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ABSTRACT

This study explores the cognitive management of a successful experienced elite handball coach during a competition. A coach's activity was examined based on a "single case" by analyzing the content of two types of interviews (semi-structured, stimulated recall) through deductive, then inductive approaches. Results showed: (a) in the planning phase, game plans intended for the competition were elaborated from situations that had long been mastered during training sessions; and (b) in the interactive phase on offense, the coach carried out adjustments through his players (especially the playmaker); on defense, changes were made using a basic knowledge of game systems. The coach's activity was organized into six prioritized tasks relating to: i) players' physical engagement; ii) management of collective duels; iii) management of individual duels; iv) refereeing; v) players' energy management; and vi) technical-tactical instruction to the substitutes. Cognition was principally distributed by interacting with the team's playmaker.

Key words: Coaching Model, Cognitive Management, Decision Making, Game Planning, Stimulated Recall

INTRODUCTION

In recent years, the field of sports sciences has seen a significant increase in research on the activity of coaches, under the generic topic of coaching (see [1]). These studies seek to improve the coach's interventions by optimizing the sport training processes [2], or by improving the quality of instruction provided to athletic educators, staff and supervisors [3, 4]. The present study focuses on the description of the cognitive management of a successful experienced elite handball coach during competition. In this regard, it is important to highlight the various means used by successful experienced elite coaches in competition situations to influence the outcome of matches by determining how they act, on which game components and for what purpose. Identifying successful experienced elite knowledge should thus facilitate the process of didactic transposition to develop a training program for coaches. However, only a few studies have examined coaches during actual competitions [5-8] and none of them have analyzed the coaching process at the top international level.

Therefore, in the present study, we identify the team management process of a top international level (i.e., double world champion and Olympics medalist) handball coach.

THE COACHING MODEL

Several coaching models are proposed in the current literature (e.g., the “Schematic Model” (SM), Abraham et al. [9]; the “Coaching Model” (CM), Côté et al. [10]; “Lyle’s model” (LM), Lyle [11]). Compared to the other models (i.e., SM, CM), the LM is certainly the most detailed and integrative example of a coaching model currently available in the literature. However, it does not deal with “detailed relationships between component elements or stages of the model ..., [and] the effect of changes in one element on others” [11, p. 110]. We chose to use the “Coaching Model” [10], given that it has been validated and supported by empirical data in the team sport context and also clearly identifies the competitive component of the coach’s activity which is the main component of the coaching process studied here.

The CM, founded on seventeen selective interviews with elite gymnastics coaches, provides a macroscopic framework for our study. Using a single case study, Gilbert and Trudel [12] adapted and validated the CM for team sports and ice hockey in particular. These two studies will enable us to place the coach’s activity in competition situations in comparison to his/her other activities. In research conducted by Côté et al. [10], transcripts of inductively-organized interviews revealed an interaction of six components involved in developing athletes. They were divided into three central components defining the coaching process: competition, training and organization and three peripheral components affecting the coaching process: the coach’s personal characteristics, the athletes’ personal characteristics and level of development, and some contextual factors. These researchers also stated: “the competition, training and organization components are constantly monitored and adjusted by the coach during the coaching process” [10, p. 11]. In such a manner, the athletes’ potential is continuously assessed and re-assessed through a process of cognitive adjustment that is in fact a mental model [13], an abstract and simplistic representation of the complex situation that is constructed while resolving the problem and which remains only temporarily in the working memory. This mental model must enable the efficient comprehension and resolution of problems.

The competition component involves applying knowledge to help athletes reach an optimal performance level according to their potential. For example, the successful experienced elite ice hockey coach studied by Gilbert and Trudel [12] cites two objectives concerning development (i.e., the athlete’s personal development and the development of technical and tactical skills in ice hockey), and a third concerning the outcome (i.e., the team’s qualification for championship playoffs). To reach these objectives, various authors have identified three categories in the competition component [10, 12, 14]: (a) competition time, (b) competition site where pre- and post-competition adjustments can be made, and (c) competitions in preparation for the championship. These three categories can be assessed during the three main phases of the competition component [10, 12, 14]. The first phase is defined as a preparation or planning phase of competition during which the coach prepares himself/herself as well as the team. The second is an interactive phase involving all the game participants during the competition itself and the third is a post-competition phase during which the match is assessed. In our case, insofar as we are only interested in the aspects that may influence the outcome of the match, only the first two phases will be studied.

ACTIVITY OF PREPARING AND PLANNING THE MATCH

Bloom et al. [14] interviewed twenty-one successful experienced elite Canadian team sports

coaches (i.e. ice hockey, field hockey, basketball and volleyball) following an unstructured interview schedule. The researchers recognized two objectives accomplished in two different locations: the coach's preparation and the team members' preparation, which can take place both on and off the competition site. The authors showed that coaches carry out activities on match days both away from the competition site (11.9%) and at the competition site (12.3%) enabling them to be physically and mentally prepared for the competition and convey the game plan. To maximize players' concentration on match day, coaches have very personalized procedures. On match days, over 90% of them review their scenarios and consider possible reactions to certain situations. For the team's preparation on match day, procedures carried out off match sites represented 5.7%, compared to 29.1% on site. The pre-game speech is an important part of the procedures at the match site, as all coaches speak with their athletes before warm-up. The aim of the pre-game talk is simply to review the game plan since coaches fear that new information will mentally overload their athletes, distract them and inhibit their performance.

ACTIVITY DURING THE INTERACTIVE PHASE

Among the coach's skills, particularly in the team sports context, the ability to manage athletes in competition situations appears to be central [15]. Because of the complexity of team sports, it has not yet been possible to establish general rules of effective instruction in different coaching situations [16].

