



Review

Coach knowledge in talent identification: A systematic review and meta-synthesis



Alexandra H. Roberts^{a,b,*}, Daniel A. Greenwood^{b,1}, Mandy Stanley^a,
Clare Humberstone^b, Fiona Iredale^a, Annette Raynor^a

^a School of Medical and Health Sciences, Edith Cowan University, Australia

^b Australian Institute of Sport, Australia

ARTICLE INFO

Article history:

Received 14 December 2018

Received in revised form 9 May 2019

Accepted 10 May 2019

Available online 17 May 2019

Keywords:

Coaching

Instinct

Aptitude

Experiential knowledge

Forecasting

Prediction

ABSTRACT

Objectives: Talent identification traditionally relies on the knowledge and perceptions of expert coaches to identify and predict potential future elite athletes. Experiential coach knowledge is a valuable source of information to guide research in this ill-defined and under-researched area. This review aims to synthesize current empirical understanding of coach knowledge as it relates to decision making in talent identification.

Design: This systematic review and meta-synthesis used the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to identify relevant literature.

Methods: Eligible studies were critically appraised for quality, and key findings from the 14 studies were integrated to allow for thematic analysis.

Results: The meta-synthesis revealed the key theme of 'instinct' as the primary contributor to coach decisions during talent identification. Subordinate themes informing coach instinct were 'drive and ambition', 'game intelligence' and 'physical and technical skills'.

Conclusions: Coaches appear to make decisions about talent based on their tacit knowledge or instinct. Understanding how coaches develop these instinctual 'feelings' may guide future research into talent identification and enhance our understanding of how experiential coach knowledge is developed and utilised in the daily training environment.

© 2019 Sports Medicine Australia. Published by Elsevier Ltd. All rights reserved.

1. Introduction

Talent identification (TID) within sport is can be viewed on a temporal continuum based on the goal of the identification or selection process: identifying and selecting for the present (immediate performance) versus identifying and selecting for a timepoint in the future (prediction). The goal of selection (performance vs prediction) influences perceptions of talent and the selection decisions made. Within high performance sporting organisations, the prediction of elite performers ('talent identification', or TID), is a priority,¹ thus allowing the efficient use of resources in the development of these athletes for future success. Existing TID research has investigated many measurable factors which may forecast future athletic performance,¹ of which many studies implicitly

use subjective coach knowledge and perceptions of future talent.² Coaches have been used to corroborate the results of TID testing (e.g. 3,4); used as part of a testing battery (e.g. 5,6); used to separate athletes into a-priori groupings (talented/non-talented; selected/non-selected) for cross-sectional designs (e.g. 7,8); and as consultants on the creation of test batteries (e.g. 9,10) or the 'correct' response to a decision-making or similar task (e.g. 11,12). The success or failure of these methods relies on the presumed accuracy of predictions/decisions made by coaches, despite a lack of scientific evidence to demonstrate their validity.

The multidimensional and nonlinear nature of talent and its development is a key limitation of existing TID processes.^{13,14} Coach knowledge and perceptions as they underpin predictions and associated decisions are an appropriate information source to address this limitation.¹⁵ Expert decisions made by the coach, such as the prediction of talent, are highly nuanced and informed through knowledge based on extensive, varied experiences, and formal education.^{16–18} There is significant anecdotal evidence of coaches' long-term predictive ability^{19–21} and fallibility^{21–23} in TID; pointing to their value as an information source within this pro-

* Corresponding author.

E-mail address: Alexandra.roberts@ausport.gov.au (A.H. Roberts).

¹ Present address: Exercise, Sport and Movement Sciences, School of Health Studies, University of Memphis, Memphis, TN, United States.

cess. The area of expert coach decisions and their impact on TID is misunderstood and under researched, likely due to the difficulty in defining the space of TID and coach knowledge. Qualitative investigations into coach declarative knowledge and perceptions related to the implementation of TID allow for a rich, detailed, understanding of *why* and *how* decisions regarding talent are made.^{16,24–26}

There have been limited longitudinal studies of the success or failure of TID, and those which have followed athletes included in TID or talent development (TDE) programs have not detailed how athletes were chosen for inclusion.²⁷ There is evidence of continual movement of athletes both into and out of TDE programs over time,²⁸ and it is probable that coach involvement plays a part in this athlete movement; consequently it is important to understand this decision making process. To the best of our knowledge there have been only two longitudinal studies which have attempted to validate the talent identifications made by coaches against the criteria it is attempting to measure: future athletic success. Schorer et al.²⁹ found that national level handball coaches were able to accurately predict the future performance level of 79% of their players ten years in advance; while a five-year study of gymnasts and their coaches found that coaches were only able to accurately predict the longevity of their athlete's careers in 52% of cases.³⁰ These limited findings illustrate the varied potential for coaches to identify talent over long periods of time. By understanding how coaches make these decisions, the amalgamation of empirical and experiential knowledge may allow us to increase the predictive ability of coaches.

Whilst the accuracy (validity) of coach decisions regarding future talent is critical, it is also essential that their decisions are consistent (reliable). Several attempts have been made to enhance coach reliability by creating checklists of essential skills or attributes for sport (e.g. 31). While promoting inter-rater reliability, the primary limitation of checklists is that they encourage static observations of athlete qualities (current abilities), rather than looking for outputs (prediction of future performance). Although these criteria may be helpful for team selections, they limit a coach's ability to allow for dynamic, nonlinear talent development over time.

It is acknowledged that individuals, including experts, can be biased,³² however it is ultimately these experts who define talent in their given field^{21,25,29} and we therefore need a better understanding of how they identify it.^{16,25} With the understanding that TID is the process of predicting or forecasting those who have the potential for future performance, the current review aimed to synthesize empirical research to understand the contributing factors underlying coach decision making in TID. A meta-synthesis approach was used to answer the review question: How do coaches identify talent?

2. Methods

The meta-synthesis was conducted using the approach outlined by Cahill et al.³³ A detailed, systematic search of literature related to coaches in TID was conducted using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines.³⁴ The SPORTDiscus, MEDLINE, PubMed, Web of Science and ScienceDirect electronic databases were searched using title, abstract and keyword search terms. These included 'talent identification', 'coach', 'sport', 'athlete' and related MeSH terms optimised to each database. The search included all articles up to May 31st 2018. The following inclusion criteria were applied:

- Coach/es were explicitly questioned about their knowledge, perceptions, understanding, opinions and/or applied practice of

predicting talent, and the results could be directly attributed to coaches;

- Where mixed methodologies were employed, qualitative results were reported and able to be analysed separately;
- Studies involved TID in a sport setting and explored coaches' explicit *predictors* of athlete success (i.e. identification/prediction of future potential, rather than selection for short-term performances)
- Primary studies that were available as full-text.

