Sport Science Relevance and Application: Perceptions of UK Coaches

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Abstract

While sport science can have significant and positive impact on coaches and athletes, there is still a general consensus that the transfer of sport science knowledge to coaching is poor. Given this apparent dilemma, this study investigated the perceptions of sport science from coaches across four different sports (football, rugby league, curling and judo) across three different levels (elite, developmental & novice). Specifically, 58 coaches (19 football; 21 rugby league; 9 curling; 9 judo) drawn evenly from novice, developmental and elite groups agreed to take part and were interviewed. Three key features emerged from the analysis 1) Practical Application and Relevance 2) Integration and Access, 3) Language. In short, there was significant variability in the extent to which sport science was considered relevant and to whom, although interestingly this was not strongly related to coaching level. This inconsistency of understanding was a barrier to sport science engagement in some instances, as was the challenge of operationalizing information for specific contexts. Furthermore, availability of opportunities and resources were often left to chance, while overuse of jargon and inability for research and practitioners to consider sport specific needs were also considered barriers to engagement. Implications for research and practice are discussed.

Introduction

Sport science is a discipline that studies the application of scientific principles and techniques with the aim of improving sporting performance (Sewell, Watkins & Griffin, 2012). Similarly, sports coaching is concerned with the direction, instruction and training of the operations of a sports team or of individual sportspeople (Martens, 2012). One key aspect of this process is improving sporting performance. In line with this apparent coherence of aims, sport scientists claim to make a significant contribution to the body of knowledge that influences athletic practice and performance (Bishop, 2008). Indeed, research investigating the effectiveness of multi-disciplinary sport science teams and interventions in applied settings has produced successful results (e.g., Collins, Morriss & Trower, 1999; Reid, Stewart & Thorne, 2004).

In relation to coaching, it is argued that sport science knowledge forms a significant part of the knowledge base required for coaches to make effective decisions and solve problems (Abraham, Collins & Martindale, 2006). However, ironically, most research has suggested that formal education programs for coaches have little impact on coach development (Nash & Sproule, 2012, Nelson, Cushion & Potrac, 2006). While this paper is not specifically investigating the reasons for any lack of impact, given the apparent contradiction relating to sport science input, understanding coaches' experiences and perceptions of sport science would be valuable.

Leading on from this, Williams and Kendall (2007a) found there to be good congruence between research needs of elite coaches and researchers. Although, this finding needs to be contextualised, as the majority of the researchers surveyed were based in Australian Institutes, which have a heavy applied focus. However, other research highlights that many high level coaches do believe sport science makes a significant contribution (Reade, Rodgers, & Spriggs, 2008), while those with a lack of access said they would be

receptive to sport psychology information and support (Blinde & Tierney, 1990) if it were available. One caveat with regards to sport science support is that the approach, qualities and knowledge of the sport scientists in question appear to be key determinants as to whether coaches would listen or not (Elem, 1996; Pain & Harwood, 2004; Partington & Orlick, 1987).

While the availability of sport science support is on the increase, funding to provide sport science support is still relatively new for many sports (Reid et al., 2004), and more often than not it is aimed at elite level coaches and teams. This leaves the dissemination and use of sport science for most coaches to second hand and adhoc means, such as coach education, magazine articles and informal communications/experiences.

While there are some positive findings with regards to the effective use of sport science within applied sport and coaching, there is still a general consensus that transfer of sport science knowledge to coaching is poor (Bishop, 2008). Researchers are often criticised for failing to ask relevant questions (Goldsmith, 2000; Reade et al., 2008) and disseminating findings that are too difficult to apply. This is perhaps not surprising as sport science research often has a very tight focus and as such, lacks applied relevance. For example, much of it is lab based, (Bishop, 2008) or conducted only with very specific groups (e.g. elite performers - Collins, Doherty & Talbot, 1993; Pain & Harwood, 2004; Reade et al., 2008; Reid et al, 2004; Williams & Kendall, 2007b). As an example, even in a very well organised, professional sport culture such as Australia, the majority of sport science research carried out is quantitative in nature, and tends to focus narrowly on sports such as cycling, rowing, athletics and swimming (Williams & Kendall, 2007b). Efforts have been made by researchers to bridge this problem, for example, Bishop (2008) has developed an applied research model for sport science to help guide the research process for effectively to overcome some of these issues. However, it would be valuable to ascertain the perception of coaches in this regard within an up-to-date, culturally specific context such as the UK.

Another problem is that many coaches seem to prefer other sources of information over sport science. For example, Reade et al., (2008) found that coaches tend to get information from other coaches and coaching conferences, while sport scientists and their publications ranked very low as source of information. While the main reasons for this were practical (e.g. lack of time to find and read journals or limited access to sport scientists), other research found that sport science knowledge is not valued as highly as experience and practical knowledge acquired from participation and other coaches (Quinlan, 2002). Although expert coaches have been shown to develop knowledge through mentors, education and consultation with sport scientists (Reade et al., 2008; Salmela, Draper, & La Plante, 1993), it is still a worrying trend.

Key lessons for sport scientists can be gleaned from the research highlighting where coaches do access sport science information. Williams and Kendall (2007a) found that coaches are more likely to go to sports periodicals and multi-disciplinary journals. Furthermore, Sands (1998) showed that research delivered through appropriate forums, with lay-language, incorporated into coach accreditation material are more likely to be used. Contextualisation of information to coaches' particular coaching environment was also seen as key (Nash & Sproule, 2012). The integration and application of sport science knowledge into practice can be particularly challenging, so it would seem important to understand this process as part of the broader research question in this paper within an up-to-date UK context.

It appears that more work needs to be done to facilitate this transfer of knowledge effectively. Better communication may be needed for sport science to have any significant applied value (Burke, 1980; Nash, Martindale, Martindale & Collins, 2012; Pain & Harwood, 2004) and perhaps different incentives need to be provided for academics (Williams &

Kendall, 2007a), who are often pressured into 'publish or perish' situations where quick and easy research publications are implicitly encouraged by their employers.

