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Examining the Roles and Consequent Decision-Making Processes of High-Level Strength and Conditioning Coaches

Paul Downes [1,*] and Dave Collins [2]

[1] School of Education and Sport, The University of Edinburgh, Edinburgh EH8 8AQ, UK
[2] Institute for Sport, Physical Education and Health Sciences, The University of Edinburgh, Edinburgh EH8 8AQ, UK; dave.collins@ed.ac.uk
* Correspondence: p.w.m.downes@gmail.com

Abstract: Research into sports coaches has identified the valuable role they play concerning social support provided to athletes together with their contribution to social and cultural interactions within both the participation and performance domains. The purpose of the present study was to qualitatively extract and examine the knowledge and on-task cognitions of high-level coaches (HLCs) within strength and conditioning (S and C). Applied cognitive task analysis (ACTA) was used to examine ten HLCs, each purposefully sampled to reflect over eight years of work in full time environments. The analysis of responses demonstrated HLCs engage in a pattern of innovative and diverse thinking, together with adaptability and multilevel planning, designed to promote an inclusive approach from performers, coaches and management. Commonality was demonstrated within the decision making of HLCs during the design of training programs. Communication was another important consideration when connecting with athletes, observing athletes, speaking to the head coach and integrating their approach with others. A confident, flexible approach to adapting to situational demands was evident and supported by the ability to recall and select from a wide range of previously learnt and tested strategies. Evidence is offered for the importance of interpersonal and social factors in HLCs' relationships with athletes and coaches. The incorporation of strategies to support versatile, dynamic decision making within future S and C coach development materials will support more impactful performances by coaches at all stages of the coaching process.

Keywords: psychosocial; ACTA; connections; contextual coaching

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1. Introduction

Sport is an arena of patterned behaviours, social structures, and interinstitutional relationships that offers unique opportunities to study and understand the complexities of social life [1]. Frey and Eitzen [1] described that group dynamics, goal attainment by social organisations, subcultures, behavioural processes, socialisation, and organisational networks are just a few psychosocial constructs that can be studied in sport settings. Both participation (focussed on amateur and community involvement) and performance (focussed on professional and achieving success through winning) domains exist within sport. However, although both offer multiple influences within societies, this paper will focus on performance. Through various types of media, a high level of spectator interest in sport is generated and, through the sporting events society can engage in, comes the opportunity to experience the feeling of being members of a group [2]. Indeed, Nelson Mandela once offered at the inaugural Laureus World Sports Awards (2000) that "*sports have the power to change the world. It has the power to inspire, the power to unite people in a way that little else does. It speaks to youth in a language they understand. Sports can create hope, where there was once only despair.*" We contended that if sports can bring about change, then effective coaching has the potential to be at the core of seismic shifts in the world and its communities.

In their various capacities, sports coaches work in tandem with athletes and are tasked with developing several capabilities to facilitate superior performances. Coaching has been considered a very complex and dynamic task, carried out in an ill-structured, constantly changing environment [3]. Furthermore, it has been shown that a coach's influence often extends beyond training into other areas of the athlete's life, including diet, academics and social interests [4]. Strength and conditioning coaches (SCCs) operate in support of technical and tactical coaches. In their role, SCCs are required to educate and train athletes for the purpose of sport performance enhancement [5]. Consequently, SCCs often foster different coach–athlete relationships to others in the performance domain. For example, Foulds et al. [6] state that SCCs have greater opportunities to create small groups and one-on-one situations to mutually goal set with athletes, show progress and have conversations beyond sport. More recently, this direction of research has begun to identify that SCCs' psychosocial skills can positively impact an athletes' holistic development [7]. Research into the characteristics of expert SCCs has focused on identifying behavioural characteristics, skills and competencies [8]. However, as suggested by Grant and Dorgo [9], obtaining degrees and certifications are simply not enough to yield the necessary practical tools for the breadth of skills required by an SCC.

The development of SCCs to effectively comprehend the cultural and psychosocial elements of their environments is not commonplace, and the lack of qualitative research involving SCCs has been described as a problem by Gearity and Mills [10]. Furthermore, we recognise that greater efforts need to be made to understand what and how effective SCCs do well, but also why they think the way that they do. Of course, accessing experts' cognitions can be a complex task. Positively, the use of Applied Cognitive Task Analysis (ACTA) in domains outside of S and C has been successfully applied in fields including clinical nursing [11], firefighting [12], flight planning [13] and helicopter pilots [14].

