Managing the Cognitive Loads Associated with Judgment and Decision-Making in a Group of Adventure Sports Coaches: A Mixed-Method Investigation

Loel Collins[1]* and Dave Collins[2],

1. **Institute of Coaching and Performance, University of Central Lancashire***

Correspondence:

2. **Moray House School of Education and Sport, University of Edinburgh**

Corresponding Author: Loel Collins, LCollins2@uclan.ac.uk

Abstract

We report a study of adventure sports (AS) professionals working in mountaineering, climbing, skiing, kayaking and mountain biking. This paper expands work on professional judgment and decision-making. The article examines the Pro-Active Coping (PAC) strategies used by AS coaches and leaders to manage the cognitive loads of decision-making. A mixed methodology was employed in which a sample of participants completed a PAC Inventory and a sub-group then completed an Applied Cognitive Task Analysis to examine a typical coaching scenario. The study determines that the participants manage their cognitive load in practice with a range of heuristics, avoidance strategies and instrumental support. These include using their own communities of practice, anticipation of events that may cause high acute cognitive load (anticipation planning) and the development of a 'straw-man plan' based on anticipated environmental conditions and client abilities. That plan is subsequently modified in response to the actual conditions and client abilities as observed. These strategies reduce the depletion of the coaches' own cognitive resources by managing the demands throughout the coaching and leadership process. We conclude that the coaches and leaders are aware of the extent of their cognitive resources and manage their expenditure, both of which are indicative of high meta-cognitive ability.

Research in this journal has recently examined the planning and focus of coaches working in hyper-dynamic environments, a situation characterised by multiple interrelating or even unmanageable factors (Collins & Collins, 2016a, 2016b). This situation is described as 'a wicked mess' by Simon, Carson and Collins (2017) and identified by Collins and Collins as causing a high cognitive load. These loads are associated with developing the performance of individuals in continually changing and potentially risky environments. In associated work, Collins, Carson and Collins (2016) identified meta-cognition as a key aspect of the coaching and leadership processes in general. Simon, Collins and Collins (2017) suggest that the complexity of coaching in these contexts is a consequence of the synergies among three linked aspects of the coaching process: (1) the hyper-dynamic environment, (2) the individual being coached and (3) the desired outcomes. Consequently, coaches of AS experience high cognitive loads while simultaneously anticipating, planning and coping within this messy hyper-dynamic context while also attempting to facilitate the development of their students. Cognitive load is the amount of information processing required to perform a given task (Reif, 2010). Cognitive load theory (Sweller, 1998) would assert that decision making would be hampered if working memory capacity is exceeded (De Jong, 2010.) The coaches are susceptible to high cognitive loads that can be acute and chronic. The coach must have the capacity to anticipate acute stressors caused by factors like an unexpected change in conditions or an emergency while also managing chronic stressors, such as anticipating the trajectory of the development of a student in a risky situation in order to assist in goal-setting, practice design and risk management.

Limited investigation has been undertaken, however, into how AS coaches and leaders[1] manage the loads associated with developing individuals in this context. Accordingly, our aim was to identify how AS coaches ensure that sufficient cognitive resources are available to manage the

[1] For simplicity, we will refer to coaches and leaders simply as 'coaches' from this point.

chronic daily demands of coaching and the potential acute loads associated with anticipated changes to situational demands. Furthermore, we ask how these strategies differ among coaches at different levels of qualification/experience. Finally, given the importance of increasing the number of female coaches across sport (e.g., Coaching Association of Canada, 2010), we were interested to see if any gender differences existed in this important coaching ability concomitant.

Adventure Sports Coaching

AS coaches work in hyper-dynamic environments and demonstrate an ability to respond and adapt to the changing needs as their students develop, the hyper-dynamic environment and the interaction of these two factors (Collins & Collins, 2016a, 2016b). The focus of this interaction is the motivations and learning needs for the individual to achieve their desired outcomes while maintaining their safe participation. Specifically, the coach operates in response the situation, a situational awareness, and its demands (Endsley, 2005) of the hyper-dynamic environment and the individual learner. Consequently, the coach must be flexible, adaptive and creative. The coach needs a range of experiences, pedagogic skills, practical skills, ability in the activity and—importantly for this paper—sufficient cognitive and meta-cognitive capacity to manage the coaching session. These complex challenges indicate the need for an examination of the characteristics of coaches and the methods they employ to manage these cognitive loads. Accordingly, we first present cognitive load theory, then proactive coping as a potential mechanism for managing cognitive load and self-regulation to cope with the stressors of the coaching ‘mess’ (Simon et al., 2017).

Cognitive Load

Cognitive load theory (Swellers,1998) identifies three linked forms of cognitive load that are dependent on the capacity of the working memory; (1) intrinsic- that is inherent in the demands of the decision and can be influenced by prior knowledge; (2) extraneous- that is generated by the nature of that information, its quality and accuracy; (3)germane - generated by the processing of that

information. Intrinsic loads may be reduced by breaking down, sequencing or proceduralising information. Extraneous loads by sense making of new material, referencing to existing schema and mental models and selection via the central executive function. Lack of clarity generates cognitive loads because of the sense making aspect rather than the generation of new schema. A focusing of the cognitive resource via the central executive towards the schema generation reduces the germane load (Chandler & Sweller, 1992). Two additional factors may also affect cognitive load in decision making. Decision fatigue; utilizing cognitive resource via repeated or complex decision making. Importantly this may effect impulsive decisions, ability to balance opposing information in 'trade-offs', via avoidance of decisions, ego depletion and impaired self-regulation (Tierney, 2011; Baumeister,2003; Anderson, 2003). Additionally, a decision-making paradox (Triantaphyllou, 2000) may also be a factor in which too many possibilities are considered (Vohs, Baumeister, Twenge, Schmeichel, Tice, and Crocker ,2005)

What is Proactive Coping?

PAC stems from notions of positive psychology (Greenglass, 2009) and encompasses two future-oriented aspects of self-regulatory behaviour (Sohl & Moyer, 2009): resource accumulation (pinpointing what is required for success) and preventive coping. These aspects include the use of resources, future appraisal, realistic goal-setting and intrinsic and extrinsic feedback. PAC is a multidimensional process that occurs over time and has four elements: internal control (suggesting aspects of emotional intelligence and a meta-cognitive capacity), planning (suggesting experience and capacity to anticipate), reflection (a capacity to learn from experiences) and self-regulation of internal resources and social support (a community of practice) (Greenglass, 2002). PAC strategies appear to be initiated by the individual, self-determined and occur simultaneously on both cognitive and behavioural levels. Consequently, those who can cope proactively demonstrate initiative, are active when faced with stressors and mobilise cognitive resources to manage those stressors.

Greenglass, Schwarzer, Jakuniec, Fiksenbaum, & Taubert, (1999) also suggest that individuals who employ PAC strategies take responsibility for their actions and do not engage in denial or self-blame when faced with the possibility of failure though this seems speculative and warrant further research.

PAC as an aspect of self-regulation.

