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Talent Identification and Development in Male Rugby Union: A Systematic Review

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Francesco Dimundo[1,2], Matthew Cole[1], Richard C. Blagrove[3], Kevin Till[4], Alexander B. T. McAuley[1], Mike Hall[2], Chim Gale[5], and Adam L. Kelly[1]
[1]Research Centre for Life and Sport Sciences (CLaSS), School of Health Sciences, Department of Sport and Exercise, Birmingham City University, UK
[2]Worcester Warriors Rugby Football Club, Sixways Stadium, UK
[3]School of Sport, Exercise, and Health Sciences, Loughborough University, UK
[4]Carnegie School of Sport, Leeds Beckett University, UK
[5]Harlequins Rugby Football Club, Twickenham Stoop Stadium, UK

Correspondence: Adam L. Kelly, Adam.Kelly@bcu.ac.uk

Abstract

The pathway towards expertise in sport has been studied within different contexts. Various methodological approaches have been used in research to explore the processes of talent identification (TID) and talent development (TD) in rugby union (RU). The aim of this study was to critically review the existing literature on TID and TD in RU in order to outline where the existing research lies, identify the most researched topics, and provide updated guidance for coaches, practitioners, and future research. Searches were conducted in the electronic databases PubMed, Web of Science, Scopus, SPORTDiscus, and Google Scholar. The following Boolean combination key words were applied: rugby union, AND, talent identification, talent development, early selection, youth selection, talent transfer, and youth development. This process was carried out in accordance with PRISMA guidelines.
Databases provided 382 studies, with a total of 253 articles fully assessed (IRR = 98.6%, k = 0.94), of which a further 234 were excluded (IRR = 97.7%, k = 0.85). Following this screening, 15 articles were added from studies and review citations, resulting in a total of 34 articles included in the review. The ecological dynamics framework was applied to collate factors from the one- and multi-dimensional findings (Sarmento et al., 2018). The most investigated topics were as follows: (1) task constraints: (a) participation history; (2) performer constraints: (a) psychological factors; (b) technical and tactical skills; (c) anthropometric factors; (d) physiological factors; (3) environmental constraints: (a) relative age effects; (b) socio-cultural factors. Practitioners need to consider the players' anthropometric, physiological, psychological, technical, and tactical profile, when selecting and developing young rugby union players. Further longitudinal mixed-method research is required to provide indications of the success of talent identification and development processes, to gain a better understanding on how these factors can affect selection and long-term progress.

Keywords

Rugby football, selection, athlete development, youth selection, development process

Introduction

Although often used interchangeably, the concepts of talent identification (TID) and talent development (TD) are separately defined. TID can be considered as the process of recognizing current participants with the potential to excel in a particular sport, whereas TD is the process of providing the most appropriate learning

environment to realize this potential (Williams & Reilly, 2000). In practical terms, the two diverse concepts are related since the effectiveness of one could directly affect the outcomes of the other. This interconnection can be explained by the fact that the progression of a player to top-level sports is multi-contextual and multi-factorial. Thus, practitioners continue to search for the unique and dynamic factors responsible for optimum developmental outcomes. In light of this, it is reasonable to suggest that the processes of TID and TD can be described using an ecological dynamics theoretical approach. This theory states that talent should be considered as a dynamically varying relationship molded by the constraints imposed by physical and social environments, the tasks experienced, and the personal resources of a player; thus, it cannot be the result of a single independent factor (Sarmento et al., 2018).

Current sport science literature has investigated the TID and TD process of various sports and across the different codes of rugby (i.e., rugby union [RU], rugby league [RL], and rugby sevens). In particular, a number of papers have attempted to provide recommendations for how to advance the talent pathway in RL (e.g., Cupples et al., 2018; Dobbin et al., 2017; Gabbett, 2002, 2006, 2008; Ireton et al., 2017; McMahon et al., 2017; Spamer & Hare, 2001; Till et al., 2010, 2011, 2013, 2015a, 2015b, 2016a, 2016b, 2016c, 2016d, 2017a, 2017b; Waldron, 2013) and rugby sevens (e.g., Higham et al., 2013; Ross et al., 2014). Contrary to RL, a paucity of investigations endeavored to address this topic in RU. However, since England RFU's and World Rugby's aim to ensure that rugby is enjoyed at all age grade (England Rugby, 2017; World Rugby, 2018) and considering that rugby is a sport in continuous evolution, there is the constant necessity to optimize the talent path in RU.

Studies report that there are no significant differences between forwards and backs for several important performance parameters, such as the distance covered in a game and the average sprint duration (Gabbett et al., 2008; McLellan et al., 2011). However, some key dissimilarities justify the importance and need for a specific investigation into the process of TID and TD, specifically in RU. In fact, it is well acknowledged that RU has a clear diversification in the requirements for forwards and backs (Cahill et al., 2013; Deutsch et al., 2007; Smart et al., 2013; Valentza, 2017; Vaz et al., 2016; World Rugby, 2018). Moreover, the activity ratio (work:rest) for RL ranges from 1:5 to 1:6 (Gabbett et al, 2008), whereas it is 1:7 to 1:20 for RU (Deutsch et al., 2007; World Rugby, 2018). In addition, it is plausible to suggest that RU teams have to select their players meticulously in order to maintain both high intensity activity during the game and technical facets of play (e.g., scrum, lineout, maul) according to the different laws of the two games. Therefore, these differences reflect the need for a diverse approach when selecting and developing players for RL and RU. These differences justify the importance and need for a specific investigation into the process of TID and TD, specifically in RU.

Rugby union is played at varying levels of age and competition (Jones et al., 2018a), with figures reporting an increasing popularity across the globe (Freitag, Kirkwood, & Pollock, 2015). National governing bodies and professional clubs invested a large portion of their financial budget on the identification and development of talented youth athletes (Jones et al., 2018a; Reilly et al., 2000). However, the complex nature of predicting youth trajectories towards expertise remains a challenge for investors and coaches selecting athletes into talent development pathways (e.g., Abbott & Collins, 2002; Baker & Horton, 2004; Williams & Reilly, 2000). Differences in the physical qualities have been suggested as key discriminative functions between playing standards and age categories in RU (Jones et al., 2018b). Despite this, for a young player to become professional and be considered an expert in RU, they are required to possess a wide range of additional skills, such as effective psychological and technical characteristics (Davids et al., 2013a).

The topic of TID and TD has been studied extensively in other sports, particularly soccer.

In fact, during a recent systematic review on TID and TD in soccer by Sarmento and colleagues (2018), three different macro-areas were identified as important aspects for TID and TD: *task constraints*, *performer constraints*, and *environmental constraints*. Each area was subcategorized (7 major factors in total) and results were presented in a one-dimensional or multi-dimensional analysis. To the authors knowledge, there are currently no articles examined the literature surrounding RU using any type of macro-areas analysis. Thus, the aim of this study was to review systematically the existing literature on TID and TD in RU in order to outline where the existing research lies, identify the most researched topics, provide updated guidance for coaches and practitioners, and outline avenues for future research.

