

20 Decision making and tactical knowledge

An Australian perspective in the development of youth football players

D. O'Connor and P. Larkin

University of Sydney, Sydney Australia

Introduction

Within invasion sports, game intelligence is an important component to proficient athlete performance. Game intelligence can be investigated as two separate but related attributes, tactical and decision-making skills. Tactical skills are defined as knowledge of in-game adaptations and decision making (Elferink-Gemser, Kannekens, Lyons, Tromp, & Visscher, 2010), involving the player performing the correct action at the right moment (Kannekens, Elferink-Gemser, & Visscher, 2011). Therefore, unlike physiological skills, tactical skills depend on cognitive information, including knowledge of the goals and actions of the game, awareness of skills and understanding of actions within the context of the game (Thomas, French, & Humphries, 1986). As a result, tactical skills comprise both declarative knowledge, such as rules of the game (i.e. knowing what to do), and procedural knowledge, such as the appropriate selection of an action within the context of the situation (i.e. doing it) (French & Thomas, 1987). On the other hand, sport-specific decision making relates to the process of selecting the most appropriate movement response, from a range of possible actions, which incorporates strategy, to achieve a specific goal (Abernethy, 1996; Hastie, 2001; MacMahon & McPherson, 2009; O'Connor & Larkin, in press).

The role of a coach within any sport is to develop the skills of their players. While tactical and decision-making skills, as demonstrated by their definitions, are inter-related, the challenge for many coaches is to develop game intelligence and the ability of their players to 'read the play'. Therefore, these skills, just like physical or technical ability, need to be taught and developed, with coaches striving to create innovative and effective learning environments to challenge and develop their players. Within Australia, the national governing body, Football Federation Australia, has responded to reports following major elite tournaments that players are limited by their tactical awareness and decision-making ability. To combat this, Football Federation Australia has used a research-based approach aimed at improving the technical ability of players, while creating a learning environment to foster decision making and tactical awareness in youth players.

The aim of this chapter is to examine strategies, based on Football Federation Australia's National Curriculum, to inform coaches on how to create learning environments to potentially foster game intelligence in players.

National Curriculum

Football training sessions, especially at a youth level, have traditionally been delivered via a coach-centred approach, whereby the coach is in control and there is little input from the

player (O'Connor, 2012). An issue with this traditional coach-centred style of coaching is the emphasis on memorising and mimicking, coupled with explicit instruction and feedback, with limited opportunity for players to learn via problem solving (Kidman & Lombardo, 2010). During a traditional session, players are generally exposed to an introductory activity, a skill phase whereby the skill is performed in a repetitive or isolated manner, followed by a game (Hodges & Franks, 2002; O'Connor, 2012; Williams & Hodges, 2005). Analysis of football coaching sessions has indicated a large proportion of time (60–72 per cent) is dedicated to skill-based training, or 'training form' activities, such as physical, technical and skill practices, which have minimal game-play context (Ford, Yates, & Williams, 2010). Conversely, 28–40 per cent of the time is dedicated to 'playing form' activities, which have a game-related focus, including small-sided and conditioning games, which are believed to promote perceptual-cognitive and technical skills (Cushion, Ford, & Williams, 2012; Ford et al., 2010).

In an attempt to move away from the traditional style of coaching and incorporate more playing form activities, Football Federation Australia has developed a National Curriculum. The National Curriculum provides coaches with an understanding of the national football philosophy, but also outlines specific coaching strategies to improve the technical and decision-making ability of players. This strategy incorporates four activities within a training session, whereby there is an instructional skill-based activity to frame the session (i.e. training form), followed by two to three game-based activities (i.e. playing form). It is believed that increasing the amount of playing form activities may improve both technical and decision-making skills, as the activities provide an opportunity to create links between the skills, decisions and action required within a game context (Ford et al., 2010).

