The Teaching and Learning of Decision Making in Team Sports

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In team sports, playing well means choosing the right course of action at the right moment and performing that course of action efficiently and consistently throughout the match. Research on decision making in sports indicates that although experts make more accurate decisions based on earlier occurring information, they tend to have speed, rather than accuracy, context-specific advantage in decision making. In light of the key notion of configuration of play, elements underlying its perception and interpretation and the ensuing anticipation and decision making are discussed. In connection with teaching-learning settings, observation and verbalization are presented as key strategies for eliciting critical thinking and the development of strategic and tactical knowledge. Finally, the authors present a dynamic model exploiting (a) action settings, (b) observation settings, and (c) debate-of-idea settings for the ultimate goal of constructing strategic and tactical knowledge in team sports.

In prior publications, we have discussed the nature and the development of tactical and strategic knowledge in team sports (Gréhaigne & Godbout, 1995; Gréhaigne, Godbout, & Bouthier, 1999). In particular, we discussed decision making as an important component of tactics and, in a different way, a part of strategic planning as well. At this point in time, we feel that (a) the conditions of decision making, as such, should be examined further and (b) that the learning of decision making should be discussed with reference to the teaching of team sports through school physical education for children 10 to 18 years of age.

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Decision Making in Sport

Any voluntary action involves not only some level of motor skill to insure efficient execution (not withstanding muscular and cardiovascular potential to sustain it) but also, by definition, the choice to perform the action. In some instances, the choice may be simple, based on a yes or no context (like turning off the radio or leaving it on). In other more complex situations, there may be a need not only to decide on acting or not but also to choose among different courses of action. For instance, once the decision has been made to move a heavy object, it might be pulled, pushed, rolled, carried in the arms, or carried in a wheelbarrow, etc., depending on the form of the object, the characteristics of the surroundings, the mover’s strength, etc. Daily life is filled with decision-action dyads of this nature.

Among the various types of activity in which humans engage, sports offer a particular context: whether for the sake of leisure or by profession, they compete against themselves or against others with the intent of winning. In individual sports, decisions will be made to insure that they go faster, jump higher, and throw harder. Most of the time, such decisions are made well in advance and when the time comes to perform, the action is conducted accordingly. Dual sports call for participants to “play” against somebody else and to perform better, knowing that the other is trying to do the same. Although general plans of action may have been established prior to the encounter, each player is faced with many decisions during the match as each one tries to outwit the other.

In this respect, team sports offer an even more complex situation, providing a bigger challenge in terms of decision making. Discussing the essence of team sports, Gréhaigne and Godbout (1995) have written that “in an opposition relationship, each of two teams must coordinate its actions in order to recover, conserve, and move the ball so as to bring it in the scoring zone and effectively score” (p. 492). Metzler (1987) wrote of the essence of team sports as a matter of “resolving in action, many together and simultaneously, series of problems not foreseen a priori as to the order in which they will appear, their frequency and their complexity. And all this in order to resolve in a contradictory way, in the same action, the attack on the adverse camp and the defense of his own camp” (p. 144). In any team sport, players are faced with four interrelated tasks: attack on the adverse camp, defense of their own camp, opposition to opponents, and cooperation with partners. The basic challenge for each player is to cooperate with partners in order to oppose more effectively the opponents either while attacking (keeping defense in mind) or while defending (setting ready to attack). As stated by Gréhaigne and Godbout (1995),

The practice of team sports [self-organization of a group confronted to another group with antagonistic interests or in view of reaching a goal (usually a target) using a common strategy (Gréhaigne & Roche, 1990)] can bring a player, expected to regain possession of, pass on or eventually propel a ball, (a) to resolve anticipation-coincidence motor problems (set of his movement before the arrival of the ball and regulate it as the ball arrives), (b) to make choices among information, among potential answers depending upon likely costs and benefits, and (c) to manage varying courses and trajectories of the players or of the ball in conditions of decisional urgency. (p. 492-493)
Thus, for each player of both teams, playing well means choosing the right course of action at the right moment and performing that course of action efficiently and doing this over and over throughout the match. To illustrate the complexity of team sports, Bouthier (1993) has presented a model (Figure 1) that helps put decision making and efficient action into perspective. This model highlights the interdependent nature of all identified components. The choice of pertinent solutions and decision making are heavily related to the remaining components. In sport action, players are faced with making decisions about actions to be undertaken. Players devise the plans in accordance with strategic decisions and make adjustments as effective action proceeds. Adjustments are based on tactical decisions (Bouthier & Savoyant, 1984; Gréhaigne & Godbout, 1995; Gréhaigne et al., 1999).