Nevertheless, some studies have investigated the cognitive component in team sports during the interactive phase [5-8, 17, 18]. Despite significant methodological differences in the CM components studied (training and competition) and the methods used, which included questionnaires [17], sessions in laboratories [18], stimulated recall sessions following competitive sporting events [5, 8], semi-structured interviews [7] and computer-simulated scenario to generate more verbalized strategies during team competitions [6], their results revealed convergent patterns.

Firstly, the coach's decision-making process is multifactorial. For example, the main results obtained by Gilbert et al. [5] showed that coaches refer to several factors (2.6 to 3.2 on average) including contextual information (information from the game) and knowledge of their players (athletes' personal characteristics) when making decisions. The same authors, in discussing this multifactor aspect in the decision-making process, advised caution when studying the interactive phase and avoiding the temptation to use interactive decision-making models if the available empirical data are insufficient. Secondly, the research conducted on the competition component of the coaching process (e.g., [6, 7]) suggested that behavior in specific situations also depends on domain-unspecific complex problem-solving competence. Thirdly, the coaches prepare themselves with intense cognitive activity. For example, Smith and Cushion [7] reported that six top level professional youth soccer coaches spent most of the game engaged in silent monitoring (over 40% of the time in the games observed), only occasionally intervening with instructions coupled with praise and encouragement.

Each one of these studies focuses on a precise aspect. However, as complex human activity is organized into a hierarchical system [19], it is necessary to highlight the priorities underlying the coaches' decisions. Coaches must take action according to priorities and advance to the next level once the problems from lower levels have been resolved. Yet these various studies do not provide us with information on the automatic procedures carried out by the coaches that are necessary in any complex activity to free the cognitive function from a certain number of constraints. These automatic procedures free the attention and enable the coaching to be better adapted [20].

With regard to the preceding remarks, in the main goal to explore the cognitive management of a successful experienced elite handball coach during competition using the CM, we will attempt to respond to the issue raised in the Gilbert et al. [5] study on the management of the interactive phase by contributing the empirical data necessary to elaborate a model. To this end, we will try to determine the hierarchical organization of the coach's tasks and the adjustment routines used by a successful experienced elite coach during competition.

METHOD

PARTICIPANT AND PROCEDURE

To reach our objectives, a single case study design was chosen [21, 22]. The coach was chosen in consideration of three criteria characterizing an experienced, elite, and successful coach [10, p. 4]: i) a minimum of ten years of coaching experience was required, ii) a performance outcome measure, having played at the international level, and iii) recognition as one of the best to develop elite athletes. He was a 59-year-old former international player, coach of a men's national team for over fifteen years and had won five medals at the most important international competitions (i.e. World Championship and Olympic Games) including a double World Champion title.

The participant was contacted after his second World Champion title by the first author of this article who is a former handball player and has been coaching and teaching at the national level for several years. During this initial contact, the general nature of the current study was explained and the coach agreed to participate. To ensure anonymity and confidentiality, pseudonyms have been used throughout this paper. Nevertheless, due to the particular status of the participant (i.e., no other coach in the world has won as many titles at this level), it was decided that the results of this study would be published only once the players mentioned in these interviews had ended their careers.

DATA COLLECTION

During the summer of 2002, two interviews were conducted using two different techniques in the coach's office at the National Handball Federation headquarters by the first author of this paper. The number of interviews and the different techniques used were chosen to ensure the internal validity and the reliability of the collected data, which according to the recommendations of Sparkes [23], could be obtained by using triangulation and overlapping the sources and methods to collect data.

A semi-constructed format was used for the first interview schedule, which focused mainly on the planning phase of the competition even though the coach also spoke of contexts from specific matches. This interview lasted one hour and forty-five minutes. The participant was asked to talk about the preparation phase at competition (i.e., "What methods do you use to prepare yourself for a competition? How do you prepare your players for a particular match? What messages do you give just before the match?"). The second, held one month later and which lasted two hours and fifteen minutes, used the stimulated recall technique [24, 25] to study the cognitive management specifically during the interactive phase. We adapted the collection strategy used by Trudel et al. [25] by proceeding in three phases. First, following the semi-directive interview, we chose a match based on the comments of Yinger [26] who states that the participant should not have watched the video beforehand. Furthermore, it seemed essential to choose a "knock-out" match rather than a round robin match. Indeed, in a "knock-out" match, each decision is made and each action taken for the sole purpose of achieving optimal performance. Specifying the context of the

match was also necessary because all actions are a function of the team's history [5, 25]. This precision made it possible to link actions and social context.

These two conditions were expressly evoked at the end of the first interview. In light of them, the coach immediately suggested the quarter-finals of the Sydney Olympics (2000), because this match not only left its mark on him (indeed, it was at the end of this match that he decided to step down as national selector), but the defeat also revealed all his coaching procedures.

Afterwards, one week before the recall session, the first author phoned the coach and asked him to talk about his impressions of the match and a few particularly significant decisions that he recalled ($n = 14$). To prepare the stimulated recall session, the sequences relating to the most significant decisions, from the coach's and the investigator's viewpoints, were located on the videotape beforehand (the match was televised and the first author recorded it). Then, during the actual stimulated recall session, the coach was asked to comment on and explain each of these decisions while viewing the video. This interview was filmed with the camera focused on the screen to match the interviewee's comments precisely with the corresponding events when the interview was transcribed (the camera was placed behind the coach in order not to disturb him and the conversation was recorded by a portable microphone placed on his shirt)¹.

Both interviews were transcribed in their entirety and comprised thirty-nine pages. The interview transcripts were submitted to the coach to enable him to check their content and quality. The coach did not recommend any changes.