Importantly, most discussion on sport science-coaching knowledge transfer occurs in non-peer review articles or conferences (Reade et al., 2008), and as such needs to become debated more within academic circles, and across wider sporting contexts. Leading on from this background rationale, the aim of this study was to investigate the experiences, opinions and perceptions of the usefulness of sport science support and sport science knowledge across four different sports (football, rugby league, curling and judo) across three different levels of coaches (elite, developmental & novice), within a UK context. Much of the published research (Williams & Kendall, 2007a; Reid, 2004; Reade, Rodgers & Sprigg, 2008) into the use of sport science information has been carried out using elite sporting contexts. This paper aims to look at the broader use of sport science information, within different coaching contexts. Given that research highlights coaches feel there is a lack of practical application and direct relevance to their needs, a qualitative methodology was considered to be most suitable to ascertain reasons why.

Method

Participants

Three specific groups of coaches (elite, developmental and novice) were identified across four sports (judo, rugby league, football and curling). These four sports were approached due to existing relationships with the researchers and because they represent a range of individual and team sports. In total 58 coaches were interviewed. Participants comprised of 19 football coaches (6 novice; 6 developmental; 7 elite); 21 rugby league coaches (7 novice; 6 developmental; 8 elite); 9 curling coaches (3 novice; 4 developmental; 1 elite); and 9 judo coaches (3 novice; 3 developmental; and 3 elite). It has been suggested that there are fundamental differences between coaching contexts, often referring to the level of

the coach as recreational, developmental or elite, similar to this study (Erickson, Bruner, MacDonald & Côté, 2008). For the purposes of this study, coaches were considered to be novice (Level 1 & 2), developmental (Level 3) or elite (Level 4) as suggested by Lyle (2002). Further criteria for coaches' inclusion were developed as follows: Novice currently coaching on a volunteer basis within the sport. Developmental: currently coaching within an organized structure on a committed basis; Elite: working full time as a professional coach with at least 10 years of experience coaching developing and/or elite level performers. It has to be acknowledged that not all coaches fit these tight definitions, for example level 1 coaches are not always volunteers, but for the purposes of this study the interviewed coaches did conform to these criteria.

Design

A qualitative methodology was selected in order to provide a more in-depth insight into the nature of coach perceptions and use of sport science at different levels. A semi-structured interview was designed to provide the basis for an exploration of the participants' experiences and opinions and to elicit truly open-ended responses (Patton, 1990). The interview questions were developed with the aim to encourage the coaches to feel comfortable to talk about their experiences and identify the range of challenges they face. Leading on from this, the assurance of confidentiality was given to all participants. Additionally, recommendations from Patton (1990) were used to minimise interviewer bias and facilitate the use of a neutral, impartial stance when probing participant responses, whilst maximising rapport, comfort, recall, and open responses (cf. Backstrom & Hursch-Ceasar, 1981).

The interview questions were developed with a grounded theory approach in mind. As such, the questions were kept open and broad to allow the researchers to gain an unbiased insight into the participants' experiences in relation to their understanding and experience of

sport science, its usefulness, and barriers to effective dissemination. One high level coach and one experienced qualitative researcher examined the final set of questions for comprehensiveness and comprehension and no changes were required. The interview questions can be seen in figure 1.

INSERT FIGURE 1 ABOUT HERE

Procedures

After ethical permission was granted through the authors' institution, key coach education representatives at the four National Governing Bodies (NGBs) were contacted. Once the nature of the investigation was explained and confidentiality and anonymity was assured all four sports agreed to take part. The status of the coaches was identified through further contact with the relevant NGBs, and for two sports (curling and judo) the interviewers subsequently contacted the participants personally. For the other two sports (rugby league and football), the NGB representative organized both interviewees and interview slots during coach education weekends, which the researchers were invited to attend.

The interviews lasted between 60 and 80 minutes and were transcribed verbatim for future analysis. For football and rugby league focus group interviews were utilized (three in total for each sport, one for each 'coaching level'), for curling and judo individual interviews were used. While it is recognized that these different styles of interviews are likely to create a different dynamic in answering questions, and as such present a limitation, this combination of methods was dictated by the NGBs and was based on individual NGB perceptions of coach preference and practical reasons relating to the availability of timely pre-organized coach gatherings (e.g. coach education courses) that the researchers could attend. The interview guide provided a structure to which the questions were asked; however, in order to gain full understanding and clarify meaning, probing was used on an individual interview basis as required (Patton, 1990). To improve the reliability of the interviewing process

between interviewers, both researchers delivered three of the football and rugby focus group interviews together. Subsequent discussion and reflection lead to improved alignment between the interviewers styles.

Data Analysis and Trustworthiness

Following transcription, an inductive grounded theory analysis was carried out, which utilised hierarchical content analysis (Côté, Salmela, Trudel, Baria, & Russell, 1993) whereby three stages were followed (a) coding experience; (b) inductive inference and; (c) similarity processes. The structure emerging from the data is represented explicitly through the results section supported by example quotes (Cohn, 1991).

The trustworthiness of the data extracted from the transcripts is contingent upon the audit trail being complete, comprehensible and systematically related to methodological approaches (Guba & Lincoln, 1981; Guba & Lincoln, 1982, Guba & Lincoln, 1989). Several steps were taken to establish trustworthiness. First, interviewing style was used to maximise the levels of open-ended responses (as outlined above) and two researchers carried out the interviewing in order to reduce any personal bias. Furthermore, the two interviewing researchers carried out reliability and consensus validation checks (e.g., Bradley, 1993; Scanlan, Stein & Ravizza, 1989). This involved two sets of blind analysis on the two of the rugby focus group interviews, where raw data quotes were coded, and themes developed Finally, the results of the reliability and validity checks were discussed by the researchers, which acted to finalise details and confirm the level of agreement and consistency of the merging themes and categories and the subsequent support for the guidelines. In total, 221 raw data themes emerged from the data that were developed into three distinct dimensions.

Results and Discussion

Through the systematic analysis of the coaches' experiences and perceptions of sport science support and sport science knowledge, three important features emerged across sports

and levels. 1) Practical Application & Relevance 2) Integration & Access and, 3) Language. These general features are discussed below and quotes are used to exemplify the key messages that emerged.

Practical Application & Relevance

Perceptions of relevance - Lack of consistency.

There was a wide variety of perceptions regarding the applicability and usefulness of sport science. For example, some coaches perceived it as relevant and applicable to only elite coaches and athletes, as the curling coach below demonstrated.