Recognising the value of S and C as a profession, aspiring SCCs can now undertake specific tertiary education on S and C and attain internationally recognised accreditations. Both experienced SCCs and early career coaches (ECCs) are required to perform a variety of duties within their role. Various evaluations of job duties [15–17] and requirements to gain employment [18] are available within the S and C literature. Due to the wide range of responsibilities an SCC may be required to perform as part of supporting their athletes, a high degree of specificity is required within coach preparation methods. In addition to SCCs utilising a broad scientific knowledge base [19] they also need to make use of psychosocial skills. The psychosocial behaviours of SCCs have been reported to positively impact an athletes' emotional states; for example, motivation and enjoyment, and behaviours such as self-regulation [20]. Indeed, the need to "manage athletes psychologically" has been identified as a significant stressor experienced by elite coaches [21]. When applied to SCCs, however, there is little to suggest the current S and C accreditation programs are focused on preparing them to effectively manage this important element.

This lack of focus on various S and C training methods and their effectiveness places a limitation on the impact SCCs can ultimately achieve. Recently, Szedlak et al. [22] used semi-structured interviews to explore which psychosocial actions experienced SCCs believed to be essential and advocated a constructivist learning approach in order to develop these behaviours. Although this emergent psychosocial direction of research adds much-needed variance to the predominance of biophysical competency, more examination is needed regarding the cognitive development of SCCs.

Building on work in mainstream coaching which emphasises the importance of decisions, a conceptual framework of decision making for SCCs was presented by Till et al. [23]. These authors stated that SCCs need to make decisions daily for the effective implementation of their practices. Six domains of SCCs' understanding were presented and considered: (1) the "who" (SCC's athletes), (2) the "what" (declarative knowledge concerning S and C and the sport in question), (3) the "how" (principles of skill acquisition and learning), (4) context, culture and politics (social, cultural, and political context SCCs operate in), (5) "self" (existing knowledge, beliefs, values, and behaviours); and (6) PDR (planning,

delivering, and reflecting), which is the coaching process. This framework offers an encouraging introduction to the much-needed area of SSCs' decision making, but currently lacks empirical support. The growing contribution of SCCs within performance domains and the potential relationships with their athletes to impact sporting and holistic experiences is cause for the examination of SCCs' decision making if they are to maximise their contributions within society.

Reflecting these contentions, the present study had two purposes: firstly, to examine the decision-making processes of high-level coaches (HLCs) in the profession of S and C using ACTA. Secondly, to identify which areas these HLCs perceive to be most challenging for ECCs. Szedlak, Callary and Smith [24] emphasised that the cognitive development, and indeed metacognitive development, of SCCs would enhance the impact they are able to make. It is intended that the findings of this study will facilitate the development of specific approaches to prepare SCCs for the decision-making demands associated with the contexts they operate within.

2. Materials and Methods

2.1. Participants

Following ethical approval from the University Ethics Committee, participants were recruited through criterion-based purposeful sampling strategies [25]. The four selection criteria used to ensure status and remain consistent with previous S and C literature on expert level coaches were: (a) eight or more years of full-time experience (10 ± 2.9 years) as a coach, (b) completed some form of postgraduate education, (c) held at least one professional accreditation, and (d) worked in at least two different high-performance environments. A total of ten participants, 9 male and 1 female, were recruited and gave informed consent (Table 1). This sample exceeded the recommendation of 3–5 participants offered by Militello and Hutton [26] as the minimum requirement for the effective use of the ACTA approach. The experiences of the HLCs interviewed provided data spanning 32 sports coached at elite level (of international and or professional standard) and 11 sports coached at a pre-elite standard (Table 2).

Table 1. Socio-demographic characteristics of HLCs interviewed.

Number of Coaches	10 (1 female)
Age of Coaches	34.6 + 5.8 years
Years Coaching	10.0 + 2.7 years
Nationality of Coaches	Australian (5), New Zealand (4), German (1)
Education Level	PhD (3), MSc (4), MHSc (1), MSpEx (1), Mba (1)
Accreditations Held	ASCA Level 3 (3), ASCA Level 2 (4), ASCA Level 1 (1), NSCA CSCS (3), UKSCA (1)

Table 2. Work experience characteristics of HLCs interviewed.

Athletes Coached	Male (10), female (10), 4 coaches had worked with para-athletes
Sports Coached at Elite Level (International/Professional)	Alpine Skiing, Archery, Athletics, Basketball, BMX, Boxing, Canoe Sprint, Cricket, Curling, Cycling Endurance, Gymnastics, Handball, Hockey, Judo, Netball, Para Athletics, Para Curling, Para Rowing, Para Swimming, Para Winter Sports, Rowing, Rugby League, Rugby Sevens, Softball, Surfing, Surf Lifesaving, Swimming, Tennis, Triathlon, Water polo, Winter Sports
Sports Coached at Non-Elite Level	AFL, Athletics, Basketball, Netball, Rugby League, Rugby Union, Squash, Swimming, Triathlon, Water Polo, Weightlifting

2.2. Measures

We employed a qualitative methodology using ACTA to identify the characteristics of decision making within the S and C profession. This form of inquiry has been described as a set of knowledge elicitation and representation techniques intended to assist the identification of key cognitive elements required to perform a task proficiently [27]. In the initial stages of developing the ACTA, and reflecting recommendations for good practice, four pilot ACTAs were conducted to establish and refine the foundation questions to be used. This enabled the primary researcher to better understand the common duration and flow of the interviews.

