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Differences in epistemological beliefs in a group of high-level UK based caving, mountaineering and rock-climbing instructors

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ABSTRACT

The epistemological underpinning of Adventure Sports Coaches' (ASCs) coaching and leadership practice is a growing area of research. The epistemological stance that links to caving instructors, winter mountaineering instructors and rock-climbing instructors practice however has not been considered. Consequently, this paper sought to explore the epistemology of 9 UK-based ASCs (caving instructors ($n = 3$), winter mountaineering instructors ($n = 3$) and rock-climbing Instructors ($n = 3$) using an Interpretive Phenomenological Analysis approach. The study aimed to determine specifically how epistemology manifested itself and whether findings reflected previous ASC research. Results supported previous work in confirming that an Epistemological Chain existed but found that it operated in a very different manner due to the environmental constraints and heightened risk evident within these particular Adventure Sport activities. Findings have implications for National Governing Body instructor training programme design and operation, and also in how epistemology is considered to influence coaches' decision making in these Adventure Sport activities.

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Introduction

Participation in adventure recreation activities has grown globally (O'Keefe, 2019), and consequently, the demand for adventure activity coaches, instructors and guides (Eastabrook & Collins, 2020). Research had focused on high-level paddlesport coaches (Collins & Collins, 2013, 2017; Sinfield et al., 2020) and, more recently, multi-activity instructors (Mees et al., 2020). Several investigations of adventure sports professionals have explored the epistemological underpinnings of coaching and leadership practice (Christian et al., 2017; Collins et al., 2015). Many authors have referred to the importance of the coaches' epistemology (Crowther et al., 2018; Grecic et al., 2013; Mees et al., 2020, 2021) though few have considered it explicitly. Authors have highlighted how the philosophical stance of adventure sports professionals influences their practice and describe an 'epistemological chain' that links beliefs to practice (Christian et al., 2017; Collins et al., 2015). However, to date, investigations into the epistemological underpinning of caving instructors, winter mountaineering instructors and rock-climbing instructors practice have received limited interest, if any.

Acknowledging the work of Collins et al. (2015), Christian et al. (2017) and Christian et al. (2020), we aim to broaden understanding of the epistemological underpinnings of adventure sports coaches (ASCs) by including caving instructors, winter mountaineering instructors and rock-climbing

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instructors. Consequently, this paper aims to investigate the epistemology and potential for an epistemological chain (EC) in a group of UK-based caving instructors, winter mountaineering instructors and rock-climbing instructors.

Christian et al (2017, 2020) have suggested that the dynamic natural environment, typical to all adventure sports (Collins & Carson, 2021), is central to the beliefs of ASCs concerning what, how and why they teach or lead in particular ways. Logically, we first offer an overview of the caving instructors, winter mountaineering instructors and rock-climbing instructors working environments before exploring the related research in this area.

Working environment for ASCs

In the UK, ASCs typically hold National Governing Body qualifications that have evaluated the coach's competency in essential safety skills (Barry & Collins, 2021). However, limited attention is paid to pedagogic skills or perceptions of good teaching or learning, beyond the approach demonstrated in NGB qualification training and assessment programmes. It is increasingly clear that coaches develop their skills uncritically, focusing on replicating skills from congested curricula that are consolidated via periods of unmentored experience. Indeed, time pressures and a cultural and almost exclusive focus on safety and rescue techniques have led some (Mees & Collins, 2022; Mees et al., 2021) to question the value of low-level awards in adventure and outdoor education settings. In this environment, the development of the coach's epistemology has limited explicit guidance or support, except, perhaps, to align with the awarding bodies' educational philosophies, if stated (C. J. Cushion et al., 2022). Alternatively, coaches may develop their epistemologies through reflection on their own experiences of learning and teaching rather than any broader understanding or education (Melhuish & Ryan, 2022).

As with other adventure sports, winter mountaineering, caving and rock-climbing are physical activities with a degree of risk. They are typically non-competitive in origin and are guided by their ethics (Collins & Brymer, 2020; Collins & Carson, 2021). Each activity has an element of physical challenge and takes place in dynamic natural settings where the ASCs must be skilfully autonomous in that environment and acts as a precursor to any coaching or leading role being assumed (Collins & Collins, 2013). Coaching and leadership tend to be characterised by a need to work in both physical and professional isolation for extended periods in natural environments. Managing client welfare, levels of task difficulty, environment, and pedagogy present complex, hyperdynamic professional settings with conflicting demands, and require high quality, frequently time-pressured and high-stakes judgment and decision making (Barry & Collins, 2021). ASCs have to contend with a range of environmental risks such as rockfall, navigation and route finding, exposure, steep or slippery terrain, exhaustion, and environmentally induced injury. These working environments are physically stressful and psychologically demanding (Cheung, 2010), with inherent complexities in the coaching process (C. Cushion, 2010; Simon et al., 2017). This makes adventure sports coaching a challenging sub-set of mainstream coaching.

Working environment of the caving instructor

The caving instructor must contend with the additional risks presented by cold water, working at height, darkness, entrapment, confined spaces, suspension trauma, route finding and a need for self-reliance and independence (Marbach & Tourte, 2002). The remit of the caving instructor is to teach caving techniques and lead in extended horizontal and vertical underground systems, which entail prolonged periods of lone working and sole responsibility for clients. There may be extended periods of crawling, climbing, the ascent and descent of vertical pitches by rope or ladder, walking and stooping underground. Caving activity also has an inherent difficulty of rescue with limited access to outside assistance (Lambrou et al., 2003). It is one of the few remaining environments where technology has not reduced decision-making load in-action; aids such as mobile phones and GPS are inoperable underground.

Working environment of the winter mountaineering instructor

Winter mountaineering in the UK is seasonally limited to the higher mountain areas of North Wales and the Lake District, but predominantly to the Scottish Highlands in the winter. Winter mountaineering instructors are expected to be able to safely navigate and lead small groups across winter mountain landscapes in conditions of poor visibility, low temperatures, darkness, and potentially high wind speeds. The remit of winter mountaineering instructors includes teaching multi-pitch snow and ice climbing and winter mountaineering techniques and will entail working independently in remote mountain environments for long periods. Consequently, the winter mountaineering instructors must be fluent in self and client rescue in multi-pitch climbing in winter conditions.