Furthermore, the pedagogical style of the National Curriculum is player learning via guided discovery, whereby learners are guided through a problem (e.g. skill- or tactical-based problem) and encouraged to construct their own knowledge structures about methods to solve the problem (Bruner, 1961; Hodges & Franks, 2002). A key to creating such an environment within a coaching session is for players to be actively engaged in interesting and challenging activities and coaches to ask meaningful open-ended questions that guide the learner to the desired outcome of the problem. While traditional training methods relied on explicit instruction, which has been demonstrated to accelerate skill acquisition through the early stages of learning (Rendell, Farrow, Masters, & Plummer, 2011; Smeeton, Williams, Hodges, & Ward, 2005), this method of training has been associated with reduced performance under stressful conditions, such as in-game performance (Masters, 1992; Raab, 2003; Rendell et al., 2011). In contrast, a guided discovery style of learning, which has been shown to have a longer skill acquisition period, has demonstrated maintenance of skill performance within stressful conditions (Masters, 1992; Raab, 2003). Therefore, it is believed that creating a guided discovery environment, with increased time in playing form and game-related activities, players will have a greater chance to develop more robust technical and decision-making skills.

In addition to providing a guide for the structure of a coaching session, the National Curriculum also provides an indication of the core skills that should be focused upon at specific developmental stages. The curriculum separates skill development based on age, with players progressing through specific phases during their development, including, the

discovery phase (6–9 years of age), the skill acquisition phase (10–13 years of age), game training phase (14–17 years of age) and the performance phase (17 years of age and above). At each phase, there are specific core skills or aims that relate to the developmental and technical ability of the players at that age. During the discovery phase, coaches are promoted to create a deliberate play environment (Côté, 1999; Côté, Baker, & Abernethy, 2003, 2007; Côté & Hay, 2002), with less of an emphasis on coaching. Similar to street football and pickup games, these informal small-sided games are often adapted to suit the skill level of the players and are enjoyable, intrinsically motivating and provide opportunities for players to be creative, and learn by trial and error without being told ‘the right way’. Within the skill acquisition phase, the training focus is on the technical skills involved in soccer to provide a foundation for functional game skills (i.e. first touch, striking the ball, one versus one and running with the ball). While the skills focused on at this age would normally be associated with training form activities, coaches are encouraged to provide more playing form activities to ensure skills are related to game-specific performance. Following the focus on technical skills, the game training phase uses game-related activities to develop skills, such as tactical awareness (i.e. playing out from the back, midfield play and transitioning play), perception and decision making, by applying functional game skills within the team setting (Football Federation Australia, 2013). Finally, the performance phase prepares players for the competitive environment where the emphasis shifts to match analysis and winning games. Underpinning the National Curriculum and coach education is the focus for coaches to adopt a constraints-led approach when designing and developing activities to optimise player opportunities to ‘perceive-decide-and-execute’. By using a task-based approach, coaches are encouraged to manipulate constraints such as rules, pitch dimensions, scoring and player numbers to create a learning environment where players are engaged in problem-solving activities and learn the importance of space, time and risk while developing their tactical and technical skills.

Decision making

With respect to decision making, researchers have indicated that there are a number of integrated perceptual-cognitive skills that form an expert’s advantage during skilled decision making, including the ability to recognise and recall patterns of play (Helsen & Starkes, 1999; Williams, Hodges, North, & Barton, 2006); a greater sensitivity to advance cue utilisation (Helsen & Starkes, 1999; Savelsbergh, Williams, Van Der Kamp, & Ward, 2002; Ward, Ericsson, & Williams, 2013); and enhanced knowledge of event outcomes (Vaeyens, Lenoir, Williams, Mazyn, & Philippaerts, 2007a; Vaeyens, Lenoir, Williams, & Philippaerts, 2007b; Ward et al., 2013). It is this perceptual-cognitive advantage that enables skilled players to adapt rapidly to changes in the situational demands of the skill and/or game environment, thus enabling quick and accurate decisions (Vaeyens et al., 2007b). Within a football context, many studies have explored the expertise effect in relation to decision-making and perceptual-cognitive skills (e.g. Vaeyens et al., 2007a). However, due to the complex and demanding game environment, with the interaction between players and the evolving game-play, research and assessment of decision-making ability have generally been conducted using laboratory tasks, such as video-based assessments (Savelsbergh et al., 2002; Vaeyens et al., 2007b; Ward et al., 2013). While these video-based assessments provide an