Methods

Search Strategy: Databases and Inclusion Criteria

The systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-analyses guidelines. Searches were conducted using the key words of "rugby union," combined with the Boolean search of "AND," alongside combinations of the following keywords: "talent identification," "talent development," "early selection," "youth selection," "talent transfer," and "youth development." These searches were conducted on the electronic databases PubMed, Web of Science, Scopus, SPORTDiscus, and Google Scholar (February, 2019). Other studies were added following a process of citation checking in eligible papers and similar reviews.

The following inclusion criteria were applied to studies: (a) written in the English language, (b) used male participants, (c) has original and peer-reviewed data and (d) solely examined RU data, and (e) specifically researched TID and/or TD. There were no restrictions regarding study design or publication year. Studies were not excluded on the basis of participants' age or skill level. The process was performed by two independent reviewers (first and last author). Agreement on study quality between reviewers was expressed as the inter-rater reliability (IRR) percentage (%) and Cohen's kappa statistic (*k*) as reported in Figure 1. If an agreement was not reached by the two reviewers a third reviewer (second author) assisted in making the decision.

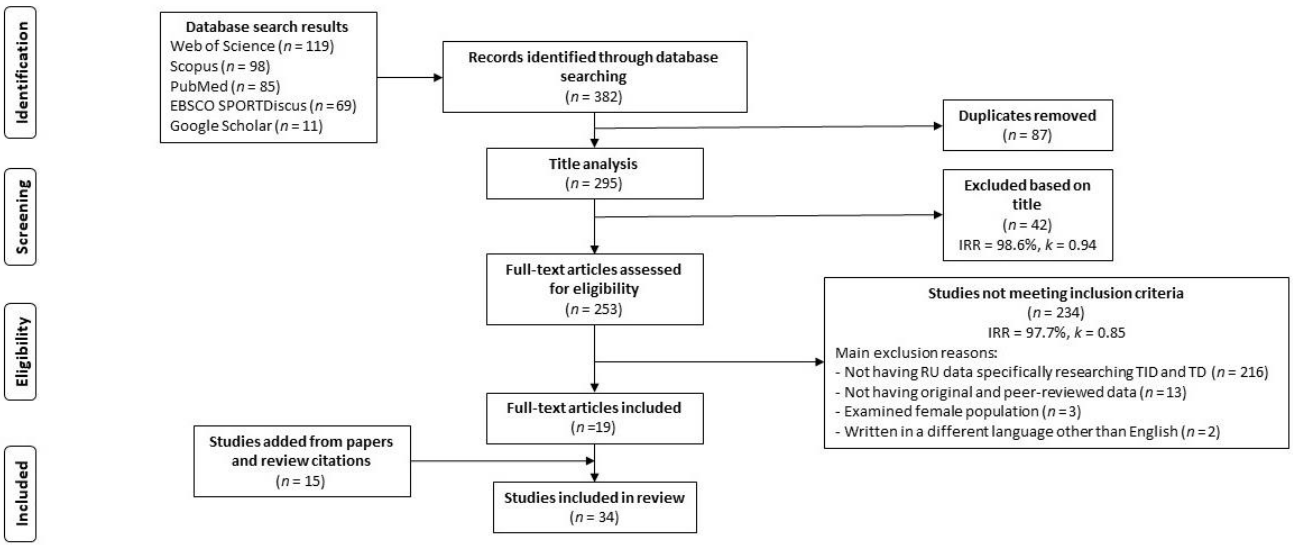

Figure 1. Schema of PRISMA guidelines followed, comprising the processes for identification, screening, eligibility, and inclusion of papers.

Quality of the Studies and Extraction of Data

Studies were assessed for their overall methodological quality following the recommendations of Faber and colleagues (2015). As such, Critical Review Forms were used to score quantitative papers using Law and colleagues (1998) assessment guidelines (counting 16 items) and Letts and colleagues (2007) for scoring qualitative studies (counting 21 items). If a paper presented both quantitative and qualitative analysis, both scoring systems were applied.

Each quantitative article was assessed objectively to determine if it contained the following components: objective (item 1), relevance of background literature (item 2), appropriateness of the study design (item 3), sample included (items 4 and 5), informed consent procedure (item 6), outcome measures (item 7), validity of measures (item 8), details of the intervention procedure (item 9), significance of results (item 10), analysis (item 11), clinical importance (item 12), description of drop-outs (item 13), conclusion (item 14), practical implications (item 15), and limitations (item 16).

Qualitative studies were assessed to identify whether they included the following: objective (item 1), literature reviewed (item 2), study design (items 3, 4, and 5), sampling (items 6, 7, 8, and 9), data collection (descriptive clarity: items 10, 11, and 12; procedural rigor: item 13), data analyses (analytical rigor: items 14 and 15; auditability: items 16 and 17; theoretical connections: item 18), overall rigor (item 19), and conclusion/implications (items 20 and 21). The score per each item was 1 (meets criteria), 0 (does not meet the criteria), or N/A (not applicable).

The overall score was expressed as a percentage by summing the points in a given article and dividing by the total number of scored items for that specific research design (i.e., 16 or 21 items). If certain items were scored as "N/A," then the total number was adjusted to reflect that. The classification adopted the guidelines provided by Faber and colleagues (2015) and Te Wierike and colleagues (2013), therefore the articles were graded as (a) excellent methodological quality—with a score >75%, (b) good methodological quality—with a score between 51 and 75%, and (c) low methodological quality—with a score ≤50%. To assess risk of bias, a Cochrane Consumers and Communication Review Group's data extraction template was adopted for this study. One author extracted the data (first author), and another verified the decision (last author), with disagreements resolved by discussion between the two authors.

Articles included in this study were classified according to the research topics that emerged from the included articles and adopted a similar ecological dynamics theoretical approach implemented by Sarmento and colleagues (2018). The ecological dynamics theoretical framework states that talent development, skill acquisition, and superior performance should be considered as a relationship that varies dynamically and is shaped by constraints affected by task (i.e., engagement in activities), performer (i.e., psychological, technical, tactical, anthropometric, and physiological characteristics), and environmental (i.e., relative age effects and socio-cultural factors) constraints of each individual (Davids et al., 2013b, 2017).

Results

Search, Selection, and Inclusion of Publication

The "Identification phase" returned 382 papers including 87 duplicates that were removed either automatically or manually. During the "Screening phase," 295 papers were examined based on their title, with 42 subsequently excluded (IRR = 98.6%, k = 0.94). A total of 253 articles were fully assessed at the "Eligibility phase," of which a high proportion (n = 216) were excluded (IRR = 97.7%, k = 0.85) because they had no RU data specifically researching TID and TD. Other papers were also excluded because they did not have original and peer-reviewed data (n = 13), they examined a female population (n = 3) or were written in a language other than English (n = 2). After this screening, 15 articles were added from studies

and review citations as reported in Figure 1. At the end of the "Selection phase," a total of 34 articles were included in the review.

Quality of the Studies

Regarding the quality of studies, a separate mean score for quantitative, qualitative, and mixed-methods articles was calculated. Only one qualitative-only paper was found, and its score was 100%. The overall means for the studies were classified as excellent: quantitative-only scoring 85.6% (*n* = 31) and mixed-methods scoring 85.7% (*n* = 2). Specifically, of the 34 articles; five scored between 51 and 75%; one scored 100%; and the remaining 28 achieved an overall rating of >75% as reported in Table 1.