Working environment of the rock-climbing instructor

Rock-climbing in the UK takes place on various terrain, from small single-pitch crags to steep multi-pitch climbing routes on higher mountains and sea cliffs. The rock-climbing instructor operates in any mountain and rock-climbing venue within the UK in non-winter conditions. The remit of the rock-climbing instructor is to safely navigate and lead small groups across steep climbing and mountainous terrain. They will be expected to effectively manage sub-optimal conditions, such as those associated with wind, rain, damp rock, or poor visibility. The remit of the rock-climbing instructor includes the guiding and coaching of multi-pitch rock-climbing and scrambling/mountaineering techniques and entails extended periods of lone working and sole responsibility for clients. The rock-climbing instructor needs to be fluent in self and client rescue in the scope of multi-pitch climbing and mountaineering.

Epistemology- its nature and impact

Epistemology is critical because it is fundamental to how the caving instructors, winter mountaineering instructors and rock-climbing instructors think, perceive, value and learn about knowledge associated with their domain (Perry, 1981). Importantly, it underpins understanding how knowledge is created, constructed, acquired and developed. Therefore, the epistemological position of the coach has far-reaching impacts based on their perceptions of knowledge, its creation and dissemination (Christian et al., 2020; Collins et al., 2015). Furthermore, underpinning the epistemological position are the ontological views of the caving instructors, winter mountaineering instructors and rock-climbing instructors (Schraw & Olafson, 2008). Ontology therefore impacts the value, control, certainty, nature, organisation, application, creation and acquisition of knowledge (Perry, 1981).

Schommer (1994) highlighted epistemological development as a continuum, with beliefs being naïve or sophisticated at the poles. The naïve perspective accepts knowledge as clear, specific, held in authorities, primarily fixed, grounded in accepted prescribed models and reinforced by authority sources such as training manuals, training courses and successful 'expert' instructional texts. In action, ASCs with a naïve position apply a narrow range of teaching strategies that ensure explicit learning and defined practices. The ASCs 'own' the knowledge, manage its dissemination and are constantly required to provide reinforcement that generate a coach-dependent performance. In contrast, the sophisticated perspective holds that knowledge is complex, changing, dynamic and learned gradually via both tacit and explicit cognitive processes, and that it can be constructed and constantly developed (Howard et al., 2000; Schommer, 1994). Such ASCs apply a range of teaching styles that are selected to optimise learning. In practice, the ASCs may utilise constructivist approaches to develop a performer's independence, self-analysis, reflection, and promotion of lifelong learning. These ASCs question authority and challenge orthodoxy or accepted practices.

Epistemology and practice

Christian et al. (2020) suggest that Schommer's (1994) spectrum can be ostensibly linked with Mosston and Ashworth's (1990) spectrum of teaching styles. Schommer's (1994) naïve pole would align with the 'instructor' centred teaching styles, whilst the sophisticated, with more student-

centred styles. Christian et al. (2020) propose that a sophisticated epistemological position requires ASCs to have a range of teaching styles and apply them effectively. The logical link is to select an appropriate teaching style in response to context, via a refined situational comprehension, which enables the choosing of the most suitable approach. In short, an epistemological position may be demonstrated by the range of styles, not just by using a specific or single style. For example, a coach who only uses student-centred approaches may be as epistemologically naïve as one using a single coach-centred approach.

Philosophy to practice

Collins et al. (2015) employed the concept of the epistemological chain (see also Grecic & Collins, 2013). The chain is a consistent, rationalised and logical relationship between the epistemology of the ASCs and their practice. In adventure sports research, Collins et al. (2015) and Christian et al. (2020) demonstrate a consistency in this relationship in the ASCs they study, supporting the notion of sophisticated epistemological beliefs underpinning high-level ASCs' practices.

Notably, a disconnect between belief and action (an epistemological void) (Collins et al., 2015) may indicate a developing belief and be desirable in coach and leader education. However, epistemological voids between ASCs and the students or with the certifying body may have significant implications for adventure sport's coherence, safety, practice and certification. Indeed, Mees et al (2021, 2022) describe an epistemological chain that links the coach to their employer and awarding body. Further, Christian et al. (2020) reflected that 'the coaching environment in which ASCs operate is the mediating factor' (p.78), suggesting that it is the hyperdynamic environment that necessitates a sophisticated epistemology.

Building on the work to date regarding the epistemology of ASCs, we ask:

(1) What is the epistemological underpinning of these caving instructors, winter mountaineering instructors and rock-climbing instructors?
(2) Do epistemological beliefs vary across domains or bear similarities to previous research findings?
(3) Does this manifest itself in an epistemological chain?
(4) How does this influence the judgements and decisions of these caving instructors, winter mountaineering instructors and rock-climbing instructors whilst operating under their specific environmental constraints?

Method

To fully appreciate the beliefs and experiences of the ASCs, this study utilised an Interpretive Phenomenological Analysis (IPA) approach (Smith et al., 2012). Reflecting our pragmatic research philosophy (Kaushik & Walsh, 2019), this was research *with* rather than *of* the participants (Reason, 2006). The work reflects the phenomenological position of Heidegger (Koch, 1995), who acknowledges that trust, rapport and a common frame of reference are integral to the research of this kind. The authors are highly experienced ASCs, with their certifications as caving, rock-climbing and mountaineering professionals viewed as crucial in comprehending the participants' experiences. Importantly, without an in-depth knowledge of coaching and leadership practice in these domains, the essential value of the actions and behaviour of the participant in action may be meaningless. In short, the views of the researcher aid in shaping and comprehending data (Maggs-Rapport, 2000).

The epistemological beliefs of the participants and how they relate to session design and delivery were explored by combining an initial pre-session interview, an observed coaching session, followed by post-session interviews. Audio and video files were digitally recorded and augmented by field notes. These were utilised as the primary data collection methods and to aid in recall.

Participants

The participants for the study ($n = 9$, seven male, two female) were high-level ASCs based in the United Kingdom (*M*age = 48.6 years, caving instructors ($n = 3$), winter mountaineering instructors ($n = 3$) & rock-climbing instructors ($n = 3$)). To ensure sufficient domain expertise, experience and inherent quality in terms of self-reflective ability, purposive sampling (Silverman, 2013) was employed based on the following criteria:

(1) A minimum of 10 years of practice following senior accreditation.
(2) Accredited as holder of the Caving Instructor Certificate (CIC),

Winter Mountaineering and Climbing Instructor (WMCI) or Mountaineering and Climbing Instructor (MCI) awards.