DATA ANALYSIS

First, a deductive content analysis was used to analyse the interview transcripts using the procedure presented by Bos and Tarnai [27]. The match planning phase category was divided into four themes comprising the coach's preparation off and on the match site and the team's preparation off and on the match site. The interactive phase category was divided into two themes: "adjustment routines" and "hierarchical organization of the coach's tasks".

Then, we used an inductive approach to complete our themes. The joint use of a deductive and inductive approach was in line with the qualitative procedures of data analysis [28-31]. This is particularly relevant when few studies exist on the subject, which is the case here, and where "no established theory is capable of anticipating the many realities that may be encountered" [29, p. 251]. As a result, the theme "coach's preparation on the match site" did not appear and two additional themes, "interaction among the CM components" and "distributed cognition" in the planning and interactive phases respectively, needed to be included. Afterwards, the corpus was divided into meaning units and each of these units was classified into these different themes. The meaning units chosen and constructed semantically constituted the themes [32]. Thus distributed, the corpus was then placed into two categories (planning and interactive phase), six first order themes (planning phase: routines for coach, routines for team, interaction among the CM components; interactive phase: adjustment routines, hierarchical sequence of the coach's concerns, distributed cognition) and sixteen second order themes (see Table 1).

Semantic units that were not related to these different categories were classified in a "miscellaneous" theme. Most often, they were descriptions of the events (see Table 1).

¹By filming the interview with the camera focused on the television screen, the coach's words could be synchronized with the events of the match. This methodological precaution was not used in analyzing the data, however, given the clarity of his comments in this case.

Table 1. Content Analysis of Transcripts

Categories	First order theme	Second order theme (example)	Code	N (%)	Kappa	z
Coach's Routines		Off-site game day routines (e.g., "I think about what it is that leads me to suggest the tactical plan until the end of the last training session")	A11	14 (2.36)	.91	16.01*
		Preliminary period (e.g., "I spent a lot of time observing the opposing teams")	A12	50 (8.42)	.94	23.14*
		Off-site game day routines (e.g., "These occur during the morning training session")	A21	13 (2.19)	.74	13.79*
		On-site game day routines (e.g., "I try to talk with the team only one hour beforehand if, in our strategy, there's an element that can be destabilizing for our opponent)	A22	70 (11.78)	.93	23.19*
Planning Phase		Preliminary period (e.g., "Before each competition, I select parts of matches. I don't edit because I don't want to take the events out of context")	A23	2 (0.34)	.48	4.58*
		Training – Competition (e.g., "Ideally, all the scenarios would have been considered and repeated enough during the training sessions so that there are automatisms.")	A31	29 (4.88)	.85	18.70*
Interactive Phase	Adjustment Routines	Offensive phase (e.g., "Something else would need to be put in place, like playing differently by changing the game leader")	B11	34 (5.72)	.63	14.46*
		Defensive phase (e.g., "I have just put Joseph in defence in Bob's position because he is better at recovering the ball, is more dissuasive...")	B12	35 (5.89)	.79	18.46*
Hierarchical Sequence of the Coach's Concerns		Player alone: Prerequisites = Physical engagement of the players (e.g., "Andre has just lost the ball, but for him what's important is that he got hit in the chin. He's holding his chin. It is his chin that is important, whereas it should be the lost ball") / Positive outcome of match is certain = Energy management of the players (e.g., "When everything is OK, you can change the players to preserve them for the following match")	B21	30 (5.05)	.51	11.38*
		Management of collective duels (e.g., "The team is up against a 3-2-1, like in the books")	B22	70 (11.78)	.76	19.13*
		Management of individual duels (e.g., "We keep shooting at the goalkeeper's strong point")	B23	50 (8.42)	.78	19.07*
		Management of the referees (e.g., "I prefer to bet on the referees, to earn their trust to act on it in the final crucial minutes")	B24	14 (2.36)	.99	18.42*
		Technical-tactical instruction to substitutes (e.g., "I comment on the match for the substitutes")	B25	3 (0.51)	.84	9.22*
		Playmaker (e.g., "I remind Joseph of the basics of the game and tell him not to play blindly")	B26	16 (2.69)	.75	14.86*
		Playmaker (e.g., "At half-time, I can't sense what needs to be said. You, as playmaker, how do you feel?")	B31	9 (1.52)	.88	13.96*
		Other players (e.g., "I don't delegate to certain members of the team")	B32	10 (1.68)	.60	9.13*
		All semantic units not indexed in the preceding categories. Most often, they were descriptions of the events (e.g., "He takes the ball, runs and shoots")	C	145 (24.41)	.81	18.67*
		Overall		594 (100.00)	.80	111.80*

Note. * $p < .0001$. The codes were allocated in the following way: The letters "A", "B", "C" were respectively linked with the categories "Planning phase", "Interactive phase" and "Miscellaneous"; the first numbers were associated with each first order themes of these categories; the second numbers were associated with each second order themes of these first order themes (e.g., all the semantic units coded "A11" are linked with the category "planning phase". [A], the first order theme "coach's routines" [1], and the second order theme "off-site game day routines" [1]).

VALIDITY AND RELIABILITY OF THE CODING PROCESS

The two interviews were transcribed by the first author of this article. Each of the units was distributed into the different categories. Fifty semantic units were randomly selected and classified by three sport psychologists, who were specialists in team sport contexts and who had basic knowledge of the qualitative approaches. Special attention was paid to meaning units that were not assigned to the same categories by the coders and the discussion that ensued systematically resulted in a consensus on the interpretation. Then, on the basis of this analysis grid, three other coders classified all of the semantic units ($n = 594$) into the various categories. The three coders were two men and one woman, respectively aged of 54, 48 and 42 years old), teaching in collective sport at the Faculty of Sport Science of the University Paris-Sud 11. Each of them had over 10 years of coaching experience (and practicing at international level for one of them) at national level. They were also experienced in qualitative methods of research.