indication of skill-based differences in perceptual-cognitive skills, such as decision making, anticipation, situational probability and pattern recognition (Vaeyens et al., 2007b; Ward et al., 2013; Williams et al., 2006), these assessments explore the decision making process in isolation to other skills. It is important to understand that during a game context, as indicated in the definition of decision making, players need to be able to *perceive* the game-play action, *decide* what the best course of action is and then *execute* this decision. Therefore, when considering decision-making skill development, especially in youth players, activities need to be developed which incorporate all three elements of successful decision-making performance.

From a coaching perspective, the ability to develop activities which promote players to *perceive-decide* and *execute* while solving a football specific problem is a challenging process. Take, for example, a youth coach who reflected on the previous game and identified that his players were comfortable in the midfield areas, however when moving into the attacking third players lacked penetration and the ability to create goal scoring opportunities. In trying to solve this problem, the coach decided he needed to promote more opportunities for players to decide when and when not to evade opponents. If the coach conducts a 4 versus 4 game in a small area there may be limited opportunities for players to make decisions related to evading opponents. To improve this situation the coach may manipulate constraints by adding one player as a joker (i.e. a player who only plays for the team in possession thus making the game a 5 v 4). Analysis of these two activities has demonstrated that the second activity promotes more game actions per players (13.4 v 9.8), with more opportunities for players to evade opponents (27 v 6) compared to the 4 v 4 game (unpublished data).

In sport, especially dynamic team sports, skilled perception precedes an appropriate action. The ability to make quick and accurate decisions, based on the perception and knowledge of the position of teammates and the opposition, and an understanding of how these players will interact is an important skill for all players (Fagereng, 2010). Players who possess this skill are believed to 'read the play' with researchers indicating that skilled players possess a superior ability at identifying and interpreting sport-specific information during the decision making process (Helsen & Starkes, 1999; Williams, 2000). Further, eye-tracking research has shown that experienced players focus less on the movements of the ball, but rather attend to information off the ball, such as player movements and positions (Williams, Davids, Burwitz, & Williams, 1994; Williams & Davids, 1998; Vaeyens et al., 2007a). Therefore, perceived visual information is an important factor when considering the decision-making ability of players.

While eye-tracking and visual-scanning testing equipment is extremely expensive, and not a practical assessment at youth level competitions, researchers have started exploring the potential influence of visual exploration information (Fagereng, 2010; Jordet, 2004, 2005). Visual exploration in a soccer context can be described as "movements of the body and/or head prior to receiving the ball, engaged in to perceive information away from the ball and to act appropriately when the ball arrives" (Jordet, 2005, p. 141). This method of assessing perceptual ability has been adapted to soccer as it is impossible for players to perceive all the information they need by just moving their eyes, therefore, they must initiate a movement of the head to scan for important information from within the game environment (Fagereng, 2010). For example, a player who is about to receive the ball with their back to the goal will

make a head movement away from the ball to look for information behind them in relation to the defending players, position of the goalkeeper, teammates or their position on the field. Retrospective studies investigating visual exploration between skilled and less skilled players have found the skilled players perform more visual exploration movements when compared to less skilled players (Fagereng, 2010; Jordet, 2004). It has also been reported that visual exploration positively correlated with pass completion rate, providing initial evidence to suggest visual exploration may impact the performance of in-game technical skills (Fagereng, 2010). Therefore, coaches may need to consider the perceptual ability of their players, and create activities that promote the scanning of visual information from within the game environment, which may impact the decision-making and skill execution ability of their players. This may be as simple as a coach conducting a small-sided game with a focus on awareness and player location. The coach may use key cues such as ‘check your shoulder’, ‘scan the field’ and ‘awareness’ before, during and after the game. The coach will then ask the players relevant questions so they can interpret their actions and see the importance of visual exploration when playing.

