JoE

Journal of Expertise
2023. Vol. 6(2) © 2023.

ISSN 2573-2773

Talent Identification and Development in Male Cricket: A Systematic Review

Tom Brown[1,2], Alexander B. T. McAuley[1], Irfan Khawaja[1], Lewis A. Gough[1], and Adam L. Kelly[1]

[1]Faculty of Health, Education and Life Sciences, Birmingham City University, UK
[2]Warwickshire County Cricket Club, Birmingham, UK

Correspondence: Tom Brown, Thomas.brown7@bcu.ac.uk

Abstract

Talent identification and talent development in cricket has received growing attention in recent years. The aim of this systematic review was to synthesise the existing literature on talent identification and development in male cricket, while highlighting recommended areas of future research. Database searches were conducted on Google Scholar, PubMed, Scopus, SPORTDiscus, and Web of Science according to the PRISMA guidelines. The Boolean combination of (((cricket)) AND ((talent identification) OR (talent development) OR (expert) OR (elite))) was applied. The initial search returned 587 records of which a total of 80 were eligible for full-text analysis (*IRR* = 96.8%, *k* = 0.88), with a subsequent final inclusion of 47 articles (*IRR* = 93.7%, *k* = 0.87). The ecological dynamics framework was applied to collate factors (Dimundo et al., 2021; Sarmento et al., 2018): (1) *task constraints*: (a) participation history; (2) *performer constraints*: (a) technical and biomechanical, (b) perceptual-cognitive, (c) psychological, and (d) anthropometrical and physiological; and, (3) *environmental constraints*: (a) socio-cultural and (b) relative age effects. Results suggest biomechanical and technical skills as well as perceptual-cognitive factors were reported most frequently, whereas there was limited inclusion for physiological and anthropometrical factors and little inclusion for environmental constraints. Future research should aim to investigate how environmental constraints affect talent identification and development.

Keywords

cricket, selection, athlete development, youth selection, development process

Introduction

National governing bodies and professional sports clubs invest a significant amount of time and money into their talent identification (TID) and talent development (TD) program, in an attempt to develop the next generation of senior athletes (Hogan & Norton, 2000; Johnston et al., 2018). As the outcomes of these systems can directly affect one another, TID and TD programs often align to effectively facilitate the development of emerging talent (Abbott et al., 2005). They share similar multi-contextual approaches, which can be explained using an ecological dynamics theoretical approach (Davids et al., 2013). Such an approach proposes that talent can be considered as dynamic, affected, and moulded by a range of constraints, as opposed to being the result of one single independent factor (Davids et al., 2017). For example, researchers have identified several contextual factors, such as parental support,

birthplace effects, and socioeconomic status, which act as both enablers and barriers to participation and subsequent development within the TID and TD processes (e.g., Kelly et al., 2020; Lawrence, 2017; McAuley et al., 2021; Vagenas & Vlachokyriakou, 2012).

Recent reviews of TID and TD have been conducted within specific sports, such as soccer (Sarmento et al., 2018) and rugby union (Dimundo et al., 2021). This is not surprising given the number of unique and individual constraints that may have an effect upon one's ability to achieve professional status (PS) within a particular sport. This suggests a need for sport-specific approaches to TID and TD work, as opposed to adopting a general model of athlete development (Coutinho et al., 2016). Indeed, both Sarmento et al. (2018) and Dimundo et al. (2021) highlighted three macro-areas as essential constraints for TID and TD, including (a) *task*, (b) *performer*, and (c) *environment*. Despite several empirical studies investigating these macro-areas within cricket, to the authors' knowledge, there is currently no systematic review that has synthesized such literature for TID and TD. Thus, there is a need to generate such a review in order to direct future research and help inform contemporary practice.

Upon analyzing the England and Wales Cricket Board's (ECB) elite youth pathway, there are no discernible differences within its guidelines that accommodate for different skill sets (i.e., batters, bowlers, and wicket-keepers; e.g., Surrey, 2020). Furthermore, selection for large proportions of this talent pathway have been identified to rely on the reports of delegated scouts and coaches (e.g., Barney, 2015), which often require the use of subjective opinions to forecast future performance capabilities (e.g., Ahmed et al., 2011). While no empirical work has investigated the effectiveness of scouting in performance cricket, research regarding the effectiveness of coaches' opinions during the TID process in general offers conflicting sentiments. On one hand, Christensen (2009) suggests that top-level coaches' opinions can offer adequate sustenance to the TID process, due to their extensive knowledge underpinned by their broad experiences. On the other hand, however, when relying solely on the subjective views of a coach or scout to predict future success, (un)conscious biases are likely to impede decision-making (Johnston & Baker, 2020). Although this alone does not invalidate coaches' opinions as an effective TID tool, it highlights that relying solely upon them could lead to erroneous decisions. Thus, it is plausible to suggest that TID practitioners should adopt a hybrid approach to inform their TID processes, which could include the use of objective data to reduce any potential biases and optimize their decision making.

When evaluating the success of various TID methodologies, several studies have identified that objective, holistic selection methodologies were more effective in predicting athletes achieving PS than those which solely relied on coach evaluations of athletes' potential (e.g., gymnastics: Liu et al., 2017; handball: Schorer et al., 2017). Interestingly, the variance between the success of coaches' predictions (i.e., gymnastics 52%; handball 79%) seems to indicate that its reliability as a TID method is sport-specific, thus highlighting the need for such research to be conducted across all sports. Moreover, Zuber et al. (2019) identified that a holistic model, which combined objective multidimensional measurements (i.e., technical skills tests, general motor performance, psychological assessment, family support, training age, and maturity and relative age data) with coaches' subjective ratings of players, could predict 88% of under 14 (U14) footballers who subsequently achieved PS. This reinforces the suggestion that a combination of the coaches' subjective views as well as objective sport-specific measurements could create the most efficient TID method. Furthermore, it is evident that predicting future performance can be a complex process, especially in a sport where developmental pathways to achieving PS may be non-linear and dependent on skill set, such as cricket (Jones et al., 2020; Brown et al., 2021).

The purpose of this study was to systematically review and synthesise the

existing literature on the TID and TD processes in male cricket. Based on the extant literature presented, considerations for researchers and practitioners are provided to advance this field of study and applied practice.

Methods

Search Strategy and Inclusion Criteria

The methods used for this systematic review follow the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines (Moher, Liberati, Tetzlaff, & Altman, 2009). All articles included were published prior to December 30th, 2020 and only empirical studies were considered. A web-based search utilizing the electronic databases Google Scholar, PubMed, Web of Science, SPORTDiscus, and Scopus was conducted to identify articles. The Boolean combination of (((cricket)) AND ((talent identification) OR (talent development) OR (expert) OR (elite))) was applied. Following the allocation of all articles into one database, two independent reviewers (first and last author) initiated the first review phase via screening the database to identify article titles that matched the following criteria: (a) related to TID in cricket, and/or (b) related to TD in cricket. Any discrepancies were then referred to a third reviewer (third author). The second review phase analyzed the abstracts of the articles identified in the first phase for the following inclusion criteria: (a) related to TID in cricket, (b) related to TD in cricket, (c) has original and peer-reviewed data, and (d) only consisted of male participants. Studies were excluded if they (a) included participants from other sports, and (b) were not written in English. Discrepancies were referred to the third reviewer.

Grading of Studies Quality

To analyze the quality of qualitative studies, the Critical Review Forms as proposed by Letts et al. (2007) was applied, whereas to analyze the quality of quantitative studies, the Critical Review Forms proposed by Law et al. (2003) was applied. Both of these forms have been previously implemented in systematic reviews focussed on TID and TD in football (Sarmento, et al., 2018) and rugby union (Dimundo et al., 2021). Qualitative studies were assessed on the following factors: (a) objective (item 1), (b) literature reviewed (item 2), (c) study design (items 3, 4, and 5), (d) sampling (items 6, 7, 8, and 9), (e) data collection (descriptive clarity: items 10, 11, and 12; procedural rigor: item 13), (f) data analyses (analytical rigor: items 14 and 15; auditability: items 16 and 17; theoretical connections: item 18) and overall rigor (item 19), and (g) conclusion/implications (items 20 and 21). Quantitative studies were assessed on the following factors: (a) objective (item 1), (b) relevance of background literature (item 2), (c) appropriateness of the study design (item 3), (d) sample included (items 4 and 5), (e) informed consent procedure (item 6), (f) outcome measures (item 7), (g) validity of measures (item 8), (h) significance of results (item 10), (i) analysis (item 11), (j) clinical importance (item 12), (k) description of drop-outs (item 13), (l) conclusion (item 14), (m) practical implications (item 15), and (n) limitations (item 16). A binary system (i.e., "1" meets criteria; "0" does not meet criteria; and, "N/A" not applicable to the study) was utilized in grading each study. Subsequently, a final percentage was calculated which represented the factors included for each study.

Results

Search, Selection, and Inclusion of Publication

Following the PRISMA guidelines, the "Identification" phase revealed 1,083 articles, which included 496 duplicates that were subsequently removed. During the "Screening" phase, 587 articles were examined based on their title and abstract, with 507 subsequently excluded (*IRR* = 96.8%, *k* = 0.88). A total of 80 articles were fully assessed at the "Eligibility" phase, which returned a final inclusion of 40 articles (*IRR* = 93.7%, *k* = 0.87). Articles were excluded for not focusing on TID and/or TD (*n* = 29), for including multiple sports (*n* = 10), and for not having original and peer-reviewed data (*n* = 1). After screening, seven articles were added from studies and review citations. Following the "Selection" phase, a total of 47 articles were included in the review as reported in Figure 1.