Reliability points were estimated using a Kappa index (k) which represents the normalized proportion of inter-observer agreement in excess of what would be expected on the basis of chance or random assignments. We used the MacKappa software [33] which calculates both general and conditional coefficients and tests the statistical significance of agreement among many observers assigning objects to nominal scales as based on Fleiss' [34] computational formulae.

The overall Kappa revealed a considerable rate of agreement among the different coders ($k = .80$; $z = 111.80$, $p < .0001$). All the conditional coefficients were also high and significant (see Table 1). Taken as a whole, these results showed an acceptable reliability of the coding.

RESULTS

The results are presented in two distinct phases. In the planning phase (coded «A» in the data analysis), we first explain the Coach's Routines (coded «A1»), then the Team Routines (coded «A2») and Interaction among the CM components (coded «A3»). In the interactive phase (from the start to the final whistle) (coded B), we describe the Adjustment routines (coded «B1»), the Hierarchical organization of the coach's concerns (coded «B2») and "distributed cognition" [35] (coded «B3»). In this latter paragraph, we discuss all the factors that may have affected the choice of play or led to making joint decisions with certain players. For each of these sections, we included excerpts of the interview with their coding as well as a key in Table 1.

In order to respect the anonymity of the players, their names were changed. We can however specify that they were the team's main players.

THE PLANNING PHASE

Coach's Routines

The preparation of the coach is carried out in a continuous way. It starts broadly before the day of the match and continues until the last training session (the morning of the match).

Off-site game day routines. The coach acquired such wide knowledge about the opponents that his interrogations and the following adaptations were mainly focused on his own team (physical form of each of his players during the last matches of preparation – particularly on the players who were able to manage the planning of the match).

“When I am engaged in a competition, I don't stop thinking of it (A11). I close my eyes and I can see our opponents playing (A11). I think about what it is that leads me to suggest the tactical plan until the end of the last training session (A11).”

Preliminary period. The coach's off-court preparation involved getting to know the opponents using a nearly ethnological approach. By observing how they functioned in the competition setting, the coach familiarized himself with their reactions as a group and the way in which they handled difficult situations.

"I spent a lot of time observing the opposing teams (A12), the way they reacted in the difficult moments (A12), what their group relations were (A12), who was the leader (A12)."

Team Routines

Off-site game day routines. The team's off-court preparation entailed a video sequence and a discussion and explanation of the game options. This internal communication made it possible to clear up the dark zones (implicit aspects) linked to his expectations.

"I was shocked, at the end of this match, to read in a newspaper that a player was not ready to take on the responsibilities that I had given him. How could a player say that to a journalist without talking to me first? For a very long time, I used to settle with a minimum of information so that everything would go the way I wanted without talking about it (A21), and especially without getting any sort of verbalized acquiescence from the persons concerned (A21). At the 2001 World Championships, there wasn't one tactic that wasn't discussed beforehand within the team itself (A21)".

To complete this preparation, the coach sought to create a positive group dynamic:

"For the World Championships, I wanted the players to have a specific meeting before the matches (A21). Before each match, 30 minutes before going to the handball stadium, the players met without me (it was a blackout on what they had said) (A21)."

On-site game day routines. The team's preparation in the locker rooms entailed presenting the line-up and saying a few key words.

"I never say, 'you're going to start by playing like this' (A22). To take the stress out of the team so they face it collectively, I give the lineout just before they go out on the court (A22). After that, it's up to the players to choose their tactics" (B31).

The game plan was therefore contained in the team line-up, which was decided upon, based on the characteristics of both his own team and the opposing team, with the aim of surprising the opponent.

The coach paid particular attention to the emotional context. He did not want the importance of the match to inhibit the potentialities of the players:

"In highly important matches, as it is the case here, I always try to take the drama out of the situation by trying to make them laugh a little (A22)."

"What could I change at the last minute in our offensive line-up (that would allow them to play a certain way) to surprise the opponent yet without destabilizing ourselves? (A22) From there, I suggest a brutal change of strategy by changing players from their usual positions (A22)."

Preliminary period. During this period, it seems particularly important to the coach to know the feelings of his players:

“For the preparation of the following World Championships, I decided to set up a meeting before the matches during which I asked the players to answer three questions: (1) What is your personal expectation about this world championship?, (2) What do you think about your position in the game plan (with three options: unsatisfied, satisfied overwhelmed - one asks me too much)? and, (3) Which engagement are you ready to take in front of everyone? (A23)”

Interaction Among the Coaching Model Components

The coach's remarks revealed a strong interaction between the training and competition components of the CM. Indeed, the competition situation requires a command of the sport and therefore long preliminary work during training sessions. Three types of pre-match preparations were noted:

“Ideally, all the scenarios should have been considered and repeated several times during the training sessions so that there are automatisms (A31).”

THE INTERACTIVE PHASE

Adjustment Routines

Adjustment routines during the competition differed depending on the phase of the game. In the offensive phase, the coach placed great importance on the playmaker's position, both as a key point and tactician:

“They're obviously not sticking with the plan and it's Joseph who's in control (B26). The bad choice was leaving Joseph at playmaker (B11). It would have been better to take a time-out and put in Georges or Andre” (B11).