Tactical understanding

Similar to decision-making skills, tactical knowledge and understanding is considered important for elite level performance (Teoldo, da Silva, Greco, & Mesquita, 2009), with players depending on cognitive information, including knowledge of the goals and actions of the game, awareness of skills and understanding of actions within the context of the game (Thomas et al., 1986). Further, during a game players are constantly using this cognitive information to coordinate their actions relative to their teammates and the opposition, with the general aim to retain or regain possession of the ball and score or prevent the opposition from scoring, or more specifically awareness of their playing position and role within the team, and when and when not to apply team tactics. This interaction between cognitive information (i.e. spatial awareness, game-play information) and the physical environment (i.e. teammates and the opposition), creates a unique task whereby well-developed tactical understanding is essential for successful performance (Gréhaigne & Godbout, 1995).

In a sport-based context, tactical knowledge or behaviour can be defined as the ability of a player to make and execute appropriate actions relative to game constraints including time, space and task (Gréhaigne & Godbout, 1995; Santos, Padilha, & Teoldo, 2014). While assessments have been devised to understand perceptual-cognitive and decision-making ability, as tactical actions and behaviours are generally performed without possession of the ball, there has been limited assessment of player’s tactical knowledge and behaviour. However, recently, researchers have developed a retrospective coding system for the assessment of player’s tactical knowledge and behaviour, The System of Tactical Assessment in Soccer (FUT-SAT) (Teoldo, Garganta, Greco, Mesquita, & Maia, 2011). The FUT-SAT has been developed to provide information reflecting the tactical behaviours of players within game situations, by assessing both offensive and defensive player actions. Investigations using the FUT-SAT have found that players with a greater understanding of the game perform more successful tactical actions which is believed to contribute to their higher levels of ability (dos Santos Gonzaga, Albuquerque, Malloy-Diniz, Greco, & Teoldo, 2014; Teoldo, Garganta, Greco, Mesquita, & Seabra, 2010). These studies demonstrate the potential this

coding system has to research applications, and provide a greater understanding of the link between tactical understanding and player performance. However, a limitation of such coding systems for youth and development coaches is the cost and time required to perform such analysis. Therefore, coaches are looking for more easily applicable methods to train and monitor tactical skill development.

How does the coach use training to develop decision making and tactical awareness in players?

While the Football Federation Australia National Curriculum aims to provide an athlete-centred and playing form approach, there is little evidence of whether youth coaches are implementing the curriculum and creating training environments that provide opportunities for youth players to enhance tactical and technical awareness and skills. The following section will provide preliminary data from the systematic observation of 45 training sessions from the Skill Acquisition and Game Training Phase of the Curriculum.

Table 20.1. Percentage of time spent within football training activities.

	Skill Acquisition Phase (%)	Game Training Phase (%)
Training Form	19.77	27.44
• Individual	3.97	8.61
• Paired	2.79	1.20
• Drills	13.02	17.63
Playing Form	43.51	35.52
• 2 v 2 – 4 v 4	22.02	11.35
• ≥ 5 v 5	21.50	24.16
Inactivity	31.06	29.99
• Player huddle	10.56	9.24
• Freeze	15.93	16.56
• Drink break	4.57	4.19

Preliminary findings reveal that with respect to training and playing form, both Skill Acquisition and Game Training phases of the Curriculum have a greater amount of time within playing form activities (Table 20.1). It has been found in previous literature that during youth football training there is generally more time allocated to training form activities (Ford et al., 2010; Partington & Cushion, 2013; Seerden, 2013). This indicates that current training sessions delivered by coaches are providing more playing form activities, which may promote the development of perceptual-cognitive and tactical awareness skills (Partington & Cushion, 2013). Further analysis of playing form activities revealed that a greater proportion of time is spent in large-sided games (five players or more) during the

Game Training Phase. This indicates that coaches are trying to implement the strategies of the National Curriculum by providing more opportunities to develop tactical awareness in simulated game environments.