Title and abstract were screened by one reviewer (AHR) to identify applicable studies, and a citation chain search (forwards and backwards) of relevant literature was conducted using Google Scholar to ensure all pertinent articles were captured. After exclusion of duplicate records, full-texts were screened by two reviewers (AHR and DG) to ensure eligibility against the inclusion criteria. Any conflicts were resolved through discussion with the remaining research team. Following screening, data were extracted for analysis (see Table 1).

Articles were assessed using the McMaster critical review form³⁵ to appraise methodological quality, with a 'Yes' response worth 1, and a 'No' or 'Not Reported' worth 0, for a maximum score of 24 points. In accordance with Ritchie et al.,³⁶ a score of >16 was defined as good quality, 12–15 as moderate and <11 as poor quality. Appraisal was conducted by the first author (AHR), with a subsample appraised independently by another author (MS) to confirm scores. As the purpose of this review was to synthesize coach knowledge, no studies were excluded based on quality; however it was used to inform the strength of evidence in the results and discussion, and recommendations for future research. Results of the critical appraisal can be found in Table 2.

A list of the questions that were asked of coaches (see Table 3) and the findings of each paper were extracted in order to identify the concepts and interpretations offered by the authors of the original studies. While not all included articles necessarily addressed 'talent identification' as a specific aim, and not all articles reported the questions asked, their findings provided information about talent identification which was considered relevant to the overarching question for this review. Second order constructs (themes) defined by the original researcher (AHR) formed the data and were analysed to develop preliminary categories that collated themes together. The analysis process entailed examining the key themes within and across studies using constant comparative method, in consultation with MS. Analysis was interpretive and iterative. Translation of the studies into each other created third order constructs, which are a synthesis of the full research team's interpretations of the second order constructs. The team discussed and refined the third order constructs, at which point the audit trail was reviewed and discussed by all authors to confirm the development of third order constructs until consensus was reached. Following consensus, the constructs were synthesized as a whole into four distinct core themes. A table was developed to assist with the translation of studies, allowing visual representation and an audit trail of each extracted construct.

3. Results

A total of 2437 articles were identified during initial database and citation chain searches, with 299 articles remaining following removal of duplicates and initial screening. After an independent assessment by AHR and DG, 14 articles met the inclusion criteria and were included in the final review. Articles were excluded during full-text review for a number of reasons, primarily due to a lack of explicit coach involvement and/or questioning; focus on team selection for short-term performance rather than prediction

Table 1
Characteristics of included studies.

Reference (region)	N	Sport	Sex	Age	Coach level	Years' experience	Coach education	Athlete age/level	Study design	Key findings
Christensen (2009) ¹⁷ (Europe)	8	Soccer	M	33–64 (mean = 45)	National	8–28 (mean = 15)	>Bachelor's degree	Youth	Interview	<ul style="list-style-type: none"> - Visual experience and pattern recognition - Pre-eminence of hard work and dedication - Coach as the arbiter of taste
Cupples and O'Connor (2011) ³⁷ (Oceania)	13	Rugby league	NR	NR	State/national	>10	NR	NR	Delphi	<ul style="list-style-type: none"> - Cognitive indicators - Game skill - Physiological
Ellingsen and Danielsen (2017) ⁴⁶ (Europe)	8	Multi-sport	7M	NR	District or higher	15–40	BA, MA or HL diploma	5–15	Interview	- Social characteristics
	2	Soccer	1 F	- Personal characteristics						
Gonçalves et al. (2017) ⁴⁷ (Europe)	2	Gymnastics			Youth and men's	>10	Level II or III	NR	Interview	- Bodily characteristics
	2	Swimming								- Environmental
	2	Skiing								- Psychological
	14	Basketball	NR	NR						- Technical tactical skills
										- Physical attributes
										- Anthropometry
Holt and Dunn (2004) ³⁸ (Europe)	6	Soccer	NR	35–64	English Youth Academy	>5	UEFA A license	NR	Interview	<ul style="list-style-type: none"> - Soccer development system - Desired player qualities - Training environment - Mental aspects
Johansson and Fahlén (2017) ³⁹ (Europe)	14	Multi-sport	NR	NR	International	NR	NR	NR	Interview	- Idea of selection
	8	Soccer								- Criteria for selections
	6	Alpine-skiing								- Selection process
										- Outcomes and consequences of selections
Johnson et al. (2008) ⁴³ (North America)	6	Swimming	M	48–57	International	>20	Level 5 American Swimming Coaches Association	NR	Interview	<ul style="list-style-type: none"> - Intrapersonal - Interpersonal - Lifestyle - Training - Environment - Systemic interaction

Table 1 (Continued)

Reference (region)	N	Sport	Sex	Age	Coach level	Years' experience	Coach education	Athlete age/level	Study design	Key findings
Jokuschies et al. (2017) ⁴² (Europe)	5	Soccer	M	47–60 (M = 55.6)	National	>10	UEFA licence; national soccer diploma	U15–U18	Interview	<ul style="list-style-type: none"> - Personality - Cognitive-perceptual skills - Motor abilities - Development - Technique - Social environment - Physical constitution - Cognitive-perceptual skills/technique - Motor abilities/technique - Personality /technique – other
Lund and Söderström (2017) ⁴¹ (Europe)	15	Soccer	M	NR	District/regional	NR	NR	U15	Interview	<ul style="list-style-type: none"> - How districts organize TID - How coaches understand and define talent and TID - Significance activities for talent development
Milistedt et al. (2013) ⁴⁸ (South America)	10	Volleyball	NR	45 + 13.8	State/national	24.8 + 12.1	NR	Juniors	Interview	<ul style="list-style-type: none"> - Stature importance - Indicators of detection - Indicators of selection - Use of detection - Methods of selection
Miller et al. (2015) ⁴⁰ (Europe)	6	Soccer	M	26–62 (mean = 45)	EPP category 1–3	>5	NR	NR	Interview	<ul style="list-style-type: none"> - Nature vs nurture - Psychology - Social skills
Mills et al. (2012) ⁴⁴ (Europe)	10	Soccer	NR	47.5 + 10.5	Premier League	14.5 + 6.2	UEFA Pro/UEFA A license	16–18 years	Interview	<ul style="list-style-type: none"> - Awareness - Resilience - Goal-directed attributes - Intelligence - Sport-specific attributes - Environmental factors
Vrljic and Mallett (2008) ⁴⁹ (Oceania)	5	Soccer	M	42–51 (mean = 46.5)	State	Mean = 20.1	Level II–III	Youth	Interview	<ul style="list-style-type: none"> - Defining 'elements' of talent - Importance of identified elements of talent - Capacity to evaluate the identified elements of talent - Selecting talented players for the state football team

NR = not reported.

