head coach. “How are you going to anticipate what is about to happen? It is related to experience.” stated the assistant coach.
Tactical understanding. Tactical understanding is the ability to understand and execute tactical instructions. During a game, the following was observed: 3rd min—a goal kick, the players move to their positions according to the formation. The formation on the field appears to be 4-3-3 [OC: supported by the coach]. The assistant coach postulated, “With the guys, we can do [drills] with full formation because we have enough players. With the girls, we do offensive formation versus defensive formation, and each of us [the coaches] deals with one line so we create small schemas for many situations. With 6 × 4, it doesn’t imitate real game completely, but it helps.”

Agreement between the coaches and the players. This aspect refers to coaches and players sharing similar approaches toward the sport/game. The head coach reflected upon the recruitment process, “As a coach, you need to recruit the players that fit your game philosophy.” The assistant coach clarified, “X is a very offensive player, and he creates a problem in the formation because we [the coaches] have a defensive philosophy and he is the first line of the defense—the apex of the defensive formation. He created holes in the defense, and we paid for it.”

Agreement among the players. This is the degree to which the players among themselves share similar approaches toward the sport/game. “New recruits are often invited to scrimmage games or practices. Then, I ask players how comfortable were they with this player, and if they think the player may fit the team. Definitely, I take their opinions into consideration,” said the head coach. “The field is very big, and it is impossible for the coach to control every point in it. That is why eventually the players make the decisions,” claimed the head coach. “[Agreement among players is] very important . . . take the same example of player X [this player discussed earlier in the interview], the other players couldn’t anticipate his defensive moves and couldn’t cover appropriately, and the team suffered from it,” explained the assistant coach.

SMM Training

Throughout the interviews, the crucial role of the practice for enhanced SMM emerged. The head coach postulated, “In practice, make them understand how to execute the tactics. If you teach them something, make sure they are performing it appropriately in time and space so all the players can understand.” The assistant coach added, “Sometimes, we put the players in their positions, move the ball, see how they move and correct their mistakes.” Furthermore, ways in which coaches enhance SMM were observed in competitive games and scrimmages. Four main themes emerged from the data for SMM facilitation (see Figure 2). These themes include practice/game setting, compensatory communication, reinforcement, and instructions.

Three categories emerged for the practice/game setting theme. These included rapid decision making (DM), reduced communication, and variety of situations. The first two were manipulated by the same subcategory: practice/game intensity. However, practice/game intensity was determined by three factors: (a) the size of
Figure 2 — The facilitation of shared mental models.
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the practice area (7 MUs), (b) the number of player per area (6 MUs), and (c) the performance’s pace (11 MUs). Variety of situations was subcategorized into specific tactical situations (e.g., high vs. low pressure, playing high balls when perceiving the opponent to struggle in that matter; 11 MUs), the number of players (e.g., 11 × 11, 11 × 10; 9 MUs), formation (e.g., 4–3–3, 4–5–1; 9 MUs), environmental conditions (e.g., atmosphere, field condition; 8 MUs), and the score (e.g., leading, being behind; 3 MUs).

Two categories were identified for compensatory communication: verbal communication and nonverbal communication. Subcategories for the verbal communication included communication made by the players as well as by the coaches (24 and 21 MUs, respectively). Compensatory nonverbal communication was slightly used by the coaches but predominantly among the players (4 and 15 MUs, respectively).

Pertaining to reinforcement, two categories emerged: verbal reinforcement and nonverbal reinforcement. Subcategories for both verbal and nonverbal types of reinforcements include reinforcement made by coaches and by players (VC = 13, NVC = 3, VP = 4, and NVP = 6 MUs).

The last theme to emerge from the data pertaining to SMM enhancement was instructions. The two categories emerged from the data for this theme were specific (immediate) instructions given by both coaches and players (18 and 11 MUs, respectively), and general instructions (expectations) provided only by the coaches (31 MUs). Evidences from the data were used to support these themes and their categories.