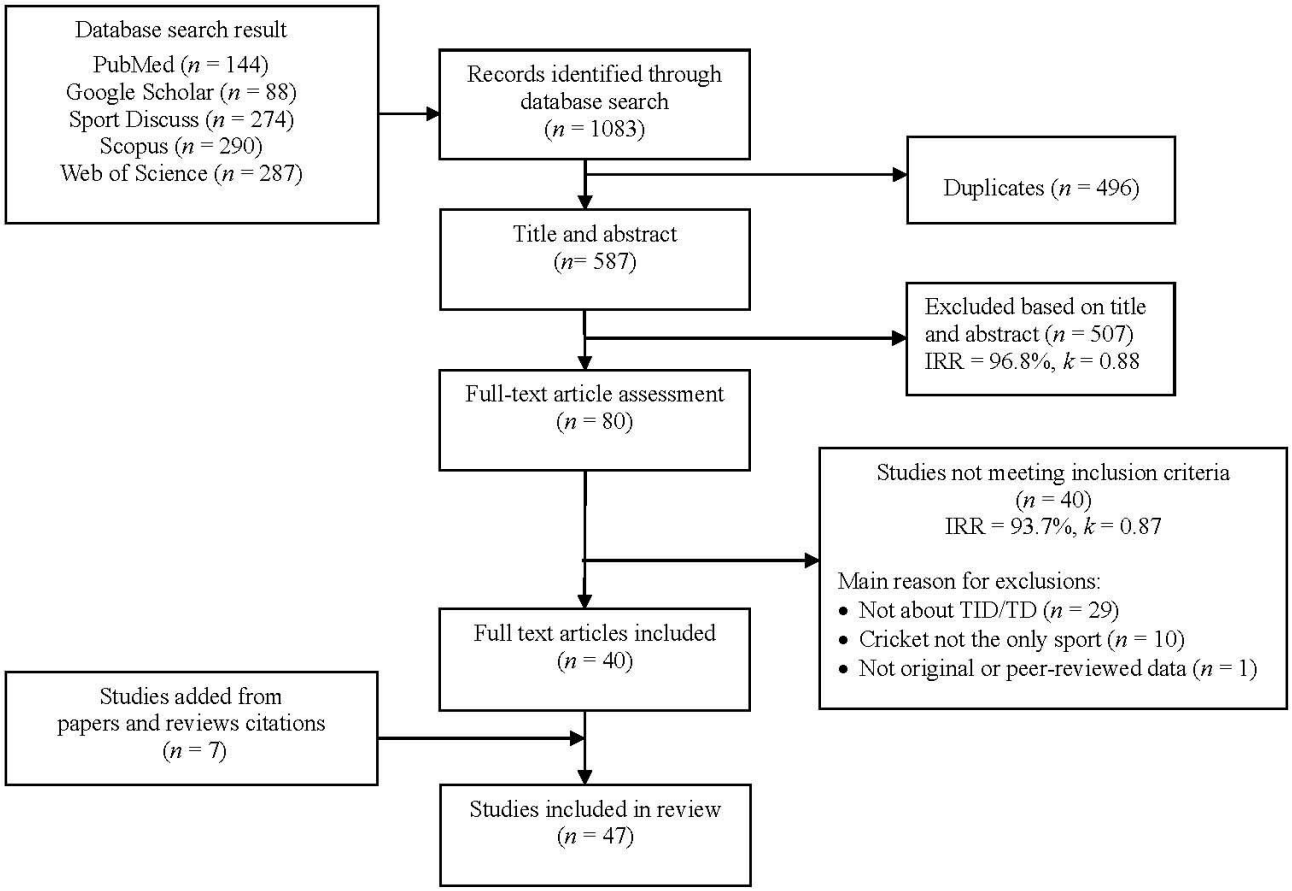

Figure 1. Schema of PRISMA guidelines followed, comprising the processes for identification, screening, eligibility, and inclusion of papers.

Quality of the Studies

To analyze the quality of the studies, a separate mean score for quantitative, qualitative, and mixed-methods articles was calculated. The overall average for the studies was classified as excellent: (a) qualitative = 84.6% (*n* = 7), (b) quantitative = 81.1% (*n* = 38), and (b) mixed methods = 81.9% (*n* = 2). Of the 47 articles, seven scored between 51% and 74%, and the remaining 40 achieved an overall rating of >75% as reported in Table 1 (See the Appendix).

General Description of the Studies

After analyzing all the studies, seven major research topics emerged from this review: (a) participation history, (b) biomechanical and technical, (c) perceptual-cognitive skills (d) psychological (e) anthropometric and physiological, (f) relative age effects, and (g) socio-cultural factors. Some studies investigated these topics in isolation whereas others investigated multiple topics in one study. To present the results in a concise manner, the authors categorized the studies into one-dimensional (OD; i.e., analyzed only one topic) and multi-dimensional (MD; i.e., analyzed two or more topics) articles. The ecological dynamics theoretical framework contends that athlete development and performance should be viewed as a dynamic relationship that is shaped and that varies by constraints affected by the task (e.g., engagement in activities), performer (e.g., physiological characteristics), and environment (e.g., socio-cultural factors) of each individual (Davids et al., 2013, 2017). Therefore, the micro-areas (i.e., the seven research topics) were grouped according to the established three macro-areas: (a) task constraints, (b) performer constraints, and (c)

environmental constraints. This ecological dynamic approach of categorizing the results is in accordance with Sarmento et al. (2018) and Dimundo et al. (2021).

The findings of the 47 articles are presented in Table 1. Articles used in this review focused on the following:

(1) *task constraints* (OD = 3, MD = 9):
   (a) participation history (OD = 3, MD = 9)
(2) *performer constraints* (OD = 21, MD = 21):
   (a) biomechanical and technical (OD = 7, MD = 16)
   (b) perceptual-cognitive skills (OD = 11, MD = 10)
   (c) psychological (OD = 4, MD = 8)
   (d) anthropometric and physiological (OD = 1, MD = 4)
(3) *environmental constraints* (OD = 0, MD = 7)
   (a) relative age effects (OD = 0, MD = 3)
   (b) socio-cultural factors (OD = 0, MD = 4)

A total of 2,705 participants were analyzed across 24 OD and 23 MD articles. Biomechanical and technical skills (*n* = 23) and perceptual-cognitive skills (*n* = 21) were the most researched topics, whereas socio-cultural (*n* = 4), and relative age effects (*n* = 3) were the least researched.

Discussion

The aim of this study was to review the existing literature investigating talent identification (TID) and talent development (TD) in male cricket. Based on an ecological dynamic theoretical framework, the following discussion focuses on the main findings of the 47 articles included within this systematic review.

Task Constraints

Participation History

Research concerning participation history can be broken down into two smaller topics: developmental trajectories and type of practice.

Development Trajectories. Two of the most researched development trajectories include *early specialization,* (i.e., where young athletes participate in only one sport from childhood) and *early sampling* (i.e., where young athletes participate in numerous sports during childhood before specializing later in adolescence; e.g., Coté, Horton, MacDonald, & Wilkes 2009). Within this review, evidence contrasts the optimum trajectory towards professional status (PS) for young batsmen with that of young bowlers. For instance, Phillips et al. (2010) identified that the majority of elite international bowlers in their sample did not specialize in cricket until after the age of 15 years and that progression to PS was unique and non-linear. This is possibly due to the early sampling trajectory being associated with superior motor skill development (Goodway & Robinson, 2015), and consequently reducing the risk of obtaining development-hampering injuries in fast bowlers (Glazier & Wheat, 2014). On the contrary, Weissensteiner et al. (2008) found no evidence to suggest that highly skilled batters experienced a greater range of sports (either organized or unorganized), including no correlation between elite performing batters participating in the sports that are most likely to offer transferable skills, such as baseball or tennis. Overall, these results suggest that future research should investigate the developmental trajectories of both batters and bowlers independently, which could enable future TD programs to adapt their structures and provide an optimal environment for young aspiring players to achieve PS based on skill set.

Type of Practice. The second topic within *participation history* was the type of practice undertaken by cricketers. For instance, Low et al. (2013) examined the team practice activities of recreational and elite (i.e., selected for county age group) cricketers aged 9 to 12 years and those aged 13 to 17 years. Their findings highlighted that across both groups, 69% of training time was spent on *training form* (i.e., drill-based activities). Additionally, Low et al. (2013) highlighted that the elite cohorts spent significantly less time in *playing form* (i.e., game-based activities) than their recreational peers. Collectively, these findings contradict empirical research and theoretical hypotheses, which suggests that coaches should place more of an emphasis on *playing form,* as its more

random and variable nature typically facilitates the retention and transfer of skill to match-like situations (Cushion, Ford, & Williams, 2012). This suggestion was further reinforced by Phillips et al. (2010), whose study of international fast bowlers highlighted the importance of *playing form*, whereby "backyard" cricket (i.e., a type of unorganized, peer-led cricket) was emphasized during their early development. In addition to these findings, Ford et al. (2010) revealed that high-performers (i.e., contracted professionals) participated in more cricket and batting-specific training between the ages of 13 and 15 years. Furthermore, Jones et al. (2020) identified that "super-elite" batsmen undertook significantly more random and varied batting-specific practice at age 16 years. Finally, Weissensteiner et al. (2008) identified that hours accumulated in cricket-specific practice differentiated low and high perceptual-cognitive skills in adult and U20 players, although this accounted for only around 13% of the variance.

These findings suggest that batting-specific practice throughout adolescence has a greater association with achieving expertise than *playing form*. Based on these results, practitioners could place more of an emphasis on *training form* when designing development plans for adolescent batters, whereas they could encourage more *playing form* for adolescent bowlers. Moving forward, future research could look to explore how TD practitioners could best utilize *playing form* in the development of adolescent bowlers more specifically. However, it may also be important to consider a more nuanced view in the future with regards to the number of sports and types of practice male cricketers engage in. For instance, perhaps engaging in multiple sports is not just about playing but about experiencing more varied practice activities, whereby enhanced performance is explained because of the structuration of the activities. More specifically, a practice that is representative of the competition (i.e., not necessarily drill-like, nor games-based). Such diversity may make players more robust, adaptive, and better performers in their main sport (i.e., cricket), which corresponds to central tenets of self-organization of complex systems according to ecological dynamics (Güllich et al. 2022). Indeed, a recent meta-analysis found that multisport coach-led practice and not youth-led play facilitated long-term performance across a wide range of sports (see Güllich et al. 2022). Distinguishing between *training form*, *playing form*, and *competition form* (i.e., practices representative of the competitions in each of the practiced sports) may provide different conclusions in the future (Pinder et al., 2011). Indeed, such a change may reduce the importance of *training form* and increase the importance of *competition form*.

Performer Constraints

Biomechanical and Technical Skills

A total of 23 articles investigated the biomechanical and technical aspects of TID and TD in cricket. Due to the skill sets that are played in cricket, this body of literature is divided into three sub-categories: (a) batting (n = 18), (b) bowling (n = 5), and (c) wicket-keeping (n = 1).

Batting. Findings from Weissensteiner et al. (2009) and Connor et al. (2020) identified that expert batters and coaches believed batters require superior technical skill to achieve expertise. Therefore, it is important to identify technical measures that have been objectively identified to positively correlate with performance. The "front-foot drive" received the most attention within published literature. For instance, during the front-foot drive, Stuelcken et al. (2005) and Taliep et al. (2007) revealed that batsmen utilized movement patterns that resulted in the delaying of important technical factors, such as downswing and front-foot movement. They suggest that this was to allow for the maximum amount of time for perceptual-cognitive information gathering occurring before making a decision, which is often referred to in a practical cricket setting as "playing late." However, these findings are in contrast to Weissensteiner et al. (2011), who highlighted that higher-skilled (i.e., national and state senior) batsmen within their sample

displayed significantly earlier initiation and completion of the front-foot stride. Nevertheless, Müller et al. (2015) revealed that during play the front-foot drive, initial weight transfer, bat downswing, and bat downswing completion differed significantly between each of their academy level batsmen. Despite these disparities, their results highlighted no significant difference in achieving success (i.e., the frequency of bat-ball contacts), suggesting that diverse technical approaches may produce similar successful outcomes.

When analyzing the manuals created to guide coaching practice (e.g., the Marylebone Cricket Club Handbook), Noorbhai and Noakes (2018) identified that 87% of such guides recommend that to ensure the bat will come down straight in line with the ball, the bat should be directed towards the stumps or first slip during back-lift. Indeed, Noorbhai and Noakes (2018) revealed that 83% of the 161 coaches within their sample (across eight nations) coached a version of the straight bat back-lift. However, Noorbhai and Noakes (2019) later identified that a lateral back-lift (i.e., the back-lift starting angled between second slip and gully and looping back round to the line of the stumps) correlated with the ability to access more scoring opportunities around the ground. These findings could explain why a number of studies have identified that a disproportionate number of international batsmen adopt the lateral back-lift (Noorbhai & Noakes, 2019; Stuelcken et al., 2005). The most notable of these studies highlighted that 90% of the top One Day international (1974-2014) and 77% of Test (1854-2014) batsmen adopted the lateral back-lift (Noorbhai et al., 2016). Together, these results demonstrate a contrast between coaching practice and achieving success at the highest levels of the game. While there is no evidence to suggest that the traditionally taught straight back-lift hinders a player's ability, it appears that the lateral back-lift is correlated with superior performances. However, it is important to consider how other constraints may be affecting the use and effectiveness of the lateral back-lift by batsmen in cricket. Future research should seek to understand the mechanism of why the lateral back-lift is used and why it appears to be associated with success in international cricket, as well as evaluating interventions to coach the skill.