2.3. Procedures

Each ACTA interview lasted between 50 and 90 min and all were recorded using a digital voice recorder. Field notes were taken throughout the interview process. Interviews commenced with a discussion about the format of the ACTA and some general questions regarding the participants' career to date. This also included their underlying philosophies towards the profession. The first ACTA element provided a broad overview of the task in question, which in the present study was directed to the process by which HLCs plan and make decisions regarding their training program content. Participants were asked to also identify the most cognitively demanding element of their process. This stage enabled the construction of a task diagram, which allowed participants to identify areas that demanded complex cognitive skills. The second stage, the knowledge audit, required the primary researcher to ask a series of questions using various probes. These probes were based on knowledge categories that characterise expertise [26]: diagnosing and predicting, situation awareness, perceptual skills, developing and knowing when to apply tricks of the trade, improvising, metacognition, recognising anomalies, and compensating for equipment limitations.

This process promoted HLCs to identify why certain elements of expertise may result in perceived errors for ECCs. For clarity, ECCs were defined to the participants as SCCs with less than three years' experience within an S and C environment but holding an undergraduate degree in S and C or sports science and a domain-relevant accreditation, for example, the National Strength and Conditioning Association (NSCA) or the Australian Strength and Conditioning Association (ASCA) Level 1 as a minimum standard. Examples of probing to maintain the direction of the ACTA included: "Is there anything else you paid attention to? Why?" "What else might influence you here?" and "Is there other information you would have liked access to?" Following data collection, each interview was transcribed. After transcription, and as part of a process of member reflection [28], each HLC was given a copy of their transcript to read through to verify the "completeness" and "accuracy" of the information at each stage. Respondents were actively encouraged to highlight anything missing or incorrect, as well as report on the perceived benefits and limitations of the ACTA itself as a method of investigation.

2.4. Analysis

The analysis method employed to the qualitative data set was a rigorous inductive, reflexive thematic analysis, following the six-phase procedure outlined by Clarke et al. [29]. Thematic analysis was selected, given that it does not contain methodological stipulations, nor is it tied to a specific theoretical framework or approach, thus allowing researcher flexibility in analysing the data [30]. The approach was inductive in nature and therefore, codes and themes were developed from the data collected. The primary researcher in the first instance familiarised themselves with the ACTA responses through a combination of re-listening to audio recordings, reading and re-reading their field notes from the ACTA interviews and the transcriptions generated. During the coding process, time was taken to revisit initial codes and revise them accordingly. To ascertain which codes were more prevalent than others, all codes were clustered and then rechecked to determine whether the patterns they described were representative of the entire data set [31]. The second

author served as a critical friend throughout this process including reviewing the coding process on a subset of data scripts. On the understanding that in relation to the research question, a theme captures something important about the data and represents a patterned response or meaning within the data set [32], four themes were identified and are presented in the results section. As part of the reporting stage, the analysis of stage one of the ACTA facilitated the construction of a task diagram (Figure 1) and a cognitive demands table. As previously described by McAndrew and Gore [27], the objective of the cognitive demands table is to provide an overview of (a) the difficult cognitive elements, (b) why it is difficult for a novice (e.g., an ECC), (c) errors a novice might commonly make, and (d) cues and strategies that experts (e.g., HLCs) use to overcome cognitively difficult elements.

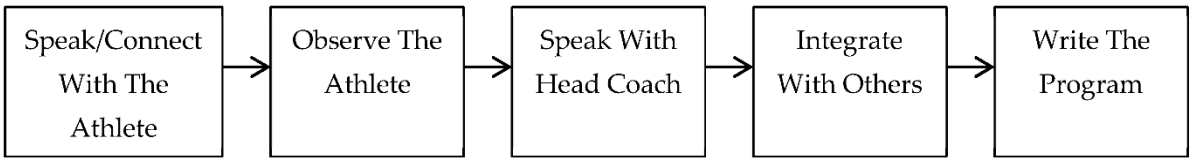

Figure 1. Task diagram illustrating the stages associated with HLC decision making when designing training programs.