The practice/game settings and SMM enhancement. The following is from a practice observation note: [The drill] included 3 small areas (about 3 × 3 yards/meters) . . . In each area, 6 players were practicing (4 vs. 2). The drill was very intense and fast. Extra balls were located next to each area, so when a ball went out the players immediately took another one and continued. Only few words came out of the player’s mouths. Throughout the drill, the coaches gave many professional comments such as, “You need to make decisions fast, quick responses” and “We have to be ready all the time.”

Compensatory communication and perceived deficit in SMM. During a practice, the following verbal communication-related behavior was observed: During the drill itself . . . sometimes, they used the player’s names to get her attention when she handled the ball. Pertaining to nonverbal communication, the lead researcher recorded the following observation: Communication included mainly hands clapping . . . clapping was related to attracting the attention of the player with the ball.

The head coach reflected on communication, “We need to use verbal and nonverbal communication smartly, thus we have our own terminology. For example, left shoulder can be a lot of things. You don’t know what it means, but the players do.”

Reinforcement and SMM facilitation. During the 43rd minute of a game, the following was observed: The keeper claps his hands, encouraging the players who took their position while screaming “good job, good job.” [Throughout practice] clapping was related to attracting the attention . . . and facilitating a performance well done.

Instructions aimed at enhancing SMM. During practice, professional comments such as “Switch it up,” “Open an angle,” “Back to defense,” “Open up,” “Get away,”
“Get far,” “Move to the middle,” and “If you didn’t get it when you check in, check out,” were provided by the coaching staff. Another example of instructions aimed at SMM enhancement was observed during the team’s half-time meeting. During the meeting, verbal and illustrated instructions were jointly used by the coaches. For instance, while displaying his ideas on the team board, the head coach instructed the players to commit diagonal movements more frequently to create confusion among the opposing team defenders. Furthermore, again while displaying his instructions on the board, the head coach asked the players to pass the ball to the sides of the field forcing the sweeper to slide from the middle toward the ball. Subsequently, to the sweeper sliding from the middle, the coach asked the players to cross the ball to the other side of the field where an open space evolves. The coach even further requested the wingman/striker to look for a $1 \times 1$ dribble next to the sidelines to draw the defense from the middle even further before a cross ball is delivered. This instruction was jointly presented with an illustration on the team’s board.

**Emotional and Social Aspects Contributing to SMM**

In several cases throughout the interviews, the coaches identified emotional and social aspects as factors affecting SMM. The coaches postulated that nonoptimal emotional or social states are associated with cognitive debilitation in general and shared cognition in particular. Briefly stated, they perceived emotional and social aspects to interact with the cognitive aspect while underlying team chemistry. For example, the assistant coach said, “You have to find a way to overcome the social obstacles that impact team chemistry from outside. They bring [a] negative effect.” Four main categories underlie the two themes of emotional and social aspects (i.e., two for each). Efficacy beliefs (5 MUs) and emotional support (8 MUs) underlie emotions. Challenge support (6 MUs) and a fair attitude (23 MUs) were identified for social aspects. The following quotes were evidence of these categories as well as the subcategories presented within each category (see Figure 3).

**Efficacy beliefs.** “Team chemistry consists of a belief that each player can impact the game,” stated the head coach. The assistant coach said, “When you know that this is your role and the way you need to do it, it impacts your emotions. It impacts being mad with yourself and others. If you understand the game, you become calmer with yourself or others.”

**Emotional support.** The assistant coach explained, “X focuses on what works well, and he supports the players who are frustrated by pointing out what works instead of what doesn’t. Clapping [during practice] was related to receiving the attention of or encouraging a player who made a mistake.”

**Challenge support.** An example of a player who supports his teammates by challenging them was provided, “X is a player who says the right things [to motivate his teammates].” The assistant coach reflected on their behaviors as coaches, “Sometimes, we make them afraid of failure instead of seeking successes, and it impacts their performance. They are playing simple when they can do more.”