General Description of the Studies

The authors categorized the studies in this review into one-dimensional (OD) (i.e., analyzed only one factor) and multi-dimensional (MD) (i.e., analyzed two or more factors) articles. This included analyzing each study according to the seven major research topics that came to light from the investigation. This allowed the authors to adopt the ecological dynamics theoretical framework, as previously presented by Sarmento and colleagues (2018). The main findings of the 34 articles are presented in Table 1.

Articles used in this review focused on the following: (1) *task constraints* (OD = 1, MD = 1): (a) participation history (OD = 1, MD = 1); (2) *performer constraints* (OD = 7, MD = 47): (a) psychological factors (OD = 1, MD = 0), (b) technical and tactical skills (OD = 2, MD = 7), (c) anthropometric factors (OD = 4, MD = 20), and (d) physiological factors (OD = 0, MD = 20); and, (3) *environmental constraints* (OD = 2, MD = 7): (a) relative age effects (OD = 2, MD = 3) and, (b) socio-cultural factors (OD = 0, MD = 4). The studies included in the systematic review accumulated a total of 50,716 players and 27 coaches. In total, ten out of 34 articles were OD in nature, with the remaining 24 comprising of MD methodologies. Although more articles were MD, 13 combined only two factors, while none of these included all of the seven major factors. It appears that anthropometric (*n* = 24), physiological (*n* = 20), and technical and tactical (*n* = 9) performer constraints were the most researched factors. See Figure 2.

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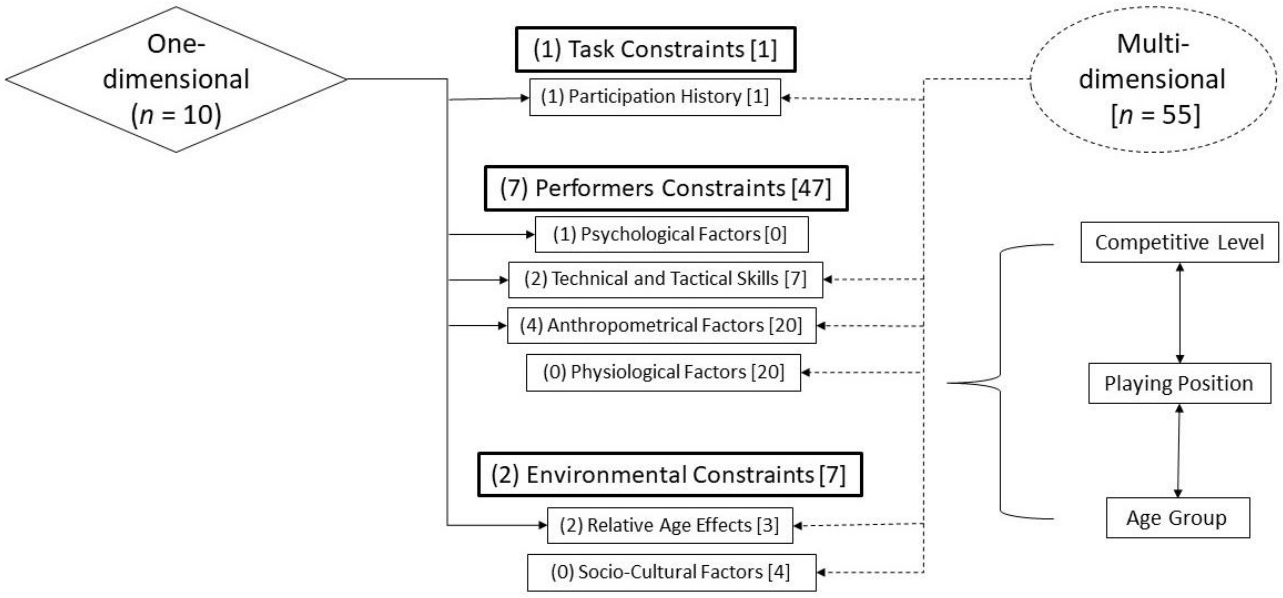

Figure 2. One-dimensional and multi-dimensional classification of papers in accordance with the ecological dynamic theoretical framework.

Table 1. Summary of the 34 articles included in this systematic review.

Authors	Aim	Participants	Constraints Examined	Results	Quality Score
Darrall-Jones et al. (2015a)	To evaluate the anthropometric, sprint, and high-intensity running profiles of English regional academy players by playing positions.	Professional regional academy U16 (*n* = 29) U18 (*n* = 24) U21 (*n* = 15)	Anthropometric and physiological factors	Forwards displayed significantly different anthropometric and sprint momentum compared to backs. Body mass and sprint momentum have the largest differences at consecutive age categories for positions.	81.3%
Darrall-Jones et al. (2015b)	To evaluate the anthropometric and physical characteristics of English regional academy players by age category.	Professional regional academy U16 (*n* = 29) U18 (*n* = 23) U21 (*n* = 15)	Anthropometric and physiological factors	Anthropometric and physical characteristics were more developed across older groups. Physiological characteristics also improved with age. Sprint times, aerobic profile, and ASR appear to remain stable across age categories.	87.5%
Delahunt et al. (2013)	To describe and contrast the body composition and anthropometric profiles of adolescent Irish rugby union players using total-body dual-energy x-ray absorptiometry.	Schoolboy U16 (*n* = 136)	Anthropometric factors	There were significant differences in fat mass characteristics between forwards and backs. The players with a higher body mass were twice as likely to be classified as forwards.	87.5%
Durandt et al. (2011)	To establish how many players in the 2005 U13 group participated in subsequent U16 and U18 tournaments.	Regional and national U13, U16, and U18 (*n* = 349)	Participation history	Talented young players (U13) were not necessarily selected to participate at later stages (U16 and/or U18). Specifically, only the 31.5% of the initial talented group reached the U16 squad and the 24.1% reached the U18 team.	73.3%
Farrow et al. (2010)	To compare expert, intermediate, and novice participants on their ability to recall and anticipate structured rugby union line-out patterns.	Senior international (*n* = 20) Provincial (*n* = 15) Novice (*n* = 14)	Technical and tactical skills	Expert rugby players were able to recall and anticipate structured patterns of play with significantly greater accuracy than the lesser skilled participants. Overall, technical videos predicted players' levels.	87.5%
Fontana et al. (2015)	To explore the anthropometric reference database of senior rugby union players competing at different levels in the southern European region.	Professional (*n* = 362)	Anthropometric factors	Forwards had greater anthropometric characteristics than backs. The lower the competitive level, the higher the within-role variability observed. Fat free mass was the variable that predicted the likelihood of being classified as an international or national player.	87.5%
Fontana et al. (2016)	To examine if and to what extent specific anthropometric and functional characteristics can accurately predict subsequent career progression in rugby union.	U16 to senior national and international (*n* = 531)	Anthropometric and physiological factors	Players' success was predicted using a linear combination of anthropometric and physical characteristics, among which a lower percent body fat and higher speed over a 15 m sprint provided the most important predictors of the highest career success.	93.3%
Grobler et al. (2017)	To determine the prevalence of RAEs in schoolboy rugby union players in South Africa. Also, to determine if RAEs were related to physical fitness parameters.	Schoolboy U14 to U16 (*n* = 281)	RAEs and anthropometric and physiological factors	Stronger and more physical players were most likely to be selected. RAEs were also prevalent in all groups, with the first two quartiles of the year overrepresented. U15s demonstrated a significant relationship between stature, hand-grip strength, and upper-body muscle endurance and RAEs.	93.8%
Hansen et al. (2011)	To investigate the discriminative ability of rebound jump squat force–time and power–time measures in differentiating speed performance and competition level in professional and academy rugby union players.	Professional (*n* = 25) Academy (*n* = 15)	Anthropometric and physiological factors	Force and power differentiated playing levels. Lean mass parameters also helped the transition from academy to professional status.	87.5%

Note. U = under; *n* = number; RDO = Rugby Development Officer; RAEs = relative age effects; BQ = birth quarter; maxV = maximal velocity; Yo-Yo IRT-1 = Yo-Yo intermittent test level 1; 30-15IFT = 30-15 intermittent fitness test; ASR = anaerobic speed reserve; PCDEQ = Psychological Characteristics of Developing Excellence Questionnaire.