As mentioned above, self-regulation offers a broad and generalised framework to understand an individual's coping response and may be orchestrated across a wide range of different coping skills and strategies (Baumiester, Vohs, & Tice, 2007). Self-regulation occurs during the performance of a task via a construct of self-imposed or selected rules (Chen & Singer, 1992) and is conceived as dependent on an internal finite resource (Baumiester, Vohs, & Tice 2007). These depletion theories are widely accepted (Vohs, Baumeister, & Schmeichel, 2012), with researchers arguing that the resources underling self-regulation are limited and that using these resources leaves fewer resources for later. In this respect PAC potentially acts on a meta-level to manage these finite resources by focusing cognitive efforts on the most significant or likely potential outcomes and recognising the optimal strategies for a given problem or context, see our comments regarding the central executive earlier. This ensures a more manageable cognitive load by focusing resources for maximum potential return—a meta-level risk-versus-benefit decision. Indeed, some authors have described self-regulation with the analogy of a muscle that can be trained and developed (Baumiester, Vohs, & Tice (2007), an idea which leads to the prospect that both self-regulation and PAC could be trainable. Others (e.g., Efklides et al., 2002) report differences in the performance of self-regulation tasks, however, and in turn highlight that this subject is complex and requiring of further investigation. In short, the analogy may not be as so straightforward as to simply require practice to 'train the muscle'.

Anticipation and PAC. Klein and Snowden (2011) identify and characterise anticipatory thinking as the process of recognising and preparing for difficult challenges. Based on earlier work, Klein, Snowden and Pin (2007) identify aspects of anticipatory thinking that reflect a naturalistic

model of decision-making: for instance, pattern matching, in which the circumstances of a situation provide cues and clues that something may be amiss, and trajectory tracking, in which preparation for how events are unfolding has likely implications for identification and recognition of interdependencies and their implications in a given context, recognition primed decision making. Klein and Snowden (2011) describe anticipatory thinking as both 'sense making' (p. 5) and a macro-cognitive process that enables the decision-maker to mentally simulate possible courses of action, evaluate the potential problems that may arise and identify possible solutions. It appears logical, however, that anticipation must also operate at a meta-level, enabling management of the PAC strategies. In this respect, it is a strategy of problem detection and solving that requires a 'reframing' of the problem and the strategies for its solution, a meta-cognitive aspect of the decision-making process. Being able to anticipate allows the coach to foresee the potential for highly acute cognitive tasks. Such a capacity potentially enables the coach to avoid situations of high load if the cognitive resources are unavailable or have been allocated to other events.

Anticipation, PAC, judgment and decision-making.

Previous work has stressed the significance of judgment and decision-making (Collins & Collins, 2013, 2016a, 2016b; Collins, Collins, & Carson, 2016) in high-level coaches who specialise in AS. We argue that judgment and decision-making in this context are consistent with a dual-processes perspective on decision-making and represent a synergy of classic and naturalistic cognitive approaches. Importantly, Collins and Collins (2013, 2015, 2016a, 2016b) argue that there are several conscious processes involved in JDM despite the apparent predominance of naturalistic (such as recognition primed decision making and heuristics) that act in addition to intuitive processes. In short, JDM combines nested classic and naturalistic decision-making processes that vary depending on the context of the decision. Pre, including planning, and post action being predominantly CDM, but not exclusively, in nature with in-action decision making being predominantly but not exclusively NDM.

Unsurprisingly, the barriers to anticipatory thinking outlined by Klein and Snowden (2011) reflect a number of heuristic biases identified by a range of authors (Cox, 2007; Girgerenzer, Todd, & ABC Research Group, 1999; Hammond, Keeney, & Raiffa, 1999; McCammon, 2004; Plouso, 1993; Renfrew, Martin, Micklewright, & St Clair Gibson, 2014; Russo & Schoemaker, 1989; Gregg, Hahadevan, & Sedikides, 2017). Reflective of the synergy of CDM and NDM these are potential 'traps' in the whole decision-making process.

Consequently, and as stated earlier, our aim was to identify how AS coaches ensure sufficient cognitive resources are available to manage the chronic daily demands of coaching and the possible acute loads associated with anticipated changes to the situational demands. Furthermore, we ask how these strategies differ among coaches.

MethodIn order to reflect the sample size accurately and enable sufficient breadth and richness of the responses, a two-part mixed approach was employed that used the PAC Inventory (PCI) (Greenglass, Schwarzer, Jakuniec, Fiksenbaum, & Taubert, 1999) as a quantitative questionnaire and (2) an Applied Cognitive Task Analysis (ACTA) (Militello & Hutton, 1998) as a qualitative structured interview instrument (Teddlie & Tashakkori, 2009). Parts 1 and 2 were both piloted and cognitive interviews undertaken (Drennan, 2003) with representative samples and reappraised prior to use. To avoid interviewer bias, the interview was structured with open-ended questions to engage participants and elicit open-ended, rich and deep responses (Frey & Fontana, 2005; Patton, 2002). The small potential sample of suitably expert coaches influenced our choice of a mixed approach and our choice for depth in preference to breadth of inquisition. With regard to credibility and data interpretation, the authors are both qualified and active AS coaches and leaders. Both hold a range of the high-level qualification in a range of AS, a combined experience of over sixty years in kayaking, canoeing, mountaineering and skiing.

Part 1: Proactive Coping Inventory

As a starting point, we hypothesised that we would see a full range of proactive coping strategies across the participants and that these may differ dependant on sex and experience.

Participants. Following institutional approval, a purposive sample of active British AS coaches (n = 65) was invited to take part in the study at professional development training conferences in the UK over the winter period 2017–18. To ensure a sufficient level of domain expertise, experience and inherent quality in terms of participants' self-reflective abilities, purposive sampling was employed based on the following criteria: (1) a minimum of five years' coaching experience since senior accreditation as a coach or leader, (2) active engagement in AS coaching over that period and (3) a willingness to examine their professional practice. Participants were clearly delineated by gender (n= 41males and n=18 females) and split into two groups based on years of experience in AS coaching (>5 years low experience and < 5years high experience)

Procedure. Once consent was received, a copy of the PCI (Greenglass, Schwarzer, Jakuniec, Fiksenbaum, & Taubert, 1999) was forwarded to each coach. The PCI comprises seven scales consisting of fifty-five items: PAC (n = 14), Reflective Coping (n = 11), Preventative Coping (n = 10), Avoidance Coping (n = 3), Instrumental Support Seeking (n = 8), Emotional Support Seeking (n = 5) and Strategic Planning (n = 4). These scales examine, on a cognitive and behavioural level, ways of coping based on resourcefulness, responsibility and vision. Participants were asked to confidentially and anonymously complete the PCI by scoring responses to each item using a four-part Likert scoring response (1: not true at all, 2: barely true, 3: somewhat true and 4: completely true).

Data processing and analysis. Data collected from the PCI were analysed in line with the recommendation of the PCI originators (Greenglass et al., 1999), using two 2 X 7 (Sex X Factor) and (Experience X Factor) ANOVAs, with Greenhouse-Geisser adjustment used throughout. At this point, participants were also asked whether they would be willing to participate in the ACTA part of

198 the research. Six were randomly selected from those who agreed. A mutually convenient date and
199 time for the second stage were agreed following consent from participants.