**A fair attitude.** “You have to be clear . . . and more stable with how you enforce your rules,” the assistant coach claimed pertaining to team rules. With relation to punishment, he added, “They [the players] remember the punishments you have
given before, and instability creates resentment.” The assistant coach concluded, “[About punishing players differently] they thought it was because she is one of the best players and not because the circumstances were different.” The head coach reflected on differences between genders: “The girls perceive us to act differently with the guys but the differences stem from the number of players we have in these teams . . . the rules are the same and so are the schedules, gear, obligations, and expectations.”

**Discussion**

The aims of this study were: (a) to examine how two competitive collegiate coaches perceived SMM components to be, and (b) to capture which SMM training methods were incorporated into their practice regimen *in situ*. Two main themes emerged as SMM components. These themes were regarded as facilitative of shared execution, and focused on game intelligence and game philosophy. *Game intelligence* was subcategorized into anticipation, creativity, knowing each other’s abilities, and experience in soccer. Anticipation was presented by the coaches as the players’
ability to predict: (a) what is about to happen and (b) the actions that follow by their teammates and their opponents. This ability is believed to be required for superior SMM because it allows the players to make decision in early stages of the upcoming event, and at the same time minimize their reliance on reaction time (Eccles & Tenenbaum, 2004; Reimer et al., 2006; Tenenbaum & Bar-Eli, 1993). Creativity was presented as an advantage, which was reflected within the team’s SMM. Creativity among the athletes was expected by the coaches so that performances would reflect “outside the box” thinking and an advantage as compared with the opponents. Correspondingly, McFadzean (1998) proposed that creative problem solving may provide the flexibility needed to gain a competitive edge. According to the coaches, “knowing each other’s abilities” was developed through repeated collaborations among the players within a carefully structured environment. In addition, shared understanding enabled the players to evaluate what they were expected to do as a part of the team. Indeed, the importance of such knowledge was supported by Reimer et al. (2006). Having “experience in soccer” and “long term exposure to the sport” were themes identified several times throughout the interviews. Thus, the coaches expected their experienced players to use their cognitive schemas of the game to their advantage. Tenenbaum and Land (2009) proposed that by applying such schemas, players store and retrieve information faster, and use this information to enhance their performance. Furthermore, through experience, athletes develop probabilistic-type schemas that allow them to better anticipate upcoming events and actions (Eccles & Tenenbaum, 2007).

The second theme, game philosophy, was divided into tactical understanding, agreement between coaches and players, and agreement among players. Tactical understanding was emphasized during the interviews, games played, and the practices. The coaches elaborated on the importance of the team’s formation (i.e., the players’ initial positions; e.g., 4-4-2, 4-5-1) as the baseline for the team’s actions. They claimed that formation provided the “big picture” to the players, and created a shared basic schema for performance expectations. Then, the player combined this big picture with other dynamic information (e.g., the situation on the field, the players’ abilities, the score) to create a more accurate and situational-related schema. Tactical understanding was developed mostly during practices. The coaches determined the formation (basic schema) and evaluated its effectiveness; however, the players eventually implemented it. Thus, an agreement between the players and the coaches and among the players regarding the game philosophy was essential for coordinated efforts. This agreement was established by recruiting players who matched with the coaches’ game philosophy.