(3) A willingness to 'unpack' and discuss their professional practice.
(4) Being well regarded by their peers and the community of practice.
(5) Geographical and timeframe availability.

In the absence of more effective or objective markers, the guidelines for selection criteria were consistent with the approach used by Nash et al. (2012) in their work parameterising coach and leader expertise. We have confidence that this group represented 'high levels' and good practice. Steps were taken to ensure the anonymity of the participants, performers or other significant people involved in the study and guard against the potential for deductive disclosure Summary of particpants are found in Table 1.

Procedure

Following ethical approval and informed consent, interview guides were designed (Tables 2 & 3) for the pre and post-session interviews. In addition, cognitive pilots were conducted (Kartoshkina & Hunter, 2014) with a representative sample ($n = 2$), and adjustments were made to three questions to improve clarity before data collection.

Pre-session interviews

The approach aimed to facilitate an insight into the philosophical stance of each participant as it related to their coaching and leadership practice. These openly structured interviews varied in length from 49 minutes to 87 minutes (mean 58 minutes) and commenced after a short rapport-building conversation. Key points were presented to encourage the participants to speak candidly and freely. Prompts were used to encourage the elicitation of specific

Table 1. Summary of participants.

Participant	Gender	Age	Qualification	Age gained	Years held Code
WMI1	M	43	WMCI (MIC)*	31	12
WMI2	M	52	WMCI	29	23
WMI3	M	44	WMCI	27	17
CI1	M	49	CIC	30	19
CI2	M	44	CIC	29	15
CI3	M	56	CIC	38	17
RI1	F	47	MCI (MIA)*	30	17
RI2	F	50	MCI	35	15
RI3	M	53	MCI	32	21

Key: WMI-Winter Mountaineering Instructors, CI- Caving Instructors, RI- Rock Climbing Instructors.

Table 2. Pre-session interview schedule.

Question	Probes	Stimuli
How long have you been working in the outdoors?	Formal settings Non-formal settings Other ASC disciplines Other non-ASC activity areas /explore	Opens definitions and meaning of 'coaching,' 'leadership,' 'professional' etc.
How long have you been working in the outdoors?	general background / scene setting According to role According to awarding body	Explores ontological and epistemological underpinnings
What do you feel are your key qualifications / experiences that underpin your practice? What are your key attributes that enable you to be a professional working in the outdoors (adventure sports coach)?	Personal identity Education / training background Experience Education background Training and CPD Sources of knowledge Experience Health and fitness management Continued training / updating Attitude to continually improve Awareness of how risk and challenge are used	Helps explore reflective practice Begins to unpack qualifications against Personal view of 'where they are at' How does the professionalism manifest itself / what makes them good / well respected?
Are there any personal or professional factors that enhance or limit your work?	'Professionalism' Personality Keeping injury free / healthy Mental health / getting scared Time management Logistics Conditions Bodyweight management / fitness	Concerns / career longevityExploring links to being / remaining skilfully independent in the coached / led environment
Where do you (or have you) gained knowledge about leading and coaching in outdoor adventurous contexts?	Flexibility Injury Equipment Formal / informal balance Preference – good points vs. bad of the preference	Explores sources of learningPrevious successful learning (other domains)
Consider your attributes and skills which allowed changes in your coaching practice or beliefs?	Changes over time? Why? Intelligence (IQ / SQ / EQ) Openness to continued learning Flexibility / adaptability	Development of a philosophy / EC? What does it take to make the changes / 'keep pushing'?
How do you manage or value the risk and benefits in your work?	Recognition of crucial / pivotal moments Critical self-reflectionIs risk exploited / harnessed or avoided? How does this change according to the day / mood / group / weather / conditions? Risk periodisation? Skill 'portability quotient'	Relate to ontology Developing epistemological stance Develop autonomy for clients own future learning / adventure

examples from their professional lives and to promote reflection on their philosophical position. The guide (Table 2) scaffolded the process to encourage a richness, depth and breadth of response through a free-flowing dialogue that allowed emergent themes to be explored in the participants' own words, thus serving as a functional platform for the IPA (Brocki & Wearden, 2006).

Table 3. Post session interview schedule.

Guide Questions	Probes/Stimuli	Purpose
How did it go?	(Purposefully generalised to 'relax' into the interview)More of what and less of what?According to plan?Plan used/abandoned/not desired? More of what and less of what? According to plan? Plan used/abandoned/not desired?	Relaxed 'opener'
What parts of the session went well?	Why?What supported this success?ASP performance?Conditions?Intuition?Experience?Familiarity?Knowledge? How do you continue to build on this? What supported this success? ASP performance? Conditions? Intuition? Experience? Familiarity? Knowledge? How do you continue to build on this?	Evidence of reflectionUse video to unpack the 'act-on' momentsEvidence of differentiationAct/store/ignore? Use video to unpack the 'act-on' moments Evidence of differentiation Act/store/ignore?
Were there any parts of the session you feel went less well?	Why?What led to this feeling?ASP performance?Conditions?Intuition?Insufficient experience?Lack of familiarity?Information/knowledge (of students)? What led to this feeling? ASP performance? Conditions? Intuition? Insufficient experience? Lack of familiarity? Information/knowledge (of students)?	Reflection in self-critiqueUse of markers or key points against which to gaugeLack of evidence of differentiation/client specificity Use of markers or key points against which to gauge Lack of evidence of differentiation/client specificity
What do you think were the key/pivotal moments of the session?	Range and scopeTimingsSafetyRisk management/utilisationChanging conditionsTuition vs. Intuition?Value of TTPPEE Timings Safety Risk management/utilisation Changing conditions Tuition vs. Intuition? Value of TTPPEE	What are the main foci of the ASP?What does the ASP place value on?Explores the '6 Strands' What does the ASP place value on? Explores the '6 Strands'
On reflection, what would be changed in future to improve the session?	How do you know?What informs this decision? What informs this decision?	Levels of theoretical underpinningValue of reflection Value of reflection
Why did you choose to intervene or not to intervene on the occasions you did?	Why?Agency/autonomy/responsibility for own learning/lack of perceived risks Agency/autonomy/responsibility for own learning/lack of perceived risks	Explores the bigger picture re' the ECWhat does the ASP respond to? What does the ASP respond to?
Did the session work against the stated aims and objectives?	Was there a void between the aims and objectives and the working practice? Why?Were there differences between the stated 'aspects of good teaching'& that videoed (ASP in action)? Why? Were there differences between the stated 'aspects of good teaching' & that videoed (ASP in action)?	Explores sources of learning

(*Continued*)

Table 3. (Continued).

