# Technical testing and match analysis statistics as part of the talent development process in an English football academy

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Technical ability is recognised as a fundamental prerequisite to achieve senior professional status in football. However, research is yet to investigate what technical attributes contribute to greater coach perceived potential within an academy environment. Therefore, the aim of this study was to examine technical ability and skill behaviour as contributing factors to coach potential ratings in an English football academy. Ninety-eight outfield academy players (Foundation Development Phase [FDP] under-9 to under-11 *n*=40; Youth Development Phase [YDP] under-12 to under-16 *n*=58) participated in the study. Four football-specific technical tests were used to measure technical ability, whilst eight match analysis statistics from competitive match-play across an entire season were observed to measure skill behaviour. A classification of 'higher-potentials' (top third) and 'lower-potentials' (bottom third) were applied through coach rankings. Within the FDP, higher-potentials performed significantly better ($P<0.05$) on the lob pass test, alongside greater reliability in possession, pass completion, and total touches for match analysis statistics. Within the YDP, higher-potentials performed significantly better ($P<0.05$) on all four technical tests, alongside greater reliability in possession, dribble completion, and total touches for match analysis statistics. Results suggest football-specific technical tests and 'in possession' skill behaviours may provide discriminative tools that align with perceived potential.

Keywords: Technical ability; Performance analysis; Skill behaviour; Talent identification, Academy soccer, Football coaching

## Introduction

Football is a sport that requires the repetition of many complex technical actions, such as dribbling, passing, tackling, and shooting (Dardouri, Amin Selmi, Haj Sassi, Gharbi, Rebhi, & Moalla, 2014; Figueiredo, Coelho-e-Silva, & Malina, 2011). Historically, objective technical analysis was rarely monitored for talent development purposes (Abt, Zhou, & Weatherby, 1998). For example, Ali (2011) states how there was a 'dearth' of studies on skill execution within academic literature, particularly when it is readily acknowledged that successful execution of skill is one of the most important aspects in football performance. More recently however, the growing interest from practitioners, alongside an increase in technology capabilities, has resulted in researchers focussing on technical tests and match analysis statistics (e.g., Archer, Drysdale, & Bradley, 2016; Forsman, Grasten, Blomqvist, Davids, liukkonen, & Konttinen, 2016; Pedretti, Pedretti, Fernandes, Rebelo, & Seabra, 2016).

Current research has illustrated the technical demands of contemporary football have increased significantly in recent years (Barnes, Archer, Hogg, Bush, & Bradley, 2014). Furthermore, there is a distinct association between greater ball possession and successful results (Gomez, Mitrotasios, Armatas, & Lago-Penas, 2018; Liu, Hopkins, & Gomez, 2016; Yang, Leicht, Lago, & Gomez, 2018). In addition, players from successful teams have been regularly shown to complete more technical actions compared to their less successful counterparts (Gomez et al., 2018; Rampinini, Impellizzeri, Castagna, Couus, & Wisloff, 2009). Therefore, from a talent development perspective, it may be important to monitor both unopposed technique and skill behaviours in youth football, using technical tests and match analysis data respectively, to measure these fundamental attributes to support greater development strategies towards senior expertise.

***Technical testing***

The acute motor skills of manipulating a ball effectively are vital factors in the professional game of football and can be tested in isolation (Vaeyens, Malina, janssens, van Retergham, Bourgois, Vrijens, & Philippaerts, 2006). Ali (2011) states the advantages of measuring these technical attributes as: (a) facilitating initial talent identification, (b) providing a strategy for skill acquisition, and (c) offering an alternative predictor for measuring technical ability compared to a skilled execution during competitive match-play. The importance of technical ability and successful football performance has been supported in previous studies, whereby an association between technical capabilities and performance outcomes at varying performance levels is demonstrated (e.g., Coelho-e-Silva et al., 2010; Figueiredo, Goncalves, Coelho-e-Silva, & Malina, 2009; Huijgen, Elferink-Gamser, Lemmink, & Visscher, 2014; Rebelo et al., 2013; Vaeyens et al., 2006).