Authors	Aim	Participants	Constraints Examined	Results	Quality Score
Hill et al. (2015)	To identify both positive and negative issues that influenced talent development using a retrospective qualitative investigation, which was conducted with academy coaches and directors within nine different English rugby union academies.	Professional regional academy (n = 15)	Psychological factors	A range of positive (e.g., self-regulated learning strategies, ownership and independence, and motivation), negative (e.g., lack of commitment, lack of development awareness, and mental health issues) and dual-effect (e.g., perfectionism, obsessive passion, and over-commitment) characteristics were identified.	100% (Qual)
Holway and Garavaglia (2009)	To explore anthropometric characteristics to establish whether front row forwards have larger muscular–skeletal parameters than the other groups of players.	Professional and semi-professional (n = 133)	Anthropometric factors	Front row forwards had larger proportional muscle and skeletal structure both than other forwards and backs, as well as similar muscle-to-bone ratio.	92.9%
Howard et al. (2016)	To evaluate the mediating effect of biological maturation on anthropometric measurements, performance indicators, and subsequent selection in a group of academy rugby union players.	Professional regional academy U14 to U17 (n = 51)	Anthropometric and physiological factors	There was a selection bias towards early-maturing players. This prevalence appears to result from the superior anthropometric attributes exhibited, which likely contributed towards improved components of speed, anaerobic power, and momentum.	93.8%
Jones et al. (2018a)	To compare the physical qualities between academy and schoolboy rugby union players.	Professional regional academy U18 (n = 55) Schoolboy U18 (n = 129)	Anthropometric and physiological factors	Academy players had superior height, body mass, strength, 20 and 40 m sprint, 10 m momentum, and aerobic fitness compared to schoolboy players.	81.3%
Jones et al. (2018b)	To compare anthropometric and physical factors between current professional and amateur rugby union players. Also, to determine which anthropometric and physical characteristics were predictive of playing standards.	Professional and amateur (n = 60)	Anthropometric and physiological factors	Professional players were anthropometrically and physically superior to amateur players. The sum of the eight skinfolds, power, and CMJ peak velocity were predictive of playing standard.	75%
Kearney (2017)	To examine RAEs in forwards and backs in international players from four different countries.	International (n = 6,663)	RAEs	RAEs were not greater in backs than in forwards. RAEs may have influenced talent development in South African rugby union to a greater extent than in other major playing nations.	92.9%
Lewis et al. (2015)	To examine the presence and prevalence of RAEs in Welsh age-grade rugby union. Also, to consider how coaches' selection processes have the potential to contribute to the manifestation of RAEs.	Regional to national U7 to U19 (n = 34,788) RDO (n = 26)	RAEs and socio-cultural factors	Those born in BQ1 were overrepresented compared to those born in BQ4. Differences increased with level of performance. Players' physical characteristics, 'open mindedness', 'work ethic', and 'overall coachability' were also noted as being important criteria when selecting players.	87.5% (Quant) 90.5% (Qual)
McCarthy and Collins (2014)	To investigate the initial academy identification process and the impact of RAEs during this phase in England. Also, the same cohort of players were assessed as they progressed (or not) into senior professional level.	Professional regional academy U16 to senior (n = 118)	RAEs	The initial selection was significantly skewed towards BQ1 and BQ2 players. However, there was evidence of a RAE reversal effect, whereby the conversion rate was skewed towards BQ3 and BQ4 players.	92.9%
Parsonage et al. (2014)	To examine conditioning-specific movement tasks and physical fitness characteristics of U16 players. Also, to perform an exploratory analysis that classified players into groups by their conditioning specific movement tasks ratings, then compare scores between the groups.	Regional and national U16 (n = 156)	Anthropometric and physiological factors	Training conditioning specific movement tasks (overhead squat, Romanian deadlift, double leg to single leg landing, single leg squatting, sprinting, and jumping) improved sprinting over 40 m and endurance running. Successful training intervention after movement screening can facilitate players' long-term development.	81.3%
Pienaar and Spamer (1998)	To determine why certain 10-years-old rugby union players who were initially identified as having talent were selected in a high-performance primary school programme.	Schoolboy U10 (n = 31)	Technical and tactical skills and anthropometric and physiological factors	The successful group was significantly better in rugby skills and motor abilities, including passing for distance, passing for accuracy, throwing over the crossbar, rolling and picking up of the ball running speed, agility run, sit and reach, and vertical jump.	87.5%