Table 2
Results of critical appraisal.

Citation	Study purpose (1)	Literature (1)	Study design (3)	Sampling (3)	Descriptive clarity (4)	Procedural rigour (1)	Analytical rigour (2)	Auditability (2)	Theoretical connection (1)	Trustworthiness (4)	Conclusions/implications (2)	Total (/24)	Quality
Christensen	1	1	3	2	2	1	2	2	1	4	2	21	Good
Cupples and O'Connor	1	1	1	2	0	2	2	2	1	3	2	16	Good
Ellingsen and Danielsen	1	1	3	2	2	1	2	1	1	4	2	20	Good
Ferreira Celestino et al.	1	1	1	1	0	0	1	1	1	3	2	12	Moderate
Goncalves et al.	1	0	1	1	0	1	1	1	1	2	2	11	Poor
Holt and Dunn	1	1	2	1	2	1	2	2	1	4	2	19	Good
Johansson and Fahlén	1	1	2	1	1	1	2	1	1	2	2	15	Moderate
Johnson et al.	1	1	1	3	4	1	2	2	1	4	2	22	Good
Jokuschies et al.	1	1	2	2	2	1	2	2	1	4	2	20	Good
Lund and Söderström	1	1	2	2	0	2	2	1	1	4	2	14	Moderate
Millstedt et al.	1	1	0	2	2	1	0	0	2	2	2	12	Moderate
Miller et al.	1	1	2	2	3	1	1	1	1	4	2	19	Good
Mills et al.	1	1	2	2	1	1	2	1	1	4	2	18	Good
Vrijic & Mallett	1	1	1	1	1	1	2	1	1	4	2	16	Good

of future ability; inability to differentiate coach results from other sources; or insufficient information regarding athlete selection or identification. See Fig. 1 for a PRISMA process flow diagram.

The included studies had several common weaknesses, with no papers fulfilling all criteria. The most common omission was in descriptive clarity, with many papers failing to provide an adequate description of the participants and the relationship between participants and researchers. Most studies demonstrated procedural rigour throughout, however many papers did not report keeping an audit trail.

The 14 articles included in this review gathered coaching knowledge in two different ways. All articles used interviews to explore coach knowledge of TID, however one study³⁷ combined interviews with questionnaires using the Delphi method (see Table 1). All but one article³⁸ were published in the last decade, demonstrating the recency of interest in this field. The majority of articles that reported the gender of the coach used a male-only sample of coaches, with only one female coach included across all studies; however a significant portion of articles did not report the gender of participant coaches.

There was a large range of coach age, experience and education reported, with a number of studies not reporting one or more of these demographic factors. The most commonly represented region was Europe. Descriptions of coaching expertise were varied, with four articles utilising 'expert' coaches. Definitions of 'expert' were varied, including one or more of: past/present national/state level coaching experience; full-time coaching role; >5 years' experience; holding a coaching license; and experience in identifying/selecting/developing talented athletes. The remaining articles described a range of coaching backgrounds including district to international level; full-time coaches; five to ten years' coaching experience; and holding a coaching certification. There were no definitions or descriptions provided for each level, and while some articles interviewed coaches of different expertise, none reported findings in such a way as to allow attribution of results by coaching level.

The most commonly investigated sport in the included articles is football/soccer. Other team sports included in this review are rugby league, basketball and volleyball. The individual sports studied are primarily closed-skill activities, including orienteering, gymnastics, swimming and skiing.

Four related themes emerged from the analysis, with one overarching theme of tacit coach knowledge, or 'instinct', being the primary contributor to decision making during TID. The three other themes informing coach knowledge were 'drive and ambition', 'game intelligence' and 'physical and technical skills'.

3.1. Coach instinct – "the coaches' eye"

When coaches are asked how they identify talented athletes, the idea of a 'gut feeling' or 'instinct' is claimed to be the preferred method of identification for many coaches. It was emphasised that 'the coaches' eye' was the most important tool during TID³⁹ for many coaches, as it allowed them to 'see' or 'glimpse'¹⁷ familiar configurations of characteristics that their experience has taught them are indicative of future high level performance. This is supported by findings from Holt and Dunn, who found that

"The performance on Saturday is still crucial in the eyes of all English coaches. It's the guide that everybody uses to make their assessments to choose the players" (p207).³⁸

A coaches' 'guide' is a form of pattern recognition formed through years of experience, in which experts are able to 'know it when they see it'.⁴⁰

Table 3
Specific questions asked in each article.

Citation	Question/s asked
Celestino et al. 2015 ⁴⁵	NR
Christensen 2009 ¹⁷	NR
Cupples and O'Connor (2011) ³⁷	NR
Ellingsen and Danielsen (2017) ⁴⁶	NR
Gonçalves et al. (2017) ⁴⁷	NR
Holt and Dunn (2004) ³⁸	<ul style="list-style-type: none"> - What is the structure and aim of your youth academy? - How do you try to develop players? - What are the most important qualities a player needs to make it as a professional? - What qualities do your current crop of players possess? - How do you prepare players for professional demands? What areas do you work on? - What are the mental strengths you are looking for in players? - What mental qualities are most important for professional players?
Johansson and Fahlén (2017) ³⁹	<ul style="list-style-type: none"> - What is the position and responsibility/power of the coach? - What is the goal/purpose of the selection? - What are the basis for the selections? Are selection criteria defined? - What abilities/skills are judged/measured? - Who has knowledge about selection criteria? - What factors are most important to consider, if you have to choose between two similar/equally good athletes? - Who is involved in selection? Who has the most power during selection? - How long is the selection period? - Are some selection situations more difficult? - Are there possibilities for appeal? Are there protests/discussions about selections? - Are the 'right' athletes selected? Are selections evaluated? - Are there any fairness issues? - Is there the possibility for athletes to influence selections?
Johnson et al. (2008) ⁴³	<ul style="list-style-type: none"> - What do you feel contributes to a swimmer achieving top performance (e.g. World Records) vs excellent performances (e.g., finaling [sic] at NCAAs)?
Jokuschies et al. (2017) ⁴²	<ul style="list-style-type: none"> - Thinking about all of your players, is there any player who has something that it takes to achieve peak performance in adulthood?
Lund and Söderström (2017) ⁴¹	NR
Milistedt et al. (2013) ⁴⁸	<ul style="list-style-type: none"> - What is the importance of height factor? - How should be done [sic] the detection of talents? And the selection? - Which is the more relevant indicators for each?
Miller et al. (2015) ⁴⁰	<ul style="list-style-type: none"> - In your experience, what is talent in soccer? How do you recognise it? - What is a typical TI experience for you? - What is it like to be a coach involved in TI at your club?
Mills et al. (2012) ⁴⁴	<ul style="list-style-type: none"> - Can you tell me a little about your coaching background and experience in football? - What things do you consider to influence player development? - What personal characteristics or qualities do you believe young footballers require in order to make it to the professional level? - Who do you consider to play a significant role in the overall development process?
Vrljic and Mallett (2008) ⁴⁹	<ul style="list-style-type: none"> - What are the 'elements' of a talented football players? - Think about the best youth player you have coached. Who was he? What position did he play? When did you coach him? When you think about this player, can you come up with any other elements associated with talent? - In your opinion, what 'elements' are most important in a player? Outline how you evaluate these elements - What is your purpose for selecting players for the state team? - Please describe in as much detail the process of how you select players for the state team