> I don't think coaches in general would be interested in it until they get to the elite level. I know that at the elite level, the weekends they do, the nutritionist, the physios, the strength and conditions are always there keeping an eye on their athletes. But for a normal coaching session, there's no need and I don't think your average coach would be interested
>
> Curling developmental

This perhaps reflects the elite focus and explicit relevance of much applied research (Reade et al., 2008; Williams & Kendall, 2007b) and typical availability of funding (Reid et al., 2004), and may be the only context in which coaches see sport science in action. This perception was operationalized through the quote by the football coach below, where the application sport science was seen as inappropriate for younger age groups.

> That's why I wouldn't do any sport science stuff. I'd put on some appropriate age related activities that the coaches could use and could see the benefits of them and they'd be football-based If they move on from there to centre of excellence academies, they'll get introduced to that. It's like bringing in sex education for under 4s isn't it, and what have you, like we're doing now but they don't really need that yet, they need to be kids.
>
> Football developmental

Indeed, the usefulness of sports science as part of coach education at lower levels was also debated and many coaches reported not understanding the relevance, as the rugby coach highlights below.

> There has been a lot of sort of feedback, there's too much sport science on Level 3 but if you're operating at a certain level, you need to have enough knowledge to be

> able to talk to your conditioner. Also, people from Level 1 and Level 2 saying there's not enough rugby league, there's too much psychology, physiology, what do I need to know that for?
>
> Rugby developmental

This is problematic, particularly in the context that many formal coach education courses have been shown to have minimal impact on coaches' practice anyway (e.g. Nash & Sproule, 2012). Furthermore, this lack of understanding has clear implications for coaches with regards to their motivation to engage with sport scientists and sport science literature outside of formal coach education requirements. This is particularly pertinent given that much coach development is reported to occur through informal means (Quilan, 2002; Reade et al., 2008).

However, this was not the whole picture, many coaches across the levels viewed sport science as useful and applicable to every level. Those who perceived it as having an important role for younger athletes appeared to understand and define sport science more broadly. Supporting this point, Nash and Sproule, (2012) found that contextualising information to coaches is key to successful integration. Examples of this application of sport science at younger ages can be seen below.

> Letting them know how long before competition that they've to eat and what they've to eat, and how much they've to drink cos you've to drink quite a lot when you're curling. Although it's a cold atmosphere, you're still sweating and you can get really lethargic if you don't drink enough on the ice. So I mean, these kids are told they have to do that and that's from the age of 8 so…we do use sport science definitely with the younger ones
>
> Curling developmental

> So now we know, if we go back to our coaching, how to deal with these different children cos they're all different. They've all got a different trait on the spectrum, they're not an introvert, an extrovert, they could be somewhere in the middle. So it allows you to deal with the individual a lot better cos you know a bit about psychology. I think it's really good for level 1 how they do touch on that cos it allows you to deal with individuals better.
>
> Rugby novice

The quotes throughout this sub-section highlight the variation that exists between coaches understanding of sport science and its application. This included the level at which

they perceive it as relevant and the ways in which the knowledge can be operationalized across different age groups. As such, it would appear sport scientists, NGBs and coach educators have a significant role to play in disseminating this over-arching understanding of sport science within the coaching context. This point is picked up on by a number of coaches and is outlined in the next sub-section.

Relevance: The need for education.

The challenge of making sport science knowledge applicable to younger children and more coaches in general was highlighted by one football coach below.

> Their experience was very much around working with elite performance, so they didn't – they hadn't necessarily worked with 5, 6, 7 year old kids who have real balance issues, co-ordination issues, which was the field that these guys were gonna be going into. So it's trying to bring things that they were saying were fundamental to elite performance to life for kids who are 5, 6, and 7 running round a playground
>
> Football novice

Indeed, this is a challenge for sport scientists as much as it is for coaches. Education and partnerships between the two disciplines would clearly add value to this process. One rugby coach highlights below that this would usefully be made an explicit part of the role of the sport scientist, both in terms of research and also applied work.

> My ideal would be for sport scientists to educate me so that I've got a better understanding of it, how it links into the game so that I have an understanding of it and hopefully pass that on in the right context.
>
> Rugby developmental

Of course, the tight focus and lack of applied relevance of much sport science research is already well documented (e.g. Goldsmith, 2000). As such, there is perhaps a longer term sea change required. However, better communication by sport scientists is likely to help significantly in the short term (Pain & Harwood, 2004).

The important point here is that coaches may need to be helped to understand and see the relevance and application of sport science. Indeed, coach education courses may usefully facilitate a coach's ability to utilise information and distinguish between what is applicable

and non-applicable within any given context. This 'problem-solving' and 'knowledge use' approach to coach education has been recommended before (e.g. Abraham & Collins, 1998; Nash, Sproule & Horton, 2011), for all knowledge application not just sport science. Indeed, one curling coach below perceives this skill to be related to open mindedness, although research would suggest it is usefully trained (Martindale & Collins, 2005).

> depends on how open a mind the coach has, I would think. I mean, let's face it, you take all the information you can get from anywhere, science or motherhood, and apply what is relevant to your situation. I don't think you can have enough information, you can always sift through what isn't relevant. Does that make sense?
>
> Curling developmental

One football coach highlighted the importance of reflecting critically on information in order to understand it and apply it to individual circumstances effectively.

> So I think there's a place for it, it's just a matter of how you use it and actually understanding it and what applies to them. If I'm the coach of a 7 or 8 year old, I might be looking at information that really has no relevance to the group of players that I'm working with but would have if I was working with 20 plus year olds. So I've gotta be mindful of what type of information, I have all this information, what do I do with it?
>
> Football developmental

Some coaches didn't understand the process of using sport science information to facilitate the reflection and planning process. For example, this football coach below perceived the need for sport science information to be redundant because he thought about his coaching instead.

> I think therefore I don't read sport science stuff.
>
> Football novice

The lack of coherence and clarity with regards sport science use amongst coaches' requires attention. Furthermore, it is clear that applying sport science knowledge to the coaching context in an effective way is a challenge. As such, consideration of the best way to help coaches learn how to critically evaluate and apply sport science effectively is needed, as is the role that sport scientists and coach educators play in facilitating this process.

Sport science application – The role of the practitioner.

The perception of the relevance and usefulness of sport science seemed to be partly related to how people defined and understood it. However, another major barrier was coaches' experiences related to the ability of sport scientists to apply the knowledge effectively.