3. Results

The ACTA interview findings are presented in three sections. Firstly, the four main themes generated as part of the task diagram stage and their associated sub themes are presented. Examples of HLC responses illustrating these themes are evidenced in Figure 1 and Table 3. Secondly, we present six cognitive elements that were identified as difficult within HLCs' roles. These were generated as part of the analysis of knowledge audit responses (Table 4). Finally, participant insights regarding perceptions of how less experienced coaches would respond in the same contexts are reported.

3.1. Task Diagram

The HLCs interviewed each possessed a similar level of experience sufficient to be considered an "expert" S and C. Within the recalled experiences of HLCs, there was commonality between the decision-making stages of program design and the manner in which they organised their concepts according to perceived role delivery importance. The examination of the themes generated at the task diagram stage of the ACTA (Table 3) demonstrated that communication was an important consideration for HLCs. Connecting with the athlete, observing the athlete, speaking to the head coach and integrating their approach with others all entail different levels of communication. Within these stages, listening to the wants, needs and perceptions of others to help form a better understanding of the context was evident in responses. This was illustrated in the response of HLC 3, who described,

> "It doesn't matter if it's a new group or an old group, I meet everyone as they walk in and try and make that real connection straight up . . . So all of a sudden they go well there's a guy here who talks about human stuff rather than worrying about the S and C side of things."

This HLC was confident in the benefits commitment to building rapport brought to their coaching. He felt that connecting with athletes would be a significant influence on the success of any training program designed.

Within Table 3, observing the athlete to gain a better understanding of the sport, the purpose of S and C within the sport, and the needs of the head coach are also stated as important stages of program design. When describing their process, HLC 7 stated,

> "I'll have a conversation at the same time (as observing) with the coach so I know where they (the athlete) sit within the system and where we are looking to get them to and what they're trying to work on in a (the sport's) perspective."

Table 3. Summary of themes within task diagram responses for training program design considerations.

Themes within Task Diagram Stage of ACTA	Example of HLC Response
Speak/Connect with the athlete	
As a person	"It doesn't matter if it's a new group or an old one, I meet everyone as they walk in and try and make that real connection straight up . . . I try and make that connection straight off that isn't necessarily S and C related. So all of a sudden, they go well there's a guy here who talks about human stuff rather than worrying about the S and C side of things."
As an athlete	"I talk to them (the athlete) about their past training, what they have done in the last few weeks, in the last months and what they think they need to do to improve or what they think they need to do to get better at their sport.""If you are working with an elite athlete-because they know a lot about the sport that I don't know because I'm not an elite athlete in that sport I try to seek as much knowledge from them and make it that shared performance preparation".
Observe the athlete	
Training/competing in the sport	"I just watch them move . . . warm-up exercises . . . I watch them move and that helps me decide what I need to immediately change over the first few weeks with this athlete in terms of how they move is going to relate to what I'm doing with them and the gym program. What exercises I'm programing, what extra stretches I might be giving them to deal with their extra movements I might be doing outside of the S and C time."
In testing/screening what the athlete is capable of	"In S and C you perform your tests you know, you see how an athlete actually physically moves, how an athlete physically performs in a speed test and conditioning assessment if you like, so you have a physical profile both from a movement and physical performance point of view."
How the athlete achieves their results	"I'm always assessing how an athlete responds to direction, how body language is when under stress or when put in stressful situations and what are his or her go-to habits or what are the fall back behaviours in times of stress, during assessments and observing during training situations and things. I try to develop an individual understanding of how each athlete will respond to different communications styles."
Speak with head coach	
Clarify direction	"I see my job as supporting the coach in the sport. In my mind that is clear . . . so I need direction and coordination from the coach in the sport to do what I do really well".
Alignment of language and opinions	"I need to spend time knowing their (the athlete's) sport . . . I need to go out and spend time with the coach and watch them in the environment. I'll have a conversation at the same time with the coach and find out where they (the athlete) sit within the system and where we are looking to get them to, and what they're trying to work on in (the sport's) perspective."
Integrate with others	
Gain additional perspectives	"I'd approach different people first and try and get my head around what it is that they see for S and C and approach the coaches first and see what do they see for the athletes what do they see in developments how S and C might integrate with the program. Whether they see value in it and that sort of thing and I approach the medical staff with the same sort of questions generally just trying to find out what or why those people, coaches and athletes, other professionals what they want and why they want it and how I might be able to facilitate that and how I might be able to fit into the picture."
Establish alignment of approach	"if you get challenged which happens a lot in my environment especially with (the sport in question) what do you fall back on? It's like if I get challenged on something, a certain exercise or where someone is in the training phase, I've got the meetings in the sport, conversations with a coach, structured planning, so we spoke about this, we want to review it but this is how we got to this point we agreed on it".

Table 4. Cognitive demands table for HLCs.