To better process the useful information that would allow him to intervene, the coach appeared to function by stages and according to a pre-established procedure. He ensured that the team's game plan as well as the structural characteristics (playmaker, type of defence, etc.) were adapted to the situation. Afterwards, he focused on the playmaker who is in charge of organizing the offense and the tactics used:

“The first action is the opposite of what I had asked (B22). They're surely not following the game instructions because of a lack of support and trust (B32). Maybe that wasn't part of their baggage (A31) and maybe I didn't have the right to ask that of them (A31). I think they talked among themselves (B32) (...). I remind Joseph of the basics of the game and tell him not to play blindly (B26) (...). The bad choice was leaving Joseph to lead (B11). I definitely should have put in Georges or Andre as playmaker right at this point (B11). There, we're trailing 5-8 and Andre becomes playmaker! (B11). I take a team time-out much too late at 5-9 (B11) and I tell them what to do (B11). It's unbelievable that I didn't put Georges and Andre in positions they're more used to” (B11).

Seeing the inefficacy of the collective processes put into place on offense, instructions were given to the playmaker who was then replaced due to the absence of any improvements.

Still unsatisfied, the coach reconsidered the choice of tactics by becoming very directing once the team time-out was taken. It was clear that the coach had trouble abandoning his two initial options early enough (using Andre and renouncing the idea of playing with a winger who usually plays in the back).

Changes in the defensive systems chosen by the coach were made in relation to the team's performance and particularly the processes that generated this performance. The coach used his "basic knowledge" of game systems according to the circumstances. The defensive systems (and the players who carried them out) were also changed, generally depending on the particular context of the match (time remaining, score, etc.). The routines used during the interactive offensive and defensive phases are summarized in Figure 1.

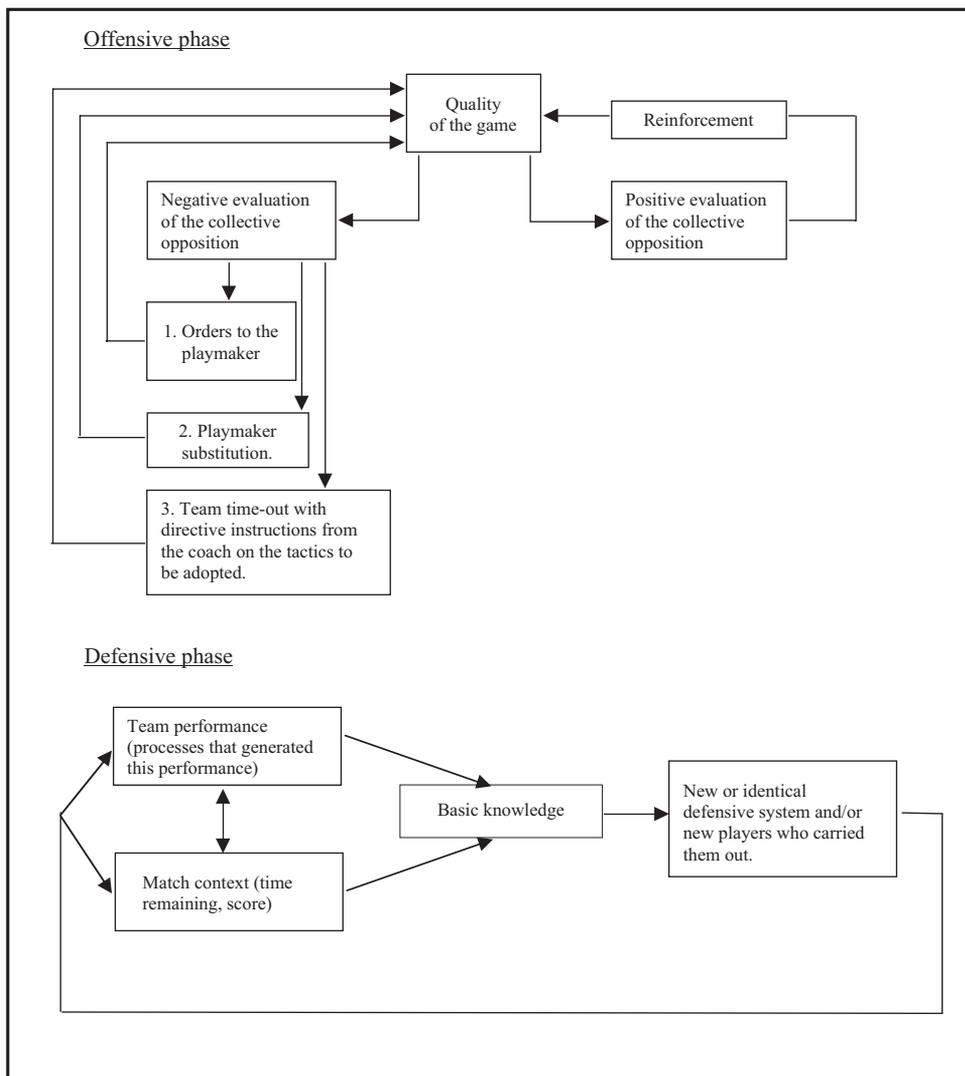


Figure 1. Adjustment Routines During Interactive Offensive and Defensive Phases

Hierarchical Organization of the Coach's Concerns

The coach's concerns are linked to six categories: (a) player alone (physical engagement / energy management), (b) management of collective duels, (c) management of individual duels, (d) management of the referees, (e) technical-tactical instruction to substitutes, and (f) playmaker (see Table 1). Some of these concerns could be related to different operational tasks (i.e., management of collective duels, management of individual duels, management of the referees, technical-tactical instruction to substitutes). One is linked to two coach's tasks (i.e., the management of the physical engagement and/or energy of the players). The last one (i.e., playmaker) is included in two different coach's tasks (i.e., management of collective duels, management of individual duels).