The two themes of game intelligence and game philosophy included balance between personal abilities (e.g., anticipation, creativity, experience), and collective abilities (e.g., knowing each other and an agreement about game philosophy). Hence, in keeping with Eccles and Tenenbaum’s (2004) work, SMM emerged as a complex and multidimensional concept, requiring a delicate balance between personal and collective factors. Moreover, the categories emerged from the coaches’ interviews may be presented in a hierarchical order from broad to narrow, as identified by Vicente and Wang (1998). Hence, game philosophy and tactical understanding represent strategies and tactics, and are considered relatively among the broad aspects, while experience, knowing each other’s abilities, creativity, and anticipation are narrow aspects which represent the functions and players categories in Vicente and Wang’s model.
The second part of this study featured the facilitation of the SMM. Four themes were identified: practice/game setting, compensatory communication, reinforcement, and instructions. Setting a practice or a game purposefully for addressing SMM emerged as an important aspect. Because (a) decision-making under temporal pressure relays on mental representation and anticipatory skills (Tenenbaum & Land, 2009), and (b) communication can serve as a compensatory mechanism to overcome impaired SMM (Eccles & Tenenbaum, 2004), the setting should be crafted to consider those aspects. Consequently, the setting was aimed at facilitating rapid decision-making, and also reducing communication transparent to their opponents. These goals were reached by establishing a high-intensity workload, which was manipulated by the size of the practice area, number of players per area, and the performance’s pace. Such principles correspond to previous findings pertaining to reduced communication (Kanki, Lozito, & Foushee, 1989), and increased implicit coordination (Entin & Serfaty, 1999) in teams under high workload conditions. These principles also correspond to the coordination and adaptation training that aims at enhancing the transition from explicit to implicit coordination under pressure. Indeed, coordination and adaptation training was found to be the most beneficial training for enhancing shared cognition in a meta-analysis conducted by Salas, Nichols, and Driskell (2007).

The setting also was used by the coaches to expose their players to various game situations in the form of simulations. To create realistic circumstances in training, the coaches allowed their players to: (a) practice relevant tactical situations (e.g., high vs. low pressure); (b) play in various formations that might be used in games; (c) play with a varying number of players (i.e., equal amount of players, while outnumbering their opponents or while outnumbered by their opponents); (d) imitate performing under varied field conditions (e.g., weather, size, turf); and (e) imitate playing while being ahead or behind in score. Indeed, situational training, as part of a team training program, was found to be beneficial for team performance (see Morey et al., 2002).

Communication related to the remaining components of SMM facilitation. While compensatory communication mostly focused on creating a concealed vocabulary (i.e., implicit communication), reinforcement and instructions emerged as overt communication aimed at enhancing SMM. When SMM is impaired, coaches and players use communication channels to ensure the appropriate decision is made to facilitate performance (Eccles & Tenenbaum, 2004). Although this communication may expose the players’ positions and reveal their intentions to opponents, sometimes the benefits exceed the costs. Hence, when used, communication should be employed with care by using unique terminology to minimize transparency. Inversely, it should be noted that enhanced SMM minimizes verbal communication and thus results in an important advantage, especially under pressure (Kidd, 1961; Stout et al., 1997).

Reinforcement was used to facilitate required behaviors and reduce undesired behaviors (Kazdin, 2001). Throughout the observations, the use of reinforcement to facilitate SMM was supported, as team members were encouraged both verbally and nonverbally after making appropriate decisions and were castigated after making wrong ones. Reinforcements were given by the coaches and also by teammates. Prior and during performance, tactical and strategic instructions were observed as the most explicit method for coaches to develop SMM. Instructions were transparent and aimed at shared understanding about expected behaviors in specific
circumstances. Precise instructions were mostly given during the performance. General instructions were mostly provided on the team’s board before a game, during the half-time or postgame meetings, and in initiated practice breaks. The importance of proactive information and communication methods are established in the literature as tools to develop SMM and consequently enhance team performance (see Eccles & Tenenbaum, 2004; Yen, Fan, Sun, Hanratty, & Dumer, 2006). Strategies for SMM development, such as leader briefing (i.e., in the preprocess phase), backing-up behaviors (i.e., in the in-process phase), and team self-correction (i.e., in the postprocess phase), rely on proactive communication in the forms of instructions and reinforcement.

**Emergent Findings**

Two aspects were consistently observed throughout the season, with both aspects complementing the tactical part of practice: (a) technical ability and (b) physical fitness. Conceptually, Tenenbaum and Land (2009) and Wulf (2007) proposed that these components indirectly affect schema utilization (i.e., SMM) through one’s availability of attentional resources and attention allocation.