> He (sport scientist) has worked at the very highest level at rugby union but he could not deliver outside of a gym. He could deliver on the rugby union pitch but not on rugby league pitch and I think that's a big one for me, that one
>
> Rugby elite

> They (sport scientists) really push the boat out and they try and get them to lift as much weight as they can and all the rest of it. Why? We don't need to lift all that weight, especially down the rink. It's a touch game and reading between the lines, the Olympic team come out like blooming Adonises. You could have hit him on the chest with a sledge hammer and it would have bounced off him. I really don't think it's done his game any good because 2 or 3 years ago he was absolutely the shot player in the world. He isn't today. The important phraseology, if you want to put it is, it's sport specific.
>
> Curling elite

Indeed, the qualities of the sport scientist have been shown for a long time to be crucial in engaging coaches successfully (e.g. Partington & Orlick, 1987), but unfortunately still seems to be a problem that exists today (Pain & Harwood, 2004). This is somewhat disheartening, as it is well recognised within sport science education that demonstrating an understanding of the needs of the sport and individual is crucial to acceptance. However, it is clearly a significant challenge, particularly so, if there is minimal or adhoc contact time within any given sport culture. However, there were also clear success stories of sport science being applied successfully within sport specific contexts.

> Well, one of my colleagues has got a Ph.D. in sport science, he's very well researched, his knowledge is second to none but his real ability to my mind is that he can apply it in a practical situation. I've come across a lot of theoretically very sound sport scientists who perhaps haven't been practical but this guy is and that's really what you need from sport science is not only the knowledge but the ability to practically apply it
>
> Rugby elite

This supports the applied research base which outlines the potential for sport science input to add considerable value to the performance enhancement process (e.g. Collins et al.,

1993; Gustafsson, Holmberg, & Hassmén, 2008; Martindale & Collins, 2005; Reade et al., 2004). However, significant variation of coaches' experience with regards to the effectiveness of sport science practitioners, would suggest it would be pertinent to review the training and/or engagement process of sport scientists to incorporate a greater focus on application skills and thorough integration.

Given that a key concern for coaches is the ability for the practitioner to fit in with the team (Pain & Harwood, 2004; Partington & Orlick, 1987), it may be useful to consult with coaches and NGBs with regards the best way to facilitate this process. Although of course, on a practical level, a lack of funding and ability for the practitioner to spend enough time with coaches and athletes has been shown to be a major barrier to effective integration (Ravizza, 1990).

Practical application – Who's in control?

Furthermore, many coaches raised concerns that sport science is taking too dominant a role within sport. In fact, role clarity was documented by Pain and Harwood (2004) and Williams and Kendall (2007a) as a major barrier to success. Examples below highlighted coach concerns about the negative impact this had on subsequent player development and performance.

> I think that in sport in general, sports science is leading too many sports rather than the sports leading the sport. I know that's true in a number of sports cos I've spoken to a lot of people across different sports. I think we, the sport, are definitely in danger of letting the sport science go off in this direction and drag the game with it when actually the game's the game. Sport science should enhance the game. The pendulum's gone too far in the other direction, in my opinion, and it needs to come back a little bit.
>
> Rugby developmental

> I just don't – well, I'm old school in one way, in that I believe that the sports scientists have taken over the game of football. Now we have fantastically presented athletes who can't play the game and that worries the life out of me.
>
> Football elite

Perhaps this is a reflection on the inability of some sport scientists to understand the needs of the sport and apply sport science accordingly. Perhaps it is through a lack of effective integration of NGBs, coaches and sport scientists, leading to poor working relationships, poorly thought out approaches and role formation. This could be related to resourcing issues, attitudes (coach and sport scientist), or simply the difficulty of building effective multi/inter-disciplinary teams.

In fact, multi-disciplinary teams in this context are often not considered or recognised as 'real teams', more grouped together as a by-product of accessing multiple service providers (Reid et al., 2004). While people generally believe that bringing together a range of expert multi-disciplinary practitioners will naturally result in comprehensive servicing, Reid et al., (2004) highlighted that this act alone does not produce results as a natural consequence. This represents a significant challenge and at the very least, this issue seems worthy of further investigation. Indeed, it is clear from the examples below, in addition to quotes within other sub-sections that many coaches believed sport science can add value if implemented correctly.

> I think all the (sport science) support is needed, as long as it's used properly, then it should work or it's proven to work for top athletes in this country at the moment. But there's been loads of different people in working and loads of different ways of doing things, it's just getting the correct mixture, I think, for the athletes to produce performance players.
>
> Judo developmental

> One of the students down there analysed all of the fights at, say the world championships, the Olympics or something like that and one of the things that they found was that there was 2 scoring zones. One is round about 30 seconds into a fight and one towards the end, when obviously they realised they were running out of time and what some coaches are doing is that they're doing training where they encourage a burst of energy at those points…That's an example of judo sport science
>
> Judo developmental

> Judo's a sport that nowadays it's almost impossible to compete in at international level if you don't have a high level of physical robustness, so there's obviously a number of things we can measure in terms of an athlete's physiology. I think we have a much better understanding of what judo is physiologically than we did maybe a couple of years ago

Judo elite

This subsection highlights the continuing need to explore and build effective working relationships between NGBs, coaches and sport scientists. Indeed, there still appears to be a long way to go with regards to wide spread successful integration of sport science, but the need for individual NGBs to think carefully and strategically about how it could best work is clear.

Integration & Access

The need for effective working relationships.

Leading on from the last section relating to effective application, the success of sport science may well depend on the development of effective working relationships between coaches and sport scientists. For example, one curling coach highlighted the usefulness of coaches speaking regularly with sport scientists to help them engage in a more sport specific way.

> What's going on just now is coaches, like James and John, speaking with them (sport scientists) and just trying to get through to them to channel their thing in a more sports specific way and I think they're beginning to get the message
>
> Curling elite

This isn't a new concept, and coaches already recognise the importance of working coherently with significant others (Martindale, Collins & Abraham, 2007; Nash, Sproule & Horton, 2011). This of course requires resource, access and willingness.

The use of sport scientists to add specialist knowledge to discussions on preparation and supporting teams at important competitions or camps seem to be more commonly employed. Examples of this are provided below within a football context.