Guide Questions	Probes/Stimuli	Purpose
What type of style or approach did you use?	Are there any models in mind?Where or how has the professional education taken place?Current/in the past/ ongoing? Where or how has the professional education taken place? Current/in the past/ongoing?	A balance of methods?Opportunities/ agency to change session direction Opportunities/agency to change session direction
When and where is the real learning taking place?	Why/according to what?Does this relate to the epistemology or ontology as discussed at initial interview? Does this relate to the epistemology or ontology as discussed at initial interview?	Explores any epistemological void
Who is in charge of the learning?	To what level is this deemed important?	Relatedness to agency
What do you feel about the level of risk within the session?	High/low?Good/bad?Why?Purposeful/ perceived/subjective/objective? Good/bad? Why? Purposeful/perceived/subjective/ objective?	Explores the 'TSC/ASC' factors and background
How does the coaching observed in this session relate to what may have happened in the 'early career' stage, and to what may be viewed as aspirational in the future?	Why?What is considered 'development' or progression within the journey of the ASP? What is considered 'development' or progression within the journey of the ASP?	Reflection/awareness of professional development in relation to epistemological stance/chain. How are the PJDM components developed?
How are the balances or ratios between 'what and when' to 'how and why''?	Why?Is there evidence of a naïve or sophisticated epistemology (simple to complex)? Is there evidence of a naïve or sophisticated epistemology (simple to complex)?	Insight into Schommer (1994) spectrum/ proceduralised practice and declarative knowledge in action
Proceduralised/mapped out or working to the needs of the students?	Does this show up in the planning or is it emergent?	Leaning on session plan vs. emergent > fluency in approach
Risk manipulated and harnessed for purposes of learning and decision making, or avoided?	Does this relate to the background or other disciplines of the ASP?How does this relate to the epistemology or ontology as discussed at initial interview? How does this relate to the epistemology or ontology as discussed at initial interview?	Exploring role of risk in the work of the ASPImportance of the EC Importance of the EC

Session observation

Augmenting the pre and post-session semi-structured interviews and steered by the participant, in-situ discussions and field observations were used as a valuable source of data (Nicholls et al., 2005). Each observed session was recorded utilising an inobtrusive chest-mounted Hero7HD GoPro camera worn by the researcher. Time-referenced field notes were kept on waterproof notepads. In-situ conversations (Purdy & Jones, 2011) which occurred throughout the sessions were recorded on notepads or a Dictaphone as the environment dictated. The video recording and field notes were specifically utilised to accurately capture the detail within each practical session and aid recollection in the post-session interview.

Post-session interviews

The approach aimed to facilitate insight into the coach's practice, namely the 'how and why' of the practical session and the thinking underpinning their actions. These openly structured interviews varied in length from 24 minutes to 49 minutes (mean 38 minutes) and commenced as soon as practical after the observed session. The question and prompts were utilised to encourage participants to speak openly and freely and to facilitate reflection on the session. In addition, once again, a guide (Table 3) scaffolded the process thus allowing emergent themes to be explored in the participants' own words.

The range of data collection methods supported a complete session picture (Cohen et al., 2011). Following each episode, interviews were digitally recorded and later transcribed verbatim and without prosodic detail by the first author.

Data analysis

The transcribed texts and audio were studied and corrected to ensure accuracy and then repeatedly reviewed in line with the interpretive phenomenological analysis procedures suggested by Smith et al. (2012). The text for each interview was read whilst listening to the original digital recording thus facilitating a complete analysis (Smith et al., 2012, p. 82). The text was considered in terms of common recurring and underlying themes while recognising the hermeneutics involved when reflecting on the main themes recounted and observed from the three data collection points. As themes emerged, they were grouped and categorised as raw data, sub-ordinate and supra-ordinate themes depending on the frequency of occurrence, relationship, content and context.

The first authors' experience was exploited to interpret the participant's actions in light of their interview responses and a reflective commentary was maintained throughout the process. During analysis, we accepted the role of personal experiences and values (Smith & Osborn, 2015). In addition, external and internal member checking was utilised (Iivari, 2018; Sparkes, 1998). A colleague with no involvement in the study but significant experience in adventure sports acted as an external check whilst participating coaches and authors provided internal checks by reading the transcripts before analysis. In cases of disagreement, the authors returned to the original transcript and discussed the codings until a consensus was reached.

Results

The initial analysis recognised 605 codified units which were then grouped into 64 raw data themes, and subsequently organised into 13 subordinate themes and four supra-ordinate themes. These were: (1) Creating an authentic learning environment, (2) The role of challenge, risk and adventure, (3) Professional practices employed, and (4) Adaptability and flexibility. In accordance with the guidelines of Smith et al. (2012), examples from at least 50% of the participants have been included and direct quotes of varying lengths utilised where appropriate to support the depth and richness of the data Results are displayed in Table 4.

Creating an authentic learning environment

Several authors have highlighted the significance of the physical environment while coaching adventure sport (Christian et al., 2020; Collins & Collins, 2012). Our findings support the significance of situational comprehension of the physical environment.

As RI 3 stated:

> The poorer the likely conditions, the more forecasts I look at in advance of the day. I do my best to ensure I can offer them a decent session by finding somewhere out of the worst of it that still works.

Table 4. Results.