Vaeyens and colleagues (2006) used a sequence of technical tests as part of their research exploring the relationship between physical and technical performance characteristics in youth football, revealing technical tests can distinguish ability groups in youth football players at under-13 to under-16 age groups. Keller, Raynor, Bruce, and Iredale (2016) used the Loughborough Short Passing Test, long passing test, shooting test, and speed dribbling test to discriminate under-18 national ‘elite’, ‘state elite’, and ‘sub-elite’ youth football players, reporting that the ‘elite’ group had higher scores compared to the others. Huijgen, Elferink-Gemser, Post, and Visscher’s (2010) longitudinal study also found that dribbling performance during adolescence could discriminate between players who achieved senior professional football status and those who reached amateur level. As a result, these technical tests can be considered as valuable measures for assessing young football players’ potential.

Alongside ability groups, technical proficiency has been illustrated to improve with age among youth football players, with the greatest developments shown to occur in pre-pubertal years (Huijgen et al., 2010; Valente-dos-Santos et al., 2014; 2012; Wilson et al., 2016). Additionally, some studies have reported growth and maturation status may also be associated with technical skill development, with biological maturity impacting the technical progression in young football players (Malina, Cumming, Kontos, Eisenmann, Ribeiro, & Aroso, 2005; Malina, Ribeiro, Aroso, Cumming, Unnithan, & kirkendall, 2007; Valente-dos-Santos et al., 2012; 2014). Moreover, time spent within practice activities, such as deliberate practice, deliberate play, and multi-sports, has been allied with developing technical ability within a football context (Huijgen, Elferink-Gemser, Ali, & Visscher, 2013; Huijgen et al., 2010; Valente-dos-Santos et al., 2014). Consequently, this highlights the importance of investigating technical ability from an age-specific perspective to support appropriate developmental strategies in youth football.

### *Match analysis statistics*

Football is characterised as a free-flowing team sport that requires the execution of many aspects of skill in a dynamic context (Kempe, Vogelbein, Memmert, & Nopp, 2014). Thus, although there are some ‘closed skills’ (i.e., penalty, corner, free-kick, throw-in), football is an ‘open skill’ game; whereby players are required to perform the correct action at the right moment to effectively operate (Carling, Williams, & Reilly, 2007). In addition, consistent technique is required for a long period of time during a game, which has been shown to be variable during the later stages of a game when fatigue sets in (Mohr, Krustrup, & Bangsbo, 2003). Match analysis refers to the objective recording and examination of behavioural events occurring during competition (Carling et al., 2007). The notational style of analysis, generically applied within academies to recognise key skill behaviours, is an objective method of providing data for player development (Appleby & Dawson, 2002; Hughes, 1988; Hughes, Hughes, & Behan, 2007). The scientific analysis of sports performance aims to advance understanding of game behaviour, with a view to improving future outcomes (McGarry, 2009; Wright, Carling, & Collins, 2014). As such, match analysis, via recording competitive games and objectively analysing them, provides both researchers and practitioners useful data on individual skill execution in football.

Maintaining possession, through passing and preserving the ball within a team’s control during competitive match-play, is associated with greater success at the highest levels of professional football (Liu et al., 2016; Yang et al., 2018). Moreover, players from more successful teams generally possess a greater pass completion percentage, alongside other technical variables such as tackles, dribbles, and shots, during competitive match-play (Rampinini et al., 2009; Yang et al., 2018). Gomez and colleagues (2018) also found greater ball possession, more attacking actions, and lower individual challenges reflected a higher league ranking at senior professional level. Although these characteristics are fundamental skills in senior professional football, current research overlooks the potential significance match analysis may provide for recognising and facilitating talent development in youth football (Atan, Foskett, & Ali, 2014; James, 2006).