Although there are correlations between biomechanical and technical skills and achieving successful batting outcomes, there appears to be no "one-size-fits-all" batting technique that all batters should adopt. Therefore, TD practitioners should be encouraged to broaden their ideals around what constitutes technical skill in batting and its importance in player development. Further, as batting technique has been highlighted to be of importance by coaches and selectors, future research should examine how they differentiate between higher- and lower-technical performers during the TID process. Moreover, a greater consideration of how other constraints might interact with batting technique should be explored. Doing so will provide context to the level at which superior technical skill contributes towards TID within performance programs, as well as highlight any further disparities between academic findings and practice.

Bowling. Several articles investigated the biomechanical and technical skills of the fast-bowling action, whereby the primary focus was to investigate the association between bowling technique and peak bowling velocity (n = 4). Peak bowling velocity refers to the speed in which a ball is delivered to a batter and is often associated with higher levels of performance (Philips et al., 2012). Thus, it is often the objective of TID and TD practitioners to identify and develop bowlers who possess superior peak bowling velocity. Using a multi-regression analysis, Salter et al. (2007) identified four variables that equated to 87% of the variance in peak bowling velocity: (a) center of mass velocity at back foot contact, (b) maximum angular velocity of bowling humerus, (c) vertical velocity of the non-bowling arm, and (d) stride length. While Worthington et al. (2013) also revealed four technical variables as the best predictors of higher peak bowling

velocity (r = 0.74), these differed from that of Slater et al.'s (2007) findings: (a) quicker run-up, (b) maintaining a straighter knee throughout the front foot contact phase (i.e., braced front leg), (c) greater upper trunk flexion from front foot contact up to ball release (i.e., angle of shoulder to trunk at ball release), and (d) delaying the onset of arm circumduction. In support of Worthington et al.'s (2013) results, Portus et al. (2004) and Wormgoor et al. (2010) also identified a braced front leg as one of the largest predictors for higher peak bowling velocity. Additionally, Portus et al. (2004), Ferdinands et al. (2013), and Wormgoor et al. (2010) highlighted that shoulder alignment in the transverse plane rotated further away from the batsman at front-foot strike, which results in a pelvic-shoulder separation, was also correlated with high peak bowling velocity.

Overall, these findings illustrate that there are diverse biomechanical and technical skills that are associated with peak bowling velocity. However, as Slater et al. (2007) highlight, the results from such studies could simply be a reflection of each study's sample, which was relatively small (range from 11 to 28), and not a true reflection of the bowling community as a whole. Nevertheless, the frequency with which certain technical aspects correlate with higher peak bowling velocity (i.e., braced front leg and pelvic-shoulder separation) suggests that TID and TD practitioners could apply interventions that either specifically develop these factors or could aid the identification of fast bowlers. Future research should analyze the effectiveness of coaching interventions to apply such knowledge into applied practice.

Injury prevention is one further biomechanical and technical factor for fast bowlers. The association between fast bowling and injury rate has previously been documented (e.g., McGrath & Finch, 1996; Niemeyer et al., 2006), and injury prevention in fast bowling is a well-researched field (e.g., Dennis et al., 2005; Orchard et al., 2015). However, only Ranson et al. (2009) investigated injury prevention in such a way that it could be included in the context of this TID and TD review. Their study investigated whether two-year coaching interventions could result in altering elements of a fast bowlers' technique that are associated with higher injury risk. The results of this study provided evidence that some aspects of fast bowlers' techniques are changeable, such as shoulder alignment at delivery stride, which had been previously identified to correlate significantly with higher injury rate (Portus et al., 2004). However, their results also highlight that other elements of fast bowling technique (i.e., trunk posture and knee mechanics) did not change over the two-year period. Thus, these results encourage further investigation into possible coaching interventions targeting injury prevention in fast bowlers that may affect long-term development outcomes, as well as an evaluation of current practices aimed at doing so.

Wicket-Keeping. Only one wicket-keeping study, which analyzed biomechanical and technical skills, was eligible for inclusion in this TID and TD review. MacDonald et al. (2018) identified that besides the crouch position, which is required at the start of every delivery, the most common movements on average recorded per innings were the lateral step (73), lateral shuffle (53), and running to the stumps (27). Their study also highlighted that the most common skill for keepers to display within the game was catching the ball from the outfield. Utilizing these findings, they recommend that wicket-keeping within TID and TD systems should incorporate taking catches on the move and from the outfield, as well as ensuring that the development lateral movement patterns are incorporated within wicket-keepers' practices. Due to the limited evidence available within wicket-keeping, further research is required to better understand the biomechanical and technical skills that underpin selection and subsequent developmental outcomes in cricket.

Perceptual-Cognitive Skills

Perceptual-cognitive skills have been identified to play a key role in the success of strike and field athletes such as cricketers (e.g., Renshaw & Freshfields, 2000). This is due primarily to high ball speed velocities that limit the amount

of time for batsmen to prepare and execute a stroke (Brenton et al., 2019). The current review identified perceptual-cognitive skills to be the second most researched factor, with 10 multidimensional and 11 one-dimensional articles analyzing its effects on development and performance. Interestingly, all articles focused solely on the batting skill set, with results from the 21 studies revealing perceptual-cognitive skills to be a significant discriminator between higher- and lower-skilled batting participants, whereby higher-skilled batters displayed superior levels of perceptual-cognitive skill. Thus, it could be argued that perceptual-cognitive skills are an important and accurate indicator of batting skill and should be considered by stakeholders as an integral characteristic included in TID and TD programs. However, upon analysis of the coaching resources from cricket's national governing bodies, such as the ECB's "icoachcricket" (ECB 2021), there is no reference to the identification or development of perceptual-cognitive skills within talent development frameworks. This highlights disparities between research and practice whereby TID and TD programs in cricket are failing to investigate and develop a well-documented differential correlating with superior batting performance. Therefore, it is recommended that stakeholders understand the process involved with implementing perceptual-cognitive skills testing and development designs within their talent pathways.

Building on the premise that higher-skilled players displayed superior perceptual-cognitive skills (Müller et al., 2006), Weissensteiner et al. (2008) aimed to synthesise practice history with perceptual-cognitive skills. To achieve this, the authors analyzed the differences between adult, U20, and U15 high-skilled (i.e., Australian state representation or higher) and low-skilled (i.e., not achieved state representation but had years of playing experience) groups. Their results identified that in order to predict ball flight, skilled adult players and U20 players displayed perceptual-cognitive skills that were above guessing level accuracy (i.e., +33%), yet neither of the U15 groups displayed this ability. In their discussion, the authors speculate that this could be due to two causes. First, the delivery speed at U15 level is likely to be significantly lower than that experienced at adult or U20 level. This suggests that superior perceptual-cognitive skills may not lead to the same advantage for U15 batters as it does for adult and U20 batters. Second, it was suggested that batters at U15 level have not experienced or have not yet been exposed to an adequate volume of bowlers and thus their movement patterns, to develop significantly superior perceptual-cognitive skills. Ford et al.'s (2010) findings support this suggestion, whereby the high-performing anticipators within their sample of 45 county contracted male cricketers had accumulated more hours in structured, batting-specific activity compared with their low-performing counterparts, from the ages of 13 to 15 years. Overall, this provides evidence that greater perceptual-cognitive skills do not necessarily occur naturally, and therefore could be developed throughout adolescence training or an increase in batting-specific activity.

Several studies have investigated the distinct nature of how perceptual-cognitive skills develop within batters, by examining the extent to which specific visual cues are required to make above guess level predictions of ball flight and trajectory. A number of studies identified that the acquisition of expert perceptual-motor skills involves utilizing early kinematic sources of information from the bowling action and that additional ball flight information provided no more advantage (Müller et al. 2006; Renshaw Fairweather 2000). Further, Müller et al. (2010) later highlighted that the need for continuous visibility of the bowling hand and arm are not essential for information pick-up. However, in their most recent study, Müller et al. (2020) identified no significant differences between first-class, elite club, and international youth West Indian batters in utilizing kinematic information to predict ball type. Instead, highly skilled players relied more on contextual factors (e.g., fielder positions) as a prediction tool. This is the first study to suggest that contextual factors can support the previously reported kinematic information in predicting ball type.

Therefore, TD practitioners should encourage batters to make use of such contextual factors during match play.

Brenton et al. (2019) was the only study that attempted to train and develop perceptual-cognitive skills among a high-performing sample of 12 batters (adolescent Australian academy players). Their results identified that their intervention group, who received perceptual-cognitive training, significantly improved their perceptual-cognitive skills when re-tested at the end of the 4-week program. Additionally, and arguably most relevant to practitioners, the intervention group also increased their mean batting average from 39 to 53 during the study, while the control group, who did not receive any perceptual-cognitive training, displayed no significant increase. Despite its small sample size, this study is the first to provide evidence that perceptual-cognitive skills can be developed to positively affect performance outcomes.

Psychological Factors

Cricket has often been described as a game which requires as much "mental strength" as technical proficiency (Bull et al., 2005). This review identified 10 studies that focused on psychological factors within their investigations into TID and/or TD. Within these studies, the concept of *mental toughness* was investigated most frequently. For instance, Bull et al. (2005) highlighted that the monitoring and development of a players' mental toughness should be a long-term process, and they designed the first mental toughness framework specific to cricket, which identified three key themes: (a) tough character, (b) tough attitude, and (c) tough thinking.

To measure levels of mental toughness within cricketers, Gucciardi and Gordon (2009) designed the Cricket Mental Toughness Inventory (CMTI). Support for the existence of their five-factor, 15-item model was revealed within three independent samples of cricketers across several different cricket playing nations (n = 1003). As a result, numerous studies have adopted and validated the use of the CMTI. As an example, within Gucciardi's (2011) analysis, all five subscales evidenced adequate levels of internal reliability. Further, Weissensteiner et al. (2012) used the CMTI to identify that only a higher degree of mental toughness could distinguish between higher-skilled (i.e., professional state) and lower-skilled (i.e., recreational senior) Australian batsmen. Other traits such as adaptive perfectionism, optimism, and coping ability were non-significant discriminators. Furthermore, Gucciardi (2011) also explored developmental experiences that lead to self-reported levels of mental toughness. The results of the study illustrated that aside from desire to achieve, attentional control facets, and global mental toughness, there was no relationship between number of years playing experience and/or training hours and mental toughness. Moreover, Gucciardi (2011) identified an inverse relationship between the number of years playing experience and desire to achieve, as well as a positive relationship between training hours and desire to achieve, attentional control, and global mental toughness. These findings suggest that quantity of training is likely to be a better indication of a player's psychological development than training age.