> Since I've joined this organisation, within the teams we have a sport scientist for every trip, every event, as we call them, and he works closely with that, with the sport scientist. Obviously he'll take the hydration and the nutrition and so on and so forth and, if you like, the aspects of preparation for the players for the game and the training.
>
> Football elite
>
> On the European Championships and World Championships where you might be playing in another part of the world, as Kevin says, then you would probably have

> two or three meetings with the sport scientist to discuss in depth the technical programme, acclimatisation, diet, rest recovery, all those issues. They would have a massive influence.
>
> Football elite

However, the ability of sport scientists to add value more substantially on a day to day basis, as part of a larger multi-disciplinary team may be needed. Interestingly, when there is resource and the will to integrate sport science within the sport structure there seem to be clear benefits.

> Who's in the support team? There's me and Simon who's - I explained my position – as full time technical coach, a full time strength and conditioning coach, we have a number of part-time positions who are based – we kinda operate this centre like a performance centre, so all the international performance athletes train here, this is their sole training venue. They're serviced by physio two days a week, nutritionist one day a week, physiologist as and when we need it. So these people are round the table on a weekly basis and discussing significant problems there and I think really we try and thrash it out between us but myself, the technical coach and the S&C coach have a kind emphasised responsibility for certain athletes. We'll have a general discussion and will be left with that individual to kind of make the decision
>
> Judo elite

The challenges of developing and maintaining working relationships across the development pathway are well documented (e.g. Martindale et al., 2007), as are the difficulties of managing a multi-disciplinary teams (e.g. Reid et al., 2004). However, it appears to be a crucial part of the puzzle in order to maximise the effectiveness of sport science application and knowledge dissemination. For example, it is reported that delivering sport science support in a multi or inter-disciplinary fashion is the best way to deliver quality outcomes in applied settings (Burwitz, Moore, & Wilkinson, 1994; Collins et al., 1993; Collins et al., 1999; Reid et al., 2004).). Indeed, it has become much more common for coaches to liaise with a support team. This has developed in line with NGBs' capability to resource 'in house' and full time commitment of sport science practitioners to athletes and coaches (Mallett & Côté, 2006). However, it is important to recognise the potential input sport scientists may have for not only supporting 'teams' per se, but also adding value to

youth sport contexts, coach development and policy/performance planning. Indeed, the NGBs have a key role to play in facilitating this process.

Access to sport science.

While the quote above provides a good example of effective integrated practice, it is important to recognise this is not the normal circumstance for the average coach.

> I suppose the governing body when we're working in rep teams, we've got access to physios, doctors, nutritionists, strength and conditioning coaches. I suppose in club land, it depends what level you're on. I've just been recently done an audit of all the youth departments in every super league club and there's varying degrees of sport science been used at different ages with kids but again that will depend upon the resource of the club, its locality to a university they might have a partnership with, so it's quite varied
>
> Rugby elite

This quote highlights that there is a great variety of different levels of 'access' to sport science knowledge and scientists for the average coach. As such, it is important to investigate further why this is the case. Is it a sport or individual issue, location, lack of resources or opportunity? Also, many interested coaches simply don't seem to have any access to information or sports scientists, something that has been highlighted in the literature for some time (Blinde & Tierney, 1990).

> I can understand how it could be useful, and listening to other sporting professionals, I believe it could make a difference however due to my limited exposure to the area I've never found it to be particularly useful. It hasn't, to date, but I would welcome anything which makes the athlete(s) coach perform at their peak performance levels
>
> Curling developmental

> So my personal experience of sport science is nil, my interest in it is one of awareness that it exists and that it can be successfully applied or applied to good effect under the right – by the right people who have the requisite knowledge
>
> Curling novice

It is clear through all coaching levels, even many interested coaches do not have any formal access to sport scientists or sport science knowledge. Some have no access at all. This needs to be addressed if the integration of sport science is to become an 'added value' aspect of coaching practice consistently on a wider scale.

Integration of sport science – Left to chance.

Taking this further, there were many examples from coaches to highlight that access to sport science information took place more through informal or chance processes than by design. One curling coach demonstrated this below.

> Some of the stuff might come down, but only probably down to my sorta level, it wouldn't go down to coaches below that
>
> Curling developmental

Furthermore, previous research has highlighted coaches' preference for informal knowledge dissemination such as through other coaches or 'experience' (Quinlan, 2002). However, clearly this poses problems with regards to quality management and equal CPD opportunity. The coach below highlights an example of the nature that this process can take.

> None is the answer (experience of sport science). Then, you know, sort of a footnote. I know from my son who is a golf professional and he is very much involved in teaching youngsters, amongst others, and also the training that he had to do to qualify, together with the training that he puts his assistants through and some of them very successfully, that the science of the, if you like, physiological side of it, the physical side if you want it simpler – is very important.
>
> Curling novice

The success of this informal dissemination and application of knowledge also depends on a number of other more coach specific issues. For example, open mindedness, time management, understanding how to access information, or having access to knowledgeable others, all help or hinder the extent to which a coach will access sport science information, something which is supported by previous literature (Pain & Harwood, 2004). Some examples of this are provided below by rugby and judo coaches.

> if I really wanted to know about it and it was related to what I was doing, then I would research it. But in general I don't just look at a lotta research topics. If there's something comes up that I'm kinda interested in, then I'll follow up on it and I'll get to know as much as I can about it. But other than that, I won't bother to be honest with you, it's a time management thing, I've not got a lot of time to do it, to be honest with you
>
> Judo developmental

> Well, probably because – 2 or 3 reasons. Well, one, I wouldn't know where to get it. Two, I would probably assume it might be a bit dry and a bit academic. And time I suppose is a factor as well.
>
> Rugby developmental

> I've a big folder on my computer of research papers and every time I get one – some of them are easy to follow, others are not. If there's one that I believe I need to read but I can't understand it, I just go and I just get somebody that can explain to me in reasonable terms, tell me in terms of what I need to know
>
> Rugby developmental

As the quotes above highlight, much of the dissemination of sport science knowledge occurs through chance or informal processes. This has implications for quality assurance and consistency of impact. However, it is important to note that particularly in this adhoc and informal situation, individual factors play a large role in the access and application of sport science. As such, perhaps the NGBs have a role to play in facilitating coach motivation, as well as offering more structured opportunities.

Knowledge dissemination: Added value.

It seems that more can be done to streamline the efficiency with which sports science/scientists and coaches interact. For example, opportunities to integrate with sport scientists at times and places where coaches are gathering anyway.