200 **Results.** Of the participants (n=65), 96% response rate was achieved(n=63). Four further
201 were discarded for failing to meet the response criteria, erroneous or unclear answers. Consequently,
202 the final data set equates to a 94% completion rate and sample size of n = 59. An initial descriptive
203 analysis of those responses was completed, followed by a comparison of results between experience
204 and gender, (Table 1.)

205 *Insert Table 1 close to this point*

206 Significant Mauchley Test results for sphericity in the data led to the use of the conservative
207 Greenhouse-Geisser adjustments as recommended by Abdi (2010). No significant interactions were
208 apparent in the experience values. In the gender analysis, results demonstrated an unsurprising
209 significant main effect for Factor (unsurprising and spurious, as the factors are evaluated with
210 different scales) but also and of interest, a significant interaction between gender and factor
211 ($F(4.67.266) = 2.48$, $p < .05$) albeit with a small effect size (Partial $eta^2 = .04$). This was followed up
212 by a Tukey test, which showed this to be due to differences in proactive coping, instrumental support
213 and avoidance seeking (see Table 1).

214 **Brief discussion of results for Part 1.** The lack of significant differences between
215 participants of different experience levels may reflect an aspect of participation in AS. Either
216 participation in AS attracts individuals who have these characteristics or active participation
217 encourages the development of proactive coping strategies. We conjecture that this may be a unique
218 aspect of coaching in this domain, namely that coping skills may be present in the coaches as a result
219 of being independent practitioners in AS before becoming coaches. This is an area worthy of further
220 investigation. Recent research (e.g., Frühauf, Hardy, Pfoestl, Hoellen, & Kopp 2017) has identified
221 reflection and learning from experience as an integrated aspect of AS. This may be an attribute that

transfers into coaching and leadership.

The gender effects are also worthy of further investigation; specifically, to check whether these are genuine gender differences per se, or aspects of the social experience of the female coaches in this environment. Constructs examined by the psychometrics used in this study are clearly important in the AS coaching role. Accordingly, it is obviously worth examining the genesis and operation of the constructs in AS.

Part 2: Applied Cognitive Task Analysis (ACTA)

An ACTA (Militello & Hutton, 1998) was used to elicit the critical cognitive elements from those members of the group who agreed to participate in the second part of the study (n = 6). The ACTA comprises a three-step process: (1) the task diagram with associated interview, (2) the knowledge audit and simulation interview and (3) a cognitive-demands table that was constructed to consolidate and synthesise the data.

Participants. Participants consisted of three female and three male coaches based in the United Kingdom (M_{age} = 35.4, SD = 9.47 years). A descriptive summary of the participating coaches can be found in Table 2. Steps were taken to ensure the anonymity of the participants, performers or other significant people involved in the study. Pseudonyms have been used where necessary and steps have also been taken to avoid deductive disclosure.

Insert Table 2 close to this point

Procedure.

Task diagram. Participants were asked to consider a task diagram prior to the initial interview. They were asked to identify the three to six major steps involved in running an AS coaching session with unknown participants in sub-optimal conditions. The sequence in which the steps were to be carried out and those requiring greater cognitive effort are highlighted in Table 3.

The following knowledge audit took the form of a semi-structured interview focused on constructing and expanding the diagram

Knowledge audit. The knowledge audit identified how the coaches' expertise was used. The knowledge audit aimed to capture important aspects of the coach's expertise and focused on knowledge categories that have been found to characterise expertise of coaching in similar contexts. These included diagnosis and prediction, situational awareness and demands, adaptability and flexibility, perceptual skills, development of and knowledge of when to apply tricks of the trade and heuristics, improvisation, meta-cognition, recognition of anomalies and compensation for equipment limitations. Probes and questions (see Table 3) were used to elicit domain-specific knowledge or skills and further examples. Depth was also achieved, allowing the nature of these skills, specific events and strategies to be examined. Initial probes were followed by increasingly specific questions that examined examples, cues and strategies of decision-making. Finally, potential errors were discussed.

Insert Table 3 close to this point

Simulation interviews. The simulation interview focuses more specifically on the coach's cognitions within the coaching process. The stimulus scenario was selected and adapted from five possible scenarios used in AS coach training, with the same challenging scenario presented verbally to each participant. This described a situation in which a student was failing to learn a key skill relevant to their progression and in which the coach's regular approaches had failed. In the scenario, the student was reported as getting frustrated and tired. The simulation probed for situation assessment, actions, critical cues and potential errors (see Table 3). A guide was constructed with questions influenced by critical incident technique (Flanagan, 1954) as a 'knowledge elicitation strategy' (Flin, O'Connor, & Crichton, 2008, p. 222). The interviews allowed us to elicit key information and explore experiences in greater depth. Specifically, the process involved a partnership between interviewer and interviewee, the key element of which was an exploration with

the interviewee of what information was influential when assessing a situation or selecting a particular course of action (Flin et al., 2008).

Cognitive-demands table. After conducting these three stages of the ACTA, a cognitive-demands table (Table 4) was used to analyse the data and focus the analysis on the research aims and objectives. The table provides a format that focuses analysis on the research aims by reviewing the common themes that emerge from the data derived from stages 1, 2 and 3. We focused on difficult cognitive elements, why those aspects are difficult, the anticipation and addressing of these challenges (cues and strategies) and anticipated common errors. The table identifies common themes in the data, connecting information and relationships.

Part 2: Analysis and Results Applied Cognitive Task Analysis

All participants identified the highest cognitive load as being associated with two interrelated stages in the initial context of meeting unknown students (Table 4). The first was the decisions associated with the initial planning of the activity prior to embarking on the coaching itself, in which a venue and location were identified. This reflected the individualised focus of the whole coaching process from the outset. Second was a linked stage in which an in the field audit of the initial planning assumptions and decisions were made. These two stages led directly to the initial coaching interactions that generated less cognitive demand. The cognitive demand lies in the initial venue selection and consolidation of a straw-man plan, namely one that is meant to be reconfigured as information is consolidated.

Insert Table 4 close to this point

General Discussion

Initial meeting and activity with clients. An initial information-gathering stage prior to meeting the clients was associated with a high cognitive load. Coaches 5 and 6 both preferred to

contact the clients in advance of any planning, whilst coaches 1, 2, 3 and 4 all started gathering information immediately prior to coaching by reviewing weather and condition forecasts and client details from booking forms. In both approaches the process reflected the expectation of the coach's employers; coaches 5 and 6 work within small coaching providers, while coaches 1, 2, 3 and 4 work with larger organisations and are constrained by logistical and practical demands.