These two types of decisions are very much influenced by the social values of the group that the players are part of and by personal motives regarding the activity (Leontiev, 1976; Nuttin, 1985; Bouthier, 1993; Bouthier, Pastré, & Samurçay, 1995). Cultural and motivational factors play an important role in the choice of solutions and in the degree of engagement into the action. Reciprocally, the development of decision competencies reinforces motivation. It is thus critical that in educational settings, students be put in situations that can be associated with real life contexts and that, consequently, give significance to their learning activity.

Any decision becomes valid only if it can be efficiently translated into action. This implies that the players actually have at their disposal the range of corresponding answers (individual or collective techniques). But players also tend to favor, among accessible answers, those valued by the group to which they belong. Reciprocally, the mastering of techniques reinforces motivation. Thus, although tactics, which are first, make up the context that justifies techniques, these

![Figure 1 — Analysis of the complexity of team sports (Bouthier, 1993).](image-url)
techniques, which are second, are not secondary. Techniques constitute the tools for tactics (Mahlo, 1969). Thus, the educational setting, instead of opposing technical learning and tactical learning, should rather articulate them in a “tactical – technical” education.

It is well known that the motor execution of a tactical choice costs energy. For some 10 years, it has been noticed that mental activity consumes energy as well. The athletic potential of a player is therefore important not only in view of the physical requirements of the action, but in view of its mental requirements as well (Bouthier, 1989a). Indeed, fatigue not only affects the quality of skill execution but affects also the lucidity of choices. Thus, the athletic potential is another limitation factor for the decisional activity in sport, and its use is modulated by the player’s motivation.

Decisional activity is also influenced by the players’ concentration and mental watchfulness and by their degree of self-control in face of stresses and pleasures associated with the game. These influence the lucidity of choices while, at the same time, they interfere with skill execution and limit or stimulate the access to the athletic potential.

In educational settings, critical aspects and moments of the game on which to focus must be pointed out as well as modalities of self-control. Depending on sport activities, educational objectives, and students’ characteristics, teachers will need to choose their entry point and their intervention levers among the various components of sport action presented in the model.

What Research Tells Us About Decision Making and Sport

Most of the research on decision making in sports appears to have been conducted in connection with expertise (McMorris & Graydon, 1997; Rippol, 1991; Tennenbaum, 1999). As will be discussed later, it is not our intent to strictly apply to school setups all the conclusions brought up in this type of research. However, it is interesting to note that some constructs considered in research on expertise in sport should also be considered when teaching decision making in school. At this level, learners are to be considered novices for the sake of this paper.

Although research results are not unequivocal as to differences between experts and novices (McMorris & Graydon, 1997), it is generally agreed that experts make faster and more accurate decisions when predicting an opponent’s response (Chamberlain & Coelho, 1993; McPherson, 1993; Williams & Grant, 1999). Thus, they display greater anticipation skills. Chamberlain and Coelho (1993) recognized that experts make more accurate decisions based on earlier occurring information; at the same time they stated that in general, experts tend to have a speed rather than accuracy advantage in decision making. However, this advantage would be context specific, that is related to the expert’s area of expertise.

The superior decision-making capabilities of the experts appears to be due not only to a more extensive declarative knowledge structure (factual knowledge, consisting of if - then statements) but to a well developed procedural knowledge base which leads to a more generalized approach to problem solving, resulting in slower access to information needed for arriving at accurate decisions. (Chamberlain & Coelho, 1993, p. 148)
There appears to be agreement in the literature with reference to experts’ superior knowledge base (both declarative and procedural), as opposed to experts’ superior visual hardware (e.g., French & McPherson, 1999; McPherson, 1993; McPherson, 1999; Nevett & French, 1997; Williams, Davids, Burwitz & Williams, 1993; Williams & Grant, 1999). As pointed out by French and McPherson (1999), experts also display better problem representation in the sense that they are better at accessing the right portion of their knowledge base to perform specific sport tasks.