Authors	Aim	Participants	Constraints Examined	Results	Quality Score
Pienaar et al. (1998)	To identify the physical, rugby specific skills, and anthropometric variables that enable coaches to identify 10-year-old schoolboys who could become successful rugby union players.	Schoolboy U10 (*n* = 218)	Technical and tactical skills and anthropometric and physiological factors	Anthropometric parameters (body height), physical characteristics (sprint and strength), and some rugby-specific skills (passing for accuracy) were qualities that predicted selected and deselected young players.	93.8%
Plotz and Spamer (2006)	To compare anthropometric, game-specific, and physical variables in talented South African and English 18-year-old players.	International U18 (*n* = 64)	Technical and tactical skills and anthropometric and physiological factors	Both South African and English groups reported no significant anthropometrical differences. English players demonstrated significantly worse results in the physical and motor abilities, while the South African players performed the best in game-specific skills.	75%
Quarrie et al. (1996)	To describe the anthropometric and physical performance characteristics of a sample of professional rugby union players to highlight differences between the positional categories of the players.	Professional (*n* = 94)	Anthropometric and physiological factors	Anthropometric characteristics of forwards differed significantly between positional categories. As an example, Locks and loose forwards were taller than the front row forwards, whereas outside backs were taller, heavier, and had greater than the inside backs.	87.5%
Read et al. (2017)	To compare the physical characteristics of academy and schoolboy U18 rugby union players by position (forwards and backs).	Regional academy and schoolboy U18 (*n* = 66)	Anthropometric and physiological factors	Academy players covered greater total distance and greater jogging distances than school players. Academy backs accumulated greater player load and the academy forwards greater sprinting distance than school players in their respective positions.	87.5%
Roberts and Fairclough (2012)	To examine whether RAEs existed in representative youth rugby union squads. Also, to what extent is an RDO, who responsible talent identification and development, was aware of RAEs.	Regional representatives U13 (*n* = 43) U14 (*n* = 47) U15 (*n* = 47) U16 (*n* = 30) RDO (*n* = 1)	RAEs and socio-cultural factors	RAEs were found to exist in all the age groups, with the largest effect size found in the U16. The RDO revealed a lack of knowledge, understanding, and awareness of RAEs.	87.5% (Quant) 81% (Qual)
Scott et al. (2003)	To evaluate the differences in aerobic fitness between forwards and backs from a professional rugby union team.	Professional (*n* = 28)	Anthropometric and physiological factors	Backs had a higher peak oxygen uptake per kilogram than forwards. The greater stature, body mass, and body fat percentage of forwards is likely to be the reason for their lower peak oxygen uptake.	87.5%
Sedeaud et al. (2013)	To investigate the changes over time in anthropometric parameters of junior and senior rugby union players in France.	Regional and national Senior (*n* = 2,051) Junior (*n* = 145) U15 (*n* = 448)	Anthropometric factors	Senior backs have become heavier by 12 kg and taller by 5.4 cm, whilst forwards have become heavier by12.3 kg and taller by 2.9 cm. Junior backs have become taller by 6 cm and heavier by 9.9 kg, whilst forwards have become taller by 4.4 cm and heavier by 11.1 kg. U15 backs have gained 5.1 cm and 6.5 kg, whilst forwards have gained 4.7 cm and 4.7 kg.	92.9%
Sedeaud et al. (2017)	To quantify the impact of selections and shared selections on the match results in French international rugby union.	Senior international (*n* = 1,054)	Technical and tactical skills and socio-cultural factors	Squads with superior collective effectiveness where more successful than those with less. Overall, the coach's culture affects selection.	86.7%
Sherwood et al. (2018)	*Study 1:* To understand whether accuracy when recalling rugby union patterns is a valid measure of on-field decision making performance. *Study 2:* To explore differences between novice and expert players on a pattern recall task that included structured, semi-structured, and unstructured rugby union patterns.	*Study 1:* Senior professional (*n* = 57) *Study 2:* Professional development squad U18 (*n* = 47) University recreational level (*n* = 41)	Technical and tactical skills	*Study 1:* Total number of years playing rugby union was correlated with recall accuracy. *Study 2:* Experts were significantly more accurate than novices when recalling structured and semi-structured patterns. However, there were no differences when recalling unstructured patterns.	87.5%

Authors	Aim	Participants	Constraints Examined	Results	Quality Score
Smart et al. (2013)	To examine the between-player differences and within-player changes in physical performance in rugby union players.	Senior professional and provincial (*n* = 1,161)	Anthropometric and physiological factors	Small-to-moderate differences between players selected and not selected for provincial teams and small-to-large differences between provincial and professional players.	81.3%
Spamer and De La Port (2006)	To identify the characteristics of U16 and U18 schoolboy rugby players in South Africa with reference to anthropometric variables, physical and motor abilities, and game-specific skills.	Schoolboy U16 (*n* = 71) U18 (*n* = 75)	Technical and tactical skills and anthropometric and physiological factors	U18s were taller, heavier, and leaner than U16s. U18s were also stronger, more agile, and had a better aerobic endurance than U16s. Conversely, U16s were faster than U18s. Game-specific handling skills of both U16 and U18 decreased across the study.	81.3%
Spamer et al. (2009)	To conduct a comparative study between elite U16 rugby union players of New Zealand and South Africa, by examining game specific skills and anthropometric and physical profiles.	Provincial U16 (*n* = 88)	Technical and tactical skills and anthropometric and physiological factors	New Zealand players outperformed the South African players in game-specific tests, physical abilities, and anthropometric measurements.	62.5%
van Gent and Spamer (2005)	To compare playing groups in terms of anthropometric, rugby-specific skills, physical, and motor components among U13, U16, U18, and U19 provincial players.	Provincial U13 (*n* = 21) U16 (*n* = 22) U18 (*n* = 18) U19 (*n* = 19)	Technical and tactical skills and anthropometric and physiological factors	There were significant differences between playing groups for anthropometric, rugby-specific, skills, physical, and motor components. Forwards developed later in terms of anthropometric components. The older the players, the fewer the differences in rugby-specific skills, physical, and motor components.	81.3%
Winn et al. (2016)	To examine whether higher levels of deprivation was associated with lower engagement in organised activities such as rugby practice and competition.	Provincial U15 (*n* = 590)	Participation history and socio-cultural factors	The more deprived players accumulated less rugby-specific practice hours and engaged in fewer sport than their less deprived peers.	87.5%
Wood et al. (2018)	To provide normative data relating to the physical fitness of elite adolescent Irish rugby union players and determine the differences in the physical capacities between players in the forward and back units.	International U18 (*n* = 89)	Anthropometric and physiological factors	Forwards had greater anthropometrics than backs. Forwards had a significantly lower CMJ height, triple hop for distance score, and 150 m shuttle test score on their right leg compared to backs. Forwards had a significantly higher 10 m sprint time than backs.	87.5%

Discussion

The aim of this study was to review the existing literature investigating TID and TD in male RU players. Based on an ecological dynamic theoretical framework, the following sections discuss the main findings of the 34 papers included in this systematic review.

Task Constraints

Participation History. Previous research in sport has identified three pathways towards senior expertise: (a) early sampling, (b) early engagement, and (c) early specialization (see Ford & Williams, 2017). Within the context of RU, there is limited research on the most appropriate pathway towards senior professional status, with only two articles identified in this systematic review (Durandt et al., 2011; Winn et al., 2016). Although there appears to be no existing literature that explores the practice history profiles of professional RU players, Winn and colleagues (2016) examined the effect of deprivation on participation in Welsh RU developmental activities. They found that those players from more deprived groups accumulated less hours of structured RU practice and participated in fewer sports when compared to those from less deprived groups. This may be due to the unviable cost, parental support, and limited access to coaching, resources, and facilities, which are crucial for improved athlete development outcomes (Côté et al., 2014). Since participation in structured practice and multi-sport activities is vital for achieving expertise in sport (see the Development Model of Sport Participation; Côté et al., 2007), this may have significant developmental implications based on individual circumstances. Thus, deprivation is an important consideration while examining who is at risk of lower access to structured practice and multi-sport activities in RU. As such, RU coaches and practitioners, as well as clubs and organizations, are encouraged to offer more equitable access to athlete development pathways, which may also provide a larger cohort of prospective talent in the future (Till & Baker, 2020).

Durandt and colleagues (2011) investigated the effectiveness of TID procedures in U13 South African players and their consequent progression towards U16 and U18 squads. Considering that 31.5% and 24.1% of the U13 players were reselected to play in the U16 and U18 squads, respectively, it is suggested that early selection processes may be flawed due to the high levels of deselection. However, it is important to note that since reaching higher competition levels is inevitably going to become increasingly difficult with age (i.e., into adulthood), deselection at some stage during the talent pathway is going to be somewhat unavoidable (Faber, Damsma, & Pion 2021). Moreover, since selection at U13 is during a stage of considerable maturational differences (Kelly & Williams, 2020), as well as the timing aligned to the introduction of more structured rules (i.e., 15-a-side) and competition (i.e., league formats) (Till et al., 2020), individual variances should be considered.