Difficult Cognitive Element for Coaches in Their Role	Why Is This Difficult in the Coach's Opinion?	Common Errors High-Level Coaches Expect to See from Less Experienced Coache	Cues and Strategies Used by Experienced Coaches to Be Effective in This Element
Identifying relevant considerations when constructing resistance training programs	There are multiple factors/people that interplay with each other Needing to consider the needs of sport and position	Low domain (the sport) knowledge Lack of integration with others Theory orientated/exercise driven focus—rather than impact/specificity focus lack of direction/low stability in decision making due to lack of clarity in philosophies	Make decisions based on experience and have an awareness of what, why and how to prioritise Reliance on tacit knowledge—know what will work for who and when Involve others in the planning stage for a more complete picture
Identification of relevant variables to ensure training is delivered as intended	Navigating between varying mindsets and purposes amongst athletes in the same session The need to have group awareness and establish a feel for energy and mood Managing the task proficiency—for example was the task too hard/too much expected?	Not knowing what is not typical—noticing is limited and distracted	Considering context—training cycle focus, time of year (bigger picture). Does it look how it should be based on these factors? Making reference to mental models—awareness of what the session should look and feel like
Management of self within the training environment	Environmental manipulation—fostering competition/energy Finding a balance of instruction vs. guidance Varied preference of athlete learning styles Athlete empowerment—creating ownership through scaffolding but not overcoaching	Limited coaching eye—failing to pick up technical errors quickly Limited contextual toolbox to solve the same problem Limited communication toolbox to appropriately tell or show an athlete Low predictive ability regarding knowing how athletes respond (who needs what, and when) Too directive—being too instructional	Taking time to consider the context (who/what/when/how) Achieve multiple interactions with athletes Reflecting on what has worked before
Responding to unexpected changes to training environment	Determining the causal factor(s) for respond—is it due to a physical, environmental or behavioural event Experience can cause assumptions (and blindspots) to decision making if not alert	Not being aware of the bigger picture—what is the wider training plan/demands Lack a philosophy, so no guiding principles to guide decision making Lack of experience to be confident in a decision to deliver an outcome (in appropriate time frame) Being consistent—keeping the target stable despite a change of approach (hitting a moving target)	Forecast ahead Reflection in action Context dictates the content Use of coach feel—intuition Reframe the same problem and change the task demands Restart a session—change goals
Drawing on coaching skills to deliver in the training environment	The need to understand individuals—their perception is their reality Being adaptable Being patient	Low knowledge of self Being closed in mindset—not being open to ideas/methods can limit awareness	Use technical knowledge to plan and understand performance Use applied knowledge to create clarity Use experiential knowledge so there is less trial and error in decision making Use coaching tongue to make the complex become simple (simplex)—create clarity
Considering the effectiveness of coaching performance	Determining criteria with which to consider before/during/after session	Low awareness surrounding; what/when/how/who to review	Determine through what HLC sees/hears/feels Gaining valid athlete feedback—energy/environment (better answers through better questions) Establish environment to gain feedback from a supporting coach

The task diagram stage revealed that more than one stage is required for HLCs to ascertain the relevant information to design a training program. Within the five common stages generated, each had subcomponents demonstrating deeper levels of cognition and self-awareness by HLCs. The results indicated that an effective training program design requires communication and collaboration with a variety of individuals within the performance environment.

3.2. Knowledge Audit

Prominent themes concerning the strategies employed by HLCs in response to difficult cognitive elements of their role included the utilisation of tacit and experiential knowledge, and the consideration of the context they were in. Indeed, this stage revealed insights beyond what HLCs knew *about* a domain and gathered descriptions of what they *do* with their knowledge. Through their ability to recall and select from a wide range of previously learnt and tested strategies, HLCs described a confident, flexible approach to adaptation for situations within their environments. Furthermore, they acknowledged that contextual changes are to be expected and prepared for, rather than being daunting and catching them unaware. When discussing the strategies they use to effectively improvise, HLC 9 recalled,

> "It depends on what happened what's going on—physical vs. environmental vs. behavioural . . . if it's a physical consideration and I have to get this high-intensity work done and they're not, then it can be we just haven't warmed up properly, start again, it could be yes I'm feeling good I think we're getting it. If it's something environmental then I'll consider the conditions and make it into race to be more competitive . . . whereas behaviourally I might need to go with a conversational and mindset approach."

Reinforcing this point, HLC 5 referred to experiential knowledge and decision making when explaining skills that helped them be effective within their role. They identified,

> "Quick decision making. The ability to know what's right for the athlete this time and the ability to adjust things on the fly."

HLCs appeared intuitive and recalled being able to manage their experiences in order to generate effective problem-solving strategies. When describing their approach to programming, HLC 9′s response illustrated the blend of contextual variables that influence their decision making by stating,

> "understanding the sport, understanding the athletes, understanding the coaches, the physios everything and the context based on the environment, the restrictions, the resources and all those other things and then building my program from that based on what outcome I decide on."

