Identification and assessment of perceptual-cognitive skills in academy soccer

Abstract

Perceptual-cognitive skills (PCS) are a fundamental component of high performance in professional soccer, and thus youth academy players must develop these skills from a young age. Consequently, it is important that stakeholders involved in talent identification and development processes (i.e., coaches and scouts) can identify and assess these skills to inform identification, (de)selection and development processes. However, little is known about the identification and assessment process of PCS by these stakeholders. The aim of this study was to critically examine how coaches working in professional soccer academies in the UK identify and assess PCS. Semi-structured interviews were conducted with 20 academy coaches working in category one to three academies in the UK. Reflexive thematic analysis generated five higher-order themes: (1) education, knowledge and understanding; (2) experience; (3) challenges; (4) club-specific context; and (5) biases; along with various secondary and tertiary themes. Findings highlighted inconsistencies and a lack of standardised methodologies for identifying and assessing PCS in talent development environments. Participants' understanding of PCS was shaped by informal learning and limited education in this area. Future research should, therefore, consider developing assessment tools and frameworks that can support coaches with the identification and assessment of PCS.

Keywords: expert performance; multidisciplinary coaching; scouting; game intelligence

Introduction

The primary aim of youth soccer academies is to identify and develop players capable of transitioning to senior teams and contributing to future club successes (Relvas et al., 2010). As the world's most popular and financially lucrative sport, soccer clubs face considerable pressure to optimise their talent identification (TID) and development (TDE) systems. TID involves identifying players participating in the sport who have the potential to progress into a high-performance development programme (Williams et al., 2020). TDE consists of a relatively systematic combination of coaching, support, training, and match-play designed to progress identified players (Williams et al., 2020). Together, these systems aim to identify players with the right attributes and support their development to reach their perceived future potential and successfully transition to senior teams.

Substantial investment in youth academies has increased the importance and pressure associated with effective TID and TDE. Misjudging a player's potential, either by overestimating or overlooking it, can have significant consequences. For players, this may include psychological impacts following deselection (Ivarsson et al., 2015; Johansson & Fahlén, 2017). For clubs, poor decisions can cascade to poor first-team performances and league positioning (Johnston et al., 2018; Larkin & Reeves, 2018). Equally, effective TID and TDE offer substantial financial and competitive advantages. To support professional soccer clubs' TID and TDE processes, researchers have examined potential predictors of future expert performance in adulthood, including physical (e.g., speed; Datson et al., 2020), skill (i.e., technical; Höner et al., 2019), sociological (e.g., practice; Ford & Williams, 2012), psychological (e.g., grit; Larkin et al., 2023), and chance-related (i.e., socioeconomic status; Kelly et al., 2024) domains (for a review, see Williams et al., 2020). Due to the complex and multifaceted nature of TID in soccer, coaches and scouts often rely on subjective evaluations based on intuition and experience to make identification and (de)selection decisions about a player's potential, typically based on current performance observed in practice or games (Baker et al., 2018; Bergkamp et al., 2019). However, the need remains for a combination of subjective expertise and objective data to enhance decision-making in talent processes (Barraclough et al., 2022; Larkin & Reeves, 2018).

The dynamic nature of professional soccer requires players to have advanced perceptual-cognitive skills (PCS; Aksum et al., 2021; Jordet et al., 2020; Roca et al., 2013), alongside advanced

47 motor (i.e., technical) skills. PCS are the ability to acquire and integrate environmental information
48 with existing knowledge to select and execute goal-directed actions (Marteniuk, 1976). Research under
49 the expert performance approach has highlighted PCS as a key differentiator between higher- and lower-
50 performing athletes (Roca et al., 2011, 2013; Scharfen & Memmert, 2019). Players' anticipation and
51 decision-making rely on effective visual search strategies and memory representations to process task-
52 specific information (Roca et al., 2011; Ward & Williams, 2003). High-skilled players can therefore
53 integrate different perceptual-cognitive mechanisms seamlessly during performance (Roca et al., 2018).
54 Consequently, understanding how skilled players 'read the game' is important in TID and TDE contexts
55 to improve identification, (de)selection, and development strategies (O'Connor et al., 2016).
56 Practitioners must recognise how PCS influence player actions and develop strategies to identify and
57 assess these skills to better evaluate current abilities and predict future potential (Jordet et al., 2020;
58 Larkin & Reeves, 2018).

59 Key stakeholders (e.g., coaches/scouts) have shown an understanding of PCS to predict future
60 performance, with attributes such as decision-making and 'game sense' increasingly recognised as
61 highly important (Roberts et al., 2019). PCS are particularly valued in relation to positional demands;
62 for instance, decision-making is often highlighted as a crucial attribute for midfielders (Bergkamp et
63 al., 2022; Christensen, 2009; Reeves et al., 2019). However, ambiguities persist in stakeholders'
64 definitions of PCS (Leso et al., 2017; O'Connor et al., 2018a). Coaches with advanced qualifications
65 view visual exploratory activity (VEA; movements of the head and body that involve looking away
66 from the ball to guide the prospective control of future actions; Eldridge et al., 2023) as critical for
67 performance and advocate for its early development, though technical skill mastery often precedes its
68 integration (Eldridge et al., 2023; Pulling et al., 2018). Coaches report evaluating VEA through player
69 behaviour, such as decision-making quality and speed of technical action, though reported VEA
70 engagement was limited due to barriers like inadequate knowledge and resources (Pulling et al., 2018).
71 This highlights a gap in the integration of PCS within TDE environments.