Superordinate Themes	Subordinate Themes	Raw Data Themes
Creating an authentic learning environment	Short term and long term goals Working to client needs Concepts and transferability	Asks and questions rather than tells Learner centred/differentiated Coaches for independence vs. guided experiences Utilises and values learning from peers/the Community of Practice/CPD Deploys range of core coaching tools What is coaching? 'Sits on hands' Learning portability/transferability Challenges the orthodox Judgement vs. procedure 'It's more than either qualifications or experience' Humanistic approach > positive human development Audits of performance of teaching and learning through questioning Develops coaching practice over time Empowers learner Uses loose parts theory/units Promotes typical behaviours Gives space for practice Informs and offers DM power to clients Adapts due to client capability/environmental dynamics
Challenge, risk and adventure	Reflection Engaged with and by challenge Mastery and control	Importance placed on the role of adventure Aspects of challenge and risk utilised Risk vs. benefit approach adopted 'Risk periodisation' considerations Engaged by DM complexity Progressive and managed exposure to risk Mastery rather than risk seeking Breadth of experience and environments 'Intuitive' DM based on strong foundations Lifelong involvement and belief in adventurous outdoor learning Learning from 'close calls'
Professional practices	Sources of information and knowledge Intuition and experience Reflection in-action and post session Independent performer	Development of cognitive space aided by pre-preparation Confidence to 'let it run' Lifelong learning—remains open Fine-tuned time management Reflection in-action and post session (recognises errors) Interplay of roles—right role at right time Actively keeping fit/managing bodyweight Need to perform at appropriate level in the present Professionalised approach, especially in pre-preparation and gaining of information Honest and open with clients Lyme Bay/Cairngorms catalyst Intuition linked to experience Control of fear/anxiety Mental and physical resilience Reputation and credibility Identity via qualification Interplay of terms unhelpful but behaviours inseparable Prompt DM from a range of alternatives

(*Continued*)

Table 4. (Continued).

Superordinate Themes	Subordinate Themes	Raw Data Themes
Adaptability and flexibility	Skilful interplay of roles Reality of consequences Complexity in risk vs. benefit DM	Challenge of environment Uncertainty of outcome requires adaptable approach Safety of ASP occasionally dependent upon client Significantly variable conditions Dynamic thinking Skills to deal with most environmental constraints (above level of award) Synergy of coaching and leadership Requirement to change roles promptly (e.g. to maintain momentum on adventurous journey) Accentuated nature of specific environments Positioning crucial Significant (overwhelming) range of tasks Genuine, natural environments Unrelenting conditions for extended periods Operation in consequential terrain

And continues to say, 'you really need to know plenty of places that work in a really wide variety of conditions that match the aspirations and abilities of your group.'

RI 1 supports RI 3 and highlights the depth of knowledge required of local conditions and venues by ASCs, which supports findings regarding the high level of situational comprehension required to offer an appropriate learning environment (see Boyes et al., 2019; Collins & Brymer, 2020; Mees & Collins, 2022 Mees et al., 2021) As he states:

> … what a day! – I had this gut feeling that Dinas Cromlech would dry up and be in the sunshine as we got kitted up. My client was well chuffed to be on this amazing mountain crag with no-one else there – it meant he could learn lots in a brilliant context!

Creating a safe, positive learning environment links to a clear understanding of the needs and wants of the client, and the situational demands beyond just situational awareness, echoing Mees et al (2021, 2022). Of particular focus is managing the anxiety caused by the perceived risk and its potential impact on client learning.

RI 2 confirms ' … most of my clients are pretty fit, but the one thing that trips me up sometimes is their "fear monkey" – it's the psychological stuff I really have to be on top of.'

WMI 3 elaborates on the point:

> there is absolutely no point in me trying to work with my client if I have scared them – it just doesn't work and at any rate, they wouldn't book with me again. I put significant effort into communicating with them beforehand to make sure we really nut out what they want or don't want. Really important if they want to be taught and to learn, or prefer me to guide them.

There is clearly a judgement made regarding the level of real risk and potential benefit to the client: namely the risk-benefit decisions that Collins and Collins highlighted in 2014. WMI 2 discusses the concept of learning through shared decision making. Having an insight into the decision making process and creating a shared mental model of practice was viewed as beneficial. This aspect reflects a cognitive attribute to adventure performance that may differ from just the physical performance.

Decision making reflects the focus of the ASCs on generating independence, as highlighted by Eastabrook and Collins (2020, 2021) and echoes Eastabrook's queries regarding the appropriateness of the skill acquisition models espoused on NGB coach development programmes

As WMI 2 states:

> I check their level of understanding of what we could be doing but also their readiness to accept the risks or not of that particular day. The winter environment can be very unforgiving. Shared understanding is necessary,

> especially on winter mountains … I offer my thought process and ask what they might do, so I know they should be safe independently of me.

In addition, engaging the client in the process assists in a shared and mutual agreement of any group and individual goal setting. CI 3 highlights the availability of options available to ASCs as 'loose parts' or discrete functional units (Nicholson, 1972), which are presented as technically focused, closed skills.

CI 3 states:

> I think it's far better for me to offer them a range of transferable bits and bobs. Concepts, almost, rather them tell them 'do this then this' because the situation in a complex cave is unlikely to be the same next time. They need to work it out themselves, although underground SRT techniques are either safe or not.

CI 3 offered a range of practice options in a realistic learning environment but actively chose not to engage in more complex coaching. This appeared as a rather utilitarian passage of technical information and demonstration. CI 1 and CI 2 also shared this practice. The adaptation, application and combination of these loose parts and functional units being left to the learner in a safe environment. Such an approach requires the CI to have a good comprehension of how these parts may be combined in different applications and contexts; the adaptive expertise noted by Mees et al. (2020), rather than simple replication. This also requires a sophisticated epistemological position, one in which knowledge is constructed rather than simply imparted. In short developing the concept of 'doing the right thing in the right place at the right time with the right people.' (Mees et al., 2021). It seems essential that these parts also have the capacity to be interchangeable and the ability to be interlinked with other parts; a point to our knowledge not noted in other research.

Reflecting earlier studies by Eastabrook and Collins (2020), the participants in this study placed value on ensuring the learning environment was safe, enjoyable, appropriately challenging and authentic. The term of authenticity is possibly overused in the literature and its complete meaning unclear, thus requiring further investigation. The importance of managing a contextually accurate learning environment is evident as a recurring theme across all supra-ordinate themes which supports an epistemologically sophisticated position.

Challenge, risk and adventure

The participating coaches embraced and manipulated levels of risk (A. West & Allin, 2010) as an integral aspect of the activities and an essential aspect of learning (Collins & Collins, 2012). In retaining this authenticity through considered exposure, it becomes necessary for the ASCs to harness and exploit the nuances of risk rather than attempt to simply remove or completely mitigate it.

As WMI 1 states:

> working in risky environments with clients is very engaging and to be honest I enjoy the complexity in the decision making. As the saying goes 'ships are safest in the harbour, but that's not where they are designed to be.' I think we all get a bit of a buzz from pushing it a bit, but ultimately, I have to be safe enough and retain some control.