Thus, research findings acknowledge that anticipation (or prediction) and decision making are key elements for performance in sports (even more so in high strategy sports) and in both cases, speed is critical (Steinberg, Chaffin, & Singer, 1998), accuracy being a necessary but insufficient condition.

It has also been recommended that perception and action be coupled for the analysis of experts’ performance (Bouthier, 1989b; Chamberlain & Coelho, 1993; Williams et al., 1993; Williams & Grant, 1999). When considering the development of decision-making skills, this suggests that anticipation, decision making, and effective action should also be associated whenever reflection on action is sought.

Selective attention (McMorris & Beazeley, 1997; Rippol & Benguigui, 1999) and attention orienting (Nougier & Rossi, 1999) have been evoked in connection with decision making and should, therefore, be considered in teaching setups in light of students’ concentration capabilities. As discussed by Williams and Grant (1999) the teaching strategy presented later in this paper will, however, focus on an implicit rather than explicit awareness strategy. As suggested by Magill (1998), attention can then be oriented toward information-rich aspects of the game as opposed to specific cues. This is very much in line with a constructivist view of the teaching/learning process.

Deliberate practice (i.e. systematic and long term practice) is considered essential for the acquisition of expert performance (Ericsson & Charness, 1994; Ericsson, Krampe, & Tesch-Römer, 1993). Many authors acknowledge that it may take as many as ten years of practice to develop expertise (Ericsson et al., 1993; French & McPherson, 1999; Helsen, Starkes, & Hodges, 1998; Thomas & Thomas, 1999). In connection with deliberate practice, simulation techniques have been discussed (Williams & Grant, 1999) as well as other learning activities more closely related to the actual practice of sport (Helsen et al., 1998).

Given the objectives pursued by school physical education and the time constraints imposed on regular physical education programs, many research findings on deliberate practice may appear irrelevant for the teaching of decision making in sport. One can at least assume, however, that if a minimal level of performance is to be achieved, some form of deliberate practice ought to be put in place (as opposed to play sessions; McMorris, 1999) and should display ecological validity, that is allow guided and experience with the task (Williams et al., 1993).

Finally, verbal report techniques are seen as important tools to obtain information on thought processes of experts and novices (French & McPherson, 1999; McPherson, 1993). In a later section of this paper, overt verbalization will be discussed, not as a measurement technique per se, but as a mean (a) to focus students’ attention on their thought process, (b) to exchange information with partners, and (c) to stimulate critical thinking.
Configuration of Play:
Anticipation Source for Decision Making

In a broad sense, a configuration is a list or a schema providing the nature and the main characteristics of all elements of a given system. In sport, the notion of configuration of play refers to the relative positioning of players in both teams in relation with the possession and the location of the ball (or any object fought for) and in relation with the various players' moves. At times, it is also referred to as pattern of play (Ali & Farraly, 1990), situation of play (McPherson, 1993), or display (McMorris & Graydon, 1997). During the game, players need to study the shift from one configuration of play to another in order to better understand the evolution of the play. For instance, in soccer, attackers who have circulated the ball at the center of the pitch and realize that the defenders have spread themselves widthwise, may elect to go on with an attack depthwise in order to get closer to the goal. In basketball, once they realize that they face a zone defense, attackers could choose to shoot from the periphery. Another choice could be to pass the ball to a player located behind the defenders in the front part of the actual play space (the specific area where players are effectively engaged in the action).

During the game, a configuration of play evolves from a state 1 to a state 2, and so on to a state n as long as the ball remains in play. There are two ways of looking at this. First, as in a picture, the configuration of play may be defined by the positions of the players at a moment M (Gréhaigne, Bouthier, & David, 1997). This would lead to a static two-dimensional study of the spatial distribution of attackers and defenders and of the position of the ball. Considering then several successive configurations of play (like a series of pictures), one could determine the reasons for attackers' and defenders' choices of action.