NR = not reported.

Coaches are able to recognise combinations of factors that identify an ideal player, which leads to the development of a socially constructed practical sense of an image of a talented athlete. When asked to articulate these combinations, coaches find it difficult to verbalise the specifics which led to their multifaceted intuitive decisions regarding future talent; an implicit, tacit knowledge source which is difficult to describe.

"This intuitive knowledge is also a source of frustration among top-level coaches because they feel they lack an accepted common language in performing their job. . . The lack of an accepted shared terminology indicates a characteristic and somewhat problematic quality of coaches' practical sense, namely that the 'distinctions are not identical'" (p373).¹⁷

Coaches appear to have constructed an image in their mind of what it is they are looking for. They believe that they will be able to recognise it when they see it, but have great difficulty in articulating exactly what it is they see or are looking for. The inability to express what it is they see is one of the hallmarks of expert knowledge, and begins to explain some of the difficulties both coaches and researchers find with the variety and inconsistency of terms used to discuss talent and its identification.

As coaches construct their 'ideal' image of a talented athlete and look for these traits in young athletes, it is inevitable that this ideal image differs from coach to coach based on their own experiences and knowledge. As such, the coach becomes the 'arbiter of taste',¹⁷ each with their own 'taste' for what they are looking for and 'style' of decision making.

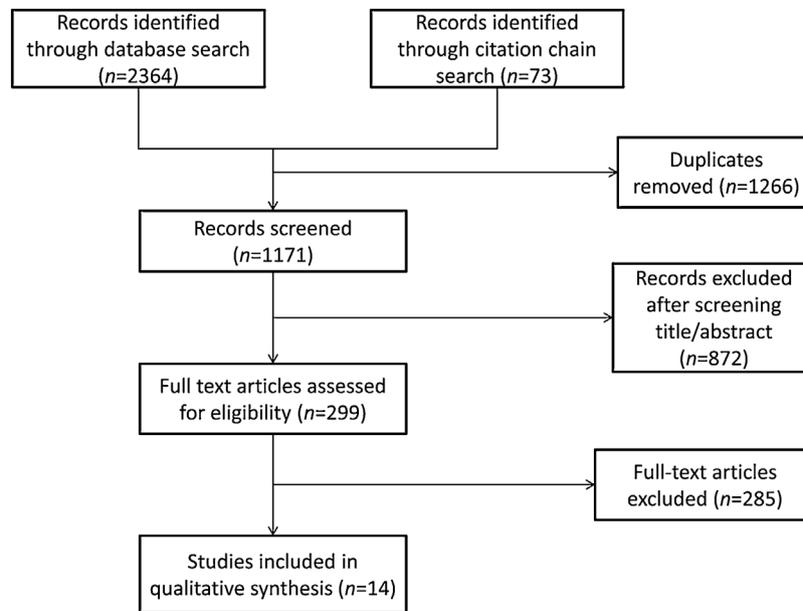


Fig. 1. PRISMA³⁴ flow diagram of screening process.

“Coaches formulated individual tastes and preferences with regard to soccer. . . a whole range of interrelated features and criteria [are] used by the coaches to identify ‘good’ and ‘bad’ players” (p375)¹⁷

Coach instinct appears to be informed by many different aspects of athletic performance. While the aspects themselves remain relatively uniform, the value or weighting that each coach places on contributing factors varies. The other aspects are identified in the key themes below, but it is the coaches’ eye and their ability to ‘see’ talent that is most valued and takes precedence over all other factors. Coaches need to get to know and spend time with athletes in order to make informed decisions regarding their future potential.

“Coaches emphasized the importance of confirming or denying the first impression of soccer skills in face-to-face meetings during and dialogues with the ‘person behind the skills’” (p377).¹⁷

It takes time for coaches to gain an understanding and opinion of talent indicators, particularly when it comes to intangible traits such as psychological or cognitive factors, as it takes time for coaches to be able to see these traits in athletes.³⁷ A number of different themes were cited as contributing to coach intuition; whilst the overarching topics were consistent between studies, the specifics within each theme were varied.

3.2. Drive and ambition

Coaches determined that an important part of identifying talented athletes are the psychological traits that can be summed up as representing the term ‘drive and ambition’. These features are observed through seeing and ‘knowing’ the athlete, predominantly based on long-term observations of players.^{17,37,40} Coaches used a wide variety of terms to describe these psychological factors, including mental toughness, self-regulation, positive attitude, maturity, desire, competitiveness, personality, inter-personal capabilities, emotional intelligence, character and awareness; many of which are interrelated or interchangeable. It was suggested that athletes demonstrate drive and ambition through their commitment to training: “They are willing to put their nose to the grindstone” (p376).¹⁷ Coaches see the athletes who are always “on time and prepared for training” (p138)³⁷ and “keep practicing after the others have gone to the locker rooms”

(p253)⁴¹ as the ones that possess the drive and ambition required to achieve at the highest levels.