Throughout the interviews, the coaches shared their views pertaining to the interaction between the cognitive and the emotional and social aspects. Indeed, Tenenbaum and Land (2009) proposed that it is harder to retrieve and use cognitive schemas when being occupied with interpersonal matters or while being overwhelmed with emotions. From these additional components, an expanded model emerged, geared toward team chemistry, including the emotional, social, and cognitive (i.e., SMM) components.

**Efficacy beliefs, a fair attitude, and social support** (i.e., challenge and emotional support received from teammates and coaches) emerged as important aspects with relation to team chemistry. Social support related to performance, task cohesion, and team climate (Rees & Hardy, 2000; Rees, Ingledew, & Hardy, 1999; Westre & Weiss, 1991). A fair attitude toward the players was associated with a mastery motivational climate, which is found to be facilitative of performance-related aspects (e.g., higher level of intrateam attraction and reduced levels of anxiety; Smith, Smoll, & Cumming, 2007, Smith, Smoll, & Curtis, 1979). Many studies have supported the predictive power of self-efficacy over adaptive cognitions and performance quality (e.g., Moritz, Feltz, Fahrbach, & Mack, 2000). Nevertheless, it was revealed recently that collective efficacy mediates the relationship between task SMM and team effectiveness (Mathieu, Rapp, Maynard, & Mangos, 2009). Moreover, the cognitive-emotional-social linkage presented by the coaches corresponds with the linkage proposed in the conceptual framework of team coordination (Eccles & Tenenbaum, 2004). Nevertheless, this linkage is far from reaching its exploratory potential.

**Limitations**

The study’s findings consist of a small participant number (N = 2) and a single context of one collegiate soccer team. Comprehensive observations in this context yielded an emergent SMM framework termed “team chemistry.” Although qualitative studies are often not aimed at achieving generalizability (Patton, 2002), the
findings of this inquiry can inform our understanding of a SMM, its components, and its facilitation in situ. Nevertheless, as the authors lacked “blindness to the hypotheses,” confirmatory bias is a competing hypothesis for these data and must be addressed in future studies. A case study such as the one presented here allowed for a rich description of participants’ experiences, which shed light on aspects, to our knowledge not yet addressed within the sport psychology literature.

Future Directions

From this case study that presented SMM’s framework in one sport context, the next step for researchers is to expand on this provisional work, broadening this work to coaches from a variety of teams and sports at each level of performance. Furthermore, the generalizability and specificity of the conceptual models presented must be studied through the employment of several methods. For example, each variable can be operationally defined via introspective and observational methods. Then, through data collection, the variable may be subjected to confirmatory techniques for testing its convergent and divergent validity, as well as testing its construct and predictive validities. Furthermore, various methodological approaches to qualitative research might be used to understand different aspects of this burgeoning research trajectory. For example, one might use participatory action research when working within a team context to answer some of the challenges the team is experiencing in regards to their shared mental models; thus, creating enhanced processes from within the context. The range of approaches open to sport scholars when seeking to understand shared mental models is mostly uncharted and worthy of attention.

Practice Implications

Several team SMM facilitation methods emerged from the specific context of the soccer program presented here. These methods centered on (a) using a recruiting system where one might consider the coaches’ and the players’ shared game philosophy, (b) setting the practice purposefully and using instructions and reinforcement appropriately, and (c) developing covert or restricted communication. Nevertheless, these methods do not necessarily fit all teams and contexts. It is, therefore, the professional staff duty to identify which of these methods may match their team and sport context.

Conclusion

This research emphasizes the importance of a particular type of postpositive qualitative research in sport psychology, and its ability to facilitate theoretical and applicable knowledge when such work intersects with cognitive psychology. More research is needed to further examine the knowledge and models proposed in this study and their validity in other sport contexts. Finally, the models and their expansion possibly may be used in the future for the development of measurement tools aimed at quantifying SMM. From what can be gleaned, researchers and practitioners alike will gain some insight regarding how coaches develop a shared understanding with their athletes. Through increased understanding, clinical sport
psychologists, as well as performance enhancement consultants, can help facilitate such models, and thus reinforce those models with the intended target, the athlete.

References