Irrespective of the order, this initial information-gathering stage initially appeared to be a classic decision-making process in which optimal information and time are invested in an effort to select an initial coaching venue and potential content. Participants drew explicitly on reflection (Schön, 1983), of their own experience with potential venues in particular conditions, seeking venues that allowed for multiple options and flexibility in terms of activity and task. Coaches 1, 2 and 6 identified the 'habitual' use of particular venues that met these requirements 'I know of good venues that allow me to see what I need…' (C6), this approach appeared to implicitly recognised a need to retain cognitive resources for later demands, though was not explicitly highlighted by the coaches. Coaches 2 and 5 identified a potential habitual and familiarity heuristic (Cox, 2007; Girgerenzer, Todd, & ABC Research Group, 1999; Hammond, Keeney, & Raiffa, 1999; McCammon, 2004; Plouso, 1993; Renfrew, Martin, Micklewright, & St Clair Gibson, 2014; Russo & Schoemaker, 1989; Gregg, Hahadevan, & Sedikides, 2017) but recognised the potential for biases and traps with this approach; both guarded against these by recognising the potential for this occurrence and auditing the decision-making process and exploiting their community of practice, a meta-cognitive aspect of the coach's activity. Coach 4 described this venue selection stage as 'a straw-man plan' in which logistical aspects (transportation, lifts, shuttles etc.) could be fixed, thus reducing cognitive load at this point in the process but enabling all other aspects to be checked, challenged and reconfigured. The logistical aspects effectively became absolutes, providing a framework within which decisions about the activity and interaction with clients could be made. This approach, however, was used to manage the

coach's own cognitive resources in anticipation of a second, linked—but more cognitively demanding—stage: the field audit cited earlier, which formed the focus of the initial coaching session. Implicitly, the coaches appeared to recognised the extent of and manage their own cognitive resources, , though this appear tacit in nature (Polyanni, 1958/1998; Nonaka & Takenchi, 1995) and requires further investigation.

The Field Audit. The information gathered regarding weather, conditions and the self-reported client abilities was used to inform venue choice and the immediate first couple of hours of coaching. A holistic view of the client, the environment and the interaction of the two was developed and then continually refined, updated and modified throughout the coaching interaction as part of an initial field audit. An escalating heuristic was applied to the client, see our note earlier regrading Cialdini, (2001). Coach 3 stated that 'the more time I spend with the clients, the more accurate my knowledge about their abilities and behaviour in the environment'. This further reduced cognitive load by reducing the options considered, some initial options are disregarded while others are reprioritised. Coaches 1 and 4 also highlighted that their abilities included responses to coaching and behaviour in the field under a range of conditions. This reflected the coaches' confidence in the information gathered as much as its accuracy: greater confidence for the coach in their decision-making reduced cognitive demands by reducing the variables and the extent of their influence but would be clearly prone to heuristic traps.

Strategies to elicit accurate information were employed by all coaches, though these did differ by coach and by case. Coaches 3, 5 and 6 initially focused on technical ability and performance, while coaches 1, 2 and 4 initially sought indications of personal traits and pedagogic points, this appeared to reflect the background. As a secondary focus, the attention switched, addressing the remaining points and triangulating the information to create a holistic view of the clients as both performers and learners. The order of this aspect of the information-gathering reflected the coaches'

own mental models of the situational demands faced in that context and anticipated contexts as the coaching process evolved. Bar-Eli, Plessner and Rabb. (2011) comment that this may prove suboptimal because key information is missed, ignored or negated and links this this is due to a cognitive capacity constraint. However, the emerging 'picture' of the client and their development enhanced the coaches' confidence in their decision-making, though this in itself may become a heuristic and prone to bias and assumption. While Cialdini, (2001) does warns against heuristics that increase cognitive effort this instance, appeared to lessen the cognitive load by reducing the inherent questioning of their decisions by accepting some fixed points and consolidating others. These appear to be logistical but also created by the instructor based on their background as cited earlier. No heuristic was applied to the weather and conditions reports; these forecasts were updated regularly in the mid- and long-term plans, while short-term anticipation of changes in conditions and weather was based on the coach's field observations, training and experience. Thus, a cognitive resource was retained to address any potential acute stressors that could be generated by unanticipated changes in conditions, coach 5 described this as 'a weather eye' meaning a situational awareness and comprehension of the demands of the context. The nature of this cognitive resource—whether it is a 'ring fenced' resource, perhaps as an aspect of working memory and linked to executive function, or an additional one, retained as an 'overdraft' in long term memory—appears unclear and warrants further investigation.

Retaining Flexibility. All the coaches anticipated deficiencies and inaccuracies in the information available at a local level. These included, for example, the reliability of regional weather forecasts in a local context, anomalies and inconsistencies in condition reports as an effect of local weather and challenges in identifying client's abilities as an outcome of client misrepresentation or misperception. Consequently, the coaches used naturalistic decision-making, (Kahneman,2011, Klein, 2008, 2015) in an effort to reduce the cognitive load prompted by sub-optimal information

while also retaining flexibility. Specifically, a conservative heuristic was applied: the less confidence the coach had in the information available, the more conservative the choice of venue. Secondly, and relatedly, an inverse heuristic was applied in which the more uncertain or dynamic the conditions, the lower the assumed ability of the clients. This assumption did not relate to the level of client performance but rather the durability, robustness and resilience of the client's performance under the pressure generated by the conditions. An anticipation of performance collapse under pressure was accommodated as an aspect of this heuristic. Consequently, the coach's adjustments to the task and delivery at the venue augmented the variety required in venue selection highlighted earlier. This combination of classic and naturalistic approaches supports our earlier contention that decision-making in this context is synergetic in the planning stages. We speculate, however, that such scepticism regarding weather and conditions reports may be reflective of the UK context of this study and is worthy of further investigation. These decisions would be less demanding in situations in which weather patterns or conditions are more predictable or fixed.

Use of the Community of Practice. The community of practice, in this case immediate colleagues and associates, was used to gain additional information regarding venues, seek support for decisions, a check and challenge, and reducing cognitive load by increasing the quality of the information available. This appeared to support the notion that it is the uncertainty and paucity of information, not its amount, that generates cognitive and germane load. The point at which the degree of certainty becomes acceptable is specific to the coach, clients and context; the riskier the context, the more certainty is required. Multiple interrelated factors are at play: for example, high coach-to-client ratios (e.g., 1:8) with well-known students in benign conditions—a sheltered lake—has a lower cognitive load than a lower coach-to-client ratio (e.g., 1:2), with unknown clients in highly dynamic conditions. This suggests that the cognitive load stems from the synergy of environmental and coaching demands (situational awareness and demands) rather than just the numbers of students involved, beyond the simple issue of reducing the span of control. This may challenge long-held

beliefs that more advanced conditions automatically necessitate a lower client-to-coach ratio in favour of a more nuanced decision based on the student's ability in context. Knowledge of student ability becomes a factor, as a coach with capable and known students may be able to operate in a more advanced environment than the same coach with the same number of unknown students. Clearly, though, a logical increase in demand brought about by an increased span of control cannot be overlooked. In short, the notions of low coach to student ratio is not as simplistic as the idea that advanced conditions equal a low ratio and is worthy of future investigation.