The psychological makeup of an athlete was highly related to the idea of competition performance and results. Coaches were generally of the opinion that while results were important to be able to track an athlete’s progress objectively, when it came to identifying athletes they were more interested in the way that athletes responded to the demands of competition. Losing was not a concern for most coaches, as they placed more value on the athlete’s mindset following a defeat – whether they worked harder^{17,42,43} or they lacked the resilience to ‘bounce back’.^{17,43,44}

Another part of drive and ambition was the ability or willingness of an athlete to make sacrifices in order to succeed. Athletes at the highest levels must prioritize their sport preparation and training, and coaches can see this capacity in younger athletes. These sacrifices include family responsibilities, social commitments, and in some cases, schoolwork. “Coaches reported that such sacrifices [family and social life] were an expected and necessary part of elite soccer” (p207–208).³⁸ Indeed, “if someone values schoolwork over soccer, this is a signal to [the coach] that the real attitude is lacking” (p253).⁴¹

Conversely, environmental factors such as the support and culture provided by an athlete’s family, teammates and coaches were considered to be integral to decisions regarding talent.^{37,40,42–47} These relationships were perceived to contribute significantly to future performance, as without adequate support and an enriching culture, “it is difficult for a young person to develop his or her talent” (p425).⁴⁶

3.3. Physical and technical skills

Over half of the included articles refer to physical attributes, such as physiological and anthropometric factors. It was important to coaches that athletes were physically gifted,⁴³ demonstrated superior athleticism,⁴⁴ and possessed favourable anthropometric characteristics^{46–48} for the sport in question. Coaches described athleticism using a number of terms including physical robustness,^{42,44} pace,⁴⁴ speed,⁴⁹ quickness,⁴⁹ strength⁴⁹ and endurance.⁴⁹ It is worth noting that several coaches emphasised that while physical factors were indicative of talent, they were not essential components of future performance, as “at no stage were

unsuitable physical size, fitness or even ball-skills determined to be fatal flaws in an individual's prospects" (p654).⁴⁰ It was generally acknowledged that physical attributes such as strength can be trained or developed,^{42,44} and as such were considered but not essential when evaluating an athlete's potential.

As expected, technical ability was an integral part of evaluating an athlete's potential. Technical proficiency was described in a number of ways, including movement fluidity,⁴² (sport specific) skills,^{17,47,49} and ball security⁴²; however most coaches struggled to describe 'technique' in more detail than the word 'technique' itself.^{17,39,42–44,47,49} This is reflected in the idea that "coaches doubted that soccer skills could be described thoroughly with either the use of words or numbers" (p375).¹⁷ Coach perceptions of technical ability overlap with athlete psychology, as an important predictor of talent was said to be an athlete's ability to demonstrate good technique under pressure,⁴² while making appropriate decisions within the game context.⁴⁹ Motor skills such as agility,^{42,48} coordination,^{42,48,49} and dexterity^{48,49} were also seen as talent indicators, although, as with technique, these skills were undefined.

3.4. Game intelligence

Game intelligence, or ability to read the game, was another common key indicator of talent^{17,40,42,44,49} and was evidenced by the ability to execute 'decision making'^{17,40,42,47} or 'problem solving'^{17,37,49} within the game context. Game intelligence was detected through watching games or match-play situations, by looking for the player's ability to "be able to get into position... [Or] have the ability to be able to read [the ball] and intercept it" (p20–21).⁴⁹

Many coaches emphasised that athlete factors interact to create favourable talent predictors.^{17,37,40,43–46} These interactions are dynamic, nonlinear and idiosyncratic, as "the 'recipe' would differ from person to person" (p426).⁴⁶ Coaches have an inherent understanding that these interactions are both individual to each athlete and vital to future success; however a true indication of how these elements interact to predict talent can only be obtained through spending time embedded in the sport and with the athletes they are attempting to identify.

4. Discussion

The aim of this review was to synthesize existing empirical knowledge of how coaches identify talented athletes for future performance. This was made difficult due to the inconsistent use and application of terminology throughout the included articles, in particular the timeframe associated with 'talent identification'. Many articles were excluded from this review because while they purported to be investigating TID (i.e. prediction), they were instead studying attributes related to selection (immediate performance) (e.g.⁵⁰). While selection of athletes for performance is an important and inevitable part of the developmental pathway, it is well documented that current success is not predictive of future performance,^{51–53} and consequently attributes which contribute to current performance levels are not the only contributors for prediction.

The concepts of prediction and selection are inherently linked, as predictions can only be made through consideration of existing qualities. It has been shown that there are several personality characteristics which, when present in young athletes, can indicate potential for future drop out and/or adherence to the demands of high performance training.⁵⁴ This is reflected in the findings of this review as coaches placed greater emphasis on psychological constructs than physical. Several articles were excluded from this review (e.g. 55,56) as they examined the performance and/or phys-

ical differences between selected and non-selected athletes (that is, selected for immediate performance) with a view to extrapolate these differences into a prediction strategy, rather than an examination of which factors are (viewed as) predictors.

Included in this review were 14 studies from eight sports and differing contexts; however, despite this diversity common themes have emerged. The most common sport in this review was football (soccer) (n=9). With an estimated 250 million participants worldwide, football is the world's most popular ball game,⁵⁷ so the emphasis is not surprising. However, despite the focus on football, there is a wide discrepancy of contexts within the included literature. The studies in this review focused on the identification of athletes between the ages of five and 18, as well as incorporating 'youth' athletes for whom no details of participant ages were provided. Additionally, there is large variability in coach participants with respect to their age, years of coaching and/or playing experience, education, and coach certification level.

As with the usage of the term 'identification', the inclusion criteria and definition of 'expert' coach varies considerably between studies. For example, the two articles examining 'youth' soccer players^{17,49} interviewed coaches from different regions (Europe and Oceania) with different age ranges (albeit a similar mean age), coaching levels and education. Despite these differences there are consistent findings from these studies covering the broad areas of ambition and drive, and physical and technical skills.

The key finding of this review is that implicit, instinctual decisions drive most TID processes, and this instinct derives from idiosyncratic combinations of and compensations for individual performance factors. Coaches use their eyes to look for or 'see' talent, however the coach gaze is also informed by what they observe in relation to drive and ambition, physical and technical skills, and game intelligence. As is common in many other domains,⁵⁸ coaches struggle to articulate exactly how they identify talent. As can be seen in the critical appraisal of the included articles (Table 2), there is great variability in the quality of reporting; with the majority of studies not reporting one or more important variables such as age, gender or experience of participant coaches. These missing variables create problems for the generalizability of the findings, and may contribute to the incongruences found even within the same sports. When these challenges are compounded by the inclusion of different sports, the difficulty in synthesizing, generalising and applying conclusions regarding coach knowledge and decision making in TID is evident.