This approach, specifically, the HLC working together with the other organisational disciplines, did not rely on a single variable in isolation. Each practitioner was aware of their influence on other aspects to build a more complete understanding of the approach(es) required. This ability to appreciate more than one aspect of performance or within a context extended to HLCs' explanation of how they determine session effectiveness. Rather than being metrically defined or confined to a biophysical variable, there was a commonality surrounding the coaching "feel" and the consideration of wider, psychosocial variables. An example of this was within HLC 9′s response,

> "sometimes I would reflect with an athlete as well and ask what do you think of that session how can we make that better? But generally you know that sometimes sessions run perfectly and sometimes they don't run great, and you'll look back and say if I understand what I wanted out of that that session, if I can tick the box and they have achieved what I wanted to achieve, if I achieve something out of that session then it doesn't matter whether that's physical, mental, it might not have been the great session but the guys left it feeling really awesome and competitive then maybe that's a win."

The HLCs made mention of interpersonal relationships with their athletes as well as acknowledging the value of energy within their training environment. Training effectiveness existed beyond adaptation through a blend of inter- and intra-personal awareness. The HLCs described finding opportunities to improve their approach in future sessions. In summarising the value of experience in helping HLCs to develop their interpersonal skills, HLC 4 reflected,

> "so I think that's probably been a big shift for me in the last five years just making sure I have a better relationship with my athletes and that was just observing how to get the most out of the athletes and what really good coaches do in terms of the interaction with the athletes and they get trust and the outcome."

3.3. Perceptions of ECCs

Low domain knowledge, specifically of the sport in question, and lack of an integrated approach were identified as common errors HLCs would expect of ECCs when required to construct training programs. These errors contrast with the importance placed on these elements within the decision-making processes of HLCs (Table 3). Importantly, a lack of experiential/tacit knowledge and a low appreciation of context were perceived as errors by ECCs when HLCs were describing how they approach difficult cognitive elements of their role (Table 4). HLC 2 described ECCs as likely being too prescriptive in their approach to delivering training sessions when they said of ECCs that,

> "I just think a degree of being too rigid in their prescription and what I found is what they plan in a session they will find hard to go away from if you like."

The ACTA responses of HLCs suggest that ECCs may not have the required resources to recall and operationalise within their environment in a timely manner to positively affect change. When discussing how ECCs would determine session effectiveness, this perceived lack of wider awareness or appreciation was evident in HLC 2′s response of ECCs.

> "They wouldn't be happy if the guys or girls didn't hit the numbers that they were expecting. I don't think they would have the insight around mood of the group and when an athlete walks out like feeling invigorated or absolutely buggered you know."

This HLC was referring to ECCs favouring a metric-driven, adaptation-orientated mindset to an effective session whilst lacking the tacit knowledge to understand the interactions within a group of athletes. ECCs seemed unaware of the impact this can have, both positively and negatively, on training sessions. This lack of understanding may be due to a perceived low knowledge of self and underdeveloped coaching philosophies within ECCs (Table 4).

> "To me the big thing is at the end of the results on court or field or something like that so that's where I start and I reverse engineer from that rather than from a young coach I feel they try and build, build, build to make that fit in to the sport, this is the average demand of the sport build them towards it."

In summarising the results, it is evident that HLCs engage in a pattern of innovative and diverse thinking, together with adaptability and multilevel planning, designed to promote an inclusive approach for performers, coaches and management. At an interaction level, the need to understand athletes as people and their circumstances outside of sport was important within HLCs' decision-making processes for program design and associated athlete support. Difficult cognitive elements were considered as identifying, interpreting, and responding to individuals within their environments and a lack of tacit knowledge and associated limitations regarding relevant strategies to adapt were perceived as sources of error by ECCs in similar situations.

4. Discussion

The present study sought to access the cognitions of HLCs to understand their decision-making processes and identify the perceived errors of less experienced coaches. These results suggest that HLCs perceive connecting with athletes, to understand their athletic and personal needs, as important and influential when designing programs. This consideration of 'the who' as part of SCCs' decision making is consistent with the framework recently proposed by Till et al. [23]. The consideration of wider personal circumstances by HLCs is also supportive of previous research into the impact of factors outside of sporting environments on athletes. For example, professional golfers believe that their personal life strongly affects their tournament performance [33]. Building on this, HLCs in this study believed that trust, care, role modelling, and authenticity are essential psychosocial behaviours for developing effective relationships with athletes [22].