However, another way of considering the problem in a more dynamic manner consists in defining the micro state of the attack/defense system on the basis of location, direction, and possible speed of all players and the ball involved in the confrontation system at this moment. Then each micro-state is determined by a distribution of the players and the ball on the pitch with regard to their respective locations, orientations, and speeds of displacement (Gréhaigne et al., 1997). Considering such dynamic configurations of play represents a more elaborate answer for describing the reality of the game.

In connection with perceptual and decisional skills, the construct of configuration of play appears crucial because it makes it possible for the players to optimize their activity during play in movement. In this case, one can hypothesize:

The perceptual learning consists in extracting configuration schemata from pertinent and typical clues whose covariance or co-presence, in a given situation, makes it possible to reduce the time of analysis and of evolution of the informational context through the choice of favored indicators that are predictive of the global situation. . . . [This allows] the identification of spatial structures likely to reveal the surprising capacity of our nervous system for detecting constants and regularities. This confronts us with the problem of identifying the criteria that determine the choice, among the possible directions that the organizational process can take, of those that will be selected and stabilized. (Paillard, 1987, p. 1422).
One can think that, in order to detect pertinent clues in a given configuration of play, a novice needs to be guided with precise landmarks. These precise and simple reference elements are probable indicators of the evolution of the situation of play, and they make it possible for the novice to ignore many parameters useless as to adequate dealing with the configuration of play. Configurations of the game vary since players’ actions bring in purposeful or random changes. Dealing adequately with a configuration of play means that a player makes a pertinent analysis of its characteristics and potential and takes an appropriate decision. However, there may be more than one pertinent analysis applicable to a configuration of play. As the opposition evolves, new relations are created between elements of the game and others are destroyed, causing the production of endless instantaneous balance states. From the point of view of the player’s activity, all these relations that constitute the whole set of configurations are not equally interesting. Some are not at stake and the player can ignore them; others must be recognized because they are the ones that will prompt the production of an adequate response in the shortest possible time.

Elements Involved in Decision Making

Faced with some event, one interprets reality and gives it meaning. In team sports, what is happening during a sequence of play actions? What interacting elements can one identify? McMorris and Graydon (1997) discuss the complexity of decision making in team games:

Knowing which cues to process, however, does not guarantee successful decision making. The cues must be perceived accurately. The inter-relationship between attackers and defenders and, in particular, the space behind, between and in front of them, must be determined. This information will tell players what options are open to them in that particular situation. This can be compared with past experience of similar situations and, based on that comparison, a decision of what action to take can be made. In making a decision, however, the players should, also, take into account their own abilities, the abilities of the opposition, the physical conditions in which the game is being played, the score at that particular moment and the area of the field in which the action is taking place (McMorris & MacGillivary, 1988). Furthermore . . . the situation is exacerbated by the fact that players often have to make decisions quickly, if the initiative is not to be lost. (p. 71)

In Figure 2, we have identified a selected number of elements that are likely to influence each player’s successive decisions to be taken during sequences of action. As illustrated in the model, decision making may be seen as triggered by a play action that offers a given configuration of play. As discussed earlier, this configuration of play will likely be perceived and interpreted differently by the various players involved in the action (and by outside observers as well) and may thus lead to differentiated decision making. Both perception, with its related more or less selective attention, and subsequent decision making may be influenced by a series of elements. Some of these elements, listed on the right hand side of the figure, depend upon each player considered individually. Others, listed on the left
hand side of the figure, reflect the collective aspect of the game that each player
must also take into account.

**Individual Aspects of Decision Making**

While team sports imply the presence of partners, choices of action rest ultimately on each player. Decision making elements related to each individual player are the following.

*Individual Strategy.* It is an advanced planning based on hypothesis of likely actions undertaken by opponents and partners (Gréhaigne et al., 1999); this prior planning may well influence the player’s selective attention and already gives a particular orientation to decisions that will be taken during the game before it has even started.

*Player’s Cognitive Map or Knowledge Base.* The declarative and procedural knowledge accumulated through past experience influences the player’s interpretation of a configuration of play perceived in connection with efficient action rules (Gréhaigne & Godbout, 1995).