Whilst there are number of studies that have examined groups of youth athletes (i.e., 'elite' versus 'non-elite'), which generally elicit superior technical abilities are possessed within advanced cohorts (e.g., Vaeyens et al., 2006; Woods, Raynor, Bruce, & McDonald, 2015), there is no exploration regarding technical characteristics within an academy environment that support developmental outcomes. Therefore, the purpose of this study was to examine the discriminant function of technical ability (technical tests) and skill behaviours (match analysis statistics) based on whether they could differentiate 'higher-potentials' and 'lower-potentials' (coach potential rankings) from an age-specific perspective (Foundation Development Phase [FDP] and Youth Development Phase [YDP]). It was hypothesised that characteristics across the technical tests and match analysis statistics would differentiate higher-potentials and lower-potentials within both age phases.

## Methods

### *Sample*

Ninety-eight participants were examined within their specific age phase; FDP (under-9 to under-11; $n$ = 40) and YDP (under-12 to under-16; $n$ = 58). All participants were recruited from the same Tier 4 English professional football club and their Category 3 academy. Only outfield players were included due to the contrasting development pathway for goalkeepers (Gil, Zabala-Lili, Bidaurrazaga-Letona, Aduna, Lekue, Santos-Concejero, & Granados, 2014). The Institutional Ethics Committee approved this study.

***Measures***

*Technical tests*

Four football-specific technical tests previously utilised in talent development research were applied (Vaeyens et al., 2006). First, the slalom dribble test requires the player to control the ball through nine cones (2 m apart) from the start to the end line and return. The timings are recorded using timing gates (Brower TC Timing System, Draper, Utah, USA), with each player completing two trials and the quicker of the two recorded for analysis. Second, the lob pass test requires the player to kick the football from a distance of 20 m into a target area divided into three concentric circles (3 m, 6 m, and 9.15 m in diameter). Each kick is scored by the circle in which the ball initially landed (3, 2, and 1 point respectively). Ten attempts (five with each foot) are attempted with a maximum of 30 points available. Third, the shooting accuracy test requires the player to kick the ball at a 16 m wide goal target from a shooting distance of 20 m and central to the goal. The goal was divided into five parallel zones; centre, 2 m wide (3 points), two areas 3 m on each side of the centre (2 points), and two areas 4 m wide at each extreme (1 point). Ten attempts (five with each foot) are attempted with a maximum of 30 points available. Fourth, the ball juggling test requires the player to keep a football off the ground with the total number of touches recorded. Two trials are completed, with a maximum of 100 touches per attempt permitted, allowing a maximum number of 200 touches. Each player completed these tests in an indoor sports hall with a hard-wood floor, with generic training kit being worn. In addition, age group-specific balls were used for the tests in-line with the Football Association regulations; size three for under-9, size four for under-10 to under-13, and size five for under-14 to under-16.

*Match analysis statistics*

Video footage examined each player during competitive match-play as they performed each skill behaviour. An average score of each skill behaviour is computed from across an entire football season, including reliability in possession percentage, pass completion percentage, number of tackles, number of blocks, number of loose balls retrieved, successful dribble completion, total touches, and goals scored. As a standard pro-forma of match analysis statistics within each academy varies based on its philosophy, this current study applied the academy's existing protocol for its data collection. The specialist software Gamebreaker© was used to perform participant analysis for each game and trained, club-appointed Performance Analysts (who were not part of the research team and were blind to the grouping of the study participants) adopted technical expert definitions (Table 1) to code behaviours ($n$ = 10). Twenty matches (25% of the data) of the matches that were included in the current study were used to calculate the Performance Analysts' reliability (15-day test-retest analysis). One match per team was randomly selected to carry out the intra- and inter-reliability analysis. An intra-class correlation coefficient test was executed to analyse the reliability levels (poor, <0.50; moderate, 0.50 to 0.75; good, 0.76 to 0.90; excellent, 0.91 to 1.00) (Koo & Li, 2016). Results showed the intra-observer reliability ranged from 0.76 to 1.00 and the inter-observer reliability ranged from 0.71 to 1.00 (Table 2).