The consideration of a person and their needs is also associated with the previous literature that has linked social support with helping athletes cope with competitive stress [34] and improve performance [35]. Indeed, as Brooks et al. [15] emphasised, SCCs are primarily coaches with responsibilities to provide social, emotional, and physical development. Within their role, SCCs are afforded frequent contact with their athletes, often away from the pressures associated with team selection [21], and opportunities within this role for the deepening of relationships and providing valuable social support should be encouraged. With this said, Jeffreys [36] acknowledged that the building and maintenance of positive relationships is an underdeveloped skill for most SCCs and, as such, capabilities to achieve this should not be assumed.

Previously identified dimensions of sport-related social support are emotional, esteem, informational, and tangible support [37]. Cutrona and Russell [38] defined emotional support as "the ability to turn to others for comfort and security during times of stress, leading the person to feel that he or she is cared for by others" (p. 322). Within the HLCs' responses, emotional support was referred to when discussing being there for their athletes by physically asking how they were and as well as observing their behaviours. Esteem was frequently alluded to when HLCs recalled their commitment to supporting athletes to increase their sense of competence and or self-confidence. Finally, both informational and tangible support was evident at the task diagram and knowledge audit stages when HLCs described providing advice or guidance to athletes as foundational elements of their role within the provision of instrumental assistance to help athletes succeed at their sport. Such possession and application of declarative knowledge has previously been reported by LaPlaca and Schempp [8], who identified strong knowledge of training, technique of movements and understanding how to apply advanced exercise science related knowledge to training as characteristics of expert SCCs.

Expert SCCs have been characterised as being able to intuitively identify what is most important and have experience working in a wide variety of environments with many different sports and sport coaches [8]. The HLCs interviewed were consistent with these characteristics and were comfortable recalling their ability to make decisions according to how the session should look and feel like to them. The ACTA interviews provided HLCs with the platform to convey their tacit knowledge within their responses and included the use of stories, analogies and metaphors when verbalising their decision-making processes. At both the task diagram and knowledge audit stages, HLCs frequently referenced the context they were in as part of their decision-making process and strategies to navigate difficult cognitive elements of their role. Mellalieu [39] suggested that applied practitioners who develop the skill of contextual intelligence are able to immerse, work, and change within a specific culture and such contextual intelligence appears to be a capability of HLCs when navigating their environments.

Rutt Leas and Chi [40] found that experts plan in a much more focused way and have deeper, more complex reasoning underlying the use of various coaching tools to achieve their aims. The present study showed this depth of planning, whilst the consideration of variables within and outside the performance environment was evident in

ACTA interviews and perceived as a source of error for ECCs. Similar differences were prominent in the inclusion of others, or lack thereof, within decision-making processes. The inclusion of others within all stages of SCCs' decision making has been advocated, with each disciplinary perspective thought to offer a great deal, and should be harnessed to formulate a shared understanding within a multidisciplinary team [23].

A coach's understanding of their own beliefs, behaviours, and values has been found to be crucial in determining quality coaching practice and ongoing personal development [41]. HLCs' responses suggested the ability to manage themselves through self-awareness was important, whilst varying capabilities were assumed of ECCs (Table 3). Indeed, a lack of defined coaching philosophies within ECCs could account for their perceived limited contextual toolbox to solve the same problem. This implies they have a limited depth and breadth of procedural knowledge to select the most appropriate solution to situations presented. With this in mind, having more tools within their toolbox was offered by Till et al. [23] as an opportunity for S and C development content to equip SCCs with methods to consider within their practice.

When discussing the management of self within the training environment, a theme was generated surrounding the limited 'communication toolbox' of ECCs to appropriately tell or show athletes what is required. The development of communication skills appears to be a consequence of time within roles and reflecting on experiences. Despite this, Pines et al. [42] encouragingly suggest that although individuals need six distinguishable forms of social support, four of these can be given by any concerned individual. These authors stated that (1) listening, (2) emotional support, (3) emotional challenge, and (4) shared social reality are types of support that can be provided by individuals concerned about the athlete but lacking expertise in the sport involved. As such, it is reasonable to expect ECCs to be comfortable with, and afforded the responsibility to, provide these forms of support within their environments. However, in contrast, support in the form of technical appreciation and technical challenge was described as needing to be provided only by individuals with expertise in the specific sport in which the athlete participates.