*Tactical Knowledge.* This kind of knowledge may rest on some theoretical concepts but remains mostly experiential, based on notions extracted from practice. Once the configuration of play has been perceived, the player may make sense of it or not. The recall of successful or unsuccessful adapted solutions helps assess the relevance of such response. Thus, strategic and tactical knowledge orients decision making. The recall may rest on long term memory, involving some action plan profile, and/or short term memory, focusing on events related to the unfolding game at hand and involving some current event profile (see current work by French & McPherson, 1999 and McPherson, 1999 for more details on the recent development of the action plan profile and current event profile constructs).

*Players’ Resources.* Knowledge about and consciousness of players’ present resources serve as a filter, allowing players to consider or reject off hand a given action hypothesis. Such resources may concern a player’s level and range of general motor skills, motor competencies, and sport specific motor skills. In many cases, especially in invasion type of team sports, where attackers must invade the defenders’ camp in order to make points, such resources also concern the player’s
physiological response capacity, considering the energy cost of hypothesized courses of action. Finally, although not necessarily at a conscious level, other variable characteristics of the player, such as concentration level and motivation, may also enhance or hinder perception and/or decision making.

*Player’s Location and Posture.* They determine the possibilities of responses given the player’s resources; a wrong perception of position and posture may misdirect decision making.

**Collective Aspects of Decision Making**

Collective aspects of the game may also influence players’ perception and/or decision making. The three following aspects have been discussed by Gréhaigne et al. (1999).

*The Collective Strategy.* This refers to the various plans, principles, or action guidelines selected prior to the match in view of organizing the activity of the players and the team as a whole during the competition. The strategy devised may either concern major general play options or specify the players’ behavior for various categories of play situations. Thus, collective strategy may direct in advance the players’ attention toward specific aspects of the game and orient, from the start, the general trend of the decision-making process.

*The Rapport of Strength.* This refers to the antagonist links that exist between several players or between the two groups of players brought together in an opposition relationship by virtue of certain rules of the game that determine an interaction mode. Advanced hypotheses about the rapport of strength and the actual perception during the encounter (with its repercussion on the current event profile) may well orient in part the players’ individual strategies and their tactical adaptation throughout the match.

*The Competency Network.* This network is made up of the various relations between the players within a team. As discussed by Gréhaigne et al. (1999), it influences the players’ play actions and behaviors depending upon their status within the team and the rapport of strength encountered. In a sense, the competency network may not influence directly players’ decision making but its weight is implicit since it is taken into account at least for the collective if not the individual strategy. Thus, the competency network will normally orient the attribution of a specific role to each player, hence its influence on decision making.

Although considered separately for the sake of the discussion, the various individual and collective elements presented above are somewhat interwoven. For instance, the blending of each player’s cognitive map, tactical knowledge, and resources leads to the recognition of a given competency network and both the rapport of strength and the competency network orient the planning of collective and individual strategies. More stable elements, such as the competency network, the rapport of strength, the cognitive map, part of tactical knowledge (action plan profile), and part of the players’ resources (e.g., motor skills), constitute a meshed background that filters the perception/interpretation/anticipation/decision sequence. For their part, as the play action unfolds, more changing elements, such as the players’ location and posture, the level of fatigue and motivation, and the current event profile add their weight and ultimately determine a more or less stable chain of relevant and/or irrelevant decisions.

This whole set of elements can only come to play at a superior cognitive level where one can make choices, face unexpected events, and find solutions for
new situations. At this point, cognitive processes serve (a) to extract information from play, (b) to make up an adequate representation of the situation, (c) to assess potential events, and (d) to draw up action scenarios.

There appears to be two theories at hand. According to supporters of a first theory (Bayer, 1979; Famose, 1990; Parlebas, 1984), the larger the players’ knowledge base, the more they can recognize constraints, regularities, and constants; and the more they can take notice of and question the unexpected, unforeseen event, i.e. transform it into information. Knowledge, from a decisional point of view, must rely on certainty, fixed, and stable references in order to confront and solve uncertainty. At the level of perceptual and decisional mechanisms, learning therefore consists in an increase of the amount of memorized knowledge and in a structuring of this knowledge (transformation into procedural knowledge; Famose, 1996).