While this systematic review provides the first comprehensive synthesis of the knowledge behind coach decision making during TID, there are several limitations in this work. First and foremost, the findings reflected in this article do not necessarily reflect 'valid' TID, as the longitudinal accuracy and overall reliability of the coaches in each article was not discussed. It has been argued that there are limited improvements to be made in the 'success rates' of TID and that improving coach predictions may only lead to minimal improvements in overall prediction success.² However, in high performance sport, very small changes can make large changes in results, so it follows that small differences in TID at the elite level has the potential to make big performance changes. Additionally, the continued interest and investment from high performance sporting organisations in TID demonstrates the continued need for research in this area.

The limited number of articles included is a result of the decision to only include those investigations specifically aiming to predict athletes who have the potential to be elite athletes several years in the future. It is worth noting that any time a squad or team is selected in open-skill sports, there is an inherent use of the coach to decide on the team. However, articles in which the coach is not specifically mentioned as part of the TID process have not been included in this analysis, despite their implied usage of the

coach. For example, Emmonds et al.⁵⁹ use players' eventual professional contract (or lack thereof) to determine 'predictors of success'. Coaches and/or scouts decide which athletes are awarded contracts, however this was not addressed in the article and as such it (and similar articles) was not included in this review. Similarly, the relative age effect was not examined in any articles. While the RAE is undoubtedly a contributor to expressions of talent and ultimate ability,⁶⁰ no coaches spoke about the phenomenon. However, in discussion of physical capacity and its contribution to prediction of talent, it was stated that an athlete's (lack of) biological maturation was a consideration when identifying future performers.⁴⁹

The small number of articles included in this review are reflective of the limited research base regarding coach perspectives on predicting talent. There are very few similarities in sport, coaching expertise, or athlete level across the included studies, demonstrating the lack of both depth and detail in the selected articles. It is acknowledged that the themes presented above may not be widely generalizable due to the small number of articles meeting the inclusion criteria. It is clear that within the literature there is a base of coach knowledge about specific subsections of athletic populations, for example male soccer players under age 15. However, with this in-depth knowledge of finite subsets comes the difficulties in synthesizing results into generalisations for use across different sports and contexts.

The aim of this article was to synthesize understanding of coach knowledge related to TID. As coaches form a large part of the TID process at all levels of the pathway, it is important to have a base empirical understanding of their decision making process. This review has highlighted several key points for future research, particularly in relation to gaining a better understanding of coach knowledge and its overall validity and reliability. A primary issue moving forward is the definition and use of concepts and terms relating to coaches and TID. As stated by Côté and Gilbert,

"... it is not clear that research on truly expert coaches exists ... Almost all research that has claimed to focus on expert coaches has relied solely on years of experience and/or performance records although there is no evidence to suggest that either one of these variables alone are valid ways to identify an expert coach." (p318)⁶¹

Without a consistent definition of terms such as 'expert coach', 'successful', and even 'identification', it will remain impractical to draw comparisons and conclusions about coach knowledge and decision making as it relates to TID.

As has been highlighted, there are inconsistencies in the reporting of coach variables. Within research relating to athletes, all pertinent details are reported. Similarly, research into coaches needs to better report all variables associated with the coaching population which may affect the results; including sex, age, coaching level, experience, education, and the athlete age and/or level that is being used as a basis for comparison or questioning. This will provide insight into the validity, reliability and generalisability of the results of these investigations.

The descriptive data reported in this paper can be used by researchers to generate hypotheses for further testing to better understand the 'coaches' eye' in TID. Future research must probe for greater breadth (i.e. more sports) and depth (more investigations into specific sports), and may focus on more quantitative measures, such as the amount of time that a coach requires to 'see' talent in an athlete. Coaches will likely remain an integral part of TID moving forward, and as such there is a need to better understand their decision making processes within this domain. By involving practitioners within research, future TID research can be more targeted, leading to greater validity, reliability and uptake of the findings by coaches and organisations alike.

5. Conclusions

To the best of our knowledge, this is the first review aiming to synthesize the empirical understanding of coach knowledge related to decision making in TID. The findings of this review indicate that while in-depth research in this field exists, there is considerable disparity in methods and inconsistent reporting of demographic details.

In future research, efforts need to be made to define terminology to ensure adequate coaching expertise is used, as well as reporting more coach-related variables when investigating knowledge or decision making. Further research in the area will allow for a greater breadth and depth of understanding, leading to useable generalisations to provide guidance to coaches, selectors and researchers.

Many TID processes have included the coach as a significant part of the process, however based on this review, it appears that coaches are unable to articulate how or in what ways they see talent; indicating that future research should further probe coaches' knowledge of TID. By better understanding this knowledge, TID researchers may be able to create more targeted approaches using empirical measurements to assist in identifying talent.

Practical implications

- Coaches rely on their eyes or 'gut instinct' in order to make decisions regarding athlete's future talent.
- Coach instinct is informed by both objective and subjective information gained over time.
- Coaches need enough time with athletes to gather knowledge regarding athlete's psychological characteristics, physical abilities and game sense in order to make a confident and informed decision regarding their potential for high level athletic performance.

Acknowledgements

This research was supported by an Industry Engagement Scholarship from Edith Cowan University and the Australian Institute of Sport. The authors would also like to thank the reviewers of this article for their time and expertise.

References

1. Johnston K, Wattie N, Schorer J et al. Talent identification in sport: a systematic review. *Sport Med* 2018; 48(1):97–109. <http://dx.doi.org/10.1007/s40279-017-0803-2>.
2. Güllich A, Copley S et al. On the efficacy of talent identification and talent development programmes, chapter 7, in *Routledge Handbook of Talent Identification and Development in Sport*, Baker J, Copley S, Schorer J, editors, New York, NY, Routledge, 2017, p. 80–98.
3. Rowat O, Fenner J, Unnithan V. Technical and physical determinants of soccer match-play performance in elite youth soccer players. *J Sports Med Phys Fitness* 2017; 57(4):369–379. <http://dx.doi.org/10.23736/S0022-4707.16.06093-X>.
4. Chidley JB, MacGregor AL, Martin C et al. Characteristics explaining performance in downhill mountain biking. *Int J Sports Physiol Perform* 2015; 10(2):183–190. <http://dx.doi.org/10.1123/ijspp.2014-0135>.
5. Falk B, Lidor R, Lander Y et al. Talent identification and early development of elite water-polo players: a 2-year follow-up study. *J Sports Sci* 2004; 22(4):347–355. <http://dx.doi.org/10.1080/02640410310001641566>.
6. Hoare DG, Warr CR. Talent identification and women's soccer: an Australian experience. *J Sports Sci* 2000; 18(9):751–758. <http://dx.doi.org/10.1080/02640410050120122>.
7. Höner O, Feichtinger P. Psychological talent predictors in early adolescence and their empirical relationship with current and future performance in soccer. *Psychol Sport Exerc* 2016; 25:17–26. <http://dx.doi.org/10.1016/j.psychsport.2016.03.004>.
8. Cripps AJ, Joyce C, Woods CT et al. Biological maturity and the anthropometric, physical and technical assessment of talent identified U16 Australian footballers. *Int J Sports Sci Coach* 2017; 12(3):344–350. <http://dx.doi.org/10.1177/1747954117710507>.