Of interest, coaches 1, 2 and 4 were selective in their use of the community of practice. Specifically, they sought out particular sources, linking their choice to trust, empathy and relationship to the learning outcomes for their proposed activity. As a consequence, the available CoP was largely based on professional respect and relevance to the proposed activity. Coaches 3, 5 and 6 used an even narrower group of immediate colleagues via closer friendship links. Interestingly, the coaches perceived the use of the CoP as a 'sign of weakness' (C2, C3, C5 and C6) and viewed it as a trait of less-experienced instructors, C3 highlighted a 'potential to be sandbagged'[2]. On investigation, this reflected the perceptions of a small group of respected and influential instructors whose seniority was based on experience and high levels of personal performance but not on specific pedagogic training. As such, this was a historical issue and highlighted the ongoing transition in AS coaching from high performers becoming coaches to suitably trained professional coaches. Coach 6 articulated this transition as 'being a *rock climbing* instructor or a rock climbing *instructor*', describing a difference in the perception of their role. Coach 5 described this as 'the paddler sustaining their paddling habit by doing a bit of coaching on the side'. This may reflect either the

[22] 'Sandbagged': describes advice given either intentionally or unintentionally that may result in greater work for the coach,

professionalisation of coaching or the growth of the outdoors sector and is worthy of further investigation.

Creating Wholistic Client View, Following the gathering of information, creation of a strawman plan and fixing of the logistics assures that a suitable flexible and secure location are selected. The primary purpose of this initial activity was to complete a 'field audit'. Coach 1 stated:

> So, I'm stood there in this place that I've chosen, gone through all the process of deciding what to do and what I could do. Getting there, what is the actual weather in front of me? What are the people in front of me? And then there is a kind of resilience to what is actually happening.

Coach 5 stated that 'no plan survives first contact….', paraphrasing an old military adage. An initial audit of the venue selection—literally, what the coach is observing at the venue against the forecasted weather and conditions—precedes any activity. Coach 4 highlighted the significance of this literal reality check. This was a specific point in an ongoing audit of forecast against reality. Coach 6 noted that the option is always retained to change venue, a Plan B, which will have been amongst a limited number those already considered and retained as a safe fall back that ensures some activity, security and the opportunity to audit the clients. If weather and conditions appear as predicted, an internal, two-part question for the coach—is this as I expect and will it change as I expect?—is then applied to the clients. Consequently, the objective of the session is to generate a 'picture' (C1 and C4) of the client as a learner in context.

Profiling performers is not new and, unsurprisingly, the coaches employed a range of observation and questioning strategies (Giblin, Farrow, Ball, & Abernethey, 2015). These appear highly individualised, both towards the performer and coach (McGarry, 2009) with coaches having preferred approaches, questions and assumptions based on their experiences and forming a set of highly personal heuristics built within the absolutes mentioned earlier. In this respect, a synergy of classic and naturalistic decision-making was apparent. Coach 5 described these as structured and

436 unstructured observation, which also applied to synergetic questions applied by the coach. An audit
437 is implied by coaches 2 and 4 and explicitly identified by coaches 1, 3, 5 and 6. In short, the question
438 'Does the client's perception of their ability match what the coach observes?'(C1) has clear safety
439 and pedagogic implications. Again, the coach asks the internalised question, 'Is this as I expect?', in
440 this case regarding the behaviour of the client in response to both coaching and the environment.
441 Understanding this aspect of a client's behaviour has safety implications as it directly influences goal
442 setting, venue selection, safety measures and coaching approach. Anticipating client responses, their
443 rate of development and their response to the environment reduces acute cognitive load by ensuring
444 that the coach can gauge and adjust the environment and activities that that client may undertake.
445 Coaches 1, 2, 3, 4 and 6 described a need for holistic observation and questioning via
446 increasingly structured activities. The coaches' conclusions were drawn from an appraisal of
447 technical performance and the clients' understanding of that performance in a range of different
448 contexts. Notably, however, the coaches also paid particular attention to the behaviour of the clients,
449 their responses to questions and their body language. Coaches 1, 2, 3 and 4 all referred to 'the whites
450 of their eyes' as indications of fear. Coaches 2, 4, 5 and 6 all looked for changes in client behaviour
451 in the immediate, short and midterm as environments changed. Coaches 1 and 3 identified 'delaying
452 tactics' (C1) and 'faffing'[3] (C3) as strategies employed by clients prior to activity about which they
453 felt uncertain. Coaches 3 and 6 identified changes in performance, such as 'shortening of paddle
454 strokes' (C5) or 'reduction in stability' on uneven terrain (C6), which both coaches attributed to
455 increasing anxiety that was a consequence of change. Importantly, the coaches used these
456 observations in comparison with earlier observations in less stressful environments, although this was
457 not explicitly articulated in the decisions about venue selection highlighted earlier.

[3] 'Faffing': an informal term meaning spending one's time doing a lot of things that are not important instead of the thing one should be doing.

Information gathered in the audit was used at two levels: initially, an *act on* (immediate safety), *store for later* (learning) or *ignore* basis, and an almost immediate secondary level that applied that created two sub-categories: namely, *act*, then *store,* in order to see a coaching and learning response. Conversely, a 'store then act later' could also be applied, combined with other information that could identify a root cause to a performance problem. Two aspects appeared to be at play in this respect: (1) a triangulation of stored information and (2) a prioritising of information in relation to any safety concerns. Coach 5 described this as 'looking for a root cause'. Outwardly, this approach demanded greater cognitive effort than just responding to the multiple individual signs, while addressing cause rather than each sign reduced cognitive load later in the coaching interaction, in this respect, the events of high cognitive loads—can be timed, when other demands are lower. The coaches recognised that, by avoiding repeated and less effective interventions in favour of a single accurate intervention, the cognitive load can be managed on coach and the learner. In this respect, it involves reducing the cognitive load by redesigning the straw-man plan and reducing and reordering the possible options.

The coaches manage the demands of new and novel situations at a macro level by using a problem-solving strategy that starts with the last decision and action by the coach; if a learning impasse is encountered and is preceded by a change in task, this is the most likely cause of the problem, for example. If, however, the impasse follows the coaches' feedback, the coaches' delivery of that feedback is to be examined. Two interrelated heuristics emerge: the first based on the most probable cause drawn from the coach's experiences and preferences and the second based on a particular response. Such heuristics appear to illustrate the coaches' recognition of the cumulative impact of arousal levels generated by the environment, for instance. Implicitly, this suggests a recognition of the student's own finite resources for coping and the effect of exceeding that capacity,

as the coaches appear to be managing both their own and their clients' cognitive resources, a practical application of Sweller (1998) cognitive load theory

A third heuristic is also at play that reflects the effect of change on the client. If something is changed (e.g., the task, environment or actions of the client), the performance is anticipated to decline while the client processes the change. Coach 5, for example, reported a need for further action only when improvement was not observed after several attempts. Coach 1 also reported making changes to the coaching of a client in advance of the anticipated need in order that learning may occur. This suggests that learning is recognised by the coach a cognitive rather than just observable process. With respect to the chronic cognitive load, it is managed in two ways: reducing the frequency of feedback that requires thought and observation and, as cited earlier, avoiding repeated less effective interventions, management of clients and coaches the intrinsic, extrinsic and germane cognitive loads. Conversely, acute cognitive load may be addressed by encouraging replication of a particular skill without a longer-term learning objective. For instance, an unexpected change in conditions may oblige a client to replicate a particular skill for safety reasons. A simple 'show, tell and copy' rather than consideration of a more sophisticated pedagogic approach requires the coach to match the approach with the demands of both the clients and the environment. Matching the pedagogic approach with the desired outcome—in other words, picking the right 'tool' for the job—emerges as a cognitive load management strategy.