Despite the relatively large ratio of playing to training form, especially during the Skill Acquisition phase, there is a large proportion of the training session where players are not physically involved in an activity. The results show that breaks in play (i.e. the coach calling players in together to give instructions or feedback (player huddles); the coach stopping an activity where players ‘freeze’ on the spot and listen to the coach; and drink breaks) make up approximately 30 per cent of the total session time. The National Curriculum highlights that team sport training sessions often under-utilise time with large amounts of inactivity due to high amounts of coach instruction and feedback and poor planning and organisation. Although the amount of inactivity is lower than other published results (36–48 per cent, O’Connor, 2012), current youth football training sessions would benefit from more time allocated to active player engagement in activities and less talking from the coach.

Due to the difficult nature of teaching decision making and tactical awareness, the National Curriculum encourages coaches to develop activities that involve problem solving, are task-based and focus on the players’ ability to perceive-decide and execute. From the perspective of an Australian elite youth coach when designing a training session to incorporate these elements, coaches should:

Think of the problem in the game and think about where it happens and what number of players and what situation it happens in and then you try to put together a practice that provides a repetition of that problem. Then you choose whether you coach, as in stop, freeze, replay and show where you think players could take up a better area. If you’re looking at prescribed good decision making, this is our style of play and this is how I want you to do it. . . . But, also then to think on the level beyond that, then you have to have a free play time or a time where it’s a game with stimulus for them to find another solution.

Recommendations for improving tactical awareness and decision making

From a practical perspective, when designing training sessions that aim to address the *perceive-decide* and *execute* processes, coaches should consider the following:

- Reinforce a growth mindset by focusing on the effort of their players. For example, praise the effort and commitment displayed by your players, encourage them to continually challenge themselves and emphasise that all players can improve their skills.
- Encourage players to use ‘trial and error’ and learn through their mistakes. Embrace the dynamic and chaotic nature of games rather than the structure and discipline of grids and drills.
- When devising new activities ensure they are purposeful and challenging – players are training just outside their comfort zone; make sure there is enough opportunity for a) repetition and b) decision making.
- Plan your questions beforehand to scaffold learning; look for teachable moments. Use appropriate questions (What? Where? How? When? Why?) that allow players to

problem solve and make decisions. Questions may also consider time, space and risk in developing tactical understanding.

- Be aware of the amount of stoppages/inactivity in your training session. Reduce this by keeping explanations concise; asking individual players questions during the activity (e.g. when interchanged); observing play rather than continually stopping and correcting.

For the past three decades, the majority of studies in football have been focused on developing the physiological attributes of players and the body of research on training those capacities is mostly complete and well applied across teams. As federations, teams and coaches begin to examine the next phases of player and team development, tactical knowledge and decision making are at the forefront of their needs. Unlike physiological attributes, tactical skills and game intelligence depend more on understanding and successfully negotiating complex and dynamic systems of play. Developing a better understanding of the activities, sequencing and organisation of those activities and specific coaching cues to promote game intelligence should provide more concrete guidelines to coaches to design more effective training activities.

References

- Abernethy, B. (1996). Training the visual-perceptual skills of athletes: Insights from the study of motor expertise. *American Journal of Sports Medicine*, 24, 589-592.
- Bruner, J. (1961). The act of discovery. *Harvard Educational Review*, 31, 21-32.
- Côté, J. (1999). The influence of the family in the development of talent in sport. *The Sport Psychologist*, 13, 395-417.
- Côté, J., Baker, J., & Abernethy, B. (2003). From play to practice: A developmental framework for the acquisition of expertise in team sport. In J. Starkes & K.A. Ericsson (Eds.), *Expert performance in sports: Advances in research on sport expertise* (pp. 89-110). Champaign, IL: Human Kinetics.
- Côté, J., Baker, J., & Abernethy, B. (2007). Practice and play in the development of sport expertise. In G. Tenenbaum & R.C. Eklund (Eds.), *Handbook of Sport Psychology* (3rd ed., pp. 184-202). Hoboken, NJ: Wiley
- Côté, J., & Hay, J. (2002). Children's involvement in sport: A developmental perspective. In J.M. Silva & D. Stevens (Eds.), *Psychological foundations of sport* (2nd ed., pp. 484-502). Boston, MA: Merrill
- Cushion, C. J., Ford, P. R., & Williams, A. M. (2012). Coach behaviours and practice structures in youth soccer: Implications for talent development. *Journal of Sports Sciences*, 30(15), 1631-1641.
- dos Santos Gonzaga, A., Albuquerque, M. R., Malloy-Diniz, L. F., Greco, P. J., & Teoldo, I. (2014). Affective Decision-Making and Tactical Behavior of Under-15 Soccer Players. *PloS one*, 9(6).
- Elferink-Gemser, M. T., Kannekens, R., Lyons, J., Tromp, Y., & Visscher, C. (2010). Knowing what to do and doing it: Differences in self-assessed tactical skills of regional, sub-elite, and elite youth field hockey players. *Journal of Sports Sciences*, 28(5), 521-528.