9. Woods TEC, Raynor AJ, Bruce L et al. The use of skill tests to predict status in junior Australian football. *J Sports Sci* 2015; 33(11):1132–1140. <http://dx.doi.org/10.1080/02640414.2014.986501>.
10. Bennett KJM, Fransen J, Scott BR et al. Positional group significantly influences the offensive and defensive skill involvements of junior representative rugby league players during match play. *J Sports Sci* 2016; 34(16):1542–1546. <http://dx.doi.org/10.1080/02640414.2015.1122206>.
11. Romeas T, Guldner A, Faubert J. 3D-multiple object tracking training task improves passing decision-making accuracy in soccer players. *Psychol Sport Exerc* 2016; 22:1–9. <http://dx.doi.org/10.1016/j.psychsport.2015.06.002>.
12. Bruce L, Farrow D, Raynor A et al. But I can't pass that far! The influence of motor skill on decision making. *Psychol Sport Exerc* 2012; 13(2):152–161. <http://dx.doi.org/10.1016/j.psychsport.2011.10.005>.
13. Abbott A, Collins D. Eliminating the dichotomy between theory and practice in talent identification and development: considering the role of psychology. *J Sports Sci* 2004; 22(5):395–408. <http://dx.doi.org/10.1080/02640410410001675324>.
14. Renshaw I, Davids KW, Shuttleworth R et al. Insights from ecological psychology and dynamical systems theory can underpin a philosophy of coaching. *Int J Sport Psychol* 2009; 40(4):580–602.
15. Larkin P, Reeves MJ. Junior-elite football: time to re-position talent identification? *Soccer Soc* 2018; 19(8):1183–1192. <http://dx.doi.org/10.1080/14660970.2018.1432389>.
16. Kearney PE, Carson HJ, Collins D. Implementing technical refinement in high-level athletics: exploring the knowledge schemas of coaches. *J Sport Sci* 2018; 36(10):1118–1126. <http://dx.doi.org/10.1080/02640414.2017.1358339>.
17. Christensen MK. "An eye for talent": talent identification and the "practical sense" of top-level soccer coaches. *Social Sport J* 2009; 26(3):365–382. <http://dx.doi.org/10.1123/ssj.26.3.365>.
18. Day D. Craft coaching and the "discerning eye" of the coach. *Int J Sports Sci Coach* 2011; 6(1):179–195. <http://dx.doi.org/10.1260/1747-9541.6.1.179>.
19. Brown J. *Sports Talent: How to Identify and Develop Outstanding Athletes*, Champagne, IL, Human Kinetics, 2001.
20. Moskowitz TJ, Wetheim LJ. *Scorecasting: The Hidden Influences Behind How Sports and Games are Won*, New York, NY, Three Rivers Press, 2011.
21. Platanov V. *My Profession—The Game*, Lulu Press, Inc., 2016.
22. Charlesworth R. *World's Best*, RC Sports (WA) Pty Ltd., 2017.
23. Lewis M. *Moneyball: The Art of Winning an Unfair Game*, New York, NY, W. W. Norton & Company, Inc, 2004.
24. MacMahon C, McPherson SL. Knowledge base as a mechanism for perceptual-cognitive tasks: skill is in the details! *Int J Sport Psychol* 2009; 40(4):565–579.
25. Rynne SB, Crudgington B, Dickinson RK et al. On the (potential) value of coaching, chapter 20, in *Routledge Handbook of Talent Identification and Development in Sport*, Baker J, Copley S, Schorer J, editors, New York, NY, Routledge, 2017, p. 285–300.
26. Bondas T, Hall EO, Wikberg A. Metasynthesis in health care research, chapter 18, in *Research Methods in Health*, Liamputtong P, editor, South Melbourne, Australia, Oxford University Press, 2014, p. 280–294.
27. Güllich A, Emrich E. Evaluation of the support of young athletes in the elite sports system. *Eur J Sport Soc* 2006; 3(2):85–108. <http://dx.doi.org/10.1080/16138171.2006.11687783>.
28. Güllich A. Selection, de-selection and progression in German football talent promotion. *Eur J Sport Sci* 2014; 14(6):530–537. <http://dx.doi.org/10.1080/17461391.2013.858371>.
29. Schorer J, Rienhoff R, Fischer L et al. Long-term prognostic validity of talent selections: comparing national and regional coaches, laypersons and novices. *Front Psychol* 2017; 8(JUL):1–8. <http://dx.doi.org/10.3389/fpsyg.2017.01146>.
30. Pion J, Hohmann A, Liu T et al. Predictive models reduce talent development costs in female gymnastics. *J Sports Sci* 2017; 35(8):806–811. <http://dx.doi.org/10.1080/02640414.2016.1192669>.
31. Wiseman AC, Bracken N, Horton S et al. The difficulty of talent identification: inconsistency among coaches through skill-based assessment of youth hockey players. *Int J Sports Sci Coach* 2014; 9(3):447–455. <http://dx.doi.org/10.1260/1747-9541.9.3.447>.
32. Chi MTH et al. Two approaches to the study of experts' characteristics, chapter 2, in *The Cambridge Handbook of Expertise and Expert Performance*, Ericsson A, Charness N, Feltovich PJ, editors, New York, NY, Cambridge University Press, 2006, p. 21–30.
33. Cahill M, Robinson K, Pettigrew J et al. Qualitative synthesis: a guide to conducting a meta-ethnography. *Br J Occup Ther* 2018; 81(3):129–137. <http://dx.doi.org/10.1177/0308022617745016>.
34. Moher D, Shamseer L, Clarke M et al. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Syst Rev* 2015; 4(1):1. <http://dx.doi.org/10.1186/2046-4053-4-1>.
35. Letts L, Wilkins S, Law M et al. *Guidelines for critical review form: Qualitative studies (Version 2.0)*, 2007. Available at: <https://srs-mcmaster.ca/wp-content/uploads/2015/04/Guidelines-for-Critical-Review-Form-Qualitative-Studies-English.pdf>. Accessed 2 May 2018.
36. Ritchie L, Wright-St Clair VA, Keogh J et al. Community integration after traumatic brain injury: a systematic review of the clinical implications of measurement and service provision for older adults. *Arch Phys Med Rehabil* 2014; 95(1):163–174. <http://dx.doi.org/10.1016/j.apmr.2013.08.237>.