****Table 1 near here****

****Table 2 near here****

Only home games were filmed and analysed unless an away team provided appropriate footage (away footage accumulated 8.5% of overall footage). Each age group had a varied number of games filmed and analysed ranging from seven to fourteen. Although all matches analysed were performed on grass, weather and surface quality varied depending on the time of the season. Additionally, as a result of age-specific development, match formats differed throughout the season between age groups; for example, the under-9's generally played four periods of 20 minutes with 5 vs. 5, compared to the under-16's who generally played two periods of 40 minutes with 11 vs. 11. Age appropriate pitches and football size were also applied. Eighty-one matches were filmed across the entire season, with each participant playing a mean number of 7.3 games that were recorded for match analysis statistics. The season accumulation subsequently supplied the match analysis statistics applied to this research. The mean score for each skill behaviour was based on an 80 minute average in-line with a full match duration (i.e., total number of skill behaviours divided by total number of 80 minute matches).

*Coach development rankings*

It is important to highlight that coach perception regarding talent development has been used in previous empirical research (e.g., Kelly, Wilson, Jackson, Turnnidge, & Williams, 2020; MacNamara & Collins, 2013). Indeed, coach observation and opinion is central to the subjective nature of youth sport, with modern objective information readily available to professional coaches to support their judgement (e.g., Sieghartsleitner, Zuber, Zibung, & Conzelmann, 2019; Tangalos, Robertson, Spittle, & Gastin, 2015). Two coaches from each age group (*n* = 16), who were deemed suitably qualified assessors (UEFA Pro, 'A', or 'B' Licenced alongside either the FA Advanced Youth Award or the FA Youth Award), were asked to rank their players from top to bottom in relation to their perception of the player's potential to develop to senior professional status. This created a linear classification of higher-potential players down to their lower-potential peers, with each age group then split into thirds using tertiles. This created a group of 'higher-potentials', who represent the top third, and a group of 'lower-potentials', who represent the bottom third. This enabled a distinct comparison between the higher- and lower-potentials within each age group, with the middle third discarded from the study ($n$ = 34). For the purpose of this age-specific research, the higher- and lower-potentials from the under-9 to under-11 were grouped together within the FDP ($n$ = 26), and the higher- and lower-potentials from the under-12 to under-16 were grouped together within the YDP ($n$ = 38). The results from the technical tests and match analysis statistics were subsequently compared between the higher- and lower-potentials throughout the FDP and YDP to observe any differences.

***Data analysis***

All data are expressed as mean ± standard deviation. As a consequence of the potential differing results between chronological age groups, such as older players generally anticipated to record superior technical capabilities, data have been standardised using $z$-scores within respective chronological age groups to allow comparisons between players within both the FDP and YDP. Initial analysis investigated group differences between higher- and lower-potentials using a MANOVA inclusive of all independent variables. Further post-hoc analysis used an independent samples $t$-test to compare the higher- and lower-potentials' mean scores of technical tests and match analysis statistics within the both FDP and YDP. A binary logistic regression of the technical tests was also used to model higher- and lower-potential status within the FDP and YDP, comprising of univariate and multivariate analyses from the technical tests and match analysis statistics. Differences were considered significant if $P < 0.05$. All analyses were conducted using IBM SPSS Version 23.

## Results

The initial analysis using a MANOVA inclusive of all dependent variables revealed a significant difference between groups of higher- and lower-potentials within the FDP ($F(12,13) = 6.069$, $P = 0.001$; Wilk's $\Lambda = 0.151$, partial $\eta^2 = 0.849$) and YDP ($F(12,25) = 4.642$, $P = 0.001$; Wilk's $\Lambda = 0.310$, partial $\eta^2 = 0.690$).

### *Technical tests*

Within the FDP, a significant difference was observed between the higher- and lower-potentials for the lob pass test, with higher-potentials demonstrating a greater mean score ($P < 0.001$). Within the YDP, significant differences were observed between higher- and lower-potentials in the ball juggling test ($P = 0.012$), the slalom dribble test ($P = 0.003$), the shooting accuracy test ($P = 0.005$), and the lob pass test ($P = 0.002$), with higher-potentials demonstrating superior scores. The descriptive statistics of *z*-scores, *t*-tests, and non-standardised mean results for all technical tests are displayed in Table 3.