Finally, we were able to show that the coach operated according to six hierarchically-organized tasks. Of these, three involved an attempt to change the adversarial relationship (collective duel management, individual duel management, refereeing), two were carried out when the outcome of the match was certain (energy management by players and technical/tactical instruction of the substitutes), and one (physical engagement) is somewhat of a prerequisite before any intervention.

As long as there is a lack of physical engagement, no strategic, tactical or technical aspects can be considered:

“We let Jovanovic run towards the goal (B21). There's no one to stop him (B21). (...) Look at that! He breaks through three defenders! (B21) No one can stop him even though he has no momentum (B21). It reminds me of the start of the match for third place at the 1997 World Championships where I take my time-out in the sixth minute (we're trailing 4-1) and I really give them a lashing” (B21).

The task of managing the collective duel in fact constituted the first and most important phase from the strategic point of view. Once the game plan was determined, the coach monitored the strategy, focusing first on the general then the specific:

“You can see it, the team is up against a 3-2-1, like in the books” (B22).

Afterwards, the performance of the playmaker mentioned above was assessed. In the individual duel management phase, when a player was ineffective despite a solid collective organization, the coach would analyse why the player was producing a game that was maladapted to the opposition. He would then try to communicate aspects of his response to this question. Another issue was why the player was playing accurately, but performing his actions poorly. In this case, it was a problem of confidence that could be handled with diametrically-opposed means (fatherly attitude with quasi-affectionate communication, or provocation by playing on the player's self-esteem).

Referees' decisions may have a strong influence on the game. The coach may adopt two different attitudes, consisting of either systematically disputing their decisions to influence the referees that make calls against them or taking a complacent approach assuming that the referee will do a good job as long as the environment is calm. In our case, the coach took a third course that attempted to create a positive relationship with the referees from the outset of the match. He showed them that he agreed with their decisions, even and especially those that were to their disadvantage, to create a climate of confidence and be able to weigh on the final decision at the appropriate time.

When the match was certain to be won because the difference in score was too wide

compared to the time remaining, the coach considered saving the energy of certain players for the remainder of the match by substituting them out despite a strong performance, and giving technical-tactical instruction to the substitutes by commenting on the events of the match (see Figure 2).

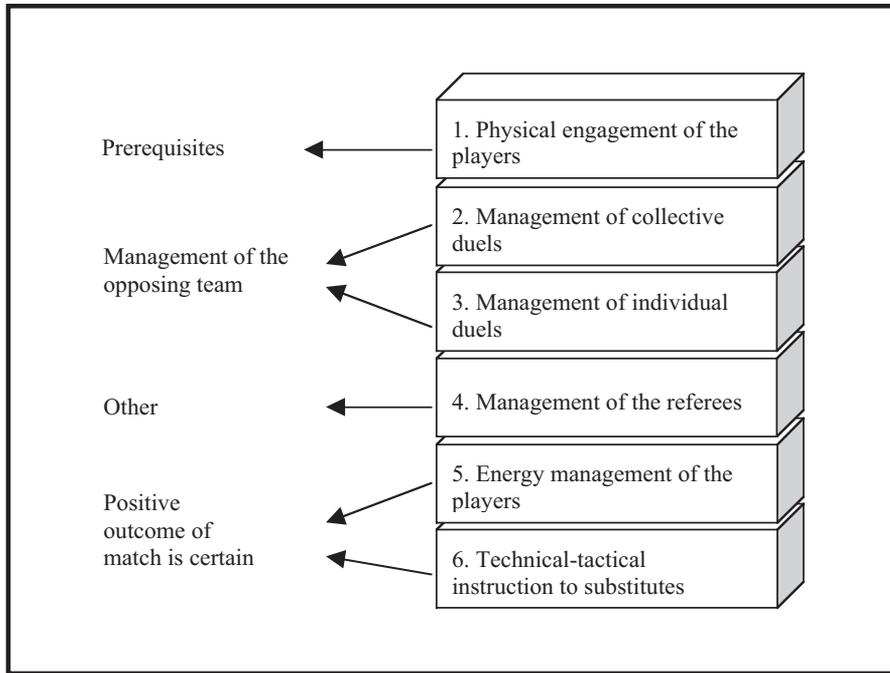


Figure 2. Hierarchical Organization of the Coach's Tasks

Distributed Cognition

As we showed previously in the adjustment routines of the offensive phase, the playmaker is accountable, at least at the beginning, for the organization of the game for his team. During half-time, when the team has a little time, the coach can exchange with the players, and more specifically with the playmaker to make the team evolve favourably:

“At half-time, I can't sense what needs to be said, and at that moment, it's interesting to listen to them (B32). How do you analyse what's going on? (B32). You, as playmaker, how do you feel? (B31). It's interesting that there's an exchange (B32), but my work and my role is to synthesize what they're saying” (B32).

As the playmaker is accountable for the planning of the game in attack, the coach agrees that the team organization can be different compared with his expectation. Indeed, when the players come from the same club team, they can execute some actions that are specific to them, without the coach being informed:

“There, it is a strange team. I don't know what's going on. I suppose it is something that comes from their team with Fernand back-right, Carl as centre and Andre back-left” (B31).

DISCUSSION

The main goal of the present study was to explore the cognitive management of a successful experienced elite handball coach during competition. To this end we used the CM [10] as an analysis framework. More specifically, we respond to the issue raised in the Gilbert et al. [5] study on the management of the interactive phase, by contributing the empirical data necessary to elaborate a model.