Overall, according to these two studies (Durandt et al., 2011; Winn et al., 2016), key stakeholders (e.g., coaches, practitioners, administrators) in charge of planning, adopting, and evaluating long-term player development programs in RU should be cautious of individual deprivation circumstances and early TID. Moving forward, future research is encouraged to substantiate these claims. Furthermore, since there appears to be no research exploring the developmental trajectories of players specifically in RU, further research identifying the most suitable pathway is warranted.

Performer Constraints

Psychological Factors. Psychological skills have been broadly investigated as a factor of achieving success in high-performance sport environments. However, due to search strategy, there only appears to be one study that has examined the psychological factors that may influence TID and TD in RU (Hill et al., 2015). Using a retrospective research design, Hill and colleagues (2015) attempted to identify the range of psychological characteristics that impact the TD process within English RU academies. They interviewed 15 professional RU coaches, who revealed that they perceived

commitment, self-regulation, resilience, realistic performance evaluation, growth mind-set, and being proactive, as key psychological characteristics that discriminate successful players in a professional RU environment. It is suggested this skillset is vital because it provides players with the essential competencies to face developmental opportunities and challenges (Hill et al., 2015).

Similar findings have been reported in previous sport literature. For instance, self-regulation has been illustrated as one of the most important characteristics for TD; as individuals without this skill tend to rely on others, attributing failures to maladaptive causes, and are not in charge of their own development (Karoly, 1993; Petlichkoff, 2004). It may therefore be useful for key stakeholders employed in RU to assess the psychological profiles of players in order to outline individual strengths and weaknesses that are important to development (e.g., Hill et al., 2018). Unfortunately, at the time of writing, there was no research investigating the following: (a) the perceptions or psychological profile of youth RU players according to their perceived experiences or responses, and (b) how psychological skills can be effectively trained specifically in youth RU players. Thus, future research is encouraged to explore the perceptions and psychological profile of young RU players, as well as considering effective methods to practically facilitate optimal psychological development.

Technical and Tactical Skills. The ability to recognize patterns of play is an essential skill for RU players (Hendricks, 2012) as it is a key component of decision-making and anticipation (Farrow et al., 2010). In this review, two studies investigated whether the ability to recall patterns could differentiate players based on competitive playing levels (Farrow et al., 2010; Sherwood et al., 2018). Sherwood and colleagues (2018) found that expert RU players were significantly more accurate than novices in recalling structured and semi-structured tactical patterns. However, there were no statistically significant differences when recalling unstructured tactical patterns. These findings are consistent with those that previously emerged in a study on soccer players (van Maarseveen et al., 2018), which concluded that pattern recall seems to be an inconsistent method to discriminate players' performance level, and therefore it should not be used as the only way to select athletes. In contrast, a study of Farrow and colleagues (2010) revealed that pattern recall could discriminate expert, intermediate, and novice RU players. Despite these findings, the major limitation of Farrow and colleagues' (2010) investigation is that they examined a tactical component that exclusively involved forward players. Therefore, ecological validity is lacking for back players due to the diverse positional requirements that exist in RU. Together, these findings suggest that pattern recall could be a useful tool for TID and TD, albeit as part of a holistic battery of assessments. Further research exploring tactical situations (e.g., structured vs. unstructured), position-specific considerations (i.e., forwards vs. backs), and playing levels (e.g., selected vs. deselected) in youth RU is warranted.

Seven multi-dimensional studies analyzed TID and TD in RU from a technical and tactical perspective. These coincided with coach culture (Sedeaud et al., 2017), as well as anthropometrical and physiological characteristics (Plotz & Spamer, 2006; Pienaar, et al., 1998; Pienaar & Spamer, 1998; Spamer & de la Port, 2006; Spamer et al., 2009; van Gent & Spamer, 2005). Broadly, these studies attempted to identify the key factors that influenced player selection. Interestingly, a novel approach was used by Sedeaud and colleagues (2017), whereby they analyzed how much collective effectiveness (i.e., the ability to play well together) impacted tactical outcomes during French senior international selection. They revealed how collective effectiveness relied on a balance between stability and workforce renewal during the selection process for competition. Indeed, discipline and cohesion between teammates have been considered crucial factors in team sports during the execution of specific strategies and tactics (Hendricks et al., 2013; Sewry et al., 2015). As

an example, during set pieces in RU games (e.g., scrum, line-out) when turnovers become more decisive, cohesion and teamwork among teammates is vital to gain an advantage over the opposition. From a position-specific perspective, van Gent and Spamer (2005) proposed forwards may require stronger cohesion and coordination in reading offensive, defensive, and breakdown situations; whereas backs may require good handling skills, off-loads, and outflanking capabilities. As such, it is suggested that teammate capabilities and position-specific requirements are important considerations during the TID and TD processes.

Two studies compared the selection process of U10 South African players (Pienaar et al., 1998; Pienaar & Spamer, 1998). As part of their longitudinal study, Pienaar and Spamer (1998) found that during the initial TID at U10, greater physical-specific skills (i.e., linear speed, agility, sit and reach, and vertical jump characteristics) were important for selection. The subsequent selection two years later at U12 compared those who were successful against those who were unsuccessful. Findings revealed that a higher level of technique-specific skills (i.e., passing for distance, passing for accuracy over 7 m, throwing over the crossbar, and rolling and picking up of the ball) discriminated selection decisions in the U10 age group. This demonstrates how selection was initially based on physical qualities, but then subsequently oriented towards technical attributes. Similar findings were revealed by Pienaar and colleagues (1998). They found how technique-specific skills, as well as some physical-specific skills, were important for U10 selection in South African youth RU. However, questions remain over the validity of these findings and the effectiveness of such TID practices due to the maturation biases of early selection, as well as considering the lack of long-term outcomes associated with these studies.

Plotz and Spamer (2006) and Spamer and colleagues (2009) adopted a cross-cultural comparison as part of their methodology when exploring youth international RU players across three nations (England, New Zealand, and South Africa). Spamer and colleagues (2009) illustrated differences between New Zealand and South African youth U16 players on several technical, physiological, and anthropometrical factors. Specifically, New Zealand players were taller, heavier, faster, as well as possessing significantly greater ground and kicking skills. Conversely, Plotz and Spamer (2006) revealed how South African youth U18 players outperformed their English and New Zealand counterparts on a number of technique-specific tests. These findings suggest differences in age and national sport culture are important considerations while exploring TID and TD processes in RU. However, it is also important to note the limited sample size (n = 88 and n = 64) in both these studies. Future research should consider the opportunities that are presented to young players in different national contexts (with larger samples), to better understand the organizational structures that support long-term development outcomes in RU.

As previously mentioned, inter-positional differences among players are an important consideration during the TID process in RU (van Gent & Spamer, 2005). van Gent and Spamer (2005) compared inter-positional characteristics among South African academy players (i.e., U13, U16, U18, and U19). They reported that forwards mature later compared to backs, while backs have superior technical and physical skills compared to forwards. This is likely due to backs being largely responsible for decision-making actions and ball-possession tactics, whereas forwards are more responsible for greater invasive actions (i.e., first contact, scrumming, turnovers). Interestingly, the older age groups (i.e., U18 and U19) had considerably fewer differences compared to the younger age groups (i.e., U13 and U16). These findings suggest that both playing position and age group are important contextual factors when exploring the TID and TD processes.