On a micro level, the coaches use a combination of loose (Nicolson, 1971) or component parts, small functional units and some structural procedures in different combinations to facilitate a solution. Existing components, units and procedures are adapted and repurposed in preference to redesigned novel solutions, thus lessening cognitive demands. Integrated within this process is reflection in action (Schön, 1983), on the effect of the coaches' actions and on action in order to

integrate the novel solution into the coaches' repertoire. Coaches 1, 2 and 5 highlighted both opportunistic and actively created chances for reflection during the activity.

Limitations and Future Research

Reflecting the geographic constraints and sample size, further investigation could logically examine the coping strategies from a larger and more geographically diverse sample. We speculated earlier that two aspects of the study—(1) the scepticism of this sample regarding weather and conditions reports and (2) the increased professionalisation of coaching in this context (the use of the community of practice and perceptions of coaches' roles)—may both be reflective of the UK context. More generally, in reporting on this sample of experts, it is logical to examine the training and development of proactive coping strategies in non-expert coaches. Specifically, and reflecting the need for these coaches to participate alongside their students in the activity, we would also ask whether managing the cognitive demands of participation in AS may predispose coaches to integrating these demands into the coaching process. The degree and genesis of the small but significant gender effects detected is also worthy of further investigation, especially if this aspect is shown to play a role in coaching efficacy and/or the workload imposed. Finally, reflecting the inherent risks associated with coaching in these activities, it would be useful to examine further how coaches may ring-fence cognitive resources to deal with the acute demands of potential emergencies.

Conclusion

What emerges from this study is management through proactive coping, rather than reduction of cognitive load by the coaches. This may reflect the characteristics of high-level performance in this domain. Coaches accommodate the finite nature of their own cognitive resources in order to manage the demands and take steps to ensure adequate cognitive resources are available for the anticipated peaks in demand. We speculate that an element of those resources may be ring-fenced to

respond to the acute demands of emergencies, although this will require further investigation. This may reflect a willingness to take tougher decisions and work harder in anticipation of greater savings later rather than easy options immediately: in short, coping with demands by managing the coaches' resources based on the anticipated demand, which in turn derives from the coaches' own reflections on their experience of their own professional practices.

With respect to proactive coping strategies, the cognitions and behaviour of the coaches focus on their goal-setting capacity. Primarily, this is self-regulation, driven by the goal. The coaches have clearly established goals for their interaction with clients that focus and prioritise their actions and thus their cognitive load. The male coaches in part 2 focused their goals around outcome, while the female coaches focused their goals around process. We suggest that a middle-ground position appears optimal and that as coaches' experience grows, an ability to move between process and outcome focus becomes optimum.

With respect to instrumental support seeking, the coaches all used their community of practice. Significantly, the male coaches restricted their community of practice to trusted friends and immediate colleagues, whilst the female coaches used a broader community of practice that relied on professional respect and recognition of the aims of the coaching. All reflected on the perception of using the community of practice as a sign of weakness, which possibly reflects a historic culture within the domain that places value on personal ability at the expense of pedagogic skills. Our own work has highlighted a middle-ground position in this regard (Collins & Collins, 2012, 2016) that still merits further investigation. With respect to avoidance coping, the planning process, information gathering and audit act to delay or mitigate the cognitive load by virtue of reducing variables and thus complexity, which in turn reduces the number of possible options, building and developing a holistic image of the clients as learners in context. This study has deepened our comprehension of the decision-making processes in expert coaches in this domain and illustrated a set of heuristics that are

synergistically with other decision-making processes to manage cognitive load. We highlight the level of cognition used by experts in this domain. The coaches acknowledge their finite cognitive resources and take steps to prioritise their use in anticipation of demand to ensure both client safety and development.

References

Abdi, H. (2010). The Greenhouse-Geisser Correction In Neil Salkind (Ed.), Encyclopedia of Research Design, pp. 54-63. Thousand Oaks, CA: Sage

Abraham, A., & Collins, D. (2011). Taking the next step: Ways forward for coaching science. Quest, 63, 366–384. doi:10.1080/00336297.2011.10483687

Alquist, J. L., & Baumeister, R. F. (2012). Self-control: Limited resources and extensive benefits. Wiley Interdisciplinary Reviews: Cognitive Science, 3, 419–423.

Anderson, C. (2003). "The Psychology of Doing Nothing: Forms of Decision Avoidance Result from Reason and Emotion". Psychological Bulletin. 129: 139–167. doi:10.1037/0033-2909.129.1.139. SSRN 895727.

Bar-Eli, M., Plessner, H., & Rabb, M. (2011). Judgements and decision making in sport. London, UK: Wiley Blackwell.

Baumeister, R, F. (2003). "The Psychology of Irrationality", in Brocas, Isabelle; Carrillo, Juan D (eds.), The Psychology of Economic Decisions: Rationality and well-being, pp. 1–15, ISBN 978-0-19-925108-7.

Baumeister, R. F., & Tice, D. M. (2016). Uncertainty depletes self-regulatory resources. Tallahassee, FL: Florida State University.

Baumeister, R.F., Vohs, K.D., & Tice, D.M. (2007). The strength model of self-control. Current Directions in Psychological Science, 16, 351–355.

Bennis, W.B., & Pachur, T. (2006). Fast and frugal heuristics in sports. Psychology of Sport and Exercise, 7, 611–629. doi:10.1016/j.psychsport.2006.06.002

Chandler P and Sweller J (1992) The split-attention effect as a factor in the design of instruction. British Journal of Educational Psychology (62): 233–246.

Chen, D., & Singer, R. N. (1992). Self-regulation and cognitive strategies in sport participation. International Journal of Sport Psychology, 23, 277–300.

Cialdini, R. (2001). Influence: Science and practice. Boston, MA: Allyn and Bacon.