First, our data showed strong interaction between the training and competition components of the CM. It is only during the planning phase that the coach works out the tactical framework of the game. This was therefore contained in the team line-up with the aim of surprising the opponent. There was significant responsibility placed on the players and the playmaker in particular. During the interactive phase, we highlighted six hierarchical levels of task organization (i.e., players' physical engagement; management of collective duels; management of individual duels; refereeing; players' energy management; technical-tactical instruction of the substitutes), as well as automatic procedures in the offensive and defensive phases. Elaborating and managing the game plan require cooperative processes among the subjects. Therefore, this socially-organized activity may favorably encourage the paradigm of distributed cognition [35]. Following the defeat of the match featured in the present study (this fact is independent of the stimulated recall interview that was made after the world championships), the coach made a substantial change in the way he worked within the coach-player relationship and was able to lead the team to the world title five months later. In certain cases, coach-athlete interactive modalities may appear as a deliberate collaboration that occurs by soliciting key players (e.g., playmaker). Placing responsibility on players produces the desired results when the strategy is changed during the course of the match.

Moreover, our data can be useful to specify the categories (i.e., competition time, intervention style) of the CM competition component in the team sport context [12] that will serve as a general framework of analysis [10].

Taken as a whole, the interaction between training and competition is in line with the interactions among the three components of the CM originally presented by Côté et al. [10]. However, results relating to the planning phase that were obtained during the semi-directive interview and at the beginning of the stimulated recall interview varied on several points compared to those presented by Bloom et al. [14]. In our study, the coach's preparation was carried out well in advance of the match day. His objective in the offensive phase was to surprise the opposing team without disrupting his own team and the game plan was not presented as such but inherent in the team line-up.

Furthermore, questioning the decisions made by the coach in the interactive phase as in social psychology [19] and work psychology [20], was found to be productive. Indeed, determining the hierarchical organization of the coach's tasks and the adjustment routines used by a successful experienced elite coach during this phase could help us to respond to the issue raised in the Gilbert et al. [5] study on the management of the interactive phase by coaches. In fact, the results complement those that already exist [5, 25] as they present a hierarchy of the coach's tasks whereby the players' physical engagement is the primary concern, in line with the results of Trudel et al. [25] obtained from their study on an ice hockey coach. Of these tasks, the intention to give technical-tactical instruction to the substitutes was mentioned by the coach only during the semi-directive interview in reference to specific matches. Because it was considered solely for matches won, it could not appear in the stimulated recall interview (match lost). This instruction therefore has its rightful place (even if it is the last) among the coach's tasks during this phase. Thus, depending on the

match's context, an objective of the players' development may appear even as the main priority remains the outcome of the competition. The results of the research conducted by Gilbert et al. [5] on a university ice hockey coach and by Côté et al. [36] with elite gymnastics coaches yielded partly similar findings. Results are only partly comparable however because the latter does not define the term "development", and in the case of the former, the development in question exceeds the framework of the athletic activity to encompass social dimensions that we do not discuss here.

Nevertheless, as with any single-case study, there were necessarily some limits to our research. To overcome these obstacles, we could have increased the quantity of data collected, but not without creating new problems. To increase the number of recall-video sequences, it would have been essential to screen other international "knock-out" matches. However, as there are only three such matches, all of which had already been watched by the coach, the study would not have complied with the methodological rules established by Yinger [26]. It would also have been possible to collect data, even if they are rare, from other "top-level" coaches (e.g., the women's national team coach, other national team coaches). However, such data would have limited the external validity of the study because of the need to ensure that both the men's and women's teams used similar coaching styles or otherwise consider the transcultural validity of these data.

CONCLUSION

The present study may help contribute to developing the efficacy of coaches in managing their teams in competitions and elaborating pedagogical content at the university or national level in order to better train team sports educators, staff and supervisors. In our opinion, such content should focus more on: (a) the dynamics of co-construction in elaborating, implementing and managing the team's game plan; (b) assembling cues on the game to facilitate anticipation; (c) conceiving different offensive and defensive adjustments by the coach; and (d) recognizing the hierarchy of the coach's tasks. Moreover, it seems to us that stimulated recall sessions are instrumental in confronting coaches with their decision making. Indeed, in stimulated recall sessions the time pressure due to the match is non-existent and therefore these sessions seem more appropriate to bring out cognitive processes. Coaches can analyse the way they handle the match, and possibly modify their strategy.

We now intend to continue this work by conducting multi-case studies with different coaches in charge of either women's or men's teams at various levels of competition to find out whether our results have a specific or general scope.

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REFERENCES

1. Gilbert, W. and Trudel, P., Analysis of Coaching Science Research Published From 1970-2001, *Research Quarterly for Exercise and Sport*, 2004, 75, 388-399.
2. Douge, B. and Hastie, P., Coach Effectiveness, *Sport Science Review*, 1993, 2(2), 14-29.
3. Gould, D., Gianni, J., Krane, V. and Hodge, K., Educational Needs of Elite US National Team, Pan American, and Olympic Coaches, *Journal of Teaching in Physical Education*, 1990, 9, 332-344.
4. Salmela, J. H., Russel, S. J., Côté, J. and Baria, A., The Structure of Expert Knowledge in Coaches, in: Nitsch, J., ed., *Advances in Sport Psychology*, Bundesinstitut für sportpsychologie, Cologne, 1994, 56-65.
5. Gilbert, W., Trudel, P. and Haughian, L., Interactive Decision Making Factors Considered by Coaches of Youth Ice Hockey During Games, *Journal of Teaching in Physical Education*, 1999, 18, 290-311.