It was recently summarised that that most SCCs have a minimum of a BSc degree and accreditation from a professional governing body, including the Australian Strength and Conditioning Association Level 1, 2 or 3 (ASCA), Accredited Strength and Conditioning Coach (UKSCA) and/or CSCS [18]. There is consensus that SCCs need to possess a high level of scientific knowledge [8,43] and indeed, there is a high level of attention directed to technical and bio-physical development within S and C research [44,45]. However, the present study highlights that HLCs are required to navigate dynamic contexts and engage in innovative and diverse thinking when deciding on strategies to employ. Importantly, it was also reported that ECCs were perceived to be underprepared to effectively interpret and operate within these settings. These perceptions are supported through empirical evidence generated using ACTA interviews with ECCs [46]. The findings of these studies are valuable resources in seeking to elevate the ability of SCCs to reflect more accurately on their performances and determine the effectiveness of the decisions made. The stages identified and explained in Figure 1 and Table 3 offer guidelines for content consideration to assist SCCs, particularly ECCs, to most accurately consider the authentic demands associated with training program design. Furthermore, Table 4 provides insightful content for those responsible for the design of S and C coach development material. The results support the deliberate construction of situated learning content that would allow SCCs to consider difficult contextual demands within which they could develop, test and review different strategies. It seems that to develop coaching expertise and effectiveness, a combination of theoretical, applied, and experiential knowledge is necessary within S and C education and development approaches [23].

There is currently a lack of consensus regarding how to most appropriately tailor SCC development material and environments to develop the abilities of SCCs to better navigate the contexts they encounter. Differences in the breadth and depth of experiences that HLCs were able to recall as part of their decision-making process was seen as a point of

difference between the strategies these experienced practitioners were able to employ, and the limitations described to be associated with ECCs. Acknowledging that such experiences take many years to accumulate, efforts need to be made to help better prepare ECCs for the cognitive demands associated within performance domains. With reference to the stages described in Table 3, ECCs are encouraged to use opportunities to observe athletes in practice and competition to better refine their interpretations and existing knowledge of the context they are operating in. From a constructivist approach, this immersion of experiences and, to an extent, socialising themselves within the context they are in, will better frame their existing knowledge. Similarly, prioritising time in forming and strengthening quality relationships with athletes as performers and people will serve to develop valuable tacit knowledge. More conversations where questions, responses, and approaches (for example) can be tested and reflected upon will create more tacit knowledge to access in the future.

According to Nonaka [47], tacit knowledge does not become part of a person's knowledge base until it is articulated and internalised. Within S and C contexts, coaches can readily achieve this at all stages of their career: for example, through video or audio recording performances and then reviewing with themselves, or ideally others, and describing their processes. Another opportunity for articulation would be within the planning stages for SCCs. As recalled in the task diagram stage of the ACTAs, including others, for example, athletes, coaches, and support staff, are opportunities to articulate an SCC's cognitions and test them under scrutiny prior to finalising an approach. Engaging in, and committing to, such practices will inevitably take time, but the present study suggests the differences between the strategies employed by HLCs and the perceived errors of ECCs offer a compelling case if SCCs at all levels are to be impactful within performance societies.

Finally, it is important to acknowledge the limitations which are a feature of the decisions taken in designing the study. Firstly, when seeking to offer general guidelines, the number of participants must always be considered. We made a conscious choice to use a rigorous and well-established tool for the examination of participants' cognitions around their work, selecting ACTA as the best approach. Whilst the small number of participants is an issue to note, it must also be seen against the criteria for this method. Secondly, although there was a predominance of male participants, the percentages involved are representative of the current worldwide working population, at least at the level and types of sport we examined. In short, while further research is always required to confirm findings, we see this study as a first to use robust empirical tools to examine the decision-making characteristics of effective HLCs. This is an important precursor to raising standards across the S and C profession.

5. Conclusions

It is important to recognise that, although the primary role of SCCs is accepted to be the improvement of athletic performance, the decision-making processes and strategies utilised by SCCs are influential to the impact they have within their environments. The breadth and depth of tacit knowledge elicited from experienced coaches in the present study offers high utility to the application of findings within the S and C domain. Specifically, the empirical evidence regarding stages of decision-making experienced coaches engage in during training program design and the identification of difficult elements within their role provide guidance to those responsible for SCC development. the evidence presented is encouraged to guide the design of authentic, situated learning experiences for SCCs within tertiary education and accreditation programs as well as the S and C workplace itself.

Those SCCs at an early stage of their career are unlikely to have developed sufficient experiences to allow them to attentively consider possibilities at the planning stage and effectively notice, then respond to the dynamics of their performance environments. The results identify common situations that experienced coaches are required to navigate. Future engagement by SCCs in similar situations that requires them to deliberately consider context, the individuals in question and previous experience(s) will be impactful in improving their decision-making processes. It is important to provide opportunities

for SCCs to devise, test and review strategies to various contextual problems in order realistically prepare them for the demands of S and C environments. Extending upon this, the importance placed on identifying what, how and why experienced professionals behave and think the way they do has been well documented in other professional domains, but it is only recently that SCCs' decision making has received attention. Further application of the ACTA methodology amongst other roles within the performance domain of sport would provide opportunities to improve the rate at which individuals develop their cognitive processes. Committing to this would raise the level of performance of both athletes and organisations.

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