Coaching Association of Canada (2010) 'Women in Coaching', www.coach.ca/eng/women/index.cfm

Collins, D., Collins, L., & Carson, H, J. (2016). 'If it feels right, do it': Intuitive decision making in a sample of high-level sport coaches. Frontiers in Psychology. 7:504 doi: 10.3389/fpsyg.2016.00504

Collins, L., & Collins, D. (2012). Conceptualising the AS coach. Journal of Adventure Education and Outdoor Learning, 12, 81–93. doi:10.1080/14729679.2011.611283

Collins, L., & Collins, D. (2013). Decision-making and risk management in ASs coaching. Quest, 65, 72–82. doi:10.1080/00336297.2012.727373

Collins, L., & Collins, D. (2015). Integration of professional judgement and decision making into high-level AS coaching practice. Journal of Sports Sciences, 33, 622–633. PubMed doi:10.1080/02640414.2014.953980

Collins, L., & Collins, D. (2016a). The foci of in-action professional judgment and decision-making in high-level ASs coaching practice. Journal of Adventure Education and Outdoor Learning, 17(2), 122-132. doi: 10.1080/14729679.2016.1227717

Collins, L., & Collins, D. (2016b). Professional judgment and decision making in the planning process of high level ASs coaching practice. Journal of Adventure Education and Outdoor Learning16:3. 256-568. doi.org/10.1080/14729679.2016.1162182

Collins, L., Carson, H, J., & Collins, D. (2016). Metacognition and professional judgment and decision making in coaching: Importance, application and evaluation. International Sports Coaching Journal. 3, 355-361 doi:10.1123/iscj.2016-0037

Cox, L.A. (2007). Does concern-driven risk management provide a viable alternative to QRA? Risk

605 Analysis, 27(1), 27–43. PubMed doi:10.1111/j.1539-6924.2006.00857.x
606 De Jong T (2010) Cognitive Load Theory, educational research, and instructional design: Some food
607 for thought. Instructional Science 38(2): 105–134.
608 Drennan J. (2003). Cognitive interviewing: Verbal data in the design and pretesting of
609 questionnaires. Journal of Advanced Nursing, 42(1), 57–63.
610 https://doi.org/10.1046/j.1365-2648.2003.02579.x
611 Efklides, A. (2002). The systemic nature of metacognitive experiences: Feelings, judgments, and
612 their interrelations. In M. Izaute, P. Chambres, & P.-J. Marescaux (Eds.), Metacognition:
613 Process, function, and use (pp. 19–34). Dordrecht, The Netherlands: Kluwer.
614 Endsley, M. R. (2000). Theoretical underpinnings of situation awareness: A critical review. In
615 Endsley, M. R., Garland, D. J. (Eds.), Situation awareness analysis and measurement
616 (pp. 3-32). Mahwah, NJ: LEA.
617 Flanagan, J. C. (1954). The critical incident technique. Psychological Bulletin, 51, 327–358.
618 Flin, R., O'Connor, P., & Crichton, M. (2008). Safety at the sharp end: A guide to non-technical
619 skills. Boca Raton, FL: CRC.
620 Frey, J. H., & Fontana, A. (2005). The interview: From neutral stance to political involvement. In N.
621 K. Denzin and Y. S. Lincoln The Sage Handbook of Qualitative Research (pp. 695–
622 726). London: SAGE Publications.
623 Frühauf, Hardy, Pfoestl, Hoellen, & Kopp (2017). A qualitative approach on motives and aspects of
624 risks in freeriding. Frontires in Psychology. doi: 10.3389/fpsyg.2017.01998.
625 Gathercole S and Alloway T (2007) Understanding working memory. A classroom guide. Harcourt
626 Assessment. Available at: https://www.mrc-cbu.cam.ac.uk/wp-
627 content/uploads/2013/01/WM-classroom-guide.pdf (accessed 11 July 2017).
628 Giacobbi, P. R., Poczwardowski, A., & Hager, P. (2005). A pragmatic research philosophy for sport

and exercise psychology. Sports Psychologist, 19(1), 18–31. https://doi.org/10.1123/tsp.19.1.18

Giblin, G., Farrow, M.R., Ball, K., & Abernethey, B. (2015). Perceiving movement patterns: Implications for skill evaluation, correction and development. RICYDE. Revisit International de Ciencias Del Deporte, 11(11), 5–17. doi:10.5232/ricyde2015.03901

Gigerenzer, G., Todd, P.M., & ABC Research Group. (1999). Simple heuristics that make us smart. New York: Oxford University Press.

Greenglass, E. (2002). Chapter 3. Proactive coping. In E. Frydenberg (Ed.), Beyond coping: Meeting goals, vision, and challenges (pp. 37–62). London: Oxford University Press.

Greenglass, E., Schwarzer, R., Jakubiec, S.D., Fiksenbaum, L., & Taubert, S. (1999). The Proactive Coping Inventory:A multidimensional research instrument. Paper presented at the 20th International Conference of the Stress and Anxiety Research Society, Cracow, Poland, July 12-14, 1999.

Gregg, A.P., Mahadevan, N., & Sedikides, C. (2017). Intellectual arrogance and intellectual humility: Correlational evidence for an evolutionary-embodied-epistemological account. The Journal of Positive Psychology, 12(1), 59–73, doi: 10.1080/17439760.2016.1167942

Hammond, J.S., Keeney, R.L., & Raiffa, H. (1999). The hidden traps in decision making. Clinical Laboratory Management Review, 13(1), 39–47. PubMed

Kahneman, D. (2011) *Thinking, Fast and Slow*, Farrar, Straus and Giroux, ISBN 978-0374275631.

Klein, G. (2008). Naturalistic decision making. Human Factors, 50, 456–460. PubMed doi:10.1518/001872008X288385ISCJ Vol. 4, No. 2, 2017

Klein, G. (2015). A naturalistic decision making perspec- tive on studying intuitive decision making. Journal of Applied Research in Memory and Cognition, 4, 164–168. doi:10.1016/j.jarmac.2015.07.001

Klein, G., & Snowden, D. (2011). Anticipatory thinking. Informed by Knowledge Expert Performance in Complex Situations. doi: 10.4324/9780203847985

Klein, G., Snowden, D., & Pin, C.L. (2007). Anticipatory thinking. In K. Mosieer & U. Fischer (Eds.), Proceedings of the 8th International Naturalistic Decision Making Conference (pp. 120–127). San Francisco State University.

McCammon, I. (2004). Heuristic traps in recreational avalanche accidents: Evidence and implications. Avalanche News, 68, 1–10.

McGarry, T. (2009). Applied and theoretical perspectives of performance analysis in sport: Scienti c issues and challenges. International Journal of Performance Analysis in Sport, 9(2), 128–140.

Militelo, L, G. and Hutton, R, J, B. (1998). Applied cognitive task analysis (ACTA): A practitioner's toolkit for understanding cognitive task demands. Ergonomics, 41(11), 1618–1641.

Morse, J. M. (2015). Critical analysis of strategies for determining rigor in qualitative inquiry. Qualitative Health Research, 25(9), 1212-1222. https://doi.org/10.1177/1049732315588501

Nicholson, S. (1971). "How Not To Treat Children: The Theory of Loose Parts". Landscape Architecture. 62: 30–34.

Nonaka, I,. & Takeuchi, H. (1995). The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation Oxford University Press,

Patton, M. (2002). Qualitative research & evaluation methods (3rd edition). SAGE Publications.

Plouso, S. (1993). The psychology of judgment and decision making. New York: McGraw Hill.

Polanyi, Michael (1958, 1998) Personal Knowledge. Towards a Post Critical Philosophy. London: Routledge

Reif, F (2010). Applying Cognitive Science to Education. Thinking and Learning in Scientific and Other Complex Domains. Cambridge, MA: The MIT Press.