72 While PCS perceptions have been studied (Bergkamp et al., 2022; Eldridge et al., 2023; Fuhre
73 et al., 2022), little is known about how coaches explicitly identify and assess these skills in practice
74 (O'Connor et al., 2018a). Academy (i.e., skilled) players typically demonstrate superior PCS (e.g.,

decision-making, anticipation, memory recall), compared to less-skilled players that do not progress, (Roca et al., 2012; Ward & Williams, 2003), and coach ratings of 'high potential' players in academy environments have been associated with superior decision-making scores on film-based situation tests (Kelly et al., 2021), reinforcing the value of PCS within TDE programmes. Given the emphasis on developing high-skilled performers, it can be suggested that coaches must be equipped to identify and assess PCS effectively to better understand their perceived relationship with future performance. The reliance on the 'coach's eye' (i.e., intuitive judgment based on experience) risks inconsistency and lacks the objectivity needed for robust PCS assessment (Christensen, 2009; Roberts et al., 2021). Research examining whether coaches use evidence-based criteria or rely primarily on subjective assessments is limited (Johansson & Fahlén, 2017; Miller et al., 2015). This study aims to address this gap by examining how professional academy coaches in the United Kingdom (UK) identify and assess PCS.

Method

Sample

This study employed purposive sampling to ensure alignment between the research question and the targeted population capable of providing relevant insights (Campbell et al., 2020). Participants were required to be actively coaching players aged 8-21 in either a full- or part-time capacity at a category one to three academy. This age range was selected to align with the Elite Player Performance Plan (EPPP) development phases: the Foundation Phase (FP, 8-11 years), the Youth Development Phase (YDP, 12-16 years), and the Professional Development Phase (PDP, 17-21 years). Including coaches across these phases provided a comprehensive perspective on how PCS are identified and assessed throughout the academy pathway. No additional inclusion criteria, such as years of coaching experience or specific age groups coached, were applied, as academy coaches typically work across various age groups and developmental stages. To maintain focus on direct coaching roles, individuals in related positions, such as heads of academies, were excluded due to their limited involvement in daily coaching activities. Category four academies were also excluded due to their limited representation within academy soccer. Participants were recruited through the lead author's professional network, using direct communication via email, direct messaging, and LinkedIn, where relevant industry professionals are

actively engaged (McRobert et al., 2018). A total of 20 coaches participated in the study, all were male as only male coaches responded to the interview invitations. Coaches had an average of 15 years of coaching experience and 10 years at the academy level. Among participants 5% held a UEFA Pro License (Level 5), 50% held a UEFA A License or Advanced Youth Award (Level 4), and 35% were UEFA B License qualified with 10% in the process of attaining. All coaches with a UEFA B License were working towards the Advanced Youth Award (Table 1). Ethical approval was granted by the university ethics committee 4 August 2023 (Ref: 23/SPS/046).

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Table 1. Participant characteristics.

Characteristic			**M (±)**
Age (years)			33.8 (7.9)
Coaching Experience (years)			15.4 (6.2)
Academy Experience (years)			9.7 (6.3)
			n (%)
Highest Coaching Qualification/s	*UEFA Pro (Level 5)*		1 (5%)
	UEFA A (Level 4)		9 (45%)
	FA Advanced Youth Award (Level 4)		3 (15%)
	UEFA B (Level 3)		7 (35%)
	UEFA C (Level 2)		2 (10%)
Academy Status	*Category 1*		7 (35%)
	Category 2		3 (15%)
	Category 3		10 (50%)
Age Group Coached	*U9*		5 (25%)
	U10	***Foundation Phase (50%)***	1 (5%)
	U11		3 (15%)
	U12		1 (5%)
	U13		2 (10%)
	U14	***Youth Development Phase (45%)***	2 (10%)
	U15		2 (10%)
	U16		3 (15%)
	U18	***Professional Development Phase (5%)***	1 (5%)

[1]Some participants hold multiple level 4 qualifications (A-License and Advanced Youth Award), meaning the total percentage exceeds 100%.

Interview guide

An interview guide was developed using an inductive approach, drawing on key PCS examined in soccer (e.g., Aksum et al., 2021; Roca et al., 2013; Vaeyens et al., 2007), stakeholder perceptions of

future performance attributes (e.g., Larkin & O'Connor, 2017; Roberts et al., 2019), approaches to player attribute assessments (e.g., Bergkamp et al., 2022; Christensen et al., 2009), and methodological challenges in assessing PCS (e.g., van Maarseveen et al., 2018). Additionally, deductive input was incorporated to address study-specific issues, ensuring alignment with the research aims (Kallio et al., 2016). The guide was reviewed by two authors and piloted with a UEFA A-licensed academy manager with over fifteen years of coaching experience. Data from the pilot interview were excluded from the final analysis. Following the pilot interview, questions were reworded for clarity, repositioned for coherence, and reviewed with the pilot participant (Majid et al., 2017). The final guide comprised eight themes designed to capture coaches' experiences while allowing flexibility to explore additional issues raised during the semi-structured interviews (Adeoye-Olatunde & Olenik, 2021). The interview guide aimed to access insights on: (1) coaches identification and assessment strategies of PCS (Larkin & O'Connor, 2017; Lund & Söderström, 2017); (2) differentiation approaches to PCS expertise (Musculus & Lobinger, 2018); (3) prioritisation of PCS identification (Christensen, 2009; O'Connor et al., 2017; Roberts et al., 2019); (4) frequency of PCS identification (Thelwell et al., 2006); (5) confidence identifying and assessing PCS (Bergkamp et al., 2022); (6) challenges identifying and assessing PCS (Fuhre et al., 2022); (7) influences on knowledge/skills surrounding PCS identification/assessment (Fuhre et al., 2022; Stodter & Cushion, 2017); and (8) future support and the work of academies in PCS identification (Kelly et al., 2020). To illustrate, a key question posed to participants was: '*Within your coaching, whether in training or games, are you able to identify your players' perceptual-cognitive skills*?'. Follow-up prompts were used to encourage further elaboration, such as: '*What specific methods or strategies do you employ to identify these skills*?'.