WMI 1 reflects on the enjoyment derived from leading and coaching, relishing the challenge of the complex decisions and professional environment in relation to risk management and exploitation. There is a difficult balance of providing authenticity whilst ensuring the client remains 'safe enough' to learn. A complex and nuanced decision given that safety is a legal requirement (Eastabrook & Collins, 2020). As an example, there is a risk of falling from height associated with any activity around a steep icy slope or rocky edge, but the likelihood of a fall can be managed by selecting a particular environment. In this case, one which promotes the development of individual ability, specifically with skilful movement over the terrain and being more balanced over the feet. It is the likelihood of a fall that is managed rather than the consequence where the inherent level of risk is managed by reducing the likelihood. This differs from those required of ASCs when in a guiding role where the

subtleties of predicting and gauging arousal levels then matching to learning potential is not required.

As CI 1 suggests:

> in my last job, we were brought up on the 6 or 7 HSE steps to risk assessment. Utter nonsense in my book. The vertical caving environment is so complicated and variable that there is no time for all that – it has to be within you somehow where you just … .'know.' Is it intuition?

While CI 1 alludes to intuition, the interviews suggest an identifiable cognitive aspect to the learning and decision-making process.

CI 2 describes:

> managing risk and working with risk is all about decisions – I don't think I'm paid to teach knot tying or SRT as it's not really that hard. I think I earn my money by making the right calls at the right time. In a cave it's about whether to push on or not, or to understand how somebody is doing as most of the time we cannot just walk out.

and

> … most of the time it's that risk/benefit thing. Should I allow things to push on a bit given the learning that it will give them? The issue is that on a wet pull-through trip for example, we have to complete it within certain timeframes, and I need to balance their learning against 'cave system' safety aspects.

CI 3 seems to acknowledge the significance of decision making, similar to the studies of Collins et al. (2018) with mountain leaders. Intuition is certainly appealing as a descriptor in its simplicity given CI 3's experience. However, intuitive decision making is rare and is more likely to be orientated to specific experiences and the frequency of decision-making opportunities in that context which are reflected on. The more that ASCs use decision making processes, the easier they are to access and this decision making appears to improve (Collins et al., 2016). In CI 3's case the cognitive aspect suggests that it is more naturalistic than intuitive. Decision making seems swift because of easy access to naturalistic processes via recognition primed and heuristic development, which is a key factor in differentiating expert vs. non-expert cognition (Klein, 2015).

WMI 1 sheds further light on his decision-making process and states:

> working in a winter mountaineering context places big [*cognitive*] demands on me from the conditions, the weather, the clients getting tired or anxious, me delivering the right session, getting off the hill before dark etc. etc. Over the years I realise that I have to make a series of 'good calls' rather than top notch or perfect calls. The main thing is just not to make any bad ones!

This highlights the potential for a series of sub-optimal decisions that are clearly synergetic, where classic decision making, and naturalistic decision making are 'weighted' and biased according to context. A choice of teaching approach that facilitates rapid skill acquisition may be suboptimal from a longer skill acquisition perspective. However, it may be highly appropriate when a skill must be applied rapidly in a safety critical context- kicking steps to cross an unexpected snow patch en-route to a rock climb in the early spring for example. Although recognised as a causal chain in accident planning or review, WMI1 suggests a readiness to acknowledge a series of best-fit or sub optimal decisions as part of a safety chain much less than a single 'grand safe decision.' The implication being that a chain of bad decisions cannot be compensated for with one good one. In the context of adventure sport, this aspect deserves further investigation.

Most of the participants report an overwhelming weight of decision making and cognitive loads associated with their practice, particularly whilst operating in complex environments commensurate to the levels of certification. Reflecting the work of Webb et al. (2021) these participants also identified that situations of uncertainty present the greatest learning potential for the ASCs. The challenge being that although most learning appears to take place through 'bad calls' (WMI 1) and 'having epics' (CI 2) there is a cognitive cost to working in dynamic and risky environments. RI 2 manages the cognitive load whilst still ensuring the challenge and adventure remain a core part of her work, and states:

> I just try to keep them in that corridor – the one between being scared or bored - feeding in a few more components or building blocks of the skills they'll need to use and then I'm orchestrating a situation where they have to use it … a bit like teaching how to take a bearing and then going for a walk in the fog!

RI 2's analogy has links to Vygotsky's (1978) concept of the Zone of Proximal Development and thus perhaps a cognitive apprenticeship. It also implies a bandwidth method as a pro-active coping strategy, supporting the cognitive load studies of Collins and Collins (2019). RI 2 is modest and underplays the complexity of balancing the rate of skill acquisition and exposure to risk, which echoes the work of Christian et al (2017, 2020) in discussing the epistemic beliefs and behaviours of high-level ASCs. However, despite the extensive experience of the participants, in terms of a 'risk quotient,' not all days feel the same.

WMI 3 concedes:

> some days I feel pretty 'on it' and I'm happy pushing it with a group, providing they are up for it too. Other days though, I just don't want to manage the risk. I feel OK in myself; I just don't feel like having a 'risky day' if you know what I mean?

This managed exposure to risk is mentioned briefly by two other participants (WM 2 and RI 3) which suggests a meta-aspect to the ASCs' decision-making process already identified by Collins and Collins (2019). This warrants further investigation as in their study the authors could not decide if this cognitive resource was 'ringfenced or acts as an overdraft' (p.10). Clearly, overdrafts must be repaid.

All the participants promoted a positive view of challenge and adventure with most citing a love of the outdoors and adventures from an early age, conferring a subsequent close lifestyle and professional relationship. Integrating challenge and adventure into pedagogical delivery suggests a sophisticated epistemological stance (, Christian et al., 2020; Schommer, 1994) supported by the risk vs. benefit approach cited by several participants. This may best be considered as an ontological position given the interaction which helps to shape the participants' worldview and subsequent behaviour. WMI 1 sought to challenge the notion of being a risk taker stating that he sought mastery in demanding environments and managed risk appropriately as part of the greater experience, corresponding directly to the findings of A. J. West (2012). He states: ' … contrary to what is publicised, we tend to be control freaks rather than thrill seekers.'

Professional practices

While coaching and leading, a student-centred approach was predominant. Physical and cognitive space for practice was commonly offered and some (CI 1 for example) removed themselves from the practice area once satisfied the client was safe.