To determine if mental toughness can be developed through the performance environment, Bell et al. (2013) developed a two-year longitudinal intervention that would expose participants to repeated punishment-conditioned stimuli in the training environment. Throughout the study, the intervention group (i.e., participants who were subjected to the punishment-conditioned stimuli) were compared to a control group who experienced no such exposure. The results identified a significant improvement for the intervention group in coach-rated mental toughness and in an evaluation of their competitive performance statistics. However, due to the longitudinal nature of the study, it cannot be determined whether other experiences external to the training environment had affected the participants' levels of mental toughness. Further, since coaches' opinions can be prone to biases, it is possible that a coach-rated evaluation is not the most reliable (Baker et al., 2018). Despite this, the results of Bell et al.

(2013) are the first to offer a potential method of developing mental toughness; thus it could be argued that TD systems should seek to adopt and evaluate the effects of applying such methods to their processes. Further research should also continue to investigate the effects that punishment-conditioned stimuli in training have on performance.

While the vast majority of the psychological literature focused on the batting skill set, Phillips et al. (2014) investigated psychological factors that were prevalent in the acquisition of expertise within fast bowlers. They identified that high levels of motivation, competitiveness, mental strength, focus, a good work ethic, and a positive attitude were essential for success. Despite these suggestions, there appears to be no research providing definitions for these traits. This results in themes such as "good attitude" being subjectively assessed by coaches and selectors, which has been well documented to lead potentially to biases in selection and TID (Baker et al., 2017). It is recommended that future research investigate the effectiveness and reliability of TID and TD practitioners' psychological evaluations and offers practical suggestions to improve TID and TD systems.

Anthropometric Measures and Physiological Characteristics

No previous literature has focused on anthropometric measures or physiological characteristics as individual factors, although eight studies examined these as part of a wider investigation including (a) batting (n = 3), (b) bowling (n = 4), and (c) wicket-keeping (n = 1). Due to the association between anthropometric measures and physiological characteristics at youth levels (i.e., either one can systematically influence the other), coupled with the multidimensional nature of these themes, they have been included together within in this discussion.

Batting. Three articles investigated the anthropometric measures and physiological characteristics of batters. First, Nunes and Coetzee (2007) identified no strength or power parameters that discriminated the most successful (top five ranked batsmen of both seasons) and less successful (bottom eight ranked) South African academy batsmen. Similarly, Taliep et al. (2010) highlighted that there was no correlation between upper-body strength (one rep-max bench press) and strike rate or batting average in domestic T20 cricket. These results appear to be counterintuitive, since the introduction of T20 cricket has resulted in the need for batters to hit the ball harder to the boundary more frequently. Instead, these findings suggest that timing, perceptual-cognitive skills, and technical factors may play a more important role in batting success than physiological characteristics such as strength and power. However, further research is required to substantiate these suggestions, as well as to explore whether anthropometric and physiological characteristics have similar effects for batters' success across different formats (i.e., First-Class, One-day, and T20).

Bowling. As previously stated, peak bowling velocity (i.e., the maximal speed a bowler can deliver the ball) is associated with higher levels of performance, and identifying factors that contribute to peak bowling velocity is of interest to both TID and TD practitioners and researchers. First, Glazier et al. (2000) identified that shoulder to wrist length and total arm length was correlated with peak bowling velocity in male MCC university cricketers. However, Wormgoor et al. (2010) identified no anthropometrical values as being significantly correlated to peak ball velocity in senior premier grade South African club bowlers. As discussed by Wormgoor et al. (2010), these contrasting findings highlight that while longer limbs in theory may benefit some bowlers, such factors are of only minor importance in determining peak bowling velocity.

Both Glazier et al. (2000) and Wormgoor et al. (2010) focused solely on adult male participants in their studies. In contrast, Pyne et al. (2006) investigated the anthropometric and physiological profile of elite male junior (Australian state representative) and elite male senior (Australian professional state) fast bowlers. Their findings identified differences

between the two groups and their peak bowling velocity profiles, such that arm length was correlated with peak bowling velocity for senior bowlers but not for junior bowlers. Additionally, body mass and percentage muscle mass were insignificant predictors for senior peak bowling velocity but proved significant predictors for junior peak bowling velocity. Furthermore, chest-depth was also positively correlated with peak bowling velocity for senior bowlers (Portus et al. 2000; Pyne et al. 2006) and was highlighted as the largest physiological difference between senior and junior bowlers (Pyne et al. 2006). These findings suggest that future research should investigate the effects of early maturation in fast bowlers, whereby findings could prove vital in the TID and TD processes due to potential biases. Specifically, early maturing bowlers, whose arm span, chest-depth, and muscle mass will likely be superior to that of their later maturing peers, could possess early performance advantages. However, these early advantages are likely to decrease as later maturing bowlers develop. Thus, TID and TD practitioners should use peak bowling velocity as a predictor of future success only when contextualized with maturation status.

Wicket-Keeping. The wicket-keeping skill set received the least attention within anthropometric and physiological literature. One study conducted by MacDonald et al. (2018) investigated key movements for wicket-keepers in One Day internationals. The major results from this study have previously been discussed within the biomechanical and technical section of this review; however, one key finding remains to be evaluated. MacDonald et al. (2018) highlighted that as the wicket-keeper is involved in play nearly every ball, a vital requirement is the ability to maintain repetitive low-intensity exercise, while being prepared to react and engage in explosive lateral movements in either direction. Based on this limited evidence, the exact physiological development requirements for wicket-keeping warrant further investigation to inform the TID and TD process.

Environmental

Socio-Cultural Effects

Societal movements such as "Black Lives Matter" have highlighted racial, cultural, and other ethical injustices within sport and wider society (Swart & Maralack, 2021). Indeed, several independent investigations have been commissioned to examine claims of discrimination in professional cricket (e.g., Brown & Kelly, 2021; ESPNcricnifo, 2020). It is therefore of great importance that equitable developmental environments are created. This review did not identify any articles that solely investigated the socio-cultural effects of TID and TD in cricket. However, a small number of articles explored socio-cultural influences within their multidisciplinary approaches (n = 4).

First, Weissensteiner et al. (2009) identified that during the sampling years (age 6 to 12 years), sufficient time and access to resources facilitated practice, play, and competition among siblings and friends. The authors suggested that such an environment aided in fostering the development of important psychological attributes such as competitiveness, strategizing, coping, and mental toughness all of which have previously been linked to achieving expertise. Supporting such suggestions, Jones et al. (2020) identified that "super elite" batsman had more older siblings than their elite peers (see McAuley et al. [2022] for a discussion on defining "elite" status), which could provide the younger sibling with exposure to an increased volume and level of competition and play from an early age. However, although included in Jones et al.'s (2019) analysis of the development of elite spin bowlers, the number of siblings a player had did not prove to be of significance. Therefore, it could be suggested that different skill sets within the game (i.e., batting, bowling, and wicket-keeping) may benefit from contrasting socio-cultural influences.

Second, Low et al. (2015) identified an overrepresentation of professional batsmen originating from small to medium sized cities (population 30,000 to 100,000), which aligns with existing literature regarding birthplace

effects in sport (e.g., Baker, Schorer, Cobley, Schimmer, & Wattie, 2009). The access to additional space and superior facilities granted from residing in medium cities is likely to facilitate greater levels of unorganized free play (Coté et al., 2006). Expert coaches believed that this significantly contributes to the development of key fundamental skills, such as creativity, adaptability, and problem-solving skills, which are paramount to later sporting success (Weissensteiner et al., 2009). However, Low et al. (2015) also identified that highly successful professional batsmen were also more likely (1.5 times) to originate from London (population >5 million) compared to other cities in the UK (population <5 million), which is in contrast to previous findings that identified an under-representation of athletes originating from larger cities (e.g., Baker et al., 2009).

As a result of the dearth of socio-cultural research viable for inclusion in this study, the authors recommend that future research investigate how socio-cultural influences, such as race and socioeconomic status, can affect the identification and development of talent in cricket. Doing so could inform TID and TD programs on objective methods of developing more equitable performance programs, which could inevitably widen the pool of potential from which coaches and selectors might identify players.

Relative Age Effects

Relative age effects (RAEs) occur when athletes are banded according to (bi)annual age groups (Kelly et al., 2021). As a result, those born at the beginning of the cut-off date are often physically and cognitively advanced and are subsequently overrepresented in talent pathways compared to those who are born toward the end of the cut-off date (Cobley et al., 2009). Three studies that investigated RAEs as part of their multidisciplinary approach were identified as eligible for inclusion by this review. As an example, both Jones et al. (2020) and Low et al. (2015) identified that distributions of birth quarter (BQ, the three-month period someone is born in within the selection year) were non-significant in differentiating county batsman from their international peers and national norms, respectively. Nevertheless, Low et al.'s (2015) findings identified that high performing county batters, defined by their superior batting average, were 1.6 times more likely to be born in BQ1 (September – November) compared to BQ4 (June – August). Therefore, it could be suggested that RAEs might affect the development of county batters.

In contrast, Jones et al. (2019) identified that international spin bowlers were relatively younger than professional county spin bowlers. As highlighted within the socio-cultural discussion of this review, these findings further suggest that success across different skill sets is likely to be associated with contrasting developmental trajectories and requirements (Brown et al., 2021). For instance, Jones et al. (2019) speculate that as they identified that achieving superior spin bowling status is not correlated with physiological attributes, relatively younger spin bowlers remain in contention with relatively older spin bowlers throughout the talent pathway. However, RAEs are not limited to disparities in physiological levels, since psychosocial and perceptual-cognitive benefits have also been highlighted in relatively older players (Baker et al., 2010). To this end, Jones et al. (2019) offer further discussion by highlighting that spin bowlers require a high level of resilience to be successful, and de-selection, typically associated with younger birth quartiles, is likely to result in the development of resilience for those spinners who do not drop out of the game. Therefore, future research should investigate if relatively younger spin bowlers possess higher levels of resilience and mental toughness and whether they are disproportionately de-selected from the talent pathway at an early age.

The three studies discussed in this section analyzed the BQ distributions at professional status (i.e., adulthood). However, RAEs are most commonly reported in youth and adolescent ages in sports (e.g., Kelly et al., 2021). None of the discussed studies investigated whether the reported BQ distributions at PS are a reflection of the youth talent pathway that supports the professional

game; therefore, it is unknown if the equal representation of BQ reported equates to equal representation throughout the talent development pathway. Subsequently, it is difficult to identify the existence or non-existence of BQ (dis)advantages within cricket. Therefore, it is recommended that future research investigates the BQ distributions of talent pathways to identify whether representation at PS reflects that of the entire pathway.

Limitations

This review included only articles that were written in English. While this might not be an issue for all sports, a large proportion of the global interest in cricket traditionally derives from non-English speaking countries (e.g., India, Pakistan, and Sri Lanka). Indeed, the omission of research from non-English speaking researchers could contribute to the lack of articles concerning socio-cultural factors that influence development in cricket. However, as England in particular has a large representation of British South Asians within its recreational demographic we advise that more research should investigate the socio-cultural influences of TID and TD. Moreover, the authors intended to incorporate studies that included female participants. However, due to the lack of research in this area, the decision was made not to include them. Therefore, it is recommended that future research incorporates female cricketers, especially as the women's game has recently become more professionalised with the introduction of a new regional structure in England (e.g., BBC, 2020) and "double header" male and female games being played within the new flagship franchise "The Hundred" (e.g., Lords, 2021).