Concerning the management and the organization of play, supporters of a second theory (Deleplace, 1979; Gréhaigne, 1989) contend that an expert can seize a clearly larger amount of information useful for the solving of problems brought about by the game than novices. Nevertheless, this amount of information remains relatively limited, and it is the quality of the information that is determining. In that respect, prior analysis of the internal logic of the sport by a coach, a teacher, or some other expert provides useful data. Based on such analyses, the players’ attention can be drawn to typical patterns of play. This way, under time constraints, the players have at their disposal an already worked out mental action picture instead of being burdened by a whole mass of information not useful for the solving of the problem at hand.

The problem, then, for a player is to succeed in encompassing the entire complexity of the game within a system made of the smallest possible number of fundamental action axes inter-related in a strong logical and functional unity. Tactics are based on successive decisions taken according to the evolution of the action. The development of tactical capacity implies the development of a capacity for deciding and deciding fast. In turn, this capacity relies on capacity for conceiving solutions. In short, the development of a capacity for choosing requires the development of knowledge and routines. So, the player, through cumulative experience, builds up an actual action matrix, always assimilating and refining the data collected into a personal mental action picture which allows him or her to act and react faster.

Figure 3 presents an operative model of decision making that emphasizes the contributions of some of the elements discussed earlier. Such a dynamic model reflects the reality of a game played under strong time constraints. One functioning hypothesis is to consider that the players’ analysis of play action under strong time constraints is conducted with reference to a few typical configurations of play and to related forerunner cues (allowing anticipation). Knowing the essential of appropriate responses to a given kind of configurations of play facilitates fast decision making (Bouthier, David, & Eloi, 1994).

The Teaching-Learning Process at School

Notions of perception, anticipation, and decision are key elements for the development of tactical thinking. Learning to make decisions in team sports is neither easy, nor trivial. The fact that practice is required to develop decision mak-
ing and tactical skills in general goes without saying. Given the limited amount of deliberate practice available in most school physical education programs, teachers’ efforts should be directed toward quality designed practice (Thomas & Thomas, 1999).

Discussing key elements for a constructivist perspective in the learning process in team sports, Gréhaigne and Godbout (1999) suggested the concurrent use of three types of settings to elicit the development of tactical skills: (a) action settings, in which students are engaged in the actual practice of the sport or of some adaptation of that sport; (b) observation settings in which students not engaged in the action setting are asked to observe performing peers and to collect information (usually with reference to performance criteria); (c) debate-of-idea settings, in which, following play action, students are invited to express themselves and exchange facts and ideas based on observations collected or on personal activity experienced. The debate may concern quantitative results cumulated during the action setting, qualitative assessments of the process involved, collective and/or individual strategic hypotheses for future action settings, and so on.

In all three types of settings, the teacher should keep in mind the importance of eliciting critical thinking. This may be obvious with debate-of-idea settings and make sense with observation settings. In addition, teachers and students must be convinced that action settings during physical education lessons are designed for teaming, not for purposeless playful activity (which in no way suggests that learning cannot be fun). Thus, besides the actual experience of play action, students should be asked to perform two other tasks that are likely to ultimately enhance their decision-making skills, namely observation and verbalization.

**Observation of Play Action**

The notion of observation, related to the construct of visual search patterns, has been given a great deal of attention in research about experts and novices
differences. There is no doubt that in action settings, players involved into action play perceive and assess configurations of play mainly through visual cues provided by their central and/or peripheral vision. This is especially so for those heavily solicited at the partial forefront and primary organization levels (Gréhaigne, 1992; Gréhaigne & Godbout, 1995). The challenge, then, for the teacher is to proactively orient, rather than strictly direct, the students’ attention toward relevant aspects of the play. This strategy may apply both to students to be immediately engaged into play action and to students assuming observation tasks.

From a pedagogical point of view, one may view the observational situation from different perspectives. For instance, in a teacher-centered perspective, the teacher observes the action involving various students and then, on the basis of his or her frame of reference, provides feedbacks to them describing, explaining, justifying, recommending, and prescribing. What the students have perceived is thus confirmed if it fits the teacher’s discourse or is put aside if it differs.