679 Renfrew, A., Martin, I., Micklewright, D., & St Clair Gibson, A. (2014). Application of decision
680 making theory to regulation of muscular work rate during self paced competitive
681 endurance activity. Sports Medicine (Auckland, N.Z.), 44, 147–158. Retrieved from
682 PubMed. doi:10.1007/s40279-013-0107-0
683 Russo, J. E., & Schoemaker, P. J. H. (1989). Decision traps: The ten barriers to brilliant decision-
684 making and how to overcome them. New York: Simon and Schuster.
685 Sandelowski, M. (1995). Qualitative analysis: What it is and how to begin. Research in Nursing &
686 Health, 18, 371–375.
687 Schön, D. (1983). The re ective practitioner: How professionals think in action. New York: Basic
688 Books.
689 Simon, S., Collins, L., & Collins, D. (2017). Observational heuristics in a group of high level paddle-
690 sport coaches. International Sports Coaching Journal, 4, 235-345
691 Sohl, S. J., & Moyers, A. (2009). Refining the conceptualization of a future-oriented self-regulatory
692 behavior: Proactive coping. Personality and Individual Differences, 47(2), 139–144.
693 Sparkes, A.C., & Smith, B. (2014). Qualitative research methods in sport, exercise and health: From
694 process to product. London: Routledge.
695 Sweller J (1998) Cognitive load during problem solving: Effects on learning. Cognitive Science (12):
696 257–285.
697 Taylor, B., & Garratt, D. (2010). The professionalisation of sports coaching: Relations of power,
698 resistance and compliance. Sport, Education and Society, 15, 121–139.
699 doi:10.1080/13573320903461103
700 Teddlie, C,. & Tashakkori, A. (2009). Foundations of mixed Methods Reaserch; integrating
701 quantitiatve and qualitative approaches in the social and behavioural sciences. Ca. Sage,
702 Tierney, J. (2011). "Do You Suffer From Decision Fatigue?". New York Times Magazine. Retrieved
703 Sept 11, 2019

Triantaphyllou, E. (2000). Multi-Criteria Decision Making: A Comparative Study. Dordrecht, The Netherlands: Kluwer Academic Publishers (now Springer). p. 320. ISBN 0-7923-6607-7.

Vohs, K. D., Baumeister, R. F., & Schmeichel, B. J. (2012). Motivation, personal beliefs, and limited resources all contribute to self-control. Journal of Experimental Social Psychology, 48(4), 943–947. doi: 10.1016/j.jesp.2012.03.002

Vohs, K., Baumeister, R.,m Twenge, J., Schmeichel, B., Tice, D., & Crocker, (2005). "Decision Fatigue Exhausts Self-Regulatory Resources — But So Does Accommodating to Unchosen Alternatives" (PDF). Archived from the original (PDF) on 2011-10-04.

Table 1: PCI Results

	Gender	Mean	Std. Deviation	N
Proactive Coping	Female	**42.17**	**6.474**	**18**
	Male	**44.73**	**4.410**	**41**
	Total	43.95	5.208	59
Reflective Coping	Female	33.61	3.550	18
	Male	33.63	6.110	41
	Total	33.63	5.426	59
Strategic Planning	Female	11.94	1.955	18
	Male	11.59	2.202	41
	Total	11.69	2.119	59
Preventative Coping	Female	27.11	3.848	18
	Male	28.80	5.269	41
	Total	28.29	4.910	59
Instrumental Support	Female	**26.00**	**4.044**	**18**
	Male	**23.85**	**4.783**	**41**
	Total	24.51	4.644	59

Emotional Support	Female	15.44	3.989	18
	Male	14.56	3.647	41
	Total	14.83	3.742	59
Avoidance-Seeking	Female	**7.11**	**2.676**	**18**
	Male	**8.37**	**1.785**	**41**
	Total	7.98	2.154	59

727

728

729

730

731

732

733

734

735

736

737

738

739

740

741

742

743

744

Table 2: ACTA participant details

Coach	Gender	Specialism
1	Female	Alpine mountaineering
2	Female	Alpine mountaineering
3	Male	Mountaineering, white-water kayaking
4	Female	Mountaineering
5	Male	White-water kayaking
6	Male	White-water kayaking, mountain biking

755 Table 3: ACTA Prompts and Questions

Question	***Guide***	***Prompts***	***Time (minutes)***
Task Diagram *Prepare a task diagram for an AS activity in which the participants are unknown to the coach and the conditions have required selection of a venue from a limited range of possibilities* *Of the steps you have just identified, which require difficult cognitive skills?*	What are they? Situational demands	Highlight on diagram Articulate and field notes from interview Ensure clarity and understanding of diagram.	20
Knowledge Audit *Have you had experiences where part of the situation just jumped out at you?*	Cues? What? When? How?	Noticing	5

Are there ways of working smarter or accomplishing more with less that you have found especially useful?	Heuristics Improvisation Tricks of the trade Contextual practices	Job Smart	5
Can you think of an example when you have improvised or noticed an opportunity to do something better?	Improvisation Adaptation Flexibility	Opportunities/ Improvisation	5
Can you think of a time when you realised that you would need to change the way you were working in order to get the job done?	Self awareness EI CI Of own DM	Meta-cognition	5
Can you describe an instance when you spotted a deviation from the norm, or knew something was amiss?	Atypical Unusual Exceptional	Anomalies	5

Have there been times when the events pointed in one direction, but your judgement told you to do something else? Or when you had to rely on experience to avoid being led astray?	Nature of that experience How long? Where? What? Potential errors Pitfalls Problems with approaches Limitations	5

Simulation Interview

A situation in which a student is failing to learn a key skill, relevant to their progression. The coaches' regular approaches have failed and the student is now getting frustrated and tired.	Challenge is pedagogic, NOT technical This should be kept to teaching approaches, NOT changes to technique that are perceived as simpler	What do you do when…?

The coach may not be able to respond to this reflecting narrowness in pedagogic approach rather than declarative knowledge. Rate the ease of response 1_5 (1 impossible, 5 miss understanding of req't)

768 Table 4: ACTA Results

Initial meeting and activity with new clients

Difficult Cognitive Element	Why Difficult	Common Errors	Cues and strategies used
Information Gathering	Inconsistency in available information Venue selection acting as a constraint	Recognition of these as variables and need for audit in short mid and long term Commitment to a venue that does not offer the requisite variety	Use of heuristics Flexibility of environment and task 'Soft' plan Synergy of CDM and NDM Community of Practice
Audit of Plan	Accuracy of information Continual updating, adjusting of a	Assuming clients perception of own skill is accurate	Varied locations at a venue Observation and questioning

	holistic model that incorporates, the client, environment, learning and there interaction	Underestimate impact of environment Confirmation and expert halo heuristic trap 'Hard plan'	Synergy of CDM and NDM Information used on an Act, store, ignore basis also act then store and store then act later, prioritising Integration with mid and long term plan

Student failing to Learn

Difficult Cognitive Element	**Why Difficult**	**Common Errors**	**Cues and strategies used**
Exhausting existing knowledge	High cognitive load associated with adaptability, creativity and client expectation	Fault allocation. Linear single solution Co-linear solution with options for different procedures	Process to find the solution Loose parts with functional units Dendritic (possibilities

stemming from a single route)