Conclusion

Over the past two decades, there has been increased interest towards talent identification (TID) and talent development (TD) in cricket within academic literature. This review highlighted a distinct disparity in the exposure each constraint has received within published literature, whereby task and performer constraints received considerably more attention than environmental constraints. Specifically, this review identified an extensive amount of research dedicated to the affects technical, biomechanical, and perceptual-cognitive skills have on the TID and TD processes. On the contrary, no studies investigated the effects of ethnicity or socio-economic status on players' ability or experiences within talent pathways. With societal movements such as the Black Lives Matter protests calling for a more equitable society and recent reports of racism being prevalent within professional cricket (e.g., ESPNcricinfo, 2020), the need for such research to inform TID and TD practitioners has arguably never been stronger. Finally, the objective measures discussed within this review can be utilized by TID and TD practitioners to inform the development of their programs and increase the efficiency of their decision making (Sieghartsleitner et al., 2019).

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 the research reported in this article was conducted in accordance with the Ethical Principles of the *Journal of Expertise.*

ORCID iDs

Tom Brown
https://orcid.org/0000-0001-6479-7117

Alexander B. T. McAuley
https://orcid.org/0000-0001-5473-8877

Irfan Khawaja
https://orcid.org/0000-0001-7544-1386

Lewis A. Gough
https://orcid.org/0000-0003-1115-7559

Adam L. Kelly
https://orcid.org/0000-0003-4929-1067

References

Abbott, A., Button, C., Pepping, G. J., & Collins, D. (2005). Unnatural selection: talent identification and development in sport. *Nonlinear Dynamics, Psychology, and Life Sciences*, *9*(1), 61-88.

Baker, J., Cobley, S., Schorer, J., & Wattie, N. (Eds.). (2017). *Routledge handbook of talent identification and development in sport*. Taylor & Francis.

Baker, J., Schorer, J., & Cobley, S. (2010). Relative age effects. *Sportwissenschaft*, *40*(1), 26-30.

Baker, J. O. E., Schorer, J., Cobley, S., Schimmer, G., & Wattie, N. (2009). Circumstantial development and athletic excellence: The role of date of birth and birthplace. *European Journal of Sport Science*, *9*(6), 329-339.

Baker, J., Schorer, J., & Wattie, N. (2018). Compromising talent: Issues in identifying and selecting talent in sport. *Quest*, *70*(1), 48-63.

Barr, G. D. I., & Kantor, B. S. (2004). A criterion for comparing and selecting batsmen in limited overs cricket. *Journal of the Operational Research Society*, *55*(12), 1266-1274.

BBC, (2020) *ECB regional retainers: 25 domestic women's cricketers given support* [online]. Retrieved from: https://www.bbc.co.uk/sport/cricket/53180318 [accessed 19th of April 2021].

Bell, J. J., Hardy, L., & Beattie, S. (2013). Enhancing mental toughness and performance under pressure in elite young cricketers: A 2-year longitudinal intervention. *Sport, Exercise, and Performance Psychology*, *2*(4), 281.

Brenton, J., Müller, S., & Mansingh, A. (2016). Discrimination of visual anticipation in skilled cricket batsmen. *Journal of Applied Sport Psychology*, *28*(4), 483-488.

Brenton, J., Müller, S., & Harbaugh, A. G. (2019). Visual-perceptual training with motor practice of the observed movement pattern improves anticipation in emerging expert cricket batsmen. *Journal of Sports Sciences*, *37*(18), 2114-2121.

Brown, T., & Kelly, A. L. (2021). Relative access to wealth and ethnicity in professional cricket. In *Birth Advantages and Relative Age Effects in Sport* (pp. 184-206). Routledge.

Bull, S. J., Shambrook, C. J., James, W., & Brooks, J. E. (2005). Towards an understanding of mental toughness in elite English cricketers. *Journal of Applied Sport Psychology*, *17*(3), 209-227.

Brown, T. W., Gough, L. A., & Kelly, A. L. (2021). Performance trajectories of bowlers and batters from youth level to senior professional status in cricket. *International Journal of Performance Analysis in Sport*, 1-15.

Christensen, M. K. (2009). "An eye for talent": Talent identification and the "practical sense" of top-level soccer coaches. *Sociology of Sport Journal*, *26*(3), 365-382.

Cobley, S., Baker, J., Wattie, N., & McKenna, J. (2009). Annual age-grouping and athlete development: A meta-analytical review of relative age effects in sport. *Sports Medicine*, *39*(3), 235-256.

Connor, J. D., Renshaw, I., & Farrow, D. (2020). Defining cricket batting expertise from the perspective of elite coaches. *PLoS One*, *15*(6), e0234802.

Coté, J., Horton, S., MacDonald, D., & Wilkes, S. (2009). The benefits of sampling sports during childhood. *Physical & Health Education Journal*, *74*(4), 6.

Coutinho, P., Mesquita, I., & Fonseca, A. M. (2016). Talent development in sport: A critical review of pathways to expert performance. *International Journal of Sports Science & Coaching*, *11*(2), 279-293.

Cushion, C., Ford, P. R., & Williams, A. M. (2012). Coach behaviours and practice structures in youth soccer: Implications for talent development. *Journal of Sports Sciences*, *30*(15), 1631-1641.

Davids, K., Araújo, D., Vilar, L., Renshaw, I., & Pinder, R. (2013). An ecological dynamics approach to skill acquisition: Implications for development of talent in sport. *Talent Development and Excellence*, *5*(1), 21-34.

Davids, K., Güllich, A., Shuttleworth, R., & Araújo, D. (2017). Understanding environmental and task constraints on talent development: Analysis of micro-structure of practice and macro-structure of development histories. In *Routledge handbook of talent*

identification and development in sport (pp. 192-206). London: Routledge.

De Bosscher, V., Shibli, S., Westerbeek, H., & van Bottenburg, M. (2016). Convergence and divergence of elite sport policies: is there a one-size-fits-all model to develop international sporting success? *Journal of Global Sport Management*, *1*(3-4), 70-89.

Dennis, R. J., Finch, C. F., & Farhart, P. J. (2005). Is bowling workload a risk factor for injury to Australian junior cricket fast bowlers?. *British Journal of Sports Medicine*, *39*(11), 843-846.

Dimundo, F., Cole, M., Blagrove, R., Till, K., McAuley, A., Hall, M., Gale, M., and Kelly, A. Talent identification and development in male rugby union: a systematic review. *Journal of Expertise*. 4(1), 33-55.

ECB, (2021) *icoachcricket*, [online]. Retrieved from: https://icoachcricket.ecb.co.uk/ [accessed 19th of April 2021].

ESPNcrickinfo, (2020) *Yorkshire promise independent review in wake of Azeem Rafiq's claims of institutional racism* [online]. Retrieved from: https://www.espncricinfo.com/story/yorkshire-promise-independent-review-in-wake-of-azeem-rafiq-s-claims-of-institutional-racism-1231215 [accessed 1st of April 2021].

Ford, P. R., Low, J., McRobert, A. P., & Williams, A. M. (2010). Developmental activities that contribute to high or low performance by elite cricket batters when recognizing type of delivery from bowlers' advanced postural cues. *Journal of Sport and Exercise Psychology*, *32*(5), 638-654.

Ferdinands, R. E., Kersting, U. G., & Marshall, R. N. (2013). Kinematic and kinetic energy analysis of segmental sequencing in cricket fast bowling. *Sports Technology*, *6*(1), 10-21.

Glazier, P., Paradisis, G. P., & Cooper, S. M. (2000). Anthropometric and kinematic influences on release speed in men's fast-medium bowling. *Journal of Sports Sciences*, *18*(12), 1013-1021.

Glazier, P. S., & Wheat, J. S. (2014). An integrated approach to the biomechanics and motor control of cricket fast bowling techniques. *Sports Medicine*, *44*(1), 25-36.

Goodway, J. D., & Robinson, L. E. (2015). Developmental trajectories in early sport specialization: a case for early sampling from a physical growth and motor development perspective. *Kinesiology Review*, *4*(3), 267-278.

Gucciardi, D. F., & Gordon, S. (2009). Development and preliminary validation of the Cricket Mental Toughness Inventory (CMTI). *Journal of Sports Sciences*, *27*(12), 1293-1310.

Gucciardi, D. F. (2011). The relationship between developmental experiences and mental toughness in adolescent cricketers. *Journal of Sport and Exercise Psychology*, *33*(3), 370-393.

Hogan, K., & Norton, K. (2000). The 'price' of Olympic gold. *Journal of Science and Medicine in Sport*, *3*(2), 203-218.

Güllich, A., Macnamara, B. N., & Hambrick, D. Z. (2022). What makes a champion? Early multidisciplinary practice, not early specialization, predicts world-class performance. *Perspectives on Psychological Science*, *17*(1), 6-29.

Johnston, K., Wattie, N., Schorer, J., & Baker, J. (2018). Talent identification in sport: a systematic review. *Sports Medicine*, *48*(1), 97-109.

Johnston, K., & Baker, J. (2020). Waste reduction strategies: factors affecting talent wastage and the efficacy of talent selection in sport. *Frontiers in Psychology*, *10*, 2925.

Jones, B., Hardy, L., Lawrence, G., Kuncheva, L., Brandon, R., Such, P., & Bobat, M. (2019). The Identification of 'Game Changers' in England Cricket's Developmental Pathway for 3 Elite Spin Bowling: A Machine Learning Approach. *Journal of Expertise*, *2*(2), 92-120.

Jones, B., Hardy, L., Lawrence, G., Kuncheva, L., Brandon, R., Bobat, M., & Thorpe, G. (2020). It Ain't What You Do—It's the Way That You Do It: Is Optimizing Challenge Key in the Development of Super-Elite Batsmen?. *Journal of Expertise*, *3*(2), 144-168.

Kelly, A. L., Erickson, K., & Turnnidge, J. (2020). Youth sport in the time of COVID-19: considerations for researchers and practitioners. *Managing Sport and Leisure*, 1-11.

Kelly, A. L., Wilson, M. R., Gough, L. A., Knapman, H., Morgan, P., Cole, M., & Williams, C. A. (2020). A longitudinal investigation into the relative age effect in an English professional football club: Exploring the "underdog hypothesis". *Science and Medicine in Football*, *4*(2), 111-118.

Kelly, A. L., Till, K., Jackson, D., Barrell, D., Burke, K., & Turnnidge, J. (2021). Talent identification and the relative age effect in male professional and international rugby union: From entry to expertise. *Frontiers in Sports and Active Living* [ePub ahead of print].

Kelly, A. L., Côté, J., Jeffreys, M., & Turnnidge, J. (Eds). (2021). *Birth advantages and relative age effects in sport: Exploring organizational structures and creating appropriate settings*. London: Routledge.

Lascu, A., Spratford, W., Pyne, D. B., & Etxebarria, N. (2020). Practical application of ecological dynamics for talent development in cricket. *International Journal of Sports Science & Coaching*, *15*(2), 227-238.

Law, M., Stewart, D., Pollock, N., Letts, L., Bosch, J., & Westmorland, M. (2003). Guidelines for critical review form–quantitative studies. 1998. *McMaster University Occupational Therapy Evidence-based Practice Research Group*.