In a learner-based and constructivist teaching style, such as the one suggested in this paper, the observation setup alluded to above might be as illustrated in Figure 4. At the center of the figure, one can see the action setting involving a given number of students (e.g., 3 vs. 3; 5 vs. 5) in interaction with the subject matter; this interaction should eventually include reflection in action. The teacher and students observing action represent the observation setting. A thicker line at the bottom indicates that the teacher also observes how each student observer proceeds, providing help if necessary. Finally, the various lines connecting members of a team (S1, S2, S3) and the team with the teacher and the student observers illustrate the debate-of-idea setting, involving reflection on action. During action play, three categories of observers may be involved: (a) the players directly involved into action play, (b) the outside student observers, and (c) the teacher. Each observer involved in such a setup has to collect information based on personal observations and will interpret reality according to a personal frame of reference. It is doubtful that an outside observer can duplicate the performer’s perception of action. It is arguable that in many instances, an outside observer stands a better chance to perceive a picture closer to reality. Whether this is true or not is, to a certain point, irrelevant. The learning process, from a constructivist perspective, implies interaction between the subject and the environment. Eventual augmented feedback should be seen as additional information that can be processed differently by the learner, depending on perception of the completed action and on the

![Figure 4 — Observational setting for the teaching/learning of team sports.](image)
learning stage exploited by the teacher.

If it is argued that the learner cannot be replaced but can only be supported and complemented in his or her observational process, this does not imply that the learner possesses an innate and final observational frame of reference. As skill learning goes, so does observation learning. Therefore, the learner is also confronted with the construction of a frame of reference with the help of the teacher and other students. Different decisions may be taken by the learner depending on what focus the observations have (orienting of attention). Consequently, although constructed by each learner, the frame of reference should reflect the objectives pursued in the classroom.

Obviously, for students directly involved into play action, observation leads to anticipation and fast decision making under the time constraints inherent to the game. Following action play, observational data may still be put to use in debate-of-idea settings involving verbalization.

**Verbalization and Debate-Of-Idea Settings**

Discussion and debates among students or between students and the teacher, preceding and/or following action play, inevitably involve overt and shared verbalization. As mentioned by several authors (e.g., Caverni, 1988; Ericsson & Simon, 1993; French & McPherson, 1999) verbalization is considered an observable source of information about cognitive processes. Considering the moment of its occurring with regard to task performance, Caverni (1988) distinguishes three types of verbalization: (a) prior verbalization (about what will be or ought to be done), (b) concurrent verbalization (think aloud protocols about what is being done), and (c) consecutive verbalization (retrospective reports; Ericsson & Simon, 1993).

In teaching setups, overt verbalization (either prior or consecutive) may still be used as a tool for both the teacher and the student to collect information about the learner’s thought processes. However, at the same time, it can also be used as a tool for eliciting reflection on action and critical thinking. In this sense, the concern expressed by Ericsson and Charness (1994) about the impact of verbal reports on underlying cognitive processes seems no longer as relevant. In a teaching setup, the very purpose of verbalization is to bring transformation.

In the debate-of-idea setting, verbalization is shared among all students, players, and observers alike, each one providing information and ideas from his or her perspective. Retrospective verbalization provides information and stimulates reflection about obstacles encountered by players in their effort to solve a problem at hand. Such information can be used by the teacher or can be shared among students while debating about proper ways to perform a task at hand (prospective verbalization). Schunk (1986) states:

> Studies demonstrate that verbalization can improve children’s learning of information, modeled actions, and strategies, as well as their self-efficacy for performing tasks. Collectively, these findings support the notion that verbalization is a key process that can help develop self-regulated learning among children. (p. 362)

In such a debate-of-idea setting, the teacher might expect to hear expressions such as “I did or did not” “I should have,” “I might have,” “I will,” “I should,” “I might,” and so on. Retrospective verbalization might help assess the perception and inter-
pretation of encountered configurations of play and the ensuing anticipation and decision. For its part, prospective verbalization and agreed upon strategies will help orient the attention of both players and observers during the upcoming action—observation setting.

An Operational Teaching Model

Given the systematic use of the three types of settings discussed earlier (action, observation, and debate of ideas), Figure 5 illustrates an operational teaching model that should enhance students’ construction of tactical knowledge and the development of their decision-making skills. At the very onset of the learning sequence, students are put in action in some form of adaptation of the game. For instance, a lesser number of players should simplify the configuration of play. However, the use of smaller play area calls for some caution and should be balanced against the number of players involved since this may cause an increase in the time constraints, a limiting factor for decision making.