CI 3 states:

> … in a vertical caving environment once they have got the gist of it, I kind of hide round the corner a bit – I want them not to be able to talk to me. I think it's for their independence in that I 'won't be there' next time, but it also gives me a second or two to plan ahead.

Both CI 1 and CI 3 recognised and articulated the need for independence, reflecting the findings of Eastabrook and Collins (2020). RI 1 relates a similar consideration in a rock-climbing environment and states:

> … to be honest, I don't need the practice – they do. I make a conscious effort not to intervene providing they are safe – I will have already told them that. 'Sitting on my hands' is weird in that I am being paid to lead but they need practice space. If time is pressing and it's cold and wet and they're fumbling I will offer to help, but I still try not to take over.

Refraining from intervening wherever possible to maintain the practice space was considered important by both R1 and WMI 2. Although RI 1 mentioned the necessity to 'sit on his hands' and WM 2 used the expression of 'letting it ru,n' other participants expressed similar sentiments using different terms. How the expert learns to distinguish between opportunities to 'let it run' or a need to

intervene is unclear and worthy of further investigation. This may be indicative of coaching decisions that align to a sophisticated epistemology (Christian et al., 2020) presumably in recognising and anticipating skills development, the construction of knowledge and its application regarding levels of risk.

The knowledge and confidence required to identify and balance benefit with risk and refrain from unnecessary intervention seems unlikely to be developed on NGB training and assessment courses. This is due to the focus on risk assessment and risk management rather than coaching or leadership, allied to short course timeframes and congested, technically orientated syllabi (British Canoeing Coach Awards Course Guide, 2022; Mountain Training UK, 2021).

It seems probably to be a product of reflection on experience, presumably also involving poor judgments and errors. In short, letting situations unfold that should not have been allowed to continue. This 'watchful neglect' (Collins & Collins, 2016, p. 7) has been identified by other authors as a means to develop independence in practice, and also learning (Martindale & Collins, 2012; Schön, 1983). It requires expert supervision but presents as a source of dissonance in co-tutored sessions and is proposed as a tactic to create time for reflection on-action and in-context. RI 2 describes this as a chance to 'to recharge' implying comprehension of a cognitive reserve.

Notably all ASCs demonstrated an ability to select from a large range of options quickly and to 'pull it down to the proper few' (CI 1). This supports the findings from other studies on option choice by experts (Collins & Collins, 2019) and supports the suggestions of Christian et al. (2020) regarding range of teaching styles being an important characteristic of coaches with sophisticated epistemological positions—a characteristic of the epistemological chain. Inexperienced instructors present a potentially overwhelming array of options (Mees et al., 2021), many of which the expert has already discounted in the distilling process. The use of these 'contextual priors' (Gredin et al., 2018) is a strategy that aids in managing the cognitive resource. In common with other ASCs, the cognitive resource is further safeguarded by prior planning and preparation for the activity, reducing unrequired or expected demands. As WMI 1 suggests ' … given where we operate, having your weather forecasts, avalanche conditions and kit together the night before is important. Very, very important.'

WMI 3 concurs and states:

> … it kind of gives me the space in my head to make the harder decisions when we are out on the hill, often in a blizzard! - Last thing I want to worry about is whether or not I have a map and compass in my jacket in them conditions.

This supports PJDM theory that although the decisions are nested, classic decision-making processes are predominant in the planning and review of activity, while naturalistic processes are predominant in-action (Collins & Collins, 2012). More importantly, the strategies of the expert ASCs facilitate time to consider and then select from a full range of pedagogical and practice opportunities according to context.

All of the participants expressed eagerness to continue learning throughout their careers, relating it to their community of practice and own professional development.

As RI 2 stated:

> … although I'm a bit of an old timer now, there's still loads to pick up. We do have professional type get-togethers, but social media and the various climbing forums are brilliant. I pick up technical tips, but the best part for me is actually keeping on top of conditions and changes.

It seems likely that RI2 also applies a degree of professional criticality to their knowledge sources, though C. J. Cushion et al. (2022) caution that this may not always be the case.

Adaptability and flexibility

The professional environment of ASCs is typically natural and unmanaged. It is susceptible to changing conditions that are unrelenting and where poor conditions need to be tolerated over

extended timeframes. Christian et al. (2020) suggest such settings promote the development of sophisticated epistemic beliefs and the resultant chains which connect them to practice. In AS environments the safety of ASCs is occasionally dependent upon the client, especially in the multi-pitch climbing scenarios.

WM1 notes:

> There have been two occasions when I have fallen off lead climbing where my client has caught me – they thought it was great and genuine and I was pushing the adventure a bit! They wanted reality rather than a 'sterilised' experience of a climbing wall which is what they got!

Although the pre-planning and venue considerations are accorded lots of thought, there is certainly a need to have alternatives given the dynamic nature of working outdoors in real environments. RI 1 states:

> although I have a fairly good idea of what I want to do with the day, sometimes it goes nothing at all like I thought it would 'cos either the venue I chose was busy or not right, as in being too greasy to safely climb, or the weather bore no resemblance to the forecasts!

But qualifies ' … you know what, those ones are often the best sessions of all. I usually tell my clients that we are kinda "working off reservation" but they come for the adventure too.'

The theme of being flexible in the working environment given its propensity to change and such uncertainty of outcome requiring an adaptable approach is echoed by RI 3, who talks in terms of interplay of roles but also making tough decisions.

> I don't get hung up on instructor, guide, teacher, coach, or whatever, I just work with what it says on my ticket. I do know though, that the knack is making a quick change from one role to another – I know to be patient and more 'hands-off' when I'm teaching but if we need to get along a wintery ridge and time is short, I'll have no qualms about dropping any coaching aspirations.

All ASCs within the study indicated the prompt need to access skills in-action which exceed those tested at the assessment stage of their respective awards. This is understandable given that at the time of assessment the assessor has to be able to guarantee the safety of the personnel involved with that process. This does however demonstrate a misalignment with the range of demanding conditions encountered post-assessment.

As CI 2 reports:

> you might have a caver injured at the bottom of a pitch through rockfall and you have to be 'on it'immediately … . a billion things whizz through your head. You don't go through this properly on assessment. Really, this decision stuff should be covered by an expert as part of training because it all relates to how you lead and coach, I think.