****Table 3 near here****

The binary logistic regression of univariate factors from the technical tests within the FDP showed a significant association between the lob pass test and higher-potentials, returning a Cox and Snell $R^2$ of 0.542. Within the YDP, univariate regressions of the ball juggle test, slalom dribble test, shooting accuracy test, and lob pass test showed significant associations with higher-potentials, with Cox and Snell $R^2$ of 0.162, 0.214, 0.200, and 0.232 respectively. The univariate logistic regressions of *z*-scores for technical tests are displayed in Table 4.

****Table 4 near here****

Further multivariate regression analysis was conducted to examine the relationship between the higher-potentials and the series of technical tests. Correlation analysis showed low collinearity between the technical tests, with the exception of the lob pass in the FDP, which had a Pearson correlation coefficient of -0.604 for the ball juggle test ($P$ = 0.029) and -0.605 for the slalom dribble test ($P$ = 0.029). Thus, the lob pass test was excluded from the multivariate regression for the FDP (Dormann et al., 2012). Results showed no significant association for technical tests with higher-potentials ($\chi^2(3) = 6.010$, $P$ = 0.111). The explanatory power of the multivariate model did not improve upon the univariate models, and only accounts for 20.6% of variance. The multivariate logistic regression within the YDP showed a significant association between the technical tests and higher-potentials ($\chi^2(4) = 19.403$, $P$ = 0.001), improving the explanatory power from univariate analysis to account for 40% of variance. The multivariate logistic regression models for the $z$-score of technical tests are displayed in Table 5.

****Table 5 near here****

***Skill behaviours***

Within the FDP, there was a significant difference between higher- and lower-potentials for reliability in possession ($P$ = 0.009), pass completion ($P$ < 0.001), and average touches ($P$ = 0.030). Within the YDP, there was a significant difference between higher- and lower-potentials for reliability in possession percentage ($P$ = 0.027), dribble completion percentage ($P$ = 0.001), and average total touches ($P$ < 0.001). The descriptive statistics of $z$-scores, $t$-tests, and non-standardised mean results for all skill behaviours are displayed in Table 3.

The binary logistic regression of univariate factors from the skill behaviours within the FDP showed significant associations between reliability in possession percentage, pass completion percentage, and average total touches with higher-potentials, returning Cox and Snell $R^2$ of 0.246, 0.405, and 0.206 respectively. Within the YDP, the univariate regressions of dribble completion percentage and average total touches showed significant associations with higher-potentials, returning Cox and Snell $R^2$ of 0.274 and 0.409, respectively. The univariate logistic regression of $z$-scores for skill behaviours are displayed in Table 6.

****Table 6 near here****

Further multivariate regression analysis was conducted to examine the relationship between the higher-potentials and the series of skill behaviours within the FDP. Correlation analysis showed some collinearity between the skill behaviours, thus those with a significant Pearson correlation coefficient of greater than 0.5 with one or more variables were excluded from the model. As a result, only reliability in possession percentage, average blocks, dribble completion percentage, and average total touches were included in the model. Multivariate logistic regression showed a significant association of technical tests with higher-potentials ($\chi^2(4) = 12.475$, $P = 0.014$). The explanatory power of the skill behaviours multivariate model improved upon the all univariate models, with the exception of pass completion percentage, and accounts for 38.1% of variance. The multivariate logistic regression model for the $z$-scores of skill behaviours are displayed in Table 7. Relationships between the individual skill behaviours within the YDP showed high collinearity, thus multivariate regression analysis was not conducted due to bias introduced upon variable selection and to keep variables independent of one another (Myers, 1990).

****Table 7 near here****

## Discussion

This observational case study within a professional football academy presented the opportunity to recognise technical factors that are associated with greater perceived development from an age-specific perspective. Key findings in the FDP identified higher-potentials had significantly greater lob pass ability, alongside reliability in possession percentage, pass completion percentage, and average total touches, compared to lower-potentials. Within the YDP, higher-potentials had significantly greater lob pass, slalom dribble, shooting accuracy, and ball juggling abilities, alongside reliability in possession percentage, dibble completion percentage, and average total touches, compared to lower-potentials.