After appropriate observation, augmented feedbacks of different nature can complement the intrinsic feedbacks experienced by each player. In the ensuing debate of ideas, each team puts together a first action project, which is then tried out in play. Following observation, the team’s capacity of implementing the game plan (action project) can be assessed, and there may be proposals for an evolution of the plan. After a new exposure to play, students may perceive the emergence of constants for various aspects of the game. This in turn can lead to the development of a new action project with the introduction of connections between action rules, play organization rules (Gréhaigne & Godbout, 1995), and required skills on the one hand and the constants that have just been identified on the other. After testing its new action project, the team may use the results of observations to appreciate positive and negative aspects of their anticipated game plan. In doing so, players are progressively putting together tactical knowledge and refining their decision-making skills. Once stabilization appears to be taking place, learning settings may be complexified and, eventually, players may be exposed to another team sport to initiate a generalization process.

The students are successively confronted with:

- Mini-Game
- Emotional feedbacks from team and student observers
- Quantitative data feedbacks from teacher and student observers
- Emergence of constants for various aspects of the game
- Action project dealing with action rules, play organization rules and motor skills
- Positive and negative aspects of anticipated game plan
- Toward tactical knowledge
- Toward another team sport for generalization
- Toward other more complex settings

Figure 5 — A model for students’ construction of knowledge in team sports.
Conclusion

In order to better understand how decision-making skills evolve in a teaching/learning system, consideration must be given to more than the presence or absence of any of a player's qualities. Many elements are involved in the "construction" of a player able to manage in team sports. On the road leading to a beginning of expertise, learning to deal with time constraints probably constitutes a fundamental element. But also it seems that the reciprocal rapport between the various elements underlying decision-making competency (see elements listed in Figure 4) evolve during a player's construction. Particularly, the acquisition of routines related to the perception of useful cues should strongly influence the player's treatment of configurations of play. Knowledge about the rules of the game is another matter to be considered. The main characteristic of rules is to provide a structure for a given sport. Rules clearly specify the nature of the problem inherent to the game and put a restriction on the means accessible to players for the resolution of obstacles engendered by play action (Almond, 1986; Deleplace, 1979; Gréhaigne, 1989).

Another difficulty is to face the challenge of learning about team sport within a time span of 20 or 30 hours. Researchers on expertise estimate that it takes 10,000 hours of practice to become an expert (Chase & Simon, 1973; Ericsson, 1996; Salmela, 1997). This is somewhat similar to the ten-year rule mentioned earlier (it would roughly mean training 10 years, 20 hours per week and 50 weeks per year). There are two ways of looking at such a conclusion: Either give up or try to do something about it. Survival of physical education may rest in part on our answer to this challenge. One way to avoid that may be not to constantly rely on knowledge and motor-competencies acquisition models used in out-of-school sport and physical activities. The challenge may be expressed as follows: How do we help the student construct knowledge about decision making, for instance, within the time span allocated by the school? The school time allocation generates a "school culture." Forquin (1989) defines it as the set of cognitive and symbolic contents (in the case of physical education, one must also consider the motor competencies) that, once selected, organized, "normalized," and "routinized" under the constraints of the didactic treatment (didactic transposition), become the object of a deliberate transmission in schools. If that definition is used, schools teach a particular body of knowledge.

The teaching-learning of a given sport and physical activity should be conceived so that students are no longer naïve when they later engage in a new physical activity. One must look for transversalities specific to a family of physical activities or even to many such families. This implies, at the level of the learning setup, an insistence on the construction of specific knowledge articulated with the fundamental problem offered by the activity or the family of activities. But soon enough, one must connect this knowledge and these competencies with categories of problems in which they are likely to be reutilized (for instance, constructing action rules that allow the utilization of a support player in soccer and stabilizing these rules in team handball and basketball: Gréhaigne & Godbout, 1997).

The simultaneous pursuit of these two objectives, the refinement and the generalization of knowledge, ought to be the minimal ambition for a physical education that would contribute to the education of a physically active adult. At a more fundamental level, this brings up the question: What is a student that can manage in team sport and more generally in sport and physical activity at large?
References


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