- Fagereng, K. (2010). *A real game examination of visual perception in soccer: testing the relationship between exploration frequency and performance in young and talented players*. Dissertation from the Norwegian School of Sport Sciences.
- Football Federation Australia. (2013). *The National Football Curriculum: The roadmap to International success*. Sydney, Australia: Football Federation Australia.
- Ford, P. R., Yates, I., & Williams, A. M. (2010). An analysis of practice activities and instructional behaviours used by youth soccer coaches during practice: Exploring the links between science and application. *Journal of Sports Sciences*, 28(5), 483-495.
- French, K. E., & Thomas, J. R. (1987). The relation of knowledge development to children's basketball performance. *Journal of Sport Psychology*, 9, 15-32.
- Gréhaigne, J. F., & Godbout, P. (1995). Tactical knowledge in team sports from a constructivist and cognitivist perspective. *Quest*, 47(4), 490-505.
- Hastie, R. (2001). Problems for judgment and decision-making. *Annual Review of Psychology*, 52(1), 653-683.
- Helsen, W. F., & Starkes, J. L. (1999). A multidimensional approach to skilled perception and performance in sport. *Applied Cognitive Psychology*, 13, 1-27.
- Hodges, N. J., & Franks, I. M. (2002). Modelling coaching practice: the role of instruction and demonstration. *Journal of Sports Sciences*, 20(10), 793-811.
- Jordet, G. (2004). *Perceptual expertise in dynamic and complex competitive team contexts. An investigation of elite football midfielders*. Dissertation from the Norwegian University of Sport and Physical Education.
- Jordet, G. (2005). Perceptual training in soccer: An imagery intervention study with elite players. *Journal of Applied Sport Psychology*, 17(2), 140-156.
- Kannekens, R., Elferink-Gemser, M. T., & Visscher, C. (2011). Positioning and deciding: Key factors for talent development in soccer. *Scandinavian Journal of Medicine and Science in Sports*, 21, 846-852.
- Kidman, L. & Lombardo, B. (2010). *Athlete-centred coaching: Developing decision makers*. (2nd Ed.) Worchester: IPC
- MacMahon, C., & McPherson, S. L. (2009). Knowledge base as a mechanism for perceptual-cognitive tasks: Skill is in the details! *International Journal of Sport Psychology*, 40, 565-579.
- Masters, R. S. W. (1992). Knowledge, knerves and know-how: The role of explicit versus implicit knowledge in the breakdown of a complex motor skill under pressure. *British Journal of Psychology*, 83, 343-358.
- O'Connor, D. (2012). Challenges facing Youth Coaches. In J.O'Dea (Ed). *Current Issues and Controversies in School and Community Health, Sport and Physical Education*, (pp. 283-294). New York, USA: Nova Science.
- O'Connor, D. & Larkin, P. (in press). Decision making for rugby. In K.Till & B. Jones (Eds). *The Science of Sport: Rugby*. Crowood Press.
- Partington, M., & Cushion, C. (2013). An investigation of the practice activities and coaching behaviors of professional top-level youth soccer coaches. *Scandinavian journal of medicine & science in sports*, 23(3), 374-382.
- Raab, M. (2003). Decision making in sports: Influence of complexity on implicit and explicit learning. *International Journal of Sport & Exercise Psychology*, 1, 310-337.