Data collection

Participant information sheets and consent forms were distributed two weeks before the interviews, allowing coaches time to consider the study's purpose and requirements (Bolderston, 2012). Upon receiving signed consent, interviews were scheduled at the coaches' convenience, with 6 conducted in person and 14 virtually. In-person interviews took place in private meeting rooms at the coaches' workplaces and were audio-recorded using the Voice Memos application on an Apple iPad (Apple Inc.,

USA), then transcribed verbatim. Virtual interviews were conducted via Microsoft Teams (Microsoft, USA), with automatic transcription and a secondary audio backup using the same method. Interviews began with icebreakers to build rapport, focusing on the coaches' backgrounds and soccer experiences (Fujii, 2017). To facilitate a shared understanding and ensure consistency in interpretation, definitions of PCS (e.g., anticipation, decision-making) were displayed on a screen. This approach helped standardise terminology, minimise ambiguity, and prompt coaches' reflections based on a common reference point, allowing for a more structured yet open discussion (see **Table 2**). While this framing introduced potential bias, it mitigated the risk of coaches narrowing the discussion to a limited subset of PCS, as informed by the research team's industry experience. Interviews lasted an average duration of 37 ± 7 mins, with the shortest interview 28 mins and the longest 49 mins.

Table 2. Definitions provided to participants throughout the interview process.

Skill	Definition	Adapted from
Scanning	Scanning is an active head movement, where a player briefly redirects their vision away from the ball to gather information and assess the surrounding game environment. It helps players maintain awareness of the field and make informed decisions.	Jordet et al., 2020
Gaze Strategies	Gaze strategies refer to the way players use their visual attention and eye movements to gather information and make decisions on the field. It involves directing focus to specific areas and objects, as well as the timing and sequence of gaze shifts.	Button et al., 2011
Anticipation	Anticipation refers to the ability to predict the actions and movements of teammates, opponents, and the ball. It involves reading the game and making proactive decisions based on expectations.	Williams & Jackson, 2019
Decision-making	Decision-making involves the ability to analyse information, assess various options, and select the most appropriate action in a given situation.	Memmert & Roca, 2019
Pattern Recall	Pattern recall refers to a player's ability to recognise and remember recurring patterns or sequences of play on the field. It involves quickly recalling previously observed patterns and making informed decisions based on that knowledge.	van Maarseveen et al., 2015
Creativity	Creativity in soccer involves the ability to generate novel and innovative solutions or actions in challenging and unpredictable situations. It encompasses thinking outside the box and finding unique ways to solve problems on the field.	Roca et al., 2021

Data analysis

Interview transcripts were cleaned and checked for accuracy in Microsoft Word, whereby transcripts were read whilst audio recordings played. Any errors in the transcription outputs were corrected before being analysed. Transcripts were uploaded to NVivo (v1.7.1, QSR International, USA), with coaches anonymised using numeric identifiers (e.g., C1 = Coach 1). Data were subject to reflexive thematic analysis due to its alignment with the study's interpretivist stance and its emphasis on the researcher's active role in meaning-making (Braun et al., 2023). Reflexivity was central throughout the research process, acknowledging that the researcher's background as an academy coach and coach educator shaped both the design and interpretation of the study (Braun et al., 2023). Analysis followed a six-step process: familiarisation, coding, theme generation, review, definition, and reporting (Braun & Clarke, 2006, 2019). Familiarisation involved repeated reading of the transcripts to immerse the research team in the data, noting initial observations and potential patterns. During coding, a combined deductive-inductive approach was adopted. The deductive approach was informed by existing literature on PCS, ensuring predefined concepts such as scanning, anticipation, and decision-making were considered. Concurrently, an inductive approach allowed novel themes to emerge directly from the data, capturing the lived experiences of coaches without being constrained by prior frameworks. This process resulted in 33 initial codes, each representing meaningful data segments relevant to the study aims. In the theme generation stage, coded data were grouped based on conceptual similarities, forming preliminary themes that reflected broader patterns within the dataset. MindNode was used at this stage to analyse the links between content and context provided by the coaches to identify what themes could be constructed (or lack of) (Braun & Clarke, 2006, 2019). MindNode facilitated this process by enabling the visual organisation of data through its mind-mapping capabilities, allowing for clear linkage of concepts discussed by participants while maintaining structure and coherence in the analysis. In the review phase, themes were iteratively refined through discussions among the research team, ensuring coherence and distinctiveness between themes while evaluating the depth of supporting data (Braun et al., 2017). During coding and theme refinement, the lead researcher critically engaged with the data by questioning personal interpretations, discussing alternative readings with research team members, and revisiting transcripts to explore disconfirming evidence (Braun et al., 2023). This reflexive stance supported transparency and depth in the analytic process and allowed for a richer, more nuanced account

of coaches' interpretations and practices around PCS. The definition phase involved naming and clearly delineating the scope of each theme, ensuring they accurately captured the underlying patterns in the data. Finally, in the reporting stage, five higher-order, seven secondary, and four tertiary themes were finalised for presentation, with illustrative quotations selected to enhance transparency and credibility. This structured six-step approach provided flexibility while leveraging the research team's subjectivity to derive a nuanced understanding of the coaches' contexts (Braun & Clarke, 2021, 2022).