Lawrence, D. W. (2017). Sociodemographic profile of an Olympic team. *Public Health*, *148*, 149-158.

Letts, L., Wilkins, S., Law, M., Stewart, D., Bosch, J., & Westmorland, M. (2007). Guidelines for critical review form: Qualitative studies (Version 2.0). *McMaster University Occupational Therapy Evidence-Based Practice Research Group*.

Lords, (2021) *The hundred inaugural finals day one of five double headers to be held at Lords* [online]. Retrieved from: https://www.lords.org/lords/news-stories/the-hundred-inaugural-finals-day-one-of-five-double. [accessed 19th of May 2021].

Low, J., Williams, A. M., McRobert, A. P., & Ford, P. R. (2013). The microstructure of practice activities engaged in by elite and recreational youth cricket players. *Journal of Sports Sciences*, *31*(11), 1242-1250.

MacDonald, D., Cronin, J., & Macadam, P. (2018). Key movements and skills of wicket-keepers in one day international cricket. *International Journal of Sports Science & Coaching*, *13*(6), 1156-1162.

Mann, D. L., Spratford, W., & Abernethy, B. (2013). The head tracks and gaze predicts: How the world's best batters hit a ball. *PLoS One*, *8*(3), e58289

McAuley, A. B. T., Baker, J., & Kelly, A. L. (2021). How nature and nurture conspire to influence athletic success. In *Birth advantages and relative age effects in sport* (pp. 159-183). London: Routledge.

McAuley, A. B. T., Baker, J., & Kelly, A. L. (2022). Defining "elite" status in sport: from chaos to clarity. *German Journal of Exercise and Sport Research*, *52*(1), 193-197.

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Annals of Internal Medicine*, *151*(4), 264-269.

Müller, S., Abernethy, B., & Farrow, D. (2006). How do world-class cricket batsmen anticipate a bowler's intention? *Quarterly Journal of Experimental Psychology*, *59*(12), 2162-2186.

Müller, S., Abernethy, B., Reece, J., Rose, M., Eid, M., McBean, R., & Abreu, C. (2009). An in-situ examination of the timing of information pick-up for interception by cricket batsmen of different skill levels. *Psychology of Sport and Exercise*, *10*(6), 644-652.

Müller, S., Abernethy, B., Eid, M., McBean, R., & Rose, M. (2010). Expertise and the spatio-temporal characteristics of anticipatory information pick-up from complex movement patterns. *Perception*, *39*(6), 745-760.

Müller, S., Brenton, J., Dempsey, A. R., Harbaugh, A. G., & Reid, C. (2015). Individual differences in highly skilled visual perceptual-motor striking skill. *Attention, Perception, & Psychophysics*, *77*(5), 1726-1736.

Müller, S., Brenton, J., & Mansingh, A. (2020). Sources of information pick-up for anticipation by skilled cricket batsmen. *European Journal of Sport Science*, 1-9.

Noorbhai, M. H., & Noakes, T. D. (2018). An evaluation of the coaching methods of the

batting backlift technique in cricket. *Journal of Qualitative Research in Sports Studies, 12*(1), 35-56.

Noorbhai, M. H., & Noakes, T. D. (2019). The lateral batting backlift technique: is it a contributing factor to success for professional cricket players at the highest level?. *South African Journal of Sports Medicine, 31*(1), 1-9.

Nunes, T., & Coetzee, B. (2007). The contribution of isokinetic strength parameters to the performance of cricket batsmen. *Isokinetics and Exercise Science, 15*(3), 233-244.

Orchard, J. W., Blanch, P., Paoloni, J., Kountouris, A., Sims, K., Orchard, J. J., & Brukner, P. (2015). Cricket fast bowling workload patterns as risk factors for tendon, muscle, bone and joint injuries. *British Journal of Sports Medicine, 49*(16), 1064-1068.

Patel, A. K., Bracewell, P. J., Gazley, A. J., & Bracewell, B. P. (2017). Identifying fast bowlers likely to play test cricket based on age-group performances. *International Journal of Sports Science & Coaching, 12*(3), 328-338.

Phillips, E., Davids, K., Renshaw, I., & Portus, M. (2010). The development of fast bowling experts in Australian cricket. *Talent Development and Excellence, 2*(2), 137-148.

Phillips, E., Portus, M., Davids, K., & Renshaw, I. (2012). Performance accuracy and functional variability in elite and developing fast bowlers. *Journal of Science and Medicine in Sport, 15*(2), 182-188.

Phillips, E., Davids, K., Renshaw, I., & Portus, M. (2014). Acquisition of expertise in cricket fast bowling: perceptions of expert players and coaches. *Journal of Science and Medicine in Sport, 17*(1), 85-90.

Pion, J., Hohmann, A., Liu, T., Lenoir, M., & Segers, V. (2017). Predictive models reduce talent development costs in female gymnastics. *Journal of Sports Sciences, 35*(8), 806-811.

Pinder, R. A., Renshaw, I., & Davids, K. (2009). Information–movement coupling in developing cricketers under changing ecological practice constraints. *Human Movement Science, 28*(4), 468-479.

Pinder, R., Davids, K., Renshaw, I., & Araújo, D. (2011). Representative learning design: Implications for sport psychology. *Journal of Sport and Exercise Psychology, 33*, 146-155.

Portus, M. R., Sinclair, P. J., Burke, S. T., Moore, D. J., & Farhart, P. J. (2000). Cricket fast bowling performance and technique and the influence of selected physical factors during an 8-over spell. *Journal of Sports Sciences, 18*(12), 999-1011.

Portus, M. R., Mason, B. R., Elliott, B. C., Pfitzner, M. C., & Done, R. P. (2004). Cricket: Technique factors related to ball release speed and trunk injuries in high performance cricket fast bowlers. *Sports Biomechanics, 3*(2), 263-284.

Pyne, D. B., Duthie, G. M., Saunders, P. U., Petersen, C. A., & Portus, M. R. (2006). Anthropometric and strength correlates of fast bowling speed in junior and senior cricketers. *The Journal of Strength & Conditioning Research, 20*(3), 620-626.

Ranson, C., King, M., Burnett, A., Worthington, P., & Shine, K. (2009). The effect of coaching intervention on elite fast bowling technique over a two year period. *Sports Biomechanics, 8*(4), 261-274.

Roberts, A. H., Greenwood, D. A., Stanley, M., Humberstone, C., Iredale, F., & Raynor, A. (2019). Coach knowledge in talent identification: A systematic review and meta-synthesis. *Journal of Science and Medicine in Sport, 22*(10), 1163-1172

Sarmento, H., Anguera, M. T., Pereira, A., & Araujo, D. (2018). Talent identification and development in male football: A systematic review. *Sports Medicine*, 48(4), 907–931.

Schorer, J., Rienhoff, R., Fischer, L., & Baker, J. (2017). Long-term prognostic validity of talent selections: comparing national and regional coaches, laypersons and novices. *Frontiers in Psychology, 8*, 1146.

Sieghartsleitner, R., Zuber, C., Zibung, M., & Conzelmann, A. (2019). Science or coaches' eye?–Both! Beneficial collaboration of multidimensional measurements and coach assessments for efficient talent selection in elite youth football. *Journal of Sports Science & Medicine, 18*(1), 32.

Smith, K. L., Weir, P. L., Till, K., Romann, M., & Cobley, S. (2018). Relative age effects

across and within female sport contexts: A systematic review and meta-analysis. *Sports Medicine*, 48(6), 1451-1478.

Salter, C. W., Sinclair, P. J., & Portus, M. R. (2007). The associations between fast bowling technique and ball release speed: A pilot study of the within-bowler and between-bowler approaches. *Journal of Sports Sciences*, *25*(11), 1279-1285.

Stuelcken, M. C., Portus, M. R., & Mason, B. R. (2005). Off-side front foot drives in men's high performance cricket. *Sports Biomechanics*, *4*(1), 17-35.

Surrey. (2020). *How we do it – ID process, programme, pathway* [online]. Retrieved from: https://www.kiaoval.com/how-we-do-it-id-process-programme-pathway/[Accessed 18th of March 2021].

Swart, K., & Maralack, D. (2021). Black Lives Matter: perspectives from South African cricket. *Sport in Society*, *24*(5), 715-730.

Taliep, M. S., Galal, U., & Vaughan, C. L. (2007). The position of the head and centre of mass during the front foot off-drive in skilled and less-skilled cricket batsmen. *Sports Biomechanics*, *6*(3), 345-360.

Taliep, M. S., Prim, S. K., & Gray, J. (2010). Upper body muscle strength and batting performance in cricket batsmen. *The Journal of Strength & Conditioning Research*, *24*(12), 3484-3487.

The Times, (2018) *Multiple eyes, multiple times: how England selectors decide who gets the call-up*, [online]. Retrieved from: https://www.thetimes.co.uk/article/multiple-eyes-multiple-times-how-england-selectors-decide-who-gets-the-call-up-nw762q2gb [accessed 19th of July 2021].

Turner, M. J., Jones, M. V., Sheffield, D., Slater, M. J., Barker, J. B., & Bell, J. J. (2013). Who thrives under pressure? Predicting the performance of elite academy cricketers using the cardiovascular indicators of challenge and threat states. *Journal of Sport and Exercise Psychology*, *35*(4), 387-397.

Turnnidge, J., Hancock, D. J., & Côté, J. (2014). The influence of birth date and place of development on youth sport participation. *Scandinavian Journal of Medicine & Science in Sports*, *24*(2), 461-468.

Weissensteiner, J., Abernethy, B., Farrow, D., & Müller, S. (2008). The development of anticipation: A cross-sectional examination of the practice experiences contributing to skill in cricket batting. *Journal of Sport and Exercise Psychology*, *30*(6), 663-684

Weissensteiner, J., Abernethy, B., & Farrow, D. (2009). Towards the development of a conceptual model of expertise in cricket batting: A grounded theory approach. *Journal of Applied Sport Psychology*, *21*(3), 276-292

Weissensteiner, J. R., Abernethy, B., & Farrow, D. (2011). Hitting a cricket ball: what components of the interceptive action are most linked to expertise? *Sports Biomechanics*, *10*(4), 324-338.

Weissensteiner, J. R., Abernethy, B., Farrow, D., & Gross, J. (2012). Distinguishing psychological characteristics of expert cricket batsmen. *Journal of Science and Medicine in Sport*, *15*(1), 74-79.

Woolmer, B., Noakes, T., Moffett, H., & Lewis, F. (2008). *Bob Woolmer's art and science of cricket*. London: New Holland

Wormgoor, S., Harden, L., & Mckinon, W. (2010). Anthropometric, biomechanical, and isokinetic strength predictors of ball release speed in high-performance cricket fast bowlers. *Journal of Sports Sciences*, *28*(9), 957-965.

Worthington, P. J., King, M. A., & Ranson, C. A. (2013). Relationships between fast bowling technique and ball release speed in cricket. *Journal of Applied Biomechanics*, *29*(1), 78-84.

Received: 23 April 2022
Revision received: 20 February 2023
Accepted: 13 April 2023.

Appendix

Table 1. Summary of the 47 articles included in this study.