Discussion

The results demonstrate that ASCs are adaptable and flexible, adding more support to Mees et al. (2020) who identified outdoor instructors as adaptive experts. Furthermore, the study's coaches' epistemological beliefs link to their practice via an identifiable epistemological chain that is manifest, in part, by the use of a broad range of teaching approaches which in turn is indicative of an adaptive expertise (Christian et al., 2020; Collins & Collins, 2014; Mees et al., 2020). This finding has a clear implication for the manner in which ASCs are trained and developed (Christian et al., 2010; Collins & Collins, 2014). Our first novel finding is the existence of this link in the caving instructors, winter mountaineering instructors and rock-climbing instructors and their practice, in addition to the ASCs already studied by Collins and Collins (2014) and Christian et al. (2017). Furthermore, we are able to

say that the coaches have a broadly sophisticated epistemological position (Schommer, 1994) which is informed by three factors:

(1) The nature of the working environments supporting the assertions of Christian et al. (2017).
(2) Their aim of developing an independent performance, which supports the findings of Eastabrook and Collins (2021).

And our second novel finding,

(3) The nature of the skills coached, namely closed skills such as safety-critical techniques which differ from the open and cognitive skills, such as movement over the terrain.

It seems likely that these three factors operate in a synergy in which the environment affects both technical requirements and safety, which in turn also relates to the possible degree of independence in that given location at that given time with the learner's skill level. In these cases, the ASCs recognised that safety skills might need to be taught in a directive or coach-led manner which may outwardly appear as being drawn from a naive epistemological position. When in fact, it is the context and security implications that dictate such an approach- a choice by the coach. This practice enabled independent, safe practice in which the learners constructed their comprehension of the skill and its adaptation to the task and environment.

The rock-climbing instructors emphasised movement over the rock face in addition to the technical safety skills, on the basis that better movement equates to less likelihood of falling. This emphasis should be seen in the context that a natural progression for most climbers is to lead-climb; namely to be on the 'sharp end' of the rope. The winter mountaineering instructors however, offered fundamental movement coaching with tools—the ice axe and crampons, to secure safe and efficient passage across variable and mixed terrain over an extended duration, as is typical on a winter mountaineering excursion. There is a requirement to guard against falling on a similar basis, though this incorporates the skilful manipulation of those tools as an added dimension. However, the caving instructors offered no movement coaching but plentiful technical input. Whilst using single rope technique for example, there was a justifiable focus on the technical rope work, which is more complex than that employed in the other contexts. The focus of coaching appears highly contextual and requires the coach to have high levels of situational comprehension for its appropriate deployment. Both the winter mountaineering instructors and caving instructors appeared to be driven by environmental security demands which drive the task requirements, use of tools or particular techniques. However, the rock-climbing instructors coached fluency, efficient movement over the terrain in addition to the ropework on the basis that it is better to avoid a fall rather than just teach the ropework to catch you once you have fallen. The winter mountaineering instructors and caving instructors chose to teach these closed skills directly while having sufficient situational comprehension to allow the learners to practice safely without any coach intervention following that initial input.

This behaviour suggests two points. First, an approach that allows the learner to construct their comprehension of the techniques taught and their adaptation to the context that can be facilitated via a range of teaching styles once the learner has experience of more learner-led tuition. Second, a level of situational comprehension that predicts developments in the learner's performance and changes to the environment that enables safe, independent practice. The coach's approach does not preclude their sophisticated epistemological position or the chain of rationalised and logical justification to their practice. The behaviours of the winter mountaineering instructors and caving instructors outwardly appears naive but are driven by their sophisticated epistemology. Logically, the coach's choice evaluation should not be measured just on the observed outcome and requires an understanding of the decision-making process. This raises questions regarding the evaluation of decision making and requires further study.

It seems likely that these professionals established their epistemological values across significant career spans. Their values being products of reflection on their own experiences in dynamic

environments with clients, those of their colleagues and in their practice as active, high-level outdoor practitioners. Their sophisticated epistemological stances being at odds with the naïve epistemological chain (Collins & Collins, 2014) demonstrated in coach education courses, via the structure, content and delivery, despite NGB claims of sophisticated epistemological underpinnings (Dempsy et al., 2022)

Reflecting the requirement for ASCs to underpin their practice with a skilful personal ability (Collins & Collins, 2012), it is contended that these reflective traits are an aspect of high-level adventure sports practice. This may also explain why ASCs do not perceive themselves to be reflective, it being integral to successful high-level ASs participation; clearly an in-action process. Two points are raised. First, the possibility of an ontological chain, already implied by Mees et al. (2020) linking the dynamic, changing and flexible world beyond an epistemological chain and second, the possibility that the reflective tools advocated on coach development are unsuitable, being on-action rather than in-action. It would be difficult to identify if coaches with these views are disposed to adventure sports settings or if they develop these dispositions toward adaptability across a career by 'surviving' their own adventures (Webb et al., 2020).

Limitations of this study and further research

Reflecting the IPA approach, sample size is not a significant weakness, however participants were white, predominantly male and with an average age of almost 50 years, which is representative of high-level ASCs. Examination of early-career or mid-career ASCs such as that completed by Mees et al (2020, 2022) with multi-activity instructors would clearly be of value.

This investigation revealed the use of 'best-fit' decision-making in which a practice is considered sufficiently safe, even if the performance is sub-optimal. This choice to accept 'safe enough' decisions while enabling progression and learning through safe experimentation and experience is a sophisticated call and warrants further research.

Conclusion

The study has demonstrated that the epistemological beliefs of caving instructors, winter mountaineering instructors and rock-climbing instructors link to their practice via epistemological chains. This confirms that they share a similar epistemological stance to other ASCs. However, we note that these epistemological positions are not identical and reflect the technical skills required to ensure security in each given setting in addition to the dynamic nature of the environment. The epistemological position being a synergy of these two factors. For example, the caving instructors and winter mountaineering instructors purposefully adopted coaching and leadership behaviours that could outwardly appear driven by a naïve epistemological position due to the nature of the environment aligning with Christian et al. (2020) proposition. However, that environment also necessitates a requirement to develop closed skills promptly or on an 'as needs' basis. The purposes being to ensure client safety in unsafe environments, this coaching being contextual and highly authentic, driving a need for rapid skill development.

It appears that ASCs hold sophisticated epistemological views and demonstrate these via epistemological chains. The epistemological position seems likely to have been developed via reflection on the ASCs' personal and professional experiences, environment being one of several factors at play, including the activities' culture, the skills being taught and the coaches experiences and reflection.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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