- Rendell, M. A., Farrow, D., Masters, R. S. W., & Plummer, N. (2011). Implicit practice for technique adaptation in expert performers. *International Journal of Sports Science and Coaching*, 6(4), 553-566.
- Santos, R., Padilha, M. B., & Teoldo, I. (2014). Relationship between Tactical Behavior and Affective Decision-Making in U-17 Youth Soccer Players. *Human Movement*, 15(2), 100-104.
- Savelsbergh, G. J. P., Williams, A. M., Van Der Kamp, J., & Ward, P. (2002). Visual search, anticipation and expertise in soccer goalkeepers. *Journal of Sports Sciences*, 20(3), 279-287.
- Seerden, G. (2013). *The role of feedback within the use of key practice activities in English professional youth soccer*. Masters Dissertation from Vrije Universiteit Amsterdam.
- Smeeton, N. J., Williams, A. M., Hodges, N. J., & Ward, P. (2005). The relative effectiveness of various instructional approaches in developing anticipation skill. *Journal of Experimental Psychology: Applied*, 11(5), 98-110.
- Teoldo, I., da Silva, J. M. G., Greco, P. J., & Mesquita, I. (2009). Tactical Principles of Soccer Game: concepts and application. *Motriz. Journal of Physical Education. UNESP*, 15(3), 657-668.
- Teoldo, I., Garganta, J., Greco, P. J., Mesquita, I., & Maia, J. (2011). System of tactical assessment in soccer (FUT-SAT): Development and preliminary validation. *Motricidade*, 7(1), 69-83.
- Teoldo, I., Garganta, J., Greco, P. J., Mesquita, I., & Seabra, A. (2010). Influence of relative age effects and quality of tactical behaviour in the performance of youth soccer players. *International Journal of Performance Analysis in Sport*, 10(2), 82-97.
- Thomas, J. R., French, K. E., & Humphries, C. A. (1986). Knowledge development and sport skill performance: Directions for motor behavior research. *Journal of Sport Psychology*, 8, 259-272.
- Vaeyens, R., Lenoir, M., Williams, A. M., Mazyn, L., & Philippaerts, R. M. (2007a). The effects of task constraints on visual search behaviour and decision-making skill in youth soccer players. *Journal of Sport and Exercise Psychology*, 19, 147-169.
- Vaeyens, R., Lenoir, M., Williams, A. M., & Philippaerts, R. M. (2007b). Mechanisms underpinning successful decision making in skilled youth soccer players: An analysis of visual search behaviors. *Journal of Motor Behavior*, 39(5), 395-408.
- Ward, P., Ericsson, K. A., & Williams, M. A. (2013). Complex perceptual-cognitive expertise in a simulated task environment. *Journal of Cognitive Engineering and Decision Making*, 7(3), 231-254.
- Williams, A. M. (2000). Perceptual skill in soccer: Implications for talent identification and development. *Journal of Sports Sciences*, 18(9), 737-750.
- Williams, A. M., & Davids, K. (1998). Visual search strategy, selective attention, and expertise in soccer. *Research Quarterly for Exercise and Sport*, 69(2), 111-128.
- Williams, A. M., Davids, K., Burwitz, L., & Williams, J. G. (1994). Visual search strategies in experienced and inexperienced soccer players. *Research Quarterly for Exercise and Sport*, 65(2), 127-135.
- Williams, A. M., & Hodges, N. J. (2005). Practice, instruction and skill acquisition in soccer: Challenging tradition. *Journal of Sports Sciences*, 23(6), 637-650.

Williams, A. M., Hodges, N. J., North, J., & Barton, G. (2006). Perceiving patterns of play in dynamic sport tasks: Investigating the essential information underlying skilled performance. *Perception*, 35, 317-332.