> actually probably the quickest way is if you've got somebody coming in because if you're doing a coaching course, with the likes of, I suppose, the development group. They've got several sessions during a season, so therefore we bring in different people, so, to have coaches in attendance listening in to that. On the other hand, I suppose giving them a talk because that way you get some sort of – you get written down information, then you can take that away. And if it's a group of like minded people, the chat afterwards is good
>
> Curling developmental

This requirement to make the most of 'education and contact opportunities', however brief they may be, has been explored within sport psychology literature to good effect (Giges & Petipas, 2000). The curling coach below highlights the invaluable nature of smaller opportunities for contact with sport scientists.

> And that was an hour's worth, set up for me on a development weekend where these people were there anyway for the athletes. They set aside a time for the coaches to sit

> in and just go through things with them. So that was good cos it gave me an understanding
>
> Curling developmental

Furthermore, one coach highlighted that tutors would usefully have a role and/or could be helped to deliver sport science in more practical and applied ways during courses, which has been highlighted before (Nash & Sproule, 2012).

> It's not the content, it's the delivery of our tutors. The good tutors, as Terry said, would be outside, and you can deliver some of the science in some of the coaching process, actually outside doing the stuff if you like
>
> Rugby developmental

Other examples that facilitate interaction and dissemination given by coaches included more formal relationships with academic institutions, one thing that has been promoted within UK bodies (SportcoachUK, 2010).

> it used to be just the coaching staff and you just used to get it off the internet but now we've actually got the partnership with 'X' University. So they'll be working on something and hopefully in the next few months, next year, that we all get a better inside knowledge of it all.
>
> Rugby novice

Indeed, as mentioned in previous research (Nash & Sproule, 2012), many coaches highlighted that more could be done to provide easily accessible resources for coaches.

> I think there is definitely a sport science element which is really undeveloped. One of our coaches who is a level 2 UKCC coach, called Russell, he's doing sport science at university and he brings some things to the club related to that. You know, I think there is a place for it which isn't really kind of promoted or developed, you know, at the moment, certainly very few resources that I'm aware of as a developing coach that I can use regarding that aspect
>
> Judo novice

> if there was a kind of good sort of comprehensive, this is what you need to know, you know, sport science for curling for dummies or something like that, that would certainly benefit coaches.
>
> Curling novice

> So the other things that are related to sport science, I've looked up things on the internet about strength training, mental training, visualisation techniques, nutrition. But to be honest, I think that – you know how I talked about in the support structure about the database for advice, you know, coupled with the coaching tips and things, I don't see why there can't be sample diaries or something like that. Judo players, particularly senior ones, are virtually athletes, but they're not getting the support that a kinda proper full time athlete gets. Now, I think if they could go on to Judo

> Scotland's website and find themselves and say, right OK, I'm a 15 year old boy or girl, whatever I am, I'm doing judo twice a week and I want to improve, they could say, right OK, you need to whatever, eat a healthy diet, here's an example of a weekly diet sheet
>
> Judo novice

It would seem that many substantial changes may need to happen before the integration of sport science and coaching happens effectively on a broad scale. However, the data seems to highlight a number of positive steps that could be taken within a shorter time scale to improve the efficiency of dissemination. For example, utilising opportunities when coaches are gathered together; improving the extent to which coach education emphasises applied sport science in a practical setting; build relationships between NGBs, clubs, coaches and academic institutions; and provide resources and/or information of NGB websites.

Language

The need for user-friendly sport science information.

The importance of available resources and access to sport scientists is clear. However, a related barrier that was highlighted was the use of appropriate language to convey information effectively to coaches. A number of quotes below emphasised that while jargon is inevitably going to exist in specific coaching and sport science contexts, academic terminology can be a huge barrier to engagement. Indeed, this is a point that has been raised in the research literature for some time (e.g. Sands, 1998).

> Rugby league coaches have rugby league jargon, and researchers have researcher jargon.
>
> Rugby elite

> Most of the coaches that I've spoken to generally say they never read any of that type of research because it's not written in the type of language that can be understood easily. It needs to be summarised in English and put in layman's terms.
>
> Rugby developmental

> It's like reading War and Peace, I've never read that much before and it's only a document with a lot of pictures in as well and the answers, it's just a case of trying to make it as user friendly as possible.
>
> Football novice

> If they think, I can understand it, They'll have a look at it. You get pages of tables of statistics and you look at N equals de de de de –
>
> Rugby elite

Furthermore, language can be a barrier even with a motivated and interested coach, which is clearly a problem.

> Well, there was one I was trying to – I was desperately trying to understand this one thing about divided attention and it blew me away and I didn't really learn much to be honest.
>
> Rugby elite

It is clear that academic jargon can form a lasting barrier to uptake and use of sport science information. As such, steps need to be taken to address the reasons why this occurs.

Building bridges - Incentivising an applied sport focus.

As a result of this potential problem, some coaches highlighted the need for sport scientists to emphasise and make the relevance of the research clear. One rugby coach makes this point below.

> The relevance needs to be emphasised because you look at these things, don't you? They're usually written for other academics, aren't they, you know, probability levels and this, that and the other, levels of significance.
>
> Rugby developmental

Indeed, there needs to be an incentive and motivation for sport scientists to focus their work for sport specific, coaching contexts (Williams & Kendall, 2007a), particularly, given the pressure many are under through the 'publish or perish' culture within academia. One coach provides an example of this need below.

> There isn't a huge amount of sport research specific to rugby league, although it's getting better.
>
> Rugby developmental

Indeed, some coaches offered ideas about what would be useful for sport scientists to do to help this process. For example, two quotes below highlight that sport scientists could usefully offer another less technical version of the research findings, if possible specific to certain contexts and sports.

> It's like when the doctors are talking, you know, bones and muscles and things. I think sport science is a particularly difficult area because the research by its definition is technical, but I mean, you almost need 2 versions of it. What does that mean to me? You need the research and then you need a popularised version if you like specific to your sport.
>
> Rugby developmental

> Until other people edit the journals and allow papers into their journals, take away the academic rigour as in, if it's not written like this, it's not coming in, then it won't change. Until we get that easy and we had coach manuals and things like that. If you can get magazines rather than journals, academic, if you can get them into readable monthly, bi-monthly.
>
> Rugby elite

However, at the same time it was recognised that there is some need for coaches to meet the academics half way in this regard.