37. Cupples B, O'Connor D. The development of position-specific performance indicators in elite youth rugby league: a coach's perspective. *Int J Sport Sci Coach* 2011; 6(1):125–142. <http://dx.doi.org/10.1260/1747-9541.6.1.125>.
38. Holt NL, Dunn JGH. Toward a grounded theory of the psychosocial competencies and environmental conditions associated with soccer success. *J Appl Sport Psychol* 2004; 16(3):199–219. <http://dx.doi.org/10.1080/10413200490437949>.
39. Johansson A, Fahlén J. Simply the best, better than all the rest? Validity issues in selections in elite sport. *Int J Sports Sci Coach* 2017; 12(4):470–480. <http://dx.doi.org/10.1177/1747954117718020>.
40. Miller PK, Cronin C, Baker G. Nurture, nature and some very dubious social skills: an interpretative phenomenological analysis of talent identification practices in elite English youth soccer. *Qual Res Sport Exerc Heal* 2015; 7(5):642–662. <http://dx.doi.org/10.1080/2159676X.2015.1012544>.
41. Lund S, Söderström T. To see or not to see: talent identification in the Swedish Football Association. *Social Sport J* 2017; 34(3):248–258. <http://dx.doi.org/10.1123/ssj.2016-0144>.
42. Jokuschies N, Gut V, Conzelmann A. Systematizing coaches' "eye for talent": player assessments based on expert coaches' subjective talent criteria in top-level youth soccer. *Int J Sports Sci Coach* 2017; 12(5):565–576. <http://dx.doi.org/10.1177/1747954117727646>.
43. Johnson MB, Castillo Y, Sacks DN et al. "Hard work beats talent until talent decides to work hard": coaches' perspectives regarding differentiating elite and non-elite swimmers. *Int J Sport Sci Coach* 2008; 3(3):417–430. <http://dx.doi.org/10.1260/174795408786238579>.
44. Mills A, Butt J, Maynard I et al. Identifying factors perceived to influence the development of elite youth football academy players. *J Sports Sci* 2012; 30(15):1593–1604. <http://dx.doi.org/10.1080/02640414.2012.710753>.
45. Ferreira Celestino T, Gomes Leitão JC, Borges Sarmento H et al. Elite coaches views on factors contributing to excellence in orienteering. *Cult Cienc y Deport* 2015; 10(28):77–86. <https://doi.org/10.12800/ccd.v10i28.517>.
46. Ellingsen JE, Danielsen AG. Norwegian children's rights in sport and coaches' understanding of talent. *Int J Child Rights* 2017; 25(2):412–437. <http://dx.doi.org/10.1163/15718182-02502006>.
47. Gonçalves L, Santos A, Tavares F et al. From talent to high performance: the view of coaches, players and club coordinators on the relevant factors in the development of a basketball player. *Cuadernos Psicol Del Deport* 2017; 7(3):129–135.
48. Miiistedt M, Mesquita I, Sobrinho AS et al. Coaches representation about detection and selection of talents on the Brazilian volleyball. *Int J Sport Sci* 2013; 3(5):157–162. <http://dx.doi.org/10.5923/j.sports.20130305.03>.
49. Vrljic K, Mallett CJ. Coaching knowledge in identifying football talent. *Int J Coach Sci* 2008; 2(January):1–34.
50. Larkin P, O'Connor D. Talent identification and recruitment in youth soccer: recruiter's perceptions of the key attributes for player recruitment. *PLoS One* 2017; 12(4):e0175716. <http://dx.doi.org/10.1371/journal.pone.0175716>.
51. Julio UF, Takito MY, Mazzei L et al. Tracking 10-year competitive winning performance of judo athletes across age groups. *Percept Mot Skills* 2011; 113(1):139–149. <http://dx.doi.org/10.2466/05.10.11.PMS.113.4.139-149>.
52. Brouwers J, De Bosscher V, Sotiriadou P. An examination of the importance of performances in youth and junior competition as an indicator of later success in tennis. *Sport Manag Rev* 2012; 15(4):461–475. <http://dx.doi.org/10.1016/j.smr.2012.05.002>.
53. Güllich A. International medallists' and non-medallists' developmental sport activities—a matched-pairs analysis. *J Sports Sci* 2017; 35(23):2281–2288. <http://dx.doi.org/10.1080/02640414.2016.1265662>.
54. Elbe A-M, Wikman JM et al. Psychological factors in developing high performance athletes, chapter 12, in *The Routledge Handbook of Talent Identification and Development in Sport*, Baker J, Copley S, Schorer J, editors, New York, NY, Routledge, 2017, p. 169–180.
55. Matthys SPJ, Vaeyens R, Vandendriessche J et al. A multidisciplinary identification model for youth handball. *Eur J Sport Sci* 2011; 11(5):355–363. <http://dx.doi.org/10.1080/17461391.2010.523850>.
56. Robertson S, Woods C, Gastin P. Predicting higher selection in elite junior Australian Rules football: the influence of physical performance and anthropometric attributes. *J Sci Med Sport* 2015; 18(5):601–606. <http://dx.doi.org/10.1016/j.jsams.2014.07.019>.
57. Rollin J, Alegi PC, Weil E, et al. Football – Soccer. *Encyclopaedia Britannica*. Available at: <https://www.britannica.com/sports/football-soccer>. Accessed 10 November 2018.
58. Wright G, Bolger F. *Expertise and Decision Support*, Wright G, Bolger F, editors, New York, NY, Plenum Press, 1992.
59. Emmonds S, Till K, Jones B et al. Anthropometric, speed and endurance characteristics of English academy soccer players: do they influence obtaining a professional contract at 18 years of age? *Int J Sports Sci Coach* 2016; 11(2):212–218. <http://dx.doi.org/10.1177/1747954116637154>.
60. Copley S, Baker J, Wattie N et al. Annual age-grouping and athlete development: a meta-analytical review of relative age effects in sport. *Sport Med* 2009; 39(39):235–256.
61. Côté J, Gilbert W. An integrative definition of coaching effectiveness and expertise. *Int J Sports Sci Coach* 2009; 4(3):307–323. <http://dx.doi.org/10.1260/174795409789623892>.