Authors	Aim	Participants	Constraints Examined	Results	Quality Score
Bell (2013)	To evaluate the effectiveness of a mental toughness intervention delivered to a group of elite youth cricketers.	Academy (*n* = 41)	Psychological factors	The intervention group demonstrated significant improvements in mental toughness in comparison with the control group, whereby their competitive performance statistics, indoor batting assessment against pace and multistage fitness test scores all improved after undergoing the mental toughness intervention. Results suggests that punishments can lead to enhanced performance under pressure if they are presented in a transformational manner.	80%
Brenton et al. (2016)	To discriminate visual anticipation skill between highly skilled, elite club, and elite youth cricket batsmen.	International (*n* = 13) Senior Club (*n* = 17) Academy (*n* = 9)	Perceptual-cognitive factors	Highly skilled and club batsmen were significantly superior to youth batsmen. Highly skilled batsmen anticipated above chance at ball release occlusion, whereas club and youth batsmen were above chance at no occlusion	86.7%
Brenton et al. (2019)	To examine whether visual anticipation can be improved in emerging experts in striking sports.	Academy (*n* = 12)	Perceptual-cognitive factors	The intervention group, but not the control group, improved anticipation to significantly above chance level across pre-to-post-tests based upon pre-ball flight information. Batting average of the intervention group was higher than the control group during the study. Findings indicate that the intervention can improve anticipation in emerging expert batsmen, beyond sport-specific practice	100%
Bull et al. (2005)	To develop a greater understanding of what mental toughness is within cricket, as well as identify how mental toughness is developed.	International (*n* = 12)	Psychological factors	The global themes of Tough Character," "Tough Attitudes," and "Tough Thinking" were identified. Further, it was highlighted that a player's environment played a crucial role in developing these themes.	88.9%

Authors	Aim	Participants	Constraints Examined	Results	Quality Score
Connor et al. (2018)	To explore the development of skilled behaviours, between professional state level cricket batters and their lesser skilled counterparts.	Professional (*n* = 6) Recreational (*n* = 8) Academy Junior (*n* = 8)	Psychological, biomechanical, and technical factors	State level batsmen played more scoring shots and scored more runs, underpinned by superior bat–ball contact and technical efficiency. State batsmen reported utilizing more contextual and tactical factors as to where to score runs compared to their junior counterparts.	(80%) Quant (73.7%) Qual
Connor et al. (2020)	To develop the current understanding regarding the crucial and defining characteristics of cricket batting.	High Performance Coach (*n* = 8)	Biomechanical and technical, psychological, and perceptual cognitive factors	The development of a conceptual model which highlights multiple factors possessed by expert batters beyond just technical proficiency. For example, self-awareness of their technical and tactical; self-regulatory behaviors and psychological strategies	83.3%
Ferdinands et al. (2013)	To examine the segmental sequencing of a sample of fast bowlers in terms of kinematics, and energy.	Semi-professional (*n* = 34)	Biomechanical and technical factors	The multiple regression model with the sequential timing variables of thoracic linear kinetic energy, upper-arm circumduction velocity and forearm rotation kinetic energy, as well as the pelvic–shoulder separation acceleration accounted for 55% of the variability in ball speed	93.3%
Ford et al. (2010)	To examine the developmental activities that contribute to the development of superior anticipation skill among elite cricket batters.	Professional (*n* = 45) Novice (*n* = 14)	Perceptual-cognitive and participation history factors	The Professional group accumulated more training hours between 13 and 15 years of age in structured cricket activity compared with the Novice group. Moreover, during this period, the proportion of structured activity hours in batting activity was greater for the Professional group compared with the Novice group. In addition, the Professional group spent significantly less time in “nets” practice compared with the Novice group.	75%

Authors	Aim	Participants	Constraints Examined	Results	Quality Score
Glazier et al. (2000)	To identify significant relationships between selected anthropo-metric and kinematic variables and ball release speed.	Recreational University (*n* = 9)	Anthropometric and biomechanical and technical factors	*Anthropometrical*: High correlations were fiund between ball release speed and shoulder plus wrist length. *Technical:* A significant relationship was found between horizontal velocity during the pre-delivery stride; angular velocity of the right humerus had a low correlation with ball release speed.	66.7%
Gucciardi (2011)	To investigate the contribution of positive and negative youth sport to self-reported mental toughness among youth-aged cricketers. Further, to examine the psycho-metric integrity of the Cricket Mental Toughness Inventory.	Recreational Youth (*n* = 308)	Participation history factors	A variety of developmental experiences were related to various mental toughness components, with initiative experiences evidencing the strongest overall relationship with mental toughness followed by negative peer influences.	93.3%
Headrick et al. (2012)	To examine the perceptual attunement of relatively skilled individuals to the physical properties of striking implements in the sport of cricket. Further, to assess whether utilizing bats with different physical properties would influence performance of a specific striking action.	School Boy U17 (*n* = 11)	Biomechanical and technical factors	Kinematic analysis of movement patterns revealed that bat velocity, step length, and bat–ball contact position measures significantly differed between bats. Data revealed how skilled youth cricketers were attuned to the different bat characteristics and harnessed movement system degeneracy to perform this complex interceptive action.	64.3%
Jones et al. (2019)	To identify the multifaceted pattern of developmental features that discriminate between elite and sub-elite cricket spin bowlers most accurately.	International (*n* = 15) Professional (*n* = 13)	Relative age effect, participation history, and sociocultural factors	Identification of 12 developmental features which discriminated the international cohort from the professional.	85%
Jones et al. (2020)	To compare the development experiences and the nature and microstructure of practice activities of super-elite and elite cricket batsmen.	International (*n* = 20)	Participation history and socio-cultural factors	Super-elite batsmen participated in larger volumes of random and varied skills-based practices at age 16. Subsequently, they adapted to, and transitioned through, the different levels of senior competition quicker.	85%

Authors	Aim	Participants	Constraints Examined	Results	Quality Score
Land & McLeod (2000)	To determine what information is available to batsmen as the ball approaches them and by tracking their eye movements.	Professional (*n* = 1) Semi-professional (*n* = 1) Amateur (*n* = 1)	Perceptual cognitive factors	Identified that a short latency for the first saccade distinguished good from poor batsmen, and that a cricket player's eye movement strategy contributes to their skill in the game.	50%
Low et al. (2015)	To examine the effect of date and place of birth on the development of expertise in male adult professional cricketers in the UK.	Professional (*n* = 740)	Participation history factors	*Birthplace Effect* There was overrepresentation of players born early in the selection years and in small- to medium-sized communities. Contradicting previous research, however, there was also an overrepresentation of players born in the large population area of the City of London and Greater London. *RAE* Higher skilled players were 1.6 times more likely to be born in birth quarter 1 compared to birth quarter 4.	91.7%
Low et al. (2013)	To identify the amount of time spent in Training Form and Playing Form for elite and recreational youth cricketers.	County Youth U9-U12 (*n* = 70) County Adolescents U13-U17 (*n* = 68) Recreational Youth U9-U12 (*n* = 98) Recreational Adolescents U13-U17 (*n* = 92)	Participation history factors	Recreational children spent around half their time in Playing Form activity, whereas both elite and adolescent groups spent little or no time in this activity.	76.9%
MacDonald, Cronin, & Macadam (2018)	To identify the movement and skill demands of wicket-keeping in one day international cricket through video analysis.	International (*n* = 8)	Biomechanical and technical factors	Following the crouch action, the highest average (times per innings) movement activities were the lateral step (78), lateral shuffle (53) and running to the stumps (27). The highest average skill activities were to receive the ball from the field (42), throw underarm (32) and take the ball following the bowler's delivery (24).	66.7%

Authors	Aim	Participants	Constraints Examined	Results	Quality Score
Mann et al. (2013)	To examine whether cricket batters can track ball flight and whether or not it is possible to watch the ball onto the bat.	International (*n* = 2) Recreational (*n* = 2)	Perceptual-cognitive factors	Elite batters used distinctive eye movement strategies, usually relying on two predictive saccades to anticipate (i) the location of ball-bounce, and (ii) the location of bat-ball contact to direct their gaze towards the ball as they hit it. These specific head and eye movement strategies play important functional roles in contributing towards interceptive expertise.	75%
McRobert et al. (2009)	To assess skill-based differences in visual search behaviours and thinking as well as to examine how these indices alter as a function of task constraints.	Professional (*n* = 10) Senior Recreational (*n* = 10)	Perceptual-cognitive factors	Less-skilled batters extracted information primarily from the ball-hand location whereas, skilled batters used a more systematic search strategy, to direct their gaze towards additional task-relevant sources of information. Further, skilled batters adopted a more exhaustive search pattern, fixating on more locations (i.e., head-shoulders and trunk-hips) than the primary cue source (i.e., ball-hand).	80%
McRobert et al. (2011)	To extend current research by systematically examining differences in the underlying processes used by skilled and less skilled batters when making anticipation judgements and to determine how these processes differed as a function of the amount of contextual information presented.	Professional (*n* = 10) Senior Recreational (*n* = 10)	Perceptual-cognitive factors	Higher skilled batters were more accurate, demonstrated more effective search behaviours, and provided more detailed verbal reports of thinking. Further, viewing a bowler multiple times prior to testing (high context) reduced batter fixation time.	93.3%

Authors	Aim	Participants	Constraints Examined	Results	Quality Score
Müller et al. (2006)	*Study 1*: To determine the timing of advance information pick-up between batsmen of different skill levels. *Study 2:* To determine possible skill related differences in cue dependency. *Study 3:* To determine how much information is carried by a single cue when it is the only source of information. *Study 4*: To examine in which combinations of cues were presented in a fashion equivalent to their usual temporal and spatial sequencing within the bowling action.	*Study 1& 2*: Professional (*n* = 31) Recreational (*n* = 10) University Recreational (*n* = 16) *Study 3 & 4*: Professional (*n* = 30) Recreational (*n* = 11) University Recreational (*n* = 17)	Perceptual-cognitive factors	Collectively the studies within this paper highlighted that, in general, Professional batters where superior in identifying type of delivery and predicting length compared to their recreational counterparts. Further, that anticipation skills differed dependant on the type of delivery. For example *Pace;* only prediction under the cue containing the bowling hand and the bowling arm for the professional players resulted in accuracy levels significantly greater than chance. *Spin;* A significant difference in interpreting ball type was found between the combination of seeing both bowling hand and bowling hand and bowling arm for professional players.	84.6%
Müller et al. (2009)	To examine the capability of high and low skilled cricket batsmen in utilizing visual information prior to and during sections of ball flight to strike balls delivered by fast bowlers.	Professional (*n* = 6) University Recreational (*n* = 6)	Perceptual-cognitive factors	Highly skilled batsmen had a superior capability to utilize information prior to ball release to judge short ball length. Expert batsmen were better able to utilize ball flight information prior to and post-bounce to attain a superior number of bat–ball contacts.	86.7%
Müller et al. (2010)	To examine expertise-related differences in anticipatory information pick-up that combined temporal and spatial occlusion methodologies.	Professional (*n* = 14) Recreational (*n* = 12) University Recreational (*n* = 15)	Perceptual-cognitive factors	*Study 1*: Only professional players were able to produce better-than-chance predictions of ball type and then only under a limited set of display conditions. *Study 2*: Expert anticipation is dependent on sensitivity to information arising from a select set of local cues and forced attentional switches between different cues negate effective information pick-up and, with it, the expert advantage.	84.6%