With regards to the technical testing within the FDP, the lob pass characterised the single technical test that distinguished the groups, accounting for 54% of variance in the univariate regression model. Perhaps due to the physical capabilities required for striking the ball a relatively long distance for FDP players, a combination of technical proficiency and physical abilities may partially explain why higher-potentials achieved greater scores on the lob pass (Nicolai, Cattuzzo, Henrique, & Stodden, 2016). When compared to the FDP, the technical tests were collectively a better discriminator of the groups in the YDP; although they only accounted for a moderate variance in the model for all variables, multivariate analysis did account for 21% of the between group variance. Consequently, this highlights technical competency as an influential factor when discriminating talented football players within this developmental context.

These results are comparable to those of Vaeyens et al. (2006) who, with the exception of under-12's, studied the same age groups that are analysed in the YDP in this current study. Since this current study incorporated the same battery of tests as Vaeyens and colleagues (2006), it provides further evidence of the discriminative function of these particular technical tests in youth football players. Similarly, the current findings also support those of Keller et al. (2016), who found that their passing tests, shooting accuracy test, and dribble speed test distinguished better performance in their YDP groups. Together, these studies offer a range of literature to suggest that technical tests may prove useful in identifying and developing youth football players within the YDP. Further, with technical ability important for the future career progression of youth football players (Barnes et al., 2014), these tests offer the option for academies to highlight specific technical abilities as key developmental indicators as part of their talent development process (Hoare & Warr, 2000; Rosch, Hodgson, Peterson, Graf-Baumann, Junge, Chomiak, & Dvorak, 2000; Vanderfold, Meyers, Skelly, Stewart, & Hamilton, 2004).

The age-specific discrepancies in the technical testing results are likely explained by the rate at which technical ability improves with age amongst youth football players. For instance, it has been suggested that the greatest improvements are shown to occur in pre-pubertal years, after which technical skills are gradually developed towards adulthood (Huijgen et al., 2010; Valente-dos-Santos et al., 2014; 2012; Wilson et al., 2016). Furthermore, with a greater discriminatory functions evident within the YDP, the results also partially support previous studies that have revealed growth and maturation status to be associated with technical skill development (Malina et al., 2005; 2007; Valente-dos-Santos et al., 2014). In the context of this current study, as an example, greater slalom dribble speed may be partially a result of enhanced growth and maturation status that subsequently allows more mature players to run faster with the ball (see Kelly & Williams, 2020). Therefore, it may be important to highlight the discriminating technical factors among youth football players that may vary with the timing and tempo of growth, consequently adding to the dynamic talent development process (Kelly, Wilson, & Williams 2018).

The outcome of a player's reliability in possession is based on the combined execution of a technical action (i.e., pass or dribble) and a tactical decision (i.e., anticipation and awareness). The ability to maintain possession, particularly under pressure, is an important skill in senior professional football (Gomez et al., 2018; Liu et al., 2016; Yang et al., 2018). Thus, the current findings show that being able to maintain the ball effectively (reliability in possession) is also important from a talent development perspective. Likewise, it is proposed that pass completion is a combination of technical execution and cognitive function. For instance, a player requires the ability to execute a pass technically well (i.e., with the correct weight and angle), but also to select the correct option (i.e., decision-making and positioning). Rampinini and colleagues (2009) also demonstrated players from more successful senior professional football teams generally possess a higher pass completion rate compared to their less successful counterparts during competitive match-play. As a result, the feature of possessing superior pass completion appears to be a significant characteristic for early talent development.