6. Hagemann, N., Strauss, B. and Büsch, D., The Complex Problem-Solving Competence of Team Coaches, *Psychology of Sport and Exercise*, 2008, 9, 301-317.
7. Smith, M. and Cushion, J., An Investigation of the In-Game Behaviours of Professional, Top-Level Youth Soccer Coaches, *Journal of Sports Sciences*, 2006, 24, 355-366.
8. Wilcox, S. and Trudel, P., Constructing the Coaching Principles and Beliefs of a Youth Ice Hockey Coach, *Avante*, 8, 4(3), 39-66.
9. Abraham, A., Collins, D. and Martindale, R., The Coaching Schematic: Validation Through Expert Coach Consensus, *Journal of Sports Sciences*, 2006, 24, 549-564.
10. Côté, J., Salmela, J. H., Trudel, P., Baria, A. and Russel, S., The Coaching Model: A Grounded Assessment of Expert Gymnastic Coaches' Knowledge, *Journal of Sport and Exercise Psychology*, 1995, 17, 1-17.
11. Lyle, J., *Sports Coaching Concepts: A Framework for Coaches' Behaviour*, Routledge, London, 2002.
12. Gilbert, W., and Trudel, P., Validation of the Coaching Model in a Team Sport Context. *International Sport Journal*, 2000, 4(2), 120-128.
13. Johnson-Laird, P. N., *Mental Models: Towards a Cognitive Science of Language, Inference, and Consciousness*, Cambridge, MA: Harvard, 1983.
14. Bloom, G. A., Durand-Bush, N. and Salmela, J. H., Pre- and Postcompetition Routines of Expert Coaches of Team Sports, *The Sport Psychologist*, 1997, 11, 127-141.
15. Horton, S., Baker, J. and Deakin, J., Experts in Action: A Systematic Observation of 5 National Team Coaches, *International Journal of Sport Psychology*, 2005, 36, 299-319.
16. More, K. G. and Franks, I. M., Measuring Coaching Effectiveness, in: Hughes, M. and Franks, I.M., eds., *Notational Analysis of Sport*, Routledge, London, 2002, 243-256.
17. Duke, A. and Corlett, J., Factors Affecting University Women's Basketball Coaches' Timeout Decisions, *Canadian Journal of Sport Sciences*, 1992, 17, 333-337.
18. Jones, D. F., Housner, L. D. and Kornspan, A. S., Interactive Decision Making and Behavior of Experienced and Inexperienced Basketball Coaches Practice Planning, *Applied Research in Coaching and Athletics Annual*, 1997, 10, 201-227.
19. Carver, C. S. and Scheier, M. F., Control Theory: A Useful Conceptual Framework for Personality-Social, Clinical and Health Psychology, *Psychological Bulletin*, 1982, 92, 111-135.
20. Leplat, J., Cognitive Skills at Work, in: Bainbridge, L. and Ruiz Quintanilla, S.A., eds., *Developing Skills With Information Technology*, John Wiley and Sons, Chichester, UK, 1989, 35-63.
21. Ragin, C. C., "Casing" and the Process of Social Inquiry, in: Ragin, C.C. and Becker, H.S., eds., *What is a Case? Exploring the Foundations of Social Inquiry*, Cambridge University Press, Cambridge, UK, 1992, 217-226.
22. Yin, R.K., *Case Study Research: Design and Methods*, 2nd ed., Sage, Thousand Oaks, CA, 1994.
23. Sparkes, A.C., Validity in Qualitative Inquiry and the Problem of Criteria: Implications for Sport Psychology, *The Sport Psychologist*, 1998, 12, 333-345.
24. Calderhead, J., Stimulated Recall: A Method for Research on Teaching, *British Journal of Educational Psychology*, 1981, 51, 157-174.
25. Trudel, P., Haughian, L. and Gilbert, W., L'Utilisation de la Technique du Rappel Stimulé pour Mieux Comprendre le Processus d'Intervention de l'Entraîneur en Sport [The Use of the "Stimulated Recall" Technique for Better Understanding the Process of Intervention of the Sports Coach], *Revue des Sciences de l'Éducation*, 1996, 22, 503-522.
26. Yinger, R.J., Examining Thought in Action: A Theoretical and Methodology Critique of Research on Interactive Teaching, *Teaching and Teacher Education*, 1986, 2, 263-28.
27. Bos, W. and Tarnai, C., Content Analysis in Empirical Social Research, *International Journal of Education Research*, 1999, 31, 659-671.
28. Guba, E.G., The Alternative Paradigm Dialogue, Guba, E.G., ed., *The Paradigm Dialogue*, Sage, Newbury Park, CA, 1990, 17-27.

29. Meyer, B.B. and Wenger, M. S., Athletes and Adventure Education: An Empirical Investigation, *International Journal of Sport Psychology*, 1998, 29, 243-266.
30. Miles, M. B. and Huberman, A. M., *Qualitative Data Analysis: An Expanded Sourcebook*, 2nd edn., Sage, Thousand Oaks, CA, 1994.
31. Schwandt, T.A., *Qualitative Inquiry*, Sage. Thousand Oaks, CA, 1997.
32. Berelson, B., *Content Analysis in Communication Research*, Hafner, New York, 1971.
33. Watkins, M.W., MacKappa [Computer Software], Pennsylvania State University, 2002.
34. Fleiss, J.L., Measuring Nominal Scale Agreement Among Many Raters, *Psychological Bulletin*, 1971, 76, 378-382.
35. Hutchins, E., *Cognition in the Wild*, MIT Press, Cambridge, MA, 1995.
36. Côté, J., Salmela, J. H. and Russel, S., The Knowledge of High-Performance Gymnastic Coaches: Competition and Training Considerations, *The Sport Psychologist*, 1995, 9, 76-95.