Authors	Aim	Participants	Constraints Examined	Results	Quality Score
Müller et al. (2015)	To investigate the pick-up of visual information to time weight transfer and bat kinematics within an exemplar group of cricket experts using an in situ temporal occlusion paradigm.	Academy (*n* = 8)	Perceptual-cognitive factors	Individual differences exist in the coordination pattern of a complex whole body visual perceptual-motor skill, but these different patterns are used to achieve a similar outcome.	86.7%
Müller et al. (2020)	To investigate whether skilled West Indian cricket batsmen could use contextual and kinematic information to anticipate the type of ball being bowled.	Professional (*n* = 10) Elite Club (*n* = 10) Professional Academy U17 - U19 (*n* = 11)	Perceptual cognitive factors	Prediction accuracy for all skill groups increased to above guessing level at advance cue temporal occlusions when contextual information was provided. Findings indicate that this group of skilled batsmen did not use kinematic information for anticipation in this temporal occlusion task but relied heavily upon contextual information.	86.7%
Noorbhai & Noakes (2016)	To examined whether top international batsmen use traditional techniques.	International (*n* = 65)	Biomechanical and technical factors	70+% of successful batsmen adopted a non-traditional technique. Instead, they applied a more looped action in which the initial movement of the bat was in the direction of the slips, and in extreme cases it was either towards the gully/point region or to have the face of the bat directed towards the offside.	80%
Noorbhai & Noakes (2019)	To investigate to what extent batters at provincial level use the lateral back lift.	International (*n* = 12) Professional (*n* = 49) Semi-professional (*n* = 69)	Biomechanical and technical factors	This study found that a lateral back lift becomes more common throughout the higher levels of the game. Semi-professional = 37%, Professional = 38%, and International = 75%. Wagon wheel analysis identified that those utilizing the lateral back lift were able to access more of the ground through their scoring shots.	80%
Nunes & Coetzee (2007)	To determine which of the isokinetic knee and shoulder strength parameters discriminate between successful and less successful provincial academy cricket batsmen and to assess the contribution of isokinetic knee and shoulder strength parameters to the performance of these athletes.	Academy (*n* = 22)	Biomechanical and technical factors	Isokinetic knee and shoulder strength parameters contribute to the performance of provincial academy cricket batsmen and that these components should be included in the talent identification protocols for young promising batsmen.	91.3%

Authors	Aim	Participants	Constraints Examined	Results	Quality Score
Patel et al. (2017)	To identify the key performance indicators for a fast bowler's propensity to play test cricket for New Zealand.	National Academy (*n* = 34)	Participation history factors	High workload (i.e., balls bowled), presumably reflecting a bowler's importance to the team, and high efficiency (i.e., low strike rate) are key metrics coaches and managers should consider identifying high potential fast bowlers among youth cricketers.	100%
Philips et al. (2010)	To investigate the utility of a multi-dimensional model of expertise development through cricket.	International (*n* = 11)	Participation history factors	Bowlers progressed through unique, nonlinear trajectories of development. Specifically, this study illustrated that experts possess the ability to continually adapt their behaviours under multifaceted ecological constraints.	77.8%
Philips et al. (2012)	To observe if bowlers can adapt movement patterns to maintain performance accuracy on a bowling skills test.	International (*n* = 8) Professional (*n* = 12) Professional Academy (*n* = 12)	Biomechanical and technical factors	Higher skilled bowlers were able to functionally adapt their actions to enhance accuracy on a range of bowling tasks. Further International bowlers are significantly more accurate than Professional Academy bowlers but were not significantly more consistent.	83.3%
Phillips et al. (2014)	Experiential knowledge of elite athletes and coaches was investigated to reveal insights on expertise acquisition in cricket fast bowling.	Past or Present Professional (*n* = 21)	Biomechanical and technical, psychological, and physiological factors	The importance of intrinsic motivation early in development was highlighted, along with physical, psychological and technical attributes. The most prominent perceived requirements for fast bowling skill were pace, technique fundamentals, skill, coordination, good attitude, motivation and training ethic.	83.3%
Pinder et al. (2009)	To extend understanding of information–movement coupling in cricket batting.	Youth Recreational (*n* = 12)	Biomechanical and technical factors	Changing the ecological constraints of practice and making it more representative in task design, by enhancing the availability of specific advanced information from a bowler's movements, resulted in major changes to the information–movement couplings of the batters.	75%

Authors	Aim	Participants	Constraints Examined	Results	Quality Score
Portus et al. (2004)	To identify technical factors associated with a peak ball velocity in bowlers as well as to identify the technical factors associated with trunk injuries.	Professional (*n* = 42)	Biomechanical and technical factors	*Peak Ball Velocity*: Bowlers who released the ball at greater speeds had an extended front knee and higher braking and vertical impact forces, during the front foot contact phase as well as maximum hip-shoulder separation angle occurring later in the delivery stride and a larger shoulder rotation to ball release. *Injury*: Hip to shoulder separation angle at back foot contact was greater in bowlers who reported soft tissue injuries. Shoulder counter-rotation was significantly higher in bowlers who reported lumbar spine stress fractures than non-trunk-injured bowlers.	73.3%
Pyne et al. (2006)	To characterize relationships between anthropometric and isoinertial strength characteristics and bowling speed in junior and senior cricket fast bowlers.	Professional (*n* = 24) County Adolescents U13-U15 (*n* = 48)	Biomechanical and technical, and anthropometric factors	The best multiple predictors of ball Velocity for the junior bowlers were the static jump, bench throw, body mass, percentage muscle mass, and height. For the senior bowlers, static jump and arm length correlated positively with Velocity peak.	86.7%
Ranson et al. (2009)	To determine whether two-year coaching interventions resulted in the alteration of specific elements of fast bowling technique.	National Academy (*n* = 14)	Biomechanical and technical, and participation history	Coaching interventions aimed at producing a more side-on alignment can significantly reduce shoulder alignment angle at back foot contact with a corresponding reduction in shoulder counter-rotation.	100%
Renshaw & Fairweather (2000)	To assess the perceptual discrimi-nation ability among three distinct standards of batters.	Senior National (*n* = 6) Professional (*n* = 6) Recreational (*n* = 6)	Perceptual cognitive factors	More expert batters in general showed greater perceptual discrimination skills when faced with different ball types.	84.6%

Authors	Aim	Participants	Constraints Examined	Results	Quality Score
Sarpeshkar et al. (2017)	To provide a comprehensive examination of the eye and head movement strategies that underpin the development of visual-motor expertise when intercepting a fast-moving target.	Professional and International (*n* = 13) Professional Academy U17/U19 (*n* = 10) Adult Recreational (*n* = 10) Youth Recreational (*n* = 10)	Biomechanical and technical, and perceptual-cognitive factors	Swinging trajectories alter the visual-motor behaviour of all batters and curving trajectories influence visual-motor behaviour in a non-linear fashion, with targets that curve away from the observer influencing behaviour more than those that curve inwards.	69.2%
Taliep et al. (2010)	To determine if upper body muscle strength was associated with cricket batting performance.	Professional (*n* = 18)	Physiological factors	There were no significant correlations between upper body strength, batting average, and strike rate for both the 1-Day and T/20 matches.	80%
Thomas et al. (2005)	Test the hypothesis that elite batsmen have faster reaction times than non-cricketers.	Regional Academy (*n* = 25) Novice (*n* = 9)	Perceptual cognitive, and physiological factors	Obtaining early information (i.e., within the first 100-150ms) is important for success in cricket batting. Further, results indicate that the majority of elite batsman were not right- or left-eye dominated as previously believed.	75%
Turner et al. (2013)	To assess whether cardiovascular reactivity patterns indexing challenge and threat states predicted batting performance in elite male county and national academy cricketers.	Professional (*n* = 30) National Academy (*n* = 12)	Physiological factors	Cardiovascular (CV) reactivity predicted superior performance in a pressured cricket Batting Test compared with threat CV reactivity. Additionally, participants who exhibited threat CV reactivity but performed well reported greater self-efficacy than participants who exhibited threat CV reactivity but performed poorly. Assessment of CV reactivity may be a valid way of predicting pressured sport performance in elite athletes.	93.3%

Authors	Aim	Participants	Constraints Examined	Results	Quality Score
Weissensteiner et al. (2008)	To explore the presumed links between the developmental and practice histories of cricket batsmen and their proficiency in sport-specific anticipation.	U15 Regional (*n* = 21) U15 Recreational (*n* = 20) U20 Regional (*n* = 18) U20 Recreational (*n* = 20) 20+ Regional (*n* = 13) 20 + Recreational (*n* = 10)	Perceptual-cognitive and participation history factors	Skilled adult and U20 players showed an ability to use pre-release kinematic information to anticipate ball, and skilled players of all ages were distinguishable by a greater accumulated hour of cricket-specific experience. Hours of cricket-specific practice, however, explained only a modest percentage of the variance in anticipatory skill	80% (Quant) 94.1% (Qual)
Weissensteiner et al. (2009)	To work toward the development of a conceptual model of expertise in cricket batting.	International (*n* = 3) Regional Academy (*n* = 2) Level 3+ Coaches (*n* = 5) Administrators (*n* = 5)	Biomechanical and technical, psychological, and perceptual-cognitive factors	Healthy socio-developmental environment provides the essential foundation for the development of positive psychological attributes, technical skill mastery and superior visual-perceptual skill. Further, intrinsic motivators are regarded as essential to continuation and progression along developmental pathways. Finally, aspects of contemporary society and its constraints on free play emerged as one of the major limitations to the future development of expertise.	88.9%
Weissensteiner et al. (2011)	To analyze differences in interceptive skill between highly skilled and lesser skilled cricket batsmen.	Professional (*n* = 10) Novice (*n* = 11)	Biomechanical and technical, and perceptual-cognitive factors	Highly skilled batsmen were distinguishable from less skilled counterparts by (a) higher accuracy under the normal and half-width bat conditions (b) significantly earlier initiation and completion of the front-foot stride (c) greater synchronization of the completion of the front-foot stride with the commencement of the downswing of the bat, and (d) consistent timing of downswing relative to ball bounce and impact.	76.9%
Weissensteiner et al. (2012)	To determine the psychological characteristics and skills that are fundamental to batting success in cricket.	Professional (*n* = 10) Novice (*n* = 11)	Psychological factors	Highly skilled batsmen were only distinguishable from batsmen of lesser skill by their higher degree of global mental toughness.	84.6%

Authors	Aim	Participants	Constraints Examined	Results	Quality Score
Wormgoor et al. (2013)	To identify parameters that contribute to high ball release speeds in cricket fast bowler.	Semi-professional (*n* = 28)	Biomechanical and technical, and anthropometrical factors	Greater front leg knee extension at ball release, shoulder alignment in the transverse plane rotated further away from the batsman at front foot contact, greater ankle height during the delivery stride, and greater shoulder extension strength contribute significantly to higher ball release speeds. No anthropometric variables displayed any significant correlation with ball release speed	73.3%
Worthington et al. (2013)	To identify the key aspects of technique that characterize the fastest bowlers.	Professional and International (*n* = 20)	Biomechanical factors	Four technique variables were identified as being the best predictors of ball release speed (a) quicker run-up (b) maintain a straighter knee throughout the front foot contact phase (c) exhibit larger amounts of upper trunk flexion up to ball release (d) delay the onset of arm circumduction.	76.9%