> I believe we have a duty to educate coaches coming through as much as we can. Some of the jargon if you like has still got to stay there
>
> Rugby elite

It is clear that steps need to be taken to address this concern. Interestingly, the issue raised regarding language mainly seemed to emanate from the football and rugby coaches. Although this is clearly a generalisation, it is worth considering as it may have implications for how individual NGBs tackle the issue. Perhaps this sport difference reflects coach characteristics, for example, the general nature of the previous experiences of coaches within certain sports. Or perhaps it is a sport specific issue, for example, the extent to which sport science has evolved or the differences in the technical nature within any given sport. If so, there may be different needs and approaches required depending on the context.

Conclusion

Research clearly highlights that problems still exist in the integration of sport science into applied sporting contexts (e.g. Bishop, 2008; Pain & Harwood, 2004). As such, this study was interested in examining UK coaches' experiences and perceptions of the usefulness of sport science (support and knowledge) across three different levels (novice, developmental & elite), and four different sports. Focus group and individual interviews revealed three

broad themes 1) Practical Application & Relevance 2) Integration & Access and, 3) Language.

Interestingly, there appears to be significant variation in where coaches perceive sport science to be relevant, as well as the extent to which they perceive it as useful. This seemed to be related to how the coaches defined sport science, those with a more broad understanding perceived a greater diversity of usefulness. However, this did not seem to be divided by coach 'level', which is perhaps at odds with research by Reade et al., (2008) who found that many high level coaches perceived sport science to be relevant. Indeed, in this study there was more 'within group' variation than 'between group' variation in this regard, where coaches' background experience, open mindedness and education seemed more important. However, as well as narrow definition, barriers to the usefulness of sport science also occurred when coaches had had 'bad' experiences of sport scientists in action.

This many have implications for coach education with regards to the clarity of the definition of sport science, but also for helping coaches understand how to operationalize sport science knowledge into their own sport specific, coaching contexts. Whilst recognising that sport scientists were not part of this study, the data may indicate that there is a role here for both sport scientists, and the way in which they are trained to apply knowledge, but also for NGBs in relation to the education of coaches. For example, to what extent are coaches taught and supported to identify relevant knowledge and integrate it into decisions they make?

Furthermore, it is crucial that sport scientist understand the needs within a sport fully before applying their specialist knowledge (Martindale & Collins, 2005). Interestingly, a concept already heavily promoted by sport scientists and sport science bodies (e.g. BASES). As such, issues around effective integration need to be raised. These include the resources

required to allow sport scientists the time to gain acceptance and understanding, as well as the willingness for coaches and athletes to facilitate this process (Pain & Harwood, 2004).

In other words, strong working relationships need to be developed between sport scientists, NGBs, coaches and athletes to facilitate this process (Martindale et al., 2007). It would appear that there needs to be regular opportunities for dialogue between coaches and sport scientists to help them target needs effectively and apply specialist knowledge in a way which is relevant and effective across the pathway (Burke, 1980; Pain & Harwood, 2004). This requires coaches to have a good enough knowledge of sport science to help guide this process and help bridge the gap. However, on a more strategic NGB level, the role of sport science needs to be made clear and fit with the needs of the sport. Indeed, there were some examples where coaches felt the sport was being led too strongly by sport science to the detriment of athlete development and performance.

There was a clear message emerging in relation to the adhoc nature of knowledge dissemination and integration with sport scientists. Given this finding, it would make sense for NGBs to develop a clear strategic direction for the integration of sport scientists but also for the structuring of knowledge dissemination in a way which impacts positively on coaches in a more systematic way. Indeed, it is well known that coaches develop knowledge through a range of modalities such as mentors, education, magazines, coach communication, and consultation with sport scientists (Salmela et al., 1993; Sands, 1998; Williams & Kendall, 2007a), and as such, all these options can be brought together coherently to enhance effectiveness. While it is clear that some of these changes require time and resource (e.g. ‘in house’ scientists; employed NGB role to identify & disseminate knowledge; relationship with institutions), others could perhaps be done more effectively in the short term by utilising existing opportunities (e.g., developing easily accessible resources; utilising opportunities when coaches are already gathered to disseminate relevant information).

Building on this theme, there also needs to be an appreciation that much of the sport science information is often not directly applicable to specific sports, and more needs to be done by academics to attempt to target relevant questions (Goldsmith, 2000; Reade et al., 2008). It is not difficult to see why many academics do not write and research specifically for sport and coach specific context. In the 'publish or perish' world in which academia works, with strict criteria for acceptance for publication, it doesn't make sense for efforts to be focussed on a less academic and perhaps more challenging long term applied research questions (Williams & Kendall, 2007a). However, with improved relationships between NGBs and academic institutions, the aims of research could be guided toward the needs of coaches and athletes more specifically.

While academics may not currently have incentive to write for an applied coaching population, things are happening to facilitate change. On a more individual note, researchers are starting to take on this challenge, for example, Bishop (2008) has provided guidance for academics to help them engage in this process, and some journals are explicitly aiming to publish research that aims to bridge the gap between coaching and sports science. (e.g., The International Journal of Sports Science & Coaching). Furthermore, and perhaps more crucially, in recently revised criteria by which Universities are awarded public funding based on their research 'quality' (i.e. Research Excellence Framework), ability for academics and institutions to demonstrate the 'real world' impact of their work is increasingly becoming a priority. This will hopefully drive researchers to search for more applied and impactful research questions and collaborations.

References

Abraham, A. & Collins, D. (1998). Examining and extending research in coach development. *Quest, 50,* 59-79. doi:10.1080/00336297.1998.10484264

Abraham, A., Collins, D., & Martindale R. (2006). The coaching schematic: Validation through expert consensus. *Journal of Sports Sciences*, *24*(6), 549-564. doi:10.1080/02640410500189173

Backstrom, C. H., & Hursch-Ceasar, G. (1981). *Conducting interviews: Survey research* (2nd ed.). New York, NY: John Wiley and Sons.

Bishop, D. (2008) An applied research model for the sport sciences. *Sports Medicine, 38*(3), 253-263. doi:10.2165/00007256-200838030-00005

Blinde, E. M., & Tierney, J. E. (1990). Diffusion of sport psychology into elite US swimming programs. *The Sport Psychologist, 4*(2), 130 - 144.

Burke, E. R., (1980). Bridging the gap in sports science. *Athletic Purchasing and Facilities 4*(11), 24-25.