Overall, findings illustrate the importance of technical and tactical skills in RU. More specifically, situational factors, position-specific requirements, playing level, national sport culture, and age group may all play an important role in the development of technical capabilities

in RU. Thus, future research is encouraged to consider these circumstantial factors as part of their methodologies, to gain a broader insight into the technical and tactical requirements in RU.

Anthropometric and Physiological Factors. It is common for anthropometric and physiological factors to be combined within research methodologies; therefore, these domains have been synthesised and discussed together in this section. Four studies focused solely on the analysis of anthropometric factors in Argentinian, French, Irish, and Italian RU populations (Delahunt et al., 2013; Fontana et al., 2015; Holway & Garavaglia, 2009; Sedeaud et al., 2013). In a 20-year French longitudinal investigation, Sedeaud and colleagues (2013) found that both youth and senior players selected to play in national RU academies and professional clubs became progressively heavier and taller compared to those selected during the previous years of their investigation (e.g., selected players have increased by 12.3 kg in body mass and 6 cm in height from 1988 to 2008). Similarly, a comparison between those playing in the top level of Argentinian RU and the general population showed that front row forwards (props and hookers) had largest skeletal structure and greater muscle mass (Holway & Garavaglia, 2009). This suggests that anthropometric factors are becoming increasingly important during the TID process in RU.

Inter-position differences are crucial for RU players since different roles require diverse anthropometric profiles. In fact, even at a young age, U15 and U21 French (Sedeaud et al., 2013) and U16 Irish (Delahunt et al., 2013) forwards were found to be heavier, taller, and older compared to backs, with body mass being the significant predictor of role position classification. Moreover, fat percentage also discriminated levels among players with some inter-position differences (Fontana et al., 2015). For instance, in a cross-sectional study on Italian players, the lower the level of the player, the closer the percentage of fat free mass was compared to the normal population (Fontana et al., 2015). This is in agreement with previous findings on South African youth players that reported national youth representatives had a lower body fat percentage compared to their provincial counterparts (Spamer & de la Port, 2006).

Importantly, backs possess lower fat percentage compared to forwards (Holway & Garavaglia, 2009), which is likely because they are involved in short duration high-intensity actions (Wood et al., 2018; Quarrie et al., 1996). Together, these findings suggest that the only predictive value to discriminate players' status is to measure fat percentage, with professionals being leaner than amateurs as previously reported in literature (Jones et al., 2018b). An investigation on players' selection showed that forward positions require players to be older (relative to their age group peer) if athletes want to be successful to play in this role (Sedeaud et al., 2013). In fact, some authors (Holway & Garavaglia, 2009) agreed that forwards develop anthropometric components important for their role later compared to other positions (e.g., backs), suggesting that these factors become more predictive of selection at older ages for forwards compared to other positions and thus, a more longitudinal screening on their maturity status is preferred. Cumulatively, these findings confirm that anthropometric characteristics are used by coaches as one of the main criteria for TID.

Anthropometric and physiological factors are often analyzed together as body size and speed are correlated to force production and momentum, which are vital during an invasion game such RU (e.g., while ball-carrying; Barr et al., 2014). However, other performance aspects can also interact with body sizes and physical parameters during the TID and TD processes (e.g., technical and tactical skills: Pienaar et al., 1998; Pienaar & Spamer, 1998; Plotz & Spamer, 2006; Spamer et al., 2009; Spamer & de la Port, 2006; van Gent & Spamer, 2005; relative age effects: Grobler et al., 2017). Therefore, for the purpose of the current section, a total of twenty multi-dimensional studies were selected since they included anthropometric and physiological factors (Darrall-Jones et al.,

2015a, 2015b; Fontana et al., 2016; Hansen et al., 2011; Howard et al., 2016; Jones et al., 2018a, 2018b; Parsonage et al., 2014; Quarrie et al., 1996; Read et al., 2017; Scott et al., 2003; Smart et al., 2013; Wood et al., 2018).

Overall, results show that high-performing RU players when compared to lower-performing RU players had superiority as follows: (a) maximal speed (Jones et al., 2018a; Parsonage et al., 2014); (b) acceleration (Pienaar & Spamer, 1998; Smart et al., 2013; Wood et al., 2018); (c) momentum (Darral-Jones et al., 2015a, 2015b; Fontana et al., 2016; Jones et al., 2018b; Quarrie et al., 1996); (d) maximal strength (Grobler et al., 2017; Hansen et al., 2011; Pienaar et al., 1998; Spamer & de la Port, 2006; van Gent & Spamer, 2005); (e) peak power (Howard et al., 2016); (f) agility and change of direction performance (Spamer et al., 2009); and, (g) speed endurance and aerobic qualities (Read et al., 2017; Scott et al., 2003).

Some authors (Howard et al., 2016) correlated the optimal size and physical attributes of selected players with the peak of their individual biological maturation, which include changes in skeletal, dental, reproductive, and neuroendocrine systems (Cumming et al., 2012; Malina et al., 2004). The connection among these factors affects the selection of young talent in RU since early-maturing players possess greater anthropometric and power characteristics compared to their age-equivalent but later-maturing counterparts (Howard et al., 2016). In fact, the complex phenomenon of relative age effects (see the following section) is linked to the phenomena of biological maturation, as reported also in the study of Grobler and colleagues (2017). They attempted to analyze the prevalence of relative age effects in young South African RU players and determine if they were related to anthropometrical and physiological parameters. Results showed a significant overrepresentation of those born during the early months of the selection year (i.e., relative age effects), as well as those who were relatively older being more mature and possessing greater handgrip and upper body strength (although findings varied depending on age group).

Pienaar and colleagues (1998) used a battery of eight assessments, including anthropometric, physiological, and technical tests, which were subsequently able to predict 88% of future talents from a pool of already selected U10 RU players. Among all, the technical test of "passing for accuracy over 7 m" had the highest practical significance among all other tests of the battery, indicating that passing skill is fundamental for every player to possess. However, it has been reported that although there were many more anthropometric, physiological, and technical differences among backs compared to forwards (in all age groups), these were attenuated in older squads as also reported in a previous investigation (van Gent & Spamer, 2005). Therefore, evidence suggests that "handling skills" should be monitored throughout the development of a player, alongside anthropometric and physiological qualities, if coaches aim to select and develop talented players.

In summary, the findings indicate that although anthropometric and physiological characteristics are two key factors during TID and TD in RU, a combination of other features, such as technical and tactical skills, should be encouraged to be taken into account when attempting to select talented forwards and backs of different ages. Future research is encouraged to expand on age group and position-specific characteristics of those selected into academies to better understand the mechanisms of the selection processes.

Environmental Constraints

Relative Age Effects. Skewed birthdate distributions among youth players favoring those born near the start of the cut-off date for an age group have been well-documented (Webdale et al., 2020) in sport—commonly known as relative age effects (RAEs; Barnsley et al., 1985). From an athlete development viewpoint, those born in birth quarter one (BQ1) of an annual-age group in England (i.e., September, October, November) are more likely to be endowed with superior anthropometric and physiological characteristics, cognitive skills, and an older training age compared to their later

born BQ4 peers (i.e., June, July, August) (Hancock et al., 2013).