Within both the FDP and YDP, higher-potentials also possessed a greater number of touches on the ball compared to their lower-potential counterparts. This may be due to a self-fulfilling prophecy, whereby the better players play in positions where they receive the ball more often; and as such, gain more technical development opportunities during competitive match-play compared to lower-potentials. This finding supports the application of Fenoglio (2004a; 2004b) and Thomas and Wilson's (2015) research, which reveals reducing player numbers during competitive match-play in youth sport during childhood increases technical outcomes. If players get more touches on the ball to try new skill behaviours, this provides more opportunities to develop technical capabilities (Katis & Kellis, 2009). Therefore, it is recommended that low player numbers (such as 4 vs. 4 to 6 vs. 6 formats) are utilised within the FDP, to increase individual touches on the ball and subsequently technical development opportunities for all.

Interestingly, average tackles completed, average blocks achieved, and average loose balls retrieved revealed no significant difference when comparing higher- and lower-potentials in either the FDP or YDP. These 'out of possession' factors do not require control of the ball and may therefore be easier to execute or more cognitive in nature. These findings concur with Gomez and colleagues (2018), who highlighted superior 'in possession' factors (ball possession and ending actions) and a lower ‘out of possession’ factors (individual challenges) were associated with a higher league ranking. Consequently, observing skill behaviours in possession may provide greater reliability from a talent development perspective in youth football; although position-specific requirements may also need to be considered.

***Limitations and future directions***

It is important to recognise that observational case studies contain methodological limitations, such as limited access to participants, who are often difficult to recruit (particularly for technical observation), and low external validity (Morgan, Pullon, Macdonald, McKinlay, & Gray, 2017). To address the former limitation, it is important to recognise the researchers obtained the accessibility to a large enough group of professional football academy players. In addition, statistical analyses procedures were applied to reduce potential bias introduced to both the data and models. Thus, this research does not only provide a novel illustration of technical attributes within the talent development process, it also offers a useful benchmarking tool for other football academies. For the latter limitation of external validity, the cultural and social dynamics in the English football talent pathways must be considered, since the technical abilities of these Category 3 players may be different to youth football players in other regions, countries, or categories. Thus, comparisons based on playing level, location, and category status must be made with care.

Regarding the limitations of the measures applied, it may be argued technical tests disregard the technical ability from an ecological perspective. For instance, these tests ignore the physical and mental implications during the latter stages of a competitive game (Reilly, 1997; Russell, Benton, & Kingsley, 2010), whilst also applying an environment that differs to the one that is applied to actual match-play. Nevertheless, the incorporation of a battery of tests alongside match analysis statistics provides a dynamic context, thus supporting a greater determination of technical ability. Furthermore, the variable number of matches that were available for match analysis statistics should also be noted; although it is understood that this is representative of the dynamic nature of academy development. Additionally, these statistics may also provide as useful benchmarking figures for clubs, coaches, and players alike.

Future research may offer further investigation into the technical ability and skill behaviour of youth football players, while applying characteristics from other significant talent development variables (i.e., physical performance and psychological characteristics). Consequently, this will offer the novelty of a multidimensional approach required for contemporary talent development literature, while gaining a complete impression of the talent development process (Collins, MacNamara, & Cruickshank, 2018). Furthermore, collecting these variables from a longitudinal perspective will also offer suggestions regarding what technical abilities and skill behaviours are associated with individuals who achieve professional status and those who do not. Additionally, the coaching process surrounding how these technical qualities are developed, from an age-specific context, also requires further investigation.

**Conclusion**

These results provide important insights on understanding the age-specific technical abilities that are associated with coach development rankings. First, the results suggest football-specific technical tests may provide discriminative tools to support the talent development process from an age-specific perspective. Second, 'in possession' skill behaviours, alongside gaining more touches on the ball during competitive match-play, may support greater perceived development. Third, these descriptive variables offer a useful benchmarking tool for practitioners to consider for developmental purposes. In summary, a combination of technical tests and match analysis statistics provides a broader objective context, thus offering a greater determination of technical ability. Thus, through coaches and practitioners supporting these technical developmental outcomes during childhood and adolescence, youth football players may possess greater developmental opportunities towards senior expertise.

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## Disclosure statement

The authors declare that they have no conflict of interest.

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