Burwitz, L., Moore, P. M., & Wilkinson, D. M. (1994). Future directions for performance-related sports science research: An interdisciplinary approach. *Journal of Sports Sciences*, *12*, 93-109. doi:10.1080/02640419408732159

Cohn, P. J. (1991). An exploratory study on peak performance in golf. *The Sport Psychologist, 5*, 1-14.

Collins, D., Morriss, C., & Trower, J. (1999). Getting it back: A case study of skill recovery in an elite athlete. *The Sport Psychologist, 13*, 288–289.

Collins, D., Doherty, M., & Talbot, S. (1993). Performance enhancement in motocross: A case study of the sport science team in action. *The Sport Psychologist, 7*(3), 290-297.

Côté, J., Salmela, J., Trudel, P., Baria, A. & Russell, S. (1995) The coaching model: A grounded assessment of expert gymnastic coaches' knowledge. *Journal of Sport & Exercise Psychology, 2*, 1-17.

Ellem, J. (1996). The art of coaching with the science of sport: The QAS way. *Sport Health, 14*, 22 – 23.

Erickson, K., Bruner, M. W., MacDonald, D. J., & Côté, J. (2008). Gaining insight into actual and preferred sources of coaching knowledge. *International Journal of Sports Science & Coaching, 3*(4), 527-538. doi:10.1260/174795408787186468

Giges, B. & Petipas, A. J. (2000). Brief contact interventions in sport psychology. *The Sport Psychologist, 14*, 176–187.

Goldsmith, W. (2000). Bridging the gap? Now there is a gap in the bridge! *ASCA Newsletter, 3*, 2-4.

Gustafsson, H., Holmberg, H. C., & Hassmén, P. (2008). An elite endurance athlete's recovery from underperformance aided by a multidisciplinary sport science support team. *European Journal of Sport Science, 8,* 267-276. doi:10.1080/17461390802195652

Lyle, J. (2002) Sports Coaching Concepts; A framework for coaches' behaviour. London, UK: Routledge.

Mallett, C., & Côté, J. (2006). Beyond winning and losing: Guidelines for evaluating high performance coaches. *The Sport Psychologist, 20,* 213-221.

Martens, R. (2012). *Successful coaching*. Leeds, UK: Human Kinetics.

Martindale, A., & Collins, D. (2005). Professional judgment and decision making: The role of intention for impact. *The Sport Psychologist, 19*(3), 303-317.

Martindale, R. J. J., Collins, D., & Abraham, A. (2007). Effective talent development: The elite coach perspective within UK sport. *Journal of Applied Sports Psychology, 19*(2), 187-206.

Nash, C., Martindale, R., Martindale, A., & Collins D. (2012). Parameterising Expertise in Coaching: Past, Present and Future, *Journal of Sports Sciences. 30*(10), 985-994. doi:10.1080/02640414.2012.682079

Nash, C. & Sproule, J. (2012). Coaches perceptions of coach education experiences. *International Journal of Sport Psychology, 43*, 33-52.

Nash, C., Sproule, J., & Horton, P. (2011). Excellence in coaching: The art and skill of elite practitioners. *Research Quarterly for Exercise and Sport, 82*(2), 229–238. doi:10.5641/027013611X13119541883744

Nelson, L. J., Cushion, C. J., & Potrac, P. (2006). Towards a clearer understanding of coach learning: Interrogating conceptualizations of coach education. *International Journal of Sport Sciences and Coaching, 1*(2), 1-18.

Pain, M. A., & Harwood, C. G. (2004). Knowledge and perceptions of sport psychology within English soccer. *Journal of Sports Sciences, 22*, 813 - 826. doi:10.1080/02640410410001716670

Partington, J., & Orlick, T. (1987). The sport psychology consultant: Olympic coaches' views. *The Sport Psychologist, 1*, 95 - 102.

Patton, M. (1990). *Qualitative evaluation methods* (2nd Ed.). Beverly Hills, CA: Sage.

Quinlan, D. (2002). More art than science: Top coach Dennis Quinlan joins the ongoing distance running debate. *Athletics Weekly, 56*, 26 – 27.

Ravizza, K. (1990). Sport psychology consultation issues in professional baseball. *The Sport Psychologist, 4*, 330-340.

Reade, I., Rodgers, W., & Spriggs, K. (2008). New ideas for high performance coaches: A case study of knowledge transfer in sport science. *International Journal of Sports Science & Coaching, 3*(3), 335-364. doi:10.1260/174795408786238533

Reid, C., Stewart, E. & Thorne, G. (2004) Multidisciplinary sport science teams in elite sport: Comprehensive servicing or conflict and confusion? *The Sport Psychologist, 18*, 204-217.

Salmela, J. H., Draper, S. P., & La Plante, D. (1993). Development of expert coaches of team sports. In S. Serpa, J. Alves, V. Ferreira, & A. Paulo-Brito (Eds.), *Proceedings of the VIII world congress of sport psychology* (pp. 296 – 300). Lisbon: FMH.

Sands, W. A. (1998). How can coaches use sport science? *Modern Athlete and Coach, 36*, 8 - 12.

Scanlan, T. K., Ravizza, K., & Stein, G. L. (1989). An in-depth study of former elite figure skaters: 1. Introduction to the project. *Journal of Sport and Exercise Psychology, 11*, 54-64.

Sewell, D., Watkins, P., & Griffin, M. (2012). *Sport and exercise science: An introduction*. London, UK: Hodder Education.

Spinks, W. L. (1997). Sports research and the coach. *Sports Coach, 19*, 18 - 19.

SportscoachUK. (2010). *UKCC Level 4 guidance document*. Leeds, UK: Sports Coach.

Williams, S. J., & Kendall, L. (2007b). A profile of sports science research (1983—2003). *Journal of Science and Medicine in Sport, 10*, 193 – 200. doi:10.1016/j.jsams.2006.07.016

Williams, S. J. & Kendall, L. (2007a). Perceptions of elite coaches and sports scientists of the research needs for elite coaching practice. *Journal of Sports Sciences, 25*(14), 1577 - 1586. doi:10.1080/02640410701245550

Figure 1. Interview script.

1. What is your experience of sport science?
2. How much interaction have you had with sport scientists/science?
3. What do you understand by sport science?
4. How useful do you find sport science support/literature?
5. How has sports science/sport science support impacted on your coaching?
6. What would your ideal sport science support structure look like?
7. Are there any barriers to effective sports science support?
8. How can sports science research be disseminated to assist coaches and enhance performance?