To ensure methodological rigor, several strategies were employed throughout the research process. First, reflexivity was maintained through regular discussions among the research team to critically evaluate coding decisions, theme development, and potential biases (Smith & McGannon, 2018). Additionally, credibility was strengthened by engaging in peer debriefing, where two members of the research team independently reviewed codes and themes to challenge interpretations and refine the thematic framework (Braun & Clarke, 2019; Nowell et al., 2017). While formal member reflections were not conducted, the iterative nature of the interview process allowed participants to elaborate on and clarify their perspectives, contributing to a deeper understanding of the data. Furthermore, direct participant quotations to enhance the trustworthiness of findings (Tracy, 2010).

Results and discussion

The present study utilised interview data to critically examine how coaches working in professional soccer academies approach the identification and assessment of PCS within TDE environments. Reflexive thematic analysis revealed five higher order themes: (1) education, knowledge and understanding; (2) experience; (3) challenges; (4) club-specific context; and (5) biases; as well as a variety of secondary and tertiary themes (see **Figure 1**).

Insert **Figure 1** around here

Data indicated that coaches identified PCS as important features within a player's development. However, coaches highlighted that PCS are a complex attribute to identify, interpret, and assess with a variety of context-specific challenges (see Table 3). Accordingly, there was no clear theme that could

be generated as to how coaches identify and assess PCS. Therefore, to be able to understand how coaches can advance their knowledge and applied practice related to PCS, it is important to understand '*how*' and '*why*' coaches exhibit particular behaviours (Andrew et al., 2021; Partington & Cushion, 2013; Potrac et al., 2007). This study offered a unique insight as to the complexities of identifying and assessing PCS, and potentially how (within a multidimensional approach) practitioners and researchers might advance this area of TID and TDE within soccer.

Experience

Individual experience was a frequently discussed idea that influenced how coaches approached the identification and assessment of PCS. Indeed, coach development has, traditionally, followed a 'do as I do' approach; emphasising observation and emulation of other (more experienced) coaches, potentially creating a "science to application gap" (Andrew et al., 2021; Cushion et al., 2003; Ford et al., 2010; Hendry et al., 2015; Williams & Hodges, 2005, 2023). Data were consistent with these notions, as coaches seemed to have developed their knowledge of PCS through peer-discussion during breaks, over lunch, or whilst supporting other coaches' during training sessions and/or games. These moments, combined with their own experiences, intuition, and reflection, appeared to underpin coaches' knowledge and approaches to identifying and assessing PCS. Consequently, there was notable variety, and a lack of consensus, as to what this encompassed for individuals (O'Connor et al., 2018a).

> "*It's just an assumed knowledge that when you do the badges and you do the qualifications and you get your observations, you spend time with the game… it's skills that you pick up. It's not anything I've ever actively been taught well just through myself, my own learning, reading or just time in the game*" (C7).

Coaches appeared to have used these informal experiences as support, aiding their construction of knowledge regarding PCS. This included understanding what they mean, their significance in players' skillsets, and how they incorporated the identification of these skills within their coaching practice activities, potentially creating alignment issues in TDE environments (Barraclough, J. et al., 2024).

There are arguments in support of experiential knowledge and informal education (Walker et al., 2018), as well as coaches expressing ideas/knowledge that are consistent with the skill acquisition literature (Greenwood et al., 2012). However, they often lead to practice activities that are sub-optimal for developing PCS (Andrew et al., 2021; Ford et al., 2010) such as repetition of isolated skills with limited or no opposition, and do not provide many opportunities for players to acquire processes that support the development of planning, selection, and execution of appropriate goal-directed actions (O'Connor et al., 2018b). Whilst there is evidence that practice activities and behaviours can be modulated via co-produced workshops (Andrew et al., 2021, 2024; Eather et al., 2021; Jones et al., 2023), experiential knowledge can become engrained and difficult to change (Cushion et al., 2003, 2022). As a result, there is a need for re-alignment of what PCS are and how they could be assessed; with a view of how to develop them more effectively (Cushion et al., 2003).

"It was sort of cup of tea's and I like that player because, it wasn't a, it was never a PowerPoint, these are the things that we're after. It's been in the brew room and listening to him talk and sort of going, he keeps talking about this scanning being on the half turn. So start you start looking for it a little bit more" (C18).

The range in coaches experiences (years coaching and/or qualification level) may be a factor contributing to the varying approaches towards the identification and assessment of PCS. Coaching experience and qualifications have been shown to support a more positive attitude towards VEA training in players, but with coaches only occasionally focusing on developing these skills (Eldridge et al., 2023; Pulling et al., 2018). If coaches are only infrequently incorporating VEA development, it could be suggested that they are not identifying these skills frequently either. This supports the lack of agreement regarding how to identify and assess PCS. It has been highlighted that coaching experience might influence the accuracy of judgements made on players, aligning with objective measurements (Costa et al., 2018). The coaches' experiences in this study ranged from UEFA Pro License and over 20 years coaching to those working towards the UEFA B License and with 5 years coaching experience. However, the quality of coaches' experiences related to PCS can be debated. Time spent on the grass

compared with coaches who access additional education experiences such as related undergraduate degrees may influence coaches approaches to identifying and assessing PCS (Stonebridge & Cushion, 2018). As PCS are a complex area of player development where an appreciation of the dynamic interactions and complexities of perceptual-cognitive functioning is required by coaches to support applied practices (Roca et al., 2013). Therefore, it is likely that experience alone (years coaching) may not be sufficient to support coaches with the identification and assessment of PCS.

> *"... I think that comes down to experience. It's interesting when you, cause the game is so full of, so, so complex, so fast, and so full of opinions. I find it interesting talking to people of various experiences, you'll all watch the same player in the same game, and get you know what I think sometimes where's that come from? Like I haven't. I haven't seen it like that"* (C6).

Coaches' own PCS, shaped by their prior playing and coaching experiences, may influence how they identify and assess PCS in players. Previous studies in net-sports (e.g., tennis, volleyball) have indicated that coaches with more sport-specific knowledge and experience employ different visual search strategies than less experienced coaches when observing athletes (Costa et al., 2018; Moreno et al., 2002; 2006; Robertson et al., 2018). However, a recent study examining collective team performance and gaze behaviour amongst coaches of varying expertise levels found no significant association between coaching experience and interpretation of technical or actual soccer performance vs. objective data when observing small-sided games (O'Brien-Smith et al., 2024). While coach observational strategies are important for recognising key player actions (Hernández et al., 2006), evidence on its role in PCS identification remains unclear. Coaches in this study suggested that their approaches to identifying and assessing PCS are largely experience-based, with limited structured strategies. This highlights the need for further research into how coaches' observational strategies influence PCS identification and assessment.

Education, knowledge, and understanding

Our data indicated that the lack of alignment between coaches understanding and identification of PCS were strongly linked to formal coach education. For example, the predominant PCS specific support was a < 1 hour presentation by an academic as part of the FA Advanced Youth Award course. The remaining references to coach education was that these skills have been mentioned, but not explicitly reffered to. Most development frameworks predominantly focus on sport-specific knowledge (Lefebvre et al., 2016) yet when asked about formal coach education for PCS, coach 15 stated:

> *"I wouldn't say they've covered it. I'd say they've mentioned it. So, all these words have been mentioned. But have they gone into detail of how to break it down? How to be more specific, like you said? How can I tell you that he's creative? What the what's the numbers? Like what's the accurate data that makes that player creative?"* (C15).

This education opportunity supported engagement with elements of PCS such as VEA, yet there was a lack of focus in the application of this information. The lack of PCS-specific content, time, and emphasis given to this complex area was observable, indicating an important gap in coaches' education and development, which may explain the absence of a clear understanding of, and approaches to, working with such a nuanced area of player development. For example, coach 2 stated:

> *"I've never approached it with a methodology. It's probably an experiential thing that I've developed without necessarily understanding what it is or why it is"* (C2).

Although soccer coaching in England has seen an exponential increase in the volume of educational and continual professional development (CPD) opportunities (Nelson, Potrac & Cushion, 2013; Cassidy, Potrac & McKenzie, 2006), the lack of structured PCS education was reflected in coaches' perceptions of their preparedness to identify and assess these skills. Many felt ill-equipped, noting that while PCS had been briefly mentioned in some qualifications, they were not embedded in coach education in a meaningful way. Several participants highlighted the need for earlier and more explicit integration of PCS into formal coaching frameworks to enhance their ability to develop players effectively. Academies in the UK aim to increase the number and quality of 'homegrown' players

(Allison, 2016). Driven by the implementation of the Elite Player Performance Plan (EPPP) in 2012, one of the fundamental principles of the framework was to develop world leading youth coaches (Premier League, 2011). In turn, higher quality coaching should support the overall aim of developing technically excellent players who are tactically astute and independent decision-makers (Premier League, 2011). Given the role of PCS in high-level performance, their omission as a structured component of coach education is a notable gap (Bergmann et al., 2021). The call for more detailed and earlier introductions to PCS within formal coach education frameworks, as echoed by participants, may prove valuable (Eldridge et al., 2023). However, while more explicit reference to PCS in education might appear beneficial, appropriate additional support around this topic is likely required (Partington & Cushion, 2013). Contextualised experiential learning, guided by coach educators, could help bridge this gap by moving beyond traditional approaches to coach education and toward experimental, evidence-based methods (Andrew et al., 2021; 2024). This would aid coaches in understanding 'how' to identify PCS, rather than relying solely on their own built experiences (Light, 2004; Sherwin et al., 2017).

"But no one ever really took the time to explain to me this is scanning and this is scanning done well, this is scanning done poorly. This is how we develop that. This is how we identify whether it's been done correctly" (C7).

Despite challenges articulating specific methods for identifying and assessing PCS, coaches consistently acknowledged the importance of these skills (Eldridge et al., 2023; Pulling et al., 2018), and expressed enthusiasm for further education and development opportunities in this area (Pulling et al., 2018). The pursuit of further opportunities demonstrates a positive change, as previous post-course development opportunities have been undervalued by coaches (Nash et al., 2017). However, given the lack of consensus between coaches, CPD requests varied. Examples included models and criteria, professional player insights, research-based presentations and how to utilise different technology to complement coaches' subjective judgements (Nicholls & Worsfold, 2016). These varied requests highlight a strong need for customised CPD programmes by clubs based on the needs of the staff,

considering the integration of research, technology, and practical insights, elements that are currently lacking from coaches' development provisions.

> *"Maybe an alignment just of observation. So like I said before that academies can be a melting pot of a thousand different ideas but it's the ones that actually get through that are the most important ones, and that's gotta be the same across everybody. If it's a 9's coach, if it's the 14's, 16's coach, youth team, maybe some sort of observational model that we're going right, this is how we judge the players consistency or quality of the perceptual-cognitive skills"* (C11).

> *"I think maybe like a CPD programme. Erm. That was that was tailored towards these, so understanding them erm in a little bit more depth, you know, giving some more meat around the bones in terms of what they actually look like in the game and then finding out erm, how we as coaches can erm can influence these erm, these skills, how can how can we help develop them in, in, in our players"* (C12).

Challenges identifying and assessing PCS

Coaches frequently stated challenges when considering the identification and assessment of PCS. Challenges included what specific cues to observe, when to assess, and how to gauge proficiency in these skills. Unlike technical or physical skills, PCS are often abstract and context-dependent, making them more difficult to observe reliably in dynamic, in-game environments. Coaches have typically relied on subjective observations, which are prone to biases and inconsistencies in other areas such as physical skill assessment (Bergkamp et al., 2019; Dugdale et al., 2020; Kidman & Hanrahan, 2010). Given that PCS are less tangible and situationally variable, coaches may inadvertently miss key elements, especially as individual understanding and identification approaches varied. The lack of clarity around PCS assessment reflects a broader trend, as similar findings have emerged across different samples (Eldridge et al., 2023; Pulling et al., 2018), reinforcing the need for structured guidance and support to help coaches navigate this complex area. The challenges faced are highlighted by coaches:

"There's scanning… it's like goal setting. Everyone knows the word, but no one knows the detail. So you say scan and players will say scan, but they don't understand really what it is. How to do it, when to do it, and even what they're scanning for it. They just think it means swivel your head… I've I've swivelled my head, therefore I've scanned why am I getting jumped? Why can't I find the space?" (C2).

"…I just think that for players to be aware of and help this, the coaches have gotta understand what it is and if the coaches haven't got an understanding, it's gonna be very hard, you know for coaches to assess them and then and, and develop them really" (C20).

Building on the challenges around 'how', 'what', and 'when' to assess PCS, coaches also highlighted difficulties differentiating between players' PCS levels. Similar to rating players' physical and technical skills, coaches are required to identify a players PCS. Yet, subjective assessments have demonstrated low sensitivity to differentiate between homogenous samples (Dugdale et al., 2020; Romann et al., 2017). These assessments can also be influenced by unconscious biases, such as maturation status, which may unintentionally skew evaluations (Hill et al., 2023). This lack of a standardised approach for assessing PCS resulted in an informal and subjective process where coaches rely on intuition rather than structured criteria. This subjective nature, lack of criteria, and challenge identifying PCS was highlighted by coaches:

"We don't have any any set criteria in terms of assessment. However, from a subjective point of view I think it would be relatively straight forward to rank the players" (C9).

"Nothing. And I sort of I this is me personally, I would sort of I struggle a little bit with that because sometimes I'll think a players not checked or hasn't perhaps made the decision that I I thought they would have made, but then yet the outcome is still… correct or still still the right outcome?" (C12).

Challenges associated with identifying and assessing PCS may be attributed to informal club processes and a lack of specific criteria coaches have at their disposal. There was an agreement amongst coaches that clubs do not provide sufficient support for the formal identification and assessment of PCS. Although significant developments have been made regarding physical testing within TDE environments (Kelly & Williams, 2020; Williams et al., 2020), progress around PCS remains limited. Decisions about resource investment for player development are often made by key club stakeholders (e.g., academy managers and heads of coaching; Barraclough, J. et al., 2024). Thus, influence upon these stakeholders is seemingly required to meaningfully affect and normalise an approach to PCS, similar to the work done in the physical corner. To address these challenges, future practice could involve the development of standardised frameworks and tools for assessing PCS, similar to physical skill testing protocols. For example, introducing a structured observational checklist for coaches to evaluate PCS in real-time during training or matches could help reduce subjectivity and increase consistency in assessments. Additionally, offering coach education programmes focused on understanding and identifying PCS across different ages, development stages and positions could improve coaches' ability to differentiate between players' skill levels. Lastly, enhancing collaboration between those responsible for change implementation (e.g., academy manager) and coaching staff to ensure that resources are allocated towards the development and implementation of structured PCS assessments may help shift the focus towards these skills in a more formalised and systematic manner. Coaches 5 and 12 supported this view, noting a lack of structured support for formal PCS assessment in academy environments:

"*Give you an answer generally from what my knowledge of kind of is not just the academy I work at but in general will be a resounding no*" (C5).

"*No. I wouldn't say we do. I won't say we do anything really, I think. Apart from a coach's opinion on around or a few people's opinions on around if if they're a good player and they make good decisions. Yeah, there's no strategies to it. There's no sort of assessment*" (C12).

Club specific context

Coaches' perceptions of PCS were shaped by club-specific contexts, such as the club's philosophy and values. For instance, while some studies suggest that scanning is a critical skill to develop in younger players (i.e., the foundation phase; Eldridge et al., 2023; Pulling et al., 2018), some coaches did not view it as important for this age group. Conversely, pattern recall was generally regarded as more relevant for older age groups (i.e., youth development and professional development phases). This variation in focus may reflect how a club's philosophy and values influence coaches and subsequently how they engage with PCS identification and assessment. Coach 17 supported the notion of aligning observations with club philosophies stating:

> *"... the player does something, so then we're looking at what was it that he did? Does that fit in with what we'd like him to do as a club in, and in our playing style and our our principles, our philosophy?"* (C17).

Given the informal ways coaches seem to have acquired their knowledge and beliefs about PCS, it is unsurprising that club contexts may have influenced how coaches approach different age groups. For example, EPPP coaches have previously identified club-specific constraints such as the curriculum as a reason for not employing games-based activities which increase the opportunities for PCS acquisition (Andrew et al., 2021). Further analysis of whether these perceptions are impacted by factors such as academy rating (i.e., category one to four) would aid in understanding if any environmental factors impact such perceptions. For instance, coach 4 stated:

> *"I'm trying to figure out how to get a session to flow first, yeah. Yeah, I I imagine a lot of part-time staff and age group staff would be similar with going the they might think they're looking for it, but actually you you look it I've I've given you a topic to coach and if you're not coaching that topic the head of coaching isn't happy"* (C4).

Biases

Coaches biases develop from a combination of their own coaching experiences, the philosophies of their clubs (Partington & Cushion, 2024), the limits of both formal and informal coach education (Nash

& Sproule, 2012), and interactions with tutors, colleagues, and informal mentors (Colley, 2003). This creates coaching biases around factors such as playing style preferences or predictor biases (e.g., advantageous somatotypes and early developers; Cripps et al., 2016). Coaches' biases appeared to influence their engagement with certain PCS, and their methods for identifying and assessing these skills. Though many of these influences are beyond individual control, streamlining relevant information and improving objectivity in assessing PCS may help reduce bias. While PCS assessments are inherently subjective, enhanced education and consistent self-reflection by coaches could further address this issue (Cushion, 2010). As coach 18 stated:

> *"So I know what type of footballer I was. I was a passer. I wasn't running with the ball. I wasn't. I wasn't a dribbler. So. So probably I've had to train myself a little bit to. If somebody goes, receives it and goes on a little dribble and gives it away. In the past I probably would have been a bit harsher on that than if somebody would have tried to play a pass and give it away because I resonate with the pass more than I do with the the dribbler but but also I think it's important that you don't put your limitations as a footballer on others"* (C18).

Practical implications and future directions

This study aimed to examine how academy soccer coaches identify and assess PCS. Findings revealed significant challenges, with coaches predominantly relying on subjective and intuitive judgments, underscoring the need for standardised practices. Subjective assessments driven by "gut feeling" and instinct (Roberts et al., 2019) highlight a gap that could be addressed by implementing standardised criteria and processes such as agreed terminology, position-specific and age-specific PCS benchmarks and agreement in observation approaches (Barraclough, S. et al., 2024). Collaborative efforts between practitioners and researchers could foster the development of reliable measurement tools (Höner et al., 2023) and facilitate shared mental models to enhance alignment in PCS identification and assessment (Barraclough, S. et al., 2024).

While the 'coaches eye' has demonstrated utility in assessing physical and technical-tactical skills (Alcântara et al., 2023; Dugdale et al., 2020; Romann et al., 2017), its application in PCS

assessment remains limited by inconsistent understanding of the domain. A stronger foundation of PCS knowledge among coaches is required to maximise the value of intuitive judgments (Lath et al., 2021). Moving forward, clubs could offer a variety of CPD programmes, grounded in evidence-based approaches and information that equip staff with both declarative (knowledge about PCS) and procedural knowledge (application of PCS knowledge; Dempsey et al., 2024; Stoszkowski et al., 2020; Abraham & Collins, 2011). Furthermore, mixed-methods approaches combining objective, in-situ measures with a refined 'coaches eye' could enhance assessment validity and provide discriminatory power across age groups and playing levels (McCalman et al., 2022; Pulling et al., 2018).

Limitations

The sample in the current study included academy coaches in the UK and thus factors surrounding the TID/TDE ecosystem such as coach education and club philosophies may have impacted coaches understanding and engagement with PCS, which may differ in other soccer nations (Ford et al., 2023). Gathering consensus from additional TID/TDE environments may be of benefit to improve the generalisability of the findings. In addition, coaches were unable to describe their own behaviours with accuracy and showed a reduced self-awareness of their own coaching practices, particularly when the behaviours questioned in this study are likely done without much conscious thought (Knowles et al., 2001; Partington & Cushion, 2013). Alongside interview weaknesses such as social desirability (i.e., presenting onself in a socially favourable manner) and recall bias (i.e., inability to recall events accurately; Horne, 2022), there may be a lack of truth as to how coaches do approach the identification and assessment of PCS, that is if they even do at all. Considering the in-situ cognitions or visual search strategies of coaches related to PCS when viewing competition may help to understand if coaches lead by example.

Conclusion

Our findings, in line with previous studies, highlighted that professional academy coaches value PCS (Christensen, 2009; Larkin & O'Connor, 2017). However, they struggled to articulate clear understanding and methods for assessing these skills, revealing a significant gap in practical knowledge.

For meaningful improvements in practice, coaches must first recognise and critically examine their current methods and the knowledge base informing these approaches (Harvey et al., 2010). Coaches are key decision-makers in TID programmes, thus there is a pressing need for further education and skill development regarding PCS identification and assessment (Roberts et al., 2019). As suggested by the coaches themselves, an important next step is the development of practical tools (e.g., conceptual frameworks, observation criteria) to support the coaches eye (Pulling et al., 2018; Van Maarseveen et al., 2018). This could help bring structure to the currently unstructured approach and alleviate some of the challenges coaches face. The main goal is to blend scientific rigor with the art of applied practice. If achieved, this integration could substantially enhance PCS-related processes within TID and TDE environments.

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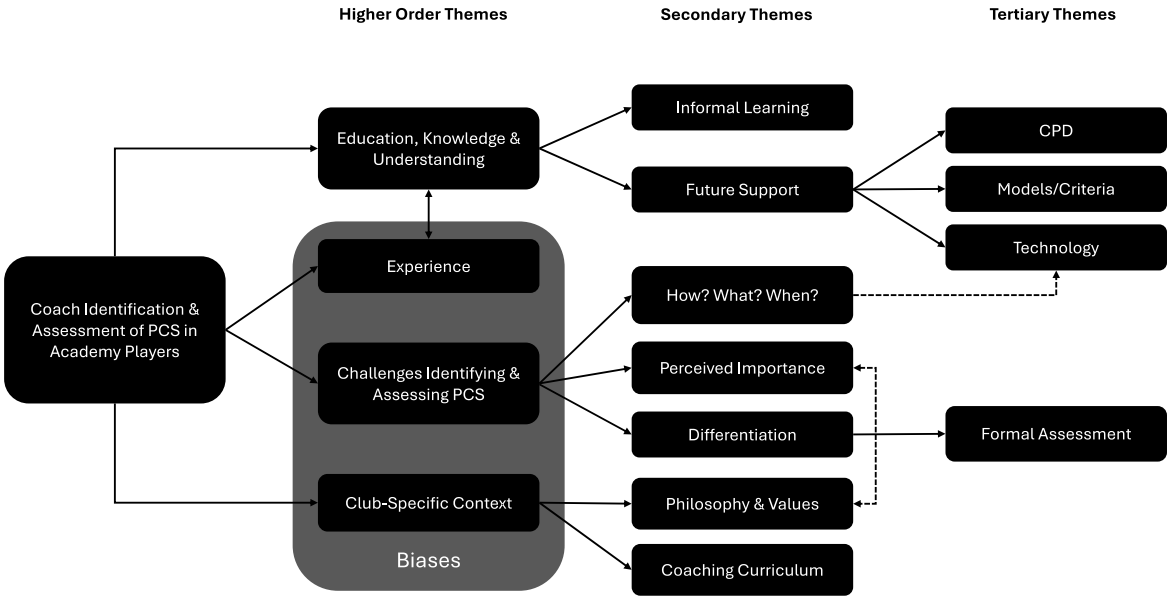

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Appendix

Appendix A – Interview Schedule

Interview Guide: 'Identification of Perceptual-cognitive Expertise in Soccer Academies: Perspectives and Strategies of EPPP Academy Coaches'

Interview Recording Starts

Introduction & Icebreaker (IB)

Greetings

Interviewer: Good afternoon, NAME. Thank you for taking the time to participate in this interview. I appreciate your willingness to share your insights. Before we begin, I'd like to briefly go over some important aspects of this interview.

Purpose and Significance: The purpose of this interview is to delve into your perspectives and strategies as an academy coach when it comes to identifying perceptual-cognitive skills in academy players. Your participation contributes to advancing our understanding of this aspect of talent identification & development. Your insights will help build upon the information you provided in the questionnaire, allowing us to gain a deeper and more comprehensive view.

Confidentiality and Voluntary Participation: Your involvement in this interview is entirely voluntary. Your responses will be treated with the confidentiality, and any personal identifiers will be kept anonymous throughout the study.

Informed Consent & Withdrawal: By participating in this interview, you've already provided implied informed consent based on the information sheet signed and returned to me earlier. However, please feel free to let me know at any point if you have concerns or if you decide to withdraw from the interview. Your choice to participate or not will not affect your rights or services in any way. Please could you confirm that you are still happy to undertake this interview?

Participant Confirmation: Do you have any questions or concerns before we begin? If everything is clear, we can proceed with the interview.

IB1: Before we delve in to the PCS topic could you please share some information about yourself, such as your role within the club, your experience in youth football, and anything else you'd like to highlight?

Thank you for this. Before we shift our focus into the identification of PCS in the players you predominantly work with, I would like to share some definitions of different PCS to familiarise you with the different PCS and prompt your thoughts surrounding different areas throughout. *After interviewer has spoken through, interview to leave the 6 PCS up on the screen for the interviewees reference.*

I will leave these on the screen for your reference. I am now going to ask you some questions focusing specifically on the identification of PCS in the players you predominantly work with.

Research Questions

1. **Main Question:** Within your coaching, whether in training or games, how do you identify and assess your players' perceptual-cognitive skills, if at all?

- ***Probes/Prompts***: Are there any specific methods or strategies you employ to identify these skills?
- ***Probes/Prompts***: How do you differentiate between different levels of perceptual-cognitive skills in your players? Are there any criteria or indicators you utilise?

2. **Main Question:** Are there any specific PCS you look to identify in the players you predominantly work with for any reason?

- ***Probes/Prompts:*** Can you elaborate on how you identify/assess the following components – if at all (e.g., scanning, gaze behaviours, anticipation, decision-making, creativity, and pattern recall)?
  Probes/Prompts: Do you identify these PCS more frequently over others?

3. **Main Question:** What has influenced your confidence when identifying PCS in the players you predominantly work with.

- ***Probes/Prompts:*** Are there any challenges in identifying certain perceptual-cognitive skills?
- ***Probes/Prompts:*** Are there any age-specific challenges or considerations in identifying/evaluating these skills?
- ***Probes/Prompts:*** Are there any position-specific challenges or considerations in identifying/evaluating these skills?

4. **Main Question:** What has informed your identification capabilities, approaches and beliefs of perceptual-cognitive skills in your players?

- ***Probes/Prompts:*** Have previous coaching experiences influenced your approach/abilities to identifying these skills? If so, how?
- ***Probes/Prompts:*** Have previous or current coaching qualifications/coach education courses influenced your approach/abilities to identifying these skills? If so, how?

5. **Main Question:** Do clubs support the identification/assessment of these skills?

6. **Main Question:** What would help you to develop these identification/evaluation skills further?

- ***Probes/Prompts:*** Are there any specific resources, training programs, or support systems that you believe would be beneficial for enhancing your identification skills?

Closing

Interviewer: Thank you NAME for sharing your valuable insights and experiences during this interview. Your contribution is appreciated and will enhance our understanding of perceptual-cognitive skills in academy soccer players.

Participant Questions or Additional Information: Before we conclude, do you have any questions or would you like to add any further information that you believe could be valuable for our study?

Confidentiality and Withdrawal: I'd like to emphasise again that your responses will be handled with the utmost confidentiality, and any personal identifiers will be kept anonymous throughout the study. Remember that you have the right to withdraw your participation at any point without any negative consequences.

Contact Information: If you have any follow-up questions or if you'd like to stay updated about the study's progress, please feel free to reach out. You can contact me through the email address provided in the information sheet.

Thank you once again for your time and contribution. Your insights will make a significant impact on the advancement of our research in talent identification and perceptual-cognitive skills in soccer academies.

Interviewer: That concludes our interview. I will stop the recording now.

Note-taking Section: