From roots to branches: Developing relational, practical, and technical competencies in performance analysis

Item Type	Article (Accepted Version)
UoW Affiliated Authors	Francis, John
Full Citation	Nicholls, S., Groom, R., Francis, John , Parmar, N. and James, N. (2026) From roots to branches: Developing relational, practical, and technical competencies in performance analysis. International Journal of Sports Science & Coaching. pp. 1-22. ISSN 1747-9541 (print) 2048-397X (eISSN) (In Press)
DOI/ISBN/ISSN	1747-9541 (print) 2048-397X (eISSN)
Journal/Publisher	International Journal of Sports Science & Coaching SAGE
Rights/Publisher Set Statement	This Contribution has been accepted for publication in the journal, but has not yet been assigned a DOI. Sage's archiving and sharing policy states that the author may share the Original Submission or Accepted Manuscript at any time after the paper is accepted and in any format [https://www.sagepub.com/journals/permissions/sages-author-archiving-and-re-use-guidelines]
License	Users who receive access to an article through a repository are reminded that the article is protected by copyright and reuse is restricted to non-commercial and no derivative uses. Users may also download and save a local copy of an article accessed in an institutional repository for the user's personal reference. For permission to reuse an article, please follow our Process for requesting permission [https://www.sagepub.com/journals/permissions/process-for-requesting-permission]
Link	https://journals.sagepub.com/home/spo

From Roots to Branches: Developing Relational, Practical, and Technical Competencies in Performance Analysis

Scott B. Nicholls[1]

Ryan Groom[1]

John W. Francis[2]

Nimai Parmar[3]

Nic James[3]

[1] *School of Sport and Exercise Science, University of Derby, Derby, UK*

[2] School of Sport and Exercise Science, *University of Worcester, Worcester, UK*

[3] *Faculty of Science and Technology, Middlesex University, London, UK*

Abstract

Whilst performance analysis is a key component of sport science and coaching practice, the novelty of this research is its focus on the often-overlooked skills and competencies needed to operate effectively within applied environments. The study explored how performance analysts collaborate with coaches and athletes in high performance sport, emphasising the relational, practical and technical competencies that underpin successful practice. Thirty-eight (38) performance analysts (experience 7.2 ± 3.8 years) in the elite UK performance analysis system completed semi-structured interviews (24 questions, lasting 38 ± 12 min), which were analysed using Braun and Clarke (2006) six-step approach. Findings highlighted that effective performance analysis relies on technical expertise, practical skills, and relational competencies. Trust, openness, and credibility were central to collaboration, while technical skills such as data collection, analysis, and tailored feedback ensured outputs were accurate and actionable. Analysts navigated organisational, technological, and resource constraints, with soft skills including adaptability, resilience, and communication critical to overcoming barriers and achieving applied impact. A tree analogy illustrates the main thematic areas ([1] data and video, [2] analysis, [3] feedback, [4] trust and openness, [5] knowledge, [6] culture, and [7] challenges), their sub-components, and the interwoven soft/hard skills underpinning effective daily practice. These findings have clear implications for educational providers and practitioners across all career stages, offering practical guidance to enhance applied practice.

Introduction

Performance analysis in sport has received considerable interest within academic research throughout the past three decades[1-3] and is widely accepted as a key component within the coaching process.[3-4] By systematically observing sports performance and quantifying sporting actions, analysts deliver detailed objective information to ultimately enhance decision-making and feedback processes.[2,5,6] Various journal sub-sections (e.g., Journal of Sports Science), separate standalone journals (e.g., International Journal of Performance Analysis in Sport), and applied positions (see Francis et al.[7]) have emerged to coincide with the rapid rise in demand and value placed upon the area. Academic interest has grown in a similar manner with several main theme areas of interest, including key performance indicators[8], system design, operational definitions, and reliability[9], key determinants of performance, performance profiling and predictive methods[10,11] and the measurement of work-rate profiles.[12] Much of this research has attempted to identify cause-and-effect relationships through reductive quantitative approaches in 'an attempt to understand the functioning of the whole through an analysis of its individual parts'.[13] Such a process is utilised to offer insight into What It Takes To Win (WITTW) within the respective sporting demographic. While this early work established the technical foundations of performance analysis, much less is known regarding the interpersonal and contextual competencies that underpin effective applied practice.

More recently, a body of research has emerged focusing on the use and implementation of performance analysis and feedback within applied sport[5,14-26], unearthing the, what, when, how, and why of applied practice from the perspectives of the coach, performance analyst and/or athlete. The aforementioned research highlights various considerations, including delivery approach (e.g., session length, group, individual), targeted outcome (e.g., development, performance, motivation, reflection), impact of emotions within feedback, time availability, participant centrality (athlete or coach centred approaches), content (e.g., video, data, combination), budget constraints (e.g., external data, software), and coaching philosophy among many others.

Unfortunately, the skills and competencies required to effectively execute the highlighted practical components are often not explicitly defined. Martin et al.[27] supported this notion, suggesting that professional practice in performance analysis is poorly defined, has limited regulation, and that no accepted professional framework had been developed. Positively, Martin et al.[27] addressed the latter of their remarks through the development of a professional framework to support applied practice role framing. The paper depicts a lighthouse analogy whereby the lightbulb represents the creation of knowledge (by the analyst) or the

understanding of knowledge (by stakeholders) when the light is switched on. Martin et al.[27] highlight that performance analysis practice (the lighthouse overall) is underpinned by five areas of expertise or foundations (contextual awareness, building relationships, performance analysis and sporting expertise, technical expertise, and professional behaviours). These foundations are built upon within a loose sequential manner by nine components of applied practice (establishing relationships and defining roles, needs analysis and service planning, system design, data collection and reliability, data management, analysis, reporting to stakeholders, feedback and review, and evaluation). These nine components are represented by the lighthouse's walls and serve to demonstrate the building of information towards the 'lightbulb of knowledge'.

Martin et al.[27] have clearly developed an extremely useful and impactful framework for professional practice; the aspects a practitioner may be required to contribute to and have highlighted the often intangible or untaught components surrounding relationship building and professional behaviours from the existing literature base. As acknowledged by the authors, Martin et al.'s[27] work likely lags current practice by virtue of the academic publication process, particularly given the rapid evolution of technologies, data availability, and analytical methods within elite sport environments. Similarly, the period (2001-2019) utilised within the review approach to develop such a framework does spread over a significant period; therefore, there is potential that the early 2000s research may not be as representative of today's practice. Since that period, the role of the performance analyst has expanded considerably, with increased integration of advanced analytics, automated data capture, real-time decision support, and interdisciplinary collaboration becoming central features of applied provision. These developments suggest that the skills and competencies required of analysts are not static, but continue to evolve alongside technological advancement and changing organisational expectations. As such, frameworks derived from earlier bodies of literature may underrepresent competencies related to data literacy, programming, communication of complex analytical outputs, and the ability to operate within increasingly data-rich, time-pressured environments. That said, we acknowledge and agree that the breadth and depth of research required to build such a framework is considerable by the nature of the task set out. Much of the supporting literature did not specifically aim to unearth the skills and competencies required to be effective as a practitioner within the applied context, *per se*.

Consequently, attention has turned towards understanding the human factors that shape applied practice, with recent work by Nelson et al.[28] providing a detailed exploration of the importance of appearing trustworthy within the performance analysis workplace. The findings

highlighted the (1) need to appear trustworthy to key contextual stakeholders, (2) generative forces that influence the need to appear trustworthy, (3) outcomes associated with being trusted or distrusted, (4) characteristics analysts convey when working with others and (5) situations that require analysts to conceal information to maintain a trustworthy image. Nelson et al.[28] and Huggan et al.[29] further presented that performance analysis courses and education need to develop the soft skills of its future workforce more effectively. The findings on the importance of appearing trustworthy and building credibility align with the growing recognition that relational competence (trust, openness and effective communication) is central to applied success. This perspective resonates with Martin et al.'s[30] conceptualisation of applied performance analysis as a value co-creation process within the performance ecosystem, where embeddedness, relationship management, and contextual intelligence are critical enablers of effective practice. Complementing this, Francis et al.[7] highlight discrepancies between advertised role expectations and the interpersonal competencies required in practice, reinforcing the need for clearer professional standards and training pathways. In combination with the interpersonal and contextual pillars identified by Martin et al.[27], there appears to be a growing need to more comprehensively understand how these qualities are developed and employed within applied practice (i.e., 'the real world').

Whilst a larger variation of specific performance analysis roles now exists (e.g., performance analyst, technical analyst, recruitment analyst, data analyst etc.), there clearly remains the question as to what are the underlying foundational skills and competencies that facilitate practitioner effectiveness within specific performance analysis domains.[20,28,31] As such, an investigation focusing upon explicitly unpicking the skills and competencies required within elite sporting environments appears a useful avenue to begin building upon and complementing the great work of Martin et al.[27] Therefore, the aim of this study was to explore how performance analysts collaborate with coaches and athletes within high performance sport environments, with a focus on identifying the relational, practical and technical competencies required to be successful within the applied environment.

Methods

Research Team and Reflexivity

The research team brought extensive experience in applied performance analysis, academia, education, and professional accreditation. This background informed the design, coding, and interpretation of the data. Throughout the study, the team engaged in reflective discussions to

ensure that findings were considered through multiple professional and theoretical lenses, recognising how prior experience may shape the analysis.

Participants

Thirty-eight (38) performance analysts (experience 7.2 ± 3.8 years) working within the UK performance analysis environment system were recruited via professional networks and sporting organisation attachment. Fifty percent of participant analysts had > 8 years' experience, 28% had 4-8 years, and 22% had < 4 years respectively. Most held a Master of Science (83%) or PhD (11%) in a sports related field. The majority were full-time (92%) with a minority part-time (8%), and roles included Head of Performance Analysis (18%) and Senior/Analyst (82%). Analysts worked across Olympic sports (53%), football (39%), and rugby (8%). The sample included 71% male and 29% female participants. Ethical approval was gained from a university's ethics committee.

Semi-Structured Interview Guide Design

Questions were themed around current research related to performance analysis practice, the role of the analyst, and feedback provision within applied practice.[15,23] The lead researcher generated a list of potential questions from the research sources, which was subsequently condensed and/or reworded to ensure similar questions were not progressed to the review stage.[23] Four applied performance analysis practitioners (experience 5.3 ± 2.5 years) and two academics (active performance analysis researchers) provided feedback from a 'critical friend' perspective on the suitability of the questions and to ensure the study held applied validity and impact. The review focused upon question applicability for various sporting environments, the clarity and wording of each question, as well as the ability for a potential participant to effectively understand what is being asked of them. The final semi-structured interview guide incorporated 24 questions with a primarily open-ended focus to allow participants to provide rich individual reflection upon experience and practice. The semi-structured interview guide included the overarching themes: 1) demographics, 2) practice and delivery, 3) decision making and collaboration, 4) feedback process, 5) tools, knowledge, and skills, 6) relationships, culture and developments and 7) reflection. The interview guide allowed flexibility in question order and enabled the researcher to probe for additional detail, clarification, and illustrative examples where appropriate.

Procedure and Data Analysis

Interviews were completed in a one-to-one format (participant and researcher) lasting 38 ± 12 min and recorded via Microsoft Teams. Each interview was transcribed verbatim within the software, manually checked by the lead researcher and subsequently offered back to the participant to verify their respective response accuracy. The written transcriptions were imported into the qualitative analysis software, QSR Nvivo 13, for exploration and further analyses.

The six-step process proposed by Braun and Clarke[32] was used to conduct an inductive thematic analysis of responses. Following the initial transcription process, the lead author read and re-read each transcript to develop familiarity with the interview content. A reflective diary was created following each transcript read through to record initial impressions and the key similarities/differences in relation to previous transcripts. Secondly, the lead author identified and generated codes across the transcription, drawing out key words or summarising appropriate sections under a relevant code using the NVivo software. All codes were reviewed, cross-compared, and combined where a similar word or synonym was used during the coding process. Thirdly, the first and last authors discussed the codes to collate sub-themes (i.e., collection of related codes), and if appropriate, higher order themes (i.e., collection of related sub-themes). All members of the research group contributed throughout each of the subsequent stages. A meeting (approximately 2 weeks after the third stage) was arranged to discuss, reflect upon, and critically challenge the developed higher order themes, sub-themes and codes, considering the appropriateness of choices made to ensure alignment with participant data. The fourth stage involved reviewing the themes in relation to the raw data to ensure all generated content accurately reflected the participant data, considering questions such as: Are the generated themes really present? What can we change to make our themes more accurately reflect the data? Fifth, the exact meaning of each theme was reached to facilitate clarity and understanding of the findings. The final and sixth stage of the process involved selecting compelling extracts that relate to the appropriate theme and research question. Within this stage, an infographic was created to visualise the identified themes, their meaning, how each of the findings connect, and facilitate reader interpretation and digestion.

Results and Discussion

This study set out to explore how performance analysts collaborate with coaches and athletes within high performance sport environments, aiming to understand the relational and practical dynamics, whilst subsequently identifying the skills and competencies required to succeed within applied practice. Seven interrelated themes were identified through the analysis: trust

and openness, culture, knowledge, data and video, analysis, feedback, and challenges. Hard and soft skills were identified as an eighth, overarching theme that intersected with all others, underpinning effective applied practice. These findings highlight the complexity of applied performance analysis, where technical expertise alone is insufficient without relational and contextual competencies.

Trust and Openness

Trust and openness were central to effective collaboration between practitioners, coaches, and athletes. Participants described these as mutually reinforcing qualities, developed over time through credibility, honesty, and shared goals. "Buy-in" referred to the point at which coaches and athletes valued and supported the practitioner's role. Initial engagement could be challenging: "sometimes they are a lot more reluctant… because there is almost a preconception of… we never used to do this… so why are we doing it now?" Overcoming this required effective communication and presentation: "the biggest differences to whether a coach buys in… is how you present it." Credibility was built through honesty, sport-specific knowledge, and consistent delivery: "to get best buy-in, you have to have a high level of trust… from the coaches and the athletes." Patience was essential: "taking the time to build relationships… gives you the buy-in." These reflections echo research that positions relational competence alongside technical expertise as a core element of applied practice,[25,28,33] extending knowledge surrounding how trust operates dynamically across feedback cycles rather than as a static condition.

An open environment allowed for the free exchange of ideas and acknowledgement of mistakes. Participants valued coaches who were receptive: "they're open to me bringing any experience that I've got." Modelling openness, such as admitting when something was not understood, was seen as earning respect. However, openness was not always embedded in organisational processes. One participant reflected on being excluded from valuable learning spaces: "I'm trying to get into the feedback sessions… I tend to be not involved… which I can never quite understand." Rather than indicating an absence of buy-in, this may reflect varying degrees of buy-in across contexts, where access, trust, and influence are negotiated and relational rather than absolute. This aligns with evidence that team culture requires active cultivation to sustain openness.[34]

Trust and openness were not isolated qualities; they were embedded within broader cultural norms that shaped collaboration: "Occasionally the coach will say, I need this… and occasionally I'll say, you need this… it's just part of the trust we have with each other." Once

established, trust accelerated cooperation: "Once they trust… you're on the home straight." It was built through reliability - "making sure the data is correct… otherwise you'll just lose that relationship straight away" - and reinforced by shared objectives: "we all have this common goal… that extra 1%… to get us a gold medal." These insights reflect established frameworks identifying reliability, competence, and integrity as pillars of trust.[28,35-37] This trust is embedded within broader organisational and team cultures, shaping how performance analysis is received and applied.

Culture

Culture captured the shared norms, values, and ways of working through which coaches, athletes, and performance analysts collaboratively shape the environment for training, competition, and feedback. In this context, culture was understood as an enacted and relational phenomenon, reflected in everyday interactions, decision-making processes, and the distribution of power and access across roles, rather than solely as an abstract organisational ideology or performance outcome. Participants emphasised that culture is both guided by coaches and co-constructed with athletes and analysts. Coaches often set the overarching direction, but athlete and analyst input are integral. One analyst explained, "The head coach has influenced the bulk of it, with the other two assistant coaches having a bit of a tweak and a bit of a spin on some of it." This highlights the hierarchical nature of decision-making within feedback environments, reflecting how authority and influence are culturally situated within coaching structures. While competition feedback remained primarily coach-led, training environments appeared to foster more open and informal interactions, enabling athletes to approach analysts directly: "Training is a lot easier for the athlete to come up and just ask me because I'm sat there with the analysis on my laptop." These accounts suggest that cultural norms regarding accessibility, role boundaries, and power differ across contexts, with training environments permitting more collaborative and dialogic engagement compared to competition settings. Collaboration and negotiation were evident in planning and debriefs: "It's quite balanced…coaches will have an idea, and that's discussed with an athlete and the performance analyst, so we then work together to get the best out of that." This aligns with evidence that effective performance cultures combine clear leadership with active engagement from athletes and support staff.[28,34,38]

Coaching philosophy shaped how the environment was structured and decisions made: "It [coaching philosophy] contributes massively to how the environment works, is set up, and operates." Philosophical alignment across staff establishes consistency, expectations, and

norms, underpinning high-performing environments.[39] Structural factors, such as programme centralisation, facilitated engagement and interaction with one analyst noting, "We're quite fortunate that now we're centralised here, we've got quite a bit of time in the day where we can access the athletes…now I think the majority of the time we don't have conflict." Beyond enabling logistical access, centralisation appeared to support the development of shared norms, expectations, and ways of working through increased day-to-day interaction. Regular informal contact helped analysts and coaches develop a deeper understanding of each other's roles and perspectives, thereby reinforcing a more aligned and collaborative culture. In this way, centralisation supports regular collaboration and enables integration of technical expertise (e.g., performance analysis) into daily practice, whilst reducing the likelihood of disciplinary silos.[26,40]

Knowledge

Knowledge emerged as a supporting theme, spanning practitioner experience, PA-specific skills, and the use of academic research. As noted in the Culture section, analysts often drew on coaches' sport-specific insights and philosophies to guide their work, recognising the centrality of coaching knowledge in decision-making: "The coach has the knowledge of the sport much better than me, he's been around in it".[39,41] Rather than equating experience with knowledge in isolation, participants emphasised the importance of developing applied, sport-specific understanding through experience that complements formal education and technical training. Practitioner experience and sporting knowledge was seen as critical for delivering feedback appropriately: "you can come up with all the analysis in the world but if it is not tailored appropriately during the feedback aspect, they reject it" echoing research on experiential learning in applied sport.[42-44] PA expertise focused on mastering core tools while developing niche skills to stand out. Engagement with literature was limited, largely due to time and access barriers: "I have a folder full of journals I want to read, but there's just not enough time". The view was also held that not all academic research aims to impact applied practice, thus a continual research-practice gap often exists.[13,45-46] Consequently, effective knowledge was understood as an integration of sport-specific understanding, experiential learning, and evidence-based practice, informing both the technical and interpersonal skills required by analysts.

Data and Video

Data and video capture formed the infrastructural foundation of analysis and feedback processes, with analysts emphasising the importance of collecting accurate, reliable, and contextually rich information. Participants described gathering data beyond their own observations, including video from opposition, commercial tracking systems, and analytics providers: "Statsbomb, Wyscout and OPTA…every stat you could possibly want…every angle of whatever you could possibly want." Third-party providers are often cited as key sources supporting workflows and analysis depth, thus ensuring competence within these appears a key developmental skillset for aspiring analysts[15,23,26,47] However, this reliance does also raise questions about data ownership and the analyst's role in interpreting versus generating insights[30], and the practical limits of data volume. Specifically, how much data is optimal, and how much of the available information is meaningfully used by coaches and athletes.

Internal processes involved live coding during matches and more detailed post-match coding and processing activities: "from 25 minutes for base coding…to a good hour, hour and a bit" for detailed analysis. Ensuring reliability was a key focus, with analysts routinely conducting inter- and intra-observer reliability tests: "I analysed 3 matches…a week in between each match…to see if I came back with the same results." Discrepancies prompted discussions and refinements in coding definitions to maintain consistency across analysts. These discussions often involved coaches, helping to confirm sport-specific interpretations of key performance indicators (e.g., why an action was coded as 'x' rather than 'y'), and ensuring alignment between analytical definitions and coaching expectations. This collaborative process not only supported methodological reliability but also contributed to shared understanding and the development of trust between coaches and analysts. These practices are supported by recent research highlighting the importance of validity and reliability practices among applied performance analysts, including routine testing and methodological checks to ensure consistent, credible outputs.[48]

Finally, analysts recognised that not all collected information would be used immediately: "we provide everything just in case…the reality is they probably don't always use it…but it's there for them if they need it." This illustrates the dual role of performance data: as a tool for immediate feedback and as a resource for ongoing decision-making. While these processes ensured the availability, reliability and accessibility of performance information, their value ultimately depended on how analysts interpreted, synthesised and communicated these data, an issue explored in the following section.

Analysis

While data and video provide the foundational inputs, their value depends on the analysts' ability to interpret, synthesise and communicate insights effectively, highlighting the critical role of analysis and feedback. Analysis encompassed the multifaceted processes and evolving methodologies employed by performance analysts in high-performance sport. During live training and competitions, analysis primarily focused on immediate feedback through "technical adjustments and tactical insights aimed at enhancing performance". Preparatory analysis involved reviewing previous performances and studying opponents' technical, tactical and movement profiles: "Video analysis is employed to highlight patterns and strategies to help us better prepare".[22,49-50] Analysts increasingly incorporate statistical data and predictive modelling (e.g., win probability, team strength or game state) to complement traditional observational techniques: "to provide a more comprehensive understanding of performance dynamics".[51] Post-performance reviews combined objective data with subjective insights to assess outcomes: "Visual aids, such as video clips with telestration, are balanced with data metrics to ensure clarity and focus during debrief sessions".[52-53] Participants highlighted the ability to interrogate and streamline large datasets to "pick out the real key points from huge amounts of data that get produced." They described applying mathematical processes tailored to performance questions while remaining rigorous and unbiased: "you're not looking for answers, you're merely trying to unearth or confirm or deny a hypothesis." These reflections echo calls for scientific rigour in applied analysis.[46,48]

Feedback

Feedback emerged as a central theme in how analysts translate analytical outputs into actionable communication with athletes and coaches, shifting the focus from interpretation of data to its delivery, timing, and psychological impact. This highlighted the challenge of presenting complex information in clear, actionable ways. Several analysts described strategies to achieve this, such as using concise visual summaries "just a two-page feedback sheet…based around a number of visualisations" to communicate pre-interpreted insights clearly, whilst balancing brevity with comprehensiveness. Feedback was also tailored to audience knowledge, requiring analysts to "take the subjective…and disseminate it to a coach that has much more knowledge…to an athlete that might not quite be used to speaking about it in those terms." Participants further considered the psychological impact of feedback, reflecting on "whether we're going to deliver this information to them as it might cause unnecessary anxiety…or…how much of the data we give to them."

Several participants emphasised the value of consistent feedback, both in terms of delivery and data presentation: "if we can give them the same structure of data each time, then they can build an understanding." This aligns with previous research, which shows that consistency in feedback processes fosters athlete trust and learning.[31,54] Participants also recognised the role of emotions in shaping feedback effectiveness, using "hot" and "cold" debriefs: "we have a defuser where it's actually feedback for players to feedback more emotionally." This echoes various works across sectors (e.g., medical, sport, education) that argue feedback timing and emotional readiness are crucial in maximising receptivity.[5,55-56]

Analysts adapted feedback to different learning preferences, combining individual and group sessions, while others highlighted the risks of relying too heavily on online delivery: "Sometimes I feel that information gets lost as a result…face-to-face is probably the priority." This preference appeared to be context-dependent, particularly when feedback was complex, sensitive, or required dialogue and clarification. Analysts also reflected on their own learning, noting how experience has shifted their practice from overwhelming athletes with detail to focusing on concise, actionable messages. This adaptive process mirrors insights from Lorimer and Jowett[57], who identified communication flexibility as a key factor in effective coach–athlete relationships.

Maintaining objectivity was critical, particularly in avoiding subjective judgements of performance: "don't describe an effort, just relay back the information." Maintaining neutrality protects the analyst–athlete relationship and ensures that feedback remains evidence-based. This reflects findings from sports skill-learning research suggesting that feedback is most effective when descriptive rather than purely evaluative, as this approach encourages learners to actively engage in the error detection process.[58] Participants discussed the importance of structuring sessions to be concise, focused, and engaging. While feedback sessions sometimes extended beyond 30 minutes, analysts suggested that the most effective sessions, whether with athletes or coaches, were clear, time-bound, and outcome-driven. One participant explained, "you go in with a very clear message…these are the key performance parameters…you need to keep people engaged with the process as well." Research supports this approach, showing that brevity and clarity improve athlete engagement and retention.[17,22,59] Subsequently, analyst education should priortise communication flexibility and emotional intelligence alongside technical skills, challenging traditional curricula that focus predominately on data and video analysis.

Challenges

Analysts described multiple challenges, for example, the conflicting preconceptions between themselves and the coaches/athletes sometimes complicated decision-making: "If your analysis goes against what the coach and athlete feel…50% of the time they would go with you". Analysts also needed to navigate sensitivities around authority and decision-making: "I don't want you [the analyst] to step on my toes." Such dynamics highlight the negotiation required to define roles and establish credibility while respecting established technical, performance analysis, and sport expertise.[20,30] Environmental constraints, such as tournament structure and the often-quick turnaround between matches, limited data processing: "The time available in a competition environment…if you want to be processing something from match 1 but match 2 is about to start." Analysts emphasised that introducing change required patience and strategic planning, often over a long period of time: "It took 4 years to convince them PA was useful." Building trust and educating athletes and coaches was central to improving buy-in.[28] Analysts described using small, incremental changes and evidence-based demonstrations to shift perceptions of the value of performance analysis: "I will take my time and introduce change slowly because people are resistant to change, people fear change." These strategies reflect the importance of interpersonal skills, credibility and trust, and relationship-building in facilitating of analytical interventions.[28] Resource limitations, including technology, funding, and access to literature, were a recurring barrier: "Sometimes the venues don't always have Wi-Fi…we don't have access to the International Journal of Performance Analysis." Financial constraints also limited the availability of additional analysts and support at competitions: "It's just the sport not having quite enough funding to allow analysis support at every event." Analysts often had to adapt workflows and prioritise tasks based on available resources, highlighting the need for flexibility and creative problem-solving within constrained environments. Analysts described ongoing challenges with technology that impacted the collection, processing, and dissemination of data. Connectivity issues, software limitations, and equipment failures could hinder timely delivery of feedback. Analysts also acknowledged the evolving landscape of performance technology, noting that keeping up with new tools, platforms, and data pipelines required continuous learning and adaptation. Strategic adoption of emerging technologies was seen as essential to maintaining relevance and maximising analytical impact. Together, these findings illustrate that performance analysis in high-performance sport is shaped by social, organisational, technical, and temporal factors. Analysts must therefore navigate relationships, adapt to logistical constraints, and integrate technical expertise with relational skill to produce actionable and credible insights. These observations suggest that analyst development

programmes could benefit from incorporating strategies for managing organisational politics and resource limitations alongside technical training.

Hard and Soft Skills

Hard skills are defined as the technical expertise encompassing job-specific competencies required to perform the role (e.g., use of software, coding, data analysis), whereas soft skills refer to more intangible attributes such as communication, adaptability, teamwork, and problem-solving. Hard and soft skills were highlighted as central to effective practice, where technical fluency was regarded as essential. Participants stressed the need for independence and troubleshooting ability: "when you're in the battle of a competitive match, there's no one there to help you… you've got to problem solve and actually have enough of an understanding of the stuff you're using." Core tools included Excel, SportsCode, and Tableau, with broader IT knowledge valued. This aligns with research emphasising autonomy and system literacy in performance roles.[7,27] Effective communication of findings was considered equally important via an "ability to present in a visual and numerical way that is understandable, usable, and non-manipulative." Outputs needed to be flexible across multiple platforms, but always clear. Prior work highlights that the influence of analysis depends on how well information is conveyed to decision-makers.[22,60]

Participants also emphasised the interpersonal aspects of practice, stating that "the effect your feedback can have is based on your choice of words and how you deliver… and can influence how an athlete perceives the performance." Analysts were expected to act as translators between data and practice, sometimes influencing decisions or protocols.[23,60] Flexibility to meet varied coach and athlete demands was seen as critical: "the ability to be adaptable… to a coach's requirements and athlete requirements." Participants similarly emphasised the need for resilience development[61] when input was ignored: "the ability to take it on the chin when your data isn't necessarily used is actually very important". Soft skills were central to sustaining credibility with analysts highlighting the need to be approachable but professional: "being willing and able to work hard… be approachable, friendly…." Likeability was also influential: "if you can't actually get coaches and athletes to like you… it becomes quite difficult to get them to want to approach you". Similar notions have been identified in previous research[62], with Brink et al.[63] further suggesting the need for more informal collaboration at times to facilitate connection and understanding between coach and practitioner. Hard and soft skills were seen as mutually dependent, whereby the technical ability established competence, and the interpersonal skills ensured outputs had buy-in and

impact. These findings suggest practitioner development programmes (e.g., University curricula) should move beyond technical training to embed relational and adaptive skills that reflect the complex realities of high-performance sport.

Skills and Competencies: The Tree Analogy

Martin et al.[27] firmly established the key areas of expertise that underpinned nine components of applied performance analysis practice within their lighthouse analogy. The infographic is easy to interpret and remains memorable to the reader. As a result, we have similarly utilised an analogy and graphical approach to represent the study and aid the reader's interpretation. The tree analogy used here represents the skills and competencies applied performance analysis practitioners are required to effectively operate within the elite environment (Figure 1). Central to this analogy is the tree itself, symbolising the continual growth of a practitioner's skillset. Trees, when young, start much smaller and less well developed within their respective environment. This mirrors the applied practitioner and their associated skillset, where an early-career practitioner begins with foundational skills that expand with greater experience and guidance/mentorship. The branches represent the seven key theme components ([1] data and video, [2] analysis, [3] feedback, [4] trust and openness, [5] knowledge, [6] culture, and [7] challenges) that the applied practitioner engages with throughout their careers. As a tree can, a less experienced practitioner may not have all the branches developed in the earlier stages of their career. For example, the inexperienced practitioner may have limited or no awareness of 1) the challenges within the applied environment or 2) the impact of team/sport culture on their practice. Consequently, these branches may have yet to form but will inevitably come into play at some point in their career. Finally, the roots represent the soft and hard skills that are entwined within all aspects of a practitioner's working capacity and ultimately support the growth of the branches and the overarching strength of the tree throughout its lifetime (Figure 1). Collectively, a strong group of trees (performance analysis practitioners) forms a forest of practitioners symbolising the strengthening of the discipline as a whole. As individual practitioners develop, the collective knowledge and skillset of the discipline also grow, ultimately raising the overall standards of effective practice across the profession.
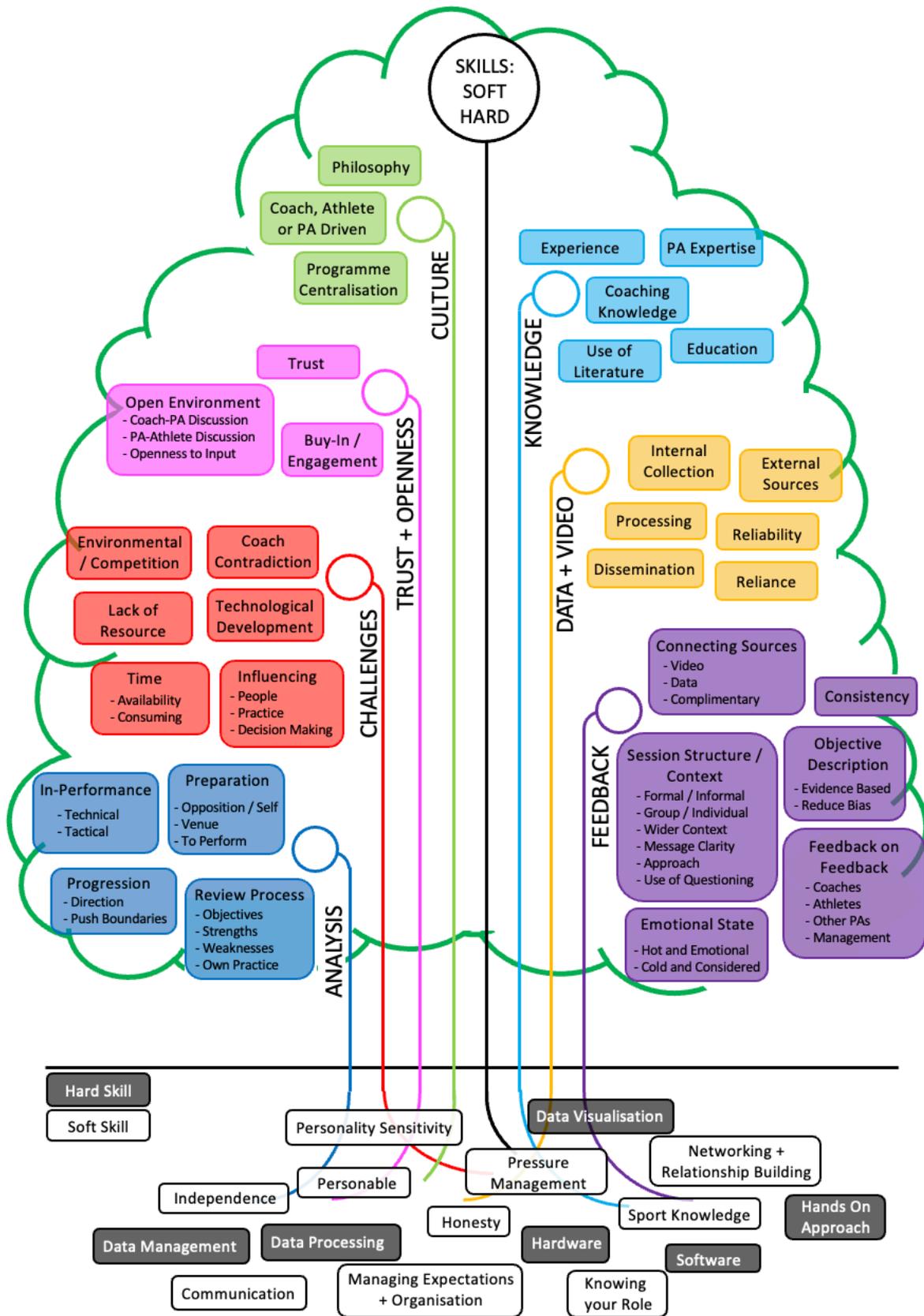
Figure 1: Skills and competencies required to be effective within applied practice. Themes represented by the colour-coded branch.

Conclusion

The study represents the first of its kind within performance analysis to directly examine the relational, practical, and technical competencies required by current and aspiring practitioners to operate effectively within the applied environment. The tree analogy clearly illustrates the key thematic areas of development, associated sub-components, and the interwoven soft/hard skills that underpin effective daily practice. The paper has highlighted themes focusing upon 1) data and video, 2) analysis, 3) feedback, 4) trust and openness, 5) knowledge, 6) culture, and 7) challenges, whilst the importance of a practitioner's soft and hard skills permeates throughout.

While these findings offer a comprehensive representation of practitioner skill requirements, these should be interpreted considering the study's contextual and methodological boundaries. The sample reflects experiences within a specific applied performance analysis context, predominantly situated within the UK, and therefore the extent to which these competencies generalise across other sporting, cultural, or organisational environments remains to be established. As such, the framework should be viewed as a foundational and evolving model, rather than a definitive or exhaustive account of practitioner skills. Notwithstanding these limitations, the findings have clear implications for educational providers in designing curricula that more closely align with the realities of applied sport environments. In addition, the framework may inform those responsible for developing professional accreditation and certification pathways, offering an evidence-based reference point for identifying core competencies, progression expectations, and areas of continuing professional development for performance analysts.

Beyond performance analysis, the framework also has potential utility for other sport science disciplines seeking to reflect upon and enhance their applied practice. Future research should explore each identified theme and sub-theme in greater depth to better understand the specific processes, strategies, and practitioner interactions that underpin effective applied provision. Longitudinal research designs may also help capture how practitioner competencies and modes of provision evolve over time. Furthermore, investigation across international and non-UK contexts would help establish whether additional competencies are required, with the longer-term aim of developing a more globally representative practitioner skills model for the performance analysis community.

Statement and Declarations

Ethical considerations

Institutional ethical approval was obtained from Middlesex University (London Sport Institute - 1187).

Consent to participate and publication

Research participants completed and signed an informed consent form after reading a participant information sheet.

Declaration of conflicting interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding statement

The authors received no financial support for the research, authorship, and/or publication of this article.

Data availability

The data subset that supports the findings of this study are available on request from the corresponding author.

References:

1. Hughes M and Franks IM. Why and how feedback has been used: A review of the literature. In: Hughes M and Franks IM (eds) *Notational analysis of sport.* London (UK): E & FN Spon; 1997, pp.1–16.
2. O'Donoghue PG. *An introduction to performance analysis of sports.* London: Routledge, 2015.
3. Butterworth A and Woodward J. Performance analysis in the coaching process. In: Butterworth A (ed.) *Professional practice in sport performance analysis*. New York: Routledge; 2023, pp. 1-18.
4. Carling C, Williams AM and Reilly T. *The handbook of soccer match analysis.* Oxon: Routledge, 2005.
5. Groom R, Cushion C, and Nelson L. The delivery of video-based performance analysis by England youth soccer coaches: Towards a grounded theory. *J Appl Sport Psychol.* 2011; 23: 16–32.
6. O'Donoghue P. The use of feedback video in sport. *Int J Perform Anal Sport.* 2006; 6: 1–14.

7. Francis JW, Kyte J and Bateman M. The role of the analyst: Comparative analysis of applied performance analyst job advertisements in the UK and Ireland (2021–2022). *Int J Perform Anal Sport.* 2024; 24:33 1–60.

8. Hughes MD and Bartlett RM. The use of performance indicators in performance analysis. *J Sports Sci.* 2002; 20: 739–54.

9. Cooper SM, Hughes M, O'Donoghue P and Nevill AM. A simple statistical method for assessing the reliability of data entered into sport performance analysis systems. *Int J Perform Anal Sport.* 2007; 7: 87–109.

10. James N, Mellalieu SD and Jones N. The development of position specific indicators in professional rugby union. *J Sports Sci.* 2005; 23: 63–72.

11. O'Donoghue P. Normative profiles of sports performance. *Int J Perform Anal Sport.* 2005; 5: 104–19.

12. Cahill N, Lamb K, Worsfold P, Headey R and Murray S. The movement characteristics of English Premiership rugby union players. *J Sports Sci.* 2013; 31: 229–37.

13. Mackenzie R and Cushion C. Performance analysis in football: A critical review and implications for future research. *J Sports Sci.* 2013; 31: 639–76.

14. Wright C, Atkins S and Jones B. An analysis of elite coaches' engagement with performance analysis services (match, notational analysis and technique analysis). *Int J Perform Anal Sport.* 2012; 12: 436–51.

15. Wright C, Atkins S, Jones B and Todd J. The role of performance analysts within the coaching process: Performance analysts survey 'the role of performance analysts in elite football club settings'. *Int J Perform Anal Sport.* 2013; 13: 240–61.

16. Francis J and Jones G. Elite rugby union players' perceptions of performance analysis. *Int J Perform Anal Sport.* 2014; 14: 188–207.

17. Wright C, Carling C, Lawlor C and Collins D. Elite football player engagement with performance analysis. *Int J Perform Anal Sport.* 2016; 16: 1007–32.

18. Painczyk H, Hendricks S and Kraak W. Utilisation of performance analysis among Western Province Rugby Union club coaches. *Int J Perform Anal Sport.* 2017; 17: 1057–72.

19. Middlemas SG, Croft HG and Watson F. Behind closed doors: The role of debriefing and feedback in a professional rugby team. *Int J Sports Sci Coach.* 2018; 13: 201–12.

20. Martin D, Swanton A, Bradley J and McGrath D. The use, integration and perceived value of performance analysis to professional and amateur Irish coaches. *Int J Sports Sci Coach.* 2018; 13: 520–32.

21. Kraak W, Magwa Z and Terblanche E. Analysis of South African semi-elite rugby head coaches' engagement with performance analysis. *Int J Perform Anal Sport.* 2018; 18: 350–66.

22. Nicholls SB, James N, Bryant E and Wells J. Elite coaches' use and engagement with performance analysis within Olympic and Paralympic sport. *Int J Perform Anal Sport.* 2018; 18: 764–79.

23. Nicholls SB, James N, Bryant E and Wells J. The implementation of performance analysis and feedback within Olympic sport: The performance analyst's perspective. *Int J Sports Sci Coach.* 2019; 14: 63–71.

24. Nicholls SB, James N, Wells J and Parmar N. Performance analysis practice within Olympic and Paralympic sports: A comparison of coach and analyst experiences. *Int J Perform Anal Sport.* 2022; 22: 343–51.

25. Kojman Y, Beeching K, Gomez MA, Parmar N and Nicholls SB. The role of debriefing in enhancing learning and development in professional boxing. *Int J Perform Anal Sport.* 2022; 22: 250–60.

26. Harkness-Armstrong A, Seth L, Lowry R and Datson N. Applied performance analysis practices in women's football. *Int J Sports Sci Coach.* 2025; 20: 568–84.

27. Martin D, O'Donoghue PG, Bradley J and McGrath D. Developing a framework for professional practice in applied performance analysis. *Int J Perform Anal Sport.* 2021; 21: 845–88.

28. Nelson L, James N, Nicholls S, Parmar N and Groom R. The importance of appearing trustworthy in the workplace: Performance analysts' perspectives. *Sport Educ Soc.* 2025; 30: 249–65.

29. Huggan R, Nelson L and Potrac, P. Developing micropolitical literacy in professional soccer: a performance analyst's tale. *Qual Res Sport Exerc Health.* 2015; 7: 504–520.

30. Martin D, O'Donoghue PG, Bradley J, Robertson S and McGrath D. Identifying the characteristics, constraints, and enablers to creating value in applied performance analysis. *Int J Sports Sci Coach.* 2024; 19: 832–46.

31. Carling C, Wright C, Nelson LJ and Bradley PS. Comment on 'Performance analysis in football: A critical review and implications for future research'. *J Sports Sci.* 2014; 32: 2–7.

32. Braun V and Clarke V. Using thematic analysis in psychology. *Qual Res Psychol.* 2006; 3: 77–101.

33. Luo Y, Li S, Cao YY and Luo Z. The predictive role of coach–athlete relationship quality in training engagement and skill development among adolescent basketball players. *Front Psychol.* 2025; 16.

34. Cruickshank A and Collins D. Culture change in elite sport performance teams: Examining and advancing effectiveness in the new era. *J Appl Sport Psychol.* 2012; 24: 338–55.

35. Soto-García D, Reynoso-Sánchez LF, García-Herrero JA, Gómez-López M and Carcedo RJ. Coach competence, justice, and authentic leadership: An athlete satisfaction model. *Int J Sports Sci Coach.* 2022; 18: 361–71.

36. Sztompka P. *Trust: A sociological theory.* Cambridge: Cambridge University Press, 1999.

37. Dirks KT. Trust in leadership and team performance: Evidence from NCAA basketball. *J Appl Psychol.* 2000; 85: 1004–12.

38. Jones RL, Bailey J and Thompson A. Ambiguity, pedagogy and humanisation: Coaching and coach education in the 21st century. *Sport Educ Soc.* 2019; 24: 911–23.

39. Lyle J. *Sports coaching concepts: A framework for coaches' behaviour.* Routledge, 2002.

40. Alfrano H and Collins D. Good practice delivery in sport science and medicine support: Perceptions of experienced sport leaders and practitioners. *Manag Sport Leis.* 2021; 26: 145–60.

41. Vergeer I and Lyle J. Coaching experience: Examining its role in coaches' decision making. *Int J Sport Exerc Psychol.* 2009; 7: 431–49.

42. Phillips E, Davids K, Renshaw I and Portus M. Expert performance in sport and the dynamics of talent development. *Sports Med.* 2010; 40: 271–83.

43. Mason RJ, Farrow D and Hattie JA. Sports coaches' knowledge and beliefs about the provision, reception, and evaluation of verbal feedback. *Front Psychol.* 2020; 11:571552.

44. Tissera K, Orth D, Huynh M and Benson AC. A coach's perspective on augmented feedback (and technology) in cricket. *Int J Sports Sci Coach.* 2023; 19: 562–72.

45. Reade I, Rodgers W and Spriggs K. New ideas for high performance coaches: A case study of knowledge transfer in sport science. *Int J Sports Sci Coach.* 2008; 3: 335–54.

46. McLean S, Kerhervé HA, Stevens N and Salmon PM. A systems analysis critique of sport-science research. *Int J Sports Physiol Perform.* 2021; 16: 1385–92.

47. Andersen LW, Francis JW and Bateman M. Danish association football coaches' perception of performance analysis. *Int J Perform Anal Sport.* 2021; 22: 149–73.

48. Francis JW, Kyte JL, Bateman M and Nicholls SB. The landscape of validity and reliability practices from applied performance analysts: Establishing a best practice framework. *Int J Sports Sci Coach.* 2025; 20: 1014–36.

49. Loo JK, Francis JW and Bateman M. Athletes' and coaches' perspectives of performance analysis in women's sports in Singapore. *Int J Perform Anal Sport.* 2020; 20: 960–81.

50. Butterworth A, O'Donoghue P and Cropley B. Performance profiling in sports coaching: A review. *Int J Perform Anal Sport.* 2013; 13: 572–93.

51. Baumer BS, Matthews GJ and Nguyen Q. Big ideas in sports analytics and statistical tools for their investigation. *Wiley Interdiscip Rev Comput Stat.* 2023; 15.

52. Jones D, Rands S and Butterworth AD. The use and perceived value of telestration tools in elite football. *Int J Perform Anal Sport.* 2020; 20: 373–88.

53. Smith J, Rands S, Bateman M and Francis J. Assessing the efficacy of video telestration in aiding memory recall among elite professional football players. *Sports Innov J.* 2022; 3: 61–81.

54. Nicolls K and Allen JB. Coaches' provision of structure for players' competence development: Perspectives of professional soccer coaches and players in Norway. *Int Sport Coach J.* 2024; 12: 411–21.

55. Abraham R and Singaram VS. Self and peer feedback engagement and receptivity among medical students with varied academic performance in the clinical skills laboratory. *BMC Med Educ.* 2024; 24: 1065.

56. Jowett S, Wachsmuth S, Boardley ID and Balduck AL. The role of emotional intelligence and quality relationships in athletes' and coaches' levels of satisfaction: A multi-study analysis. *Sports Coach Rev.* 2024; 1–24.

57. Lorimer R and Jowett S. Empathic accuracy in coach–athlete dyads who participate in team and individual sports. *Psychol Sport Exerc.* 2009; 10: 152–58.

58. Hodges NJ and Franks IM. The provision of information. In: Hughes MD, Franks IM, editors. *The essentials of performance analysis: An introduction.* Oxon: Routledge; 2008, pp.21–39.

59. Hattie J and Timperley H. The power of feedback. *Rev Educ Res.* 2007; 77: 81–112.

60. Callinan MJ, Connor JD, Sinclair WH and Leicht AS. Exploring rugby coaches' perception and implementation of performance analytics. *PLoS One.* 2023; 18: e0280799.

61. Sarkar M and Page AE. Developing individual and team resilience in elite sport: Research to practice. *J Sport Psychol Action.* 2022; 13: 40–53.

62. Burns A, Collins D and Nolte L. Coaches' experiences of performance support teams. *Int J Sports Sci Coach.* 2024; 19: 965–77.

63. Brink MS, Kuyvenhoven JP, Toering T, et al. What do football coaches want from sport science? *Kinesiology.* 2018; 50: 150–54.