From a recreational perspective, Lewis and colleagues (2016) found consistent RAEs across all Welsh age-grade and district cohorts from U7 to U19 (e.g., BQ1=29% vs. BQ4=22%). They also revealed an increasingly pronounced effect at U16 representative levels where regional and national selection occurs (e.g., BQ1=44% vs. BQ4=12%). Likewise, Roberts and Fairclough (2012) examined the North West of England representative squads from U13 to U16, revealing a significant overrepresentation of those born in BQ1 (46%) compared to those born in BQ4 (14%). Moreover, McCarthy and Collins (2014) identified a significant overrepresentation of BQ1s (48%) compared to BQ4s (8%) in a single English Premiership RU academy. Collectively, these results suggest that RAEs are prevalent throughout youth RU, with an increasingly skewed BQ distribution at higher playing levels.

While exploring whether RAEs existed at senior international level, Kearney (2017) adopted a cross-cultural comparison as part of his methodology. In contrast to the youth studies, they illustrated that only South Africa had a pronounced RAE across all playing positions at the senior level (although other countries had varying RAEs dependant on position), suggesting differences in national sport culture may be an important consideration in RAEs. This also implies that RAEs are considerably less prominent at senior levels compared to youth levels in RU.

When exploring RAEs during the transition from academy to professional level at an English Rugby Premiership club, McCarthy and Collins (2014) identified a *reversal effect* of relative age. More specifically, they revealed that despite RAEs at the academy level favoring relatively older players, there was a greater proportion of relatively younger players who successfully converted to professional level (e.g., BQ1=20% vs. BQ4=50%). This illustrates the importance of combining both youth and senior representatives together to better understand who is at risk of RAEs, as well as identifying the potential mechanisms of the youth to senior level transitions.

Socio-cultural Factors. Socio-cultural factors play an important part in the access to, and subsequent development in, TD pathways in sport (Hambrick et al., 2018). However, despite this notion, they appear to be one of the least studied across the discipline, which is echoed by just four groups of researchers in this review. As part of a socio-cultural interaction and subsequent selection at different RU levels were considered topics surrounding the following: (a) sport deprivation (Winn et al., 2016), (b) coaching culture (Lewis et al., 2015; Roberts & Fairclough 2012; Sedeaud et al., 2017), and (c) national sport culture (Sedeaud et al., 2017). Since these articles have already been considered in the preceding sections of this discussion due to their multi-dimensional nature, this particular section will only briefly summarize the importance of such socio-cultural factors in RU.

First, access to coaching and resources is an important part of the TD process (Côté et al., 2006). Indeed, birthplace effects have been highlighted as important factors with regards to developmental opportunities in sports (Côté et al., 2006). However, little is known about the impact of birthplace effects, access to RU organizational structures, and subsequent development outcomes; thus, further research is warranted. Second, the knowledge and understanding of the coach that athletes have access to is also an important consideration (Rynne et al., 2017). For instance, admittance to a highly qualified coach who has an expert understanding of the TID and TD processes will likely provide greater opportunities for subsequent selection and development outcomes when compared to limited/no access.

Finally, national sport culture can also affect selection and development opportunities in RU. As an example, those who originate from RU hotspots (e.g., England, New Zealand, South Africa) are more likely to gain access to TID and TD opportunities compared to those who grow up in places that do not have a strong RU culture (Kearney, 2017). Thus, emerging RU

nations are encouraged to be forward-thinking in their structural design to ensure they are not replicating the flaws of the current popular RU nations (i.e., avoiding early selection strategies and focus on holistic, long-term development; Bennett et al., 2019). Overall, future research is encouraged to examine the socio-cultural factors associated with TID and TD in RU, to better understand the access to and subsequent development in talent pathways.

Limitations

This review is not without limitations. First, only papers written in English were included; therefore, studies published in other languages would have been overlooked. Furthermore, some papers could have been excluded due to an unclear definition of the type of rugby used in the investigation (e.g., rugby league, rugby sevens, touch rugby, rugby football). It is also worth mentioning that the quality score of these studies could have been affected by the different metric sections. Therefore, the inclusion of a panel of experts, who may suggest more articles in line with the searching criteria, may be needed following electronic database searching. Moreover, it was the authors' initial intention to include female participants also; however, due to the lack of research within this context and the considerable differences between sexes and success in RU (Suarez-Arrones et al., 2014), only males were included. Thus, future research needs to consider the multi-dimensional factors within the female TID and TD processes in RU.

Conclusion

In the last two decades, there has been a plethora of investigations into TID and TD in RU. The existing one-dimensional and multi-dimensional factors that were reviewed permitted the recognition of the most frequently addressed topics in this area based on the following: (a) *task constraints*; (b) *performer constraints*; and (c) *environmental constraints*. Overall, although inter-positional differences were found, selected RU players appear to be taller and heavier, and have higher lean mass compared to those deselected. Moreover, talented RU players were faster and more powerful, and possessed greater technical and tactical skills (e.g., passing for accuracy over 7 m); but these differences seemed more attenuated in older high-performing players, where collective effectiveness and tactical cohesion played an important role. In general, the results revealed that coaches tended to select early-maturing players, at least during the first stages of TID process, as well as according to their subjective vision of the game. Although this procedure brings short-term benefits to the team, it could lead to the exclusion of a considerable number of promising players that require a longer time to reach maturation and showcase their talent. In fact, in this review, it emerged that RAEs can influence progression in RU, with some interesting inter-role differences in adult players.

Athletes' psychological characteristics constitute another important factor for TID and TD. Therefore, it is recommended that key stakeholders (e.g., coaches, scouts, managers) consider the interactions among constraints during their TID and TD processes. In addition, RU deprivation represents both an important task and environmental constraint that could affect participation and engagement in the initial stages of TID and TD. Together, these results confirm that the TID and TD processes follow an ecological dynamic theoretical framework; where talent is developed on the base of a combination of anthropometric, physical, technical, tactical, psychological, environmental, circumstantial, and players' individual experience factors. Therefore, it is recommended that key stakeholders (e.g., coaches, scouts, managers) consider the interactions among constraints during their TID and TD processes. There is a clear need for further research in this area. Future studies should explore factors outside the physical sphere and emphasize longitudinal research utilizing both a quantitative and qualitative approach on the afore-mentioned constraints, since several of the aspects mentioned in this review have yet to be analyzed utilizing both a multi-dimensional and mixed-methods approach.

Authors' Declarations

The authors declare that there are no personal or financial conflicts of interest regarding the research in this article.

The authors declare that they conducted the research reported in this article in accordance with the Ethical Principles of the Journal of Expertise.

The authors declare that they are not able to make the dataset publicly available but are able to provide it upon request.

ORCID iDs

Francesco Dimundo
https://orcid.org/0000-0003-3689-5216
Matthew Cole
https://orcid.org/0000-0001-9046-2505
Richard C. Blagrove
https://orcid.org/0000-0002-7057-8073
Kevin Till
https://orcid.org/0000-0002-9686-0536
Alexander B. T. McAuley
https://orcid.org/0000-0001-5473-8877
Adam L. Kelly
https://orcid.org/0000